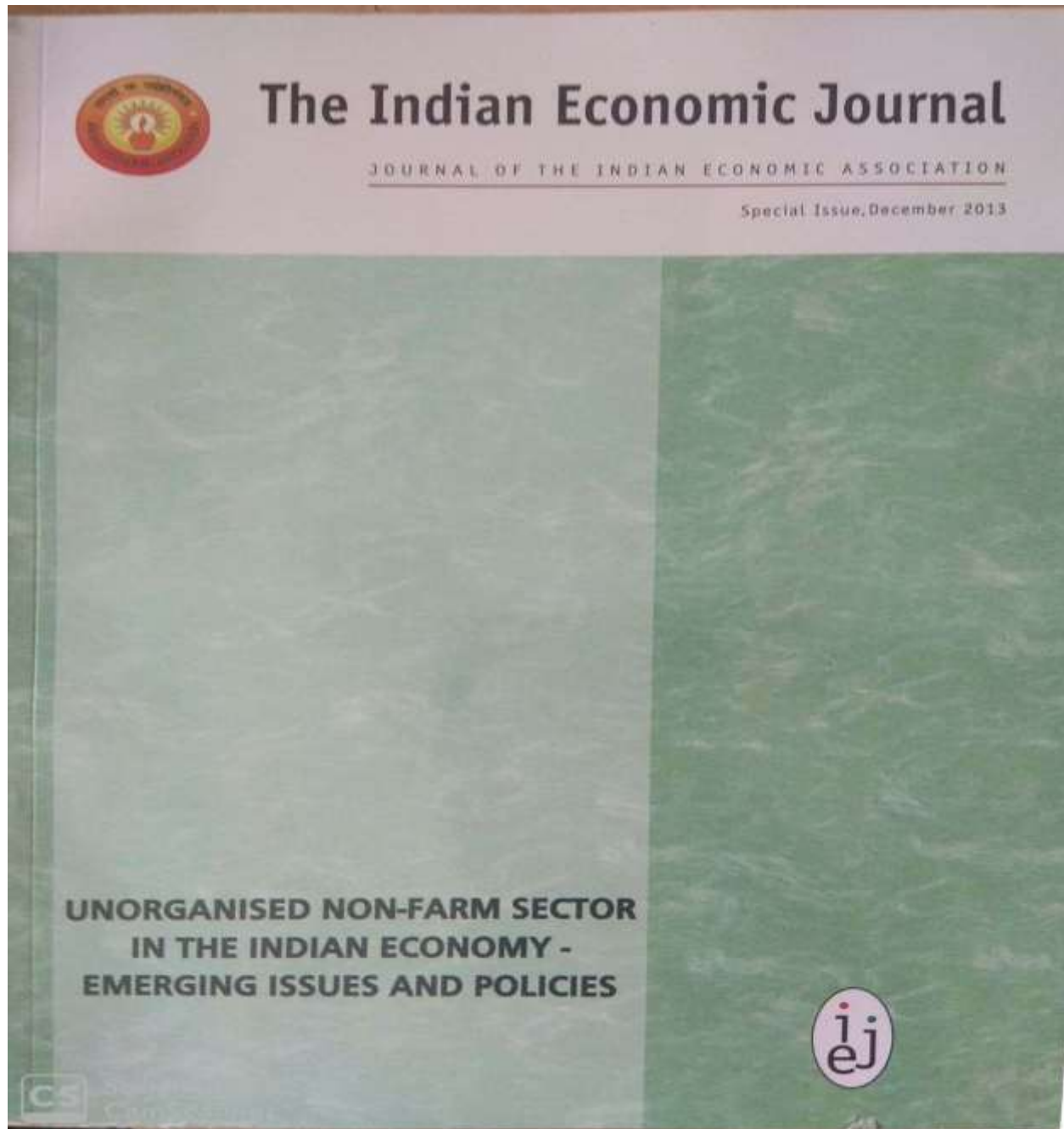


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Social Security Measures for Unorganised Sector Workers in India

Jaywant Ramdas Bhadane

Introduction

There is nothing more serious to worker and his family than unemployment. But due to cyclical fluctuations (Boom and Recession) in business sickness, industrial accidents and old age, the workers are subject to periodic unemployment. Sickness suspends his earning capacity temporarily, industrial accidents may disable him permanently or partially and old age may stop his ability to earn and support his family. However, the businessman has the sources to face the risks of business, but worker does not have any resources to face the risks of sickness, accidents, unemployment and old age. In such circumstances the government has to help the workers and provide them security. The government has started various measures to protect the workers in case of sickness, unemployment, accidents and old age. All these measures are known as social security schemes. These measures have been introduced in India only after independence. This has been mainly due to lack of official sympathy and interest in the welfare of the workers and the comparative weakness of the trade unions in pressing their demands for such measures. But the need of social security in India has always been felt by the wage earning and low salaries classes.

Since 1991, it has been one of the priority areas in the development planning in India, to strengthen the social security measures for unorganised sector workers. However, the central and state governments put several efforts in the direction, which include designing of new social security schemes, recasting of earlier schemes, effective enrolment of beneficiaries and enactment for social protection of unorganised sector workers.

According to survey conducted by NSSO in 2004-05 the total employment in the both organized and unorganized sectors in the country was 45.75 crores, of which 42.26 crores (92.4%) are engaged in the informal employments. of this workforce, 39.35 crore workers are engaged in unorganised sector and 2.91 crore workers are in the organised sector. In an unorganized sector major portion of workers are engaged in the Agriculture and the remaining workers are engaged in construction, mining, beedi, handloom, leather, fishermen and service sector. On account of their unorganised nature, these workers do not get adequate social security and welfare.



Some Concepts

1. **Agriculture:** It would include farming, dairy farming, production, cultivation, growing and harvesting of any horticultural commodity, rising of livestock, fishing and growing fodder etc.
2. **Unorganised Sector:** It consists of all private, unincorporated private enterprises owned by individuals or households engaged in the production and sale of goods and services and operated on a proprietary or partnership basis and employing less than 10 persons.
3. **Unorganised sector worker:** It means a self employed worker or a wage earner in the unorganised sector and includes wage workers in the organised sector without any social security cover. Unorganised workers consist of those working in unorganised enterprises or households excluding regular workers with social security benefits and the workers in the formal sector without any employment social security, benefits provided by the employers.
4. **Wage Workers:** These are the persons employed for remuneration among the unorganised workers, directly by employers or through agencies for contractors. Wage workers include casual and temporary workers or those employed by households including domestic workers. Wage workers also include regular workers in the unorganised sector.
5. **Self Employed Workers:** These are the workers who operate farm and non-farm enterprises or engage in a profession or trade either on own account individually or with partners or as home based workers. These workers suffer from social insecurity due to the sickness or injury or old age and are not entitled to any social security against these vulnerabilities.

Objectives of the Study

- To study the status of unorganised sector in India.
- To study the various concepts relating to unorganised workers.
- To study the various initiatives taken by Govt. regarding social security measures.
- To study the social security schemes available for labour in the unorganised sector and make suggestions.

Review of Literature

- National Commission Report (2006) on Social Security for unorganised workers, published by ILO, sub regional office for South Asia, New Delhi, has focused on various definitions relating to unorganised sector, its implementation machinery, implementation arrangement, various social security covers, social security benefits, National social security fund, grants and loans from Central Government, National Social Security Board, registration of unorganised workers etc.
- Mr. B.P.Ramesh in his paper "Extending social protection for unorganised sector workers in India" discussed recent interventions and initiatives in India for providing social security to unorganised sector workers, and argues that the initial impetus gained in social security front is not retained and sustained further.

- Social Security for the unorganised sector workers a press released, press information Bureau, Govt. Of India dated July, 13, 2013, stated that the Union Cabinet, gave its approval for social security to unorganised workers. The background information was given and the various schemes to be implemented were mentioned.
- Indian Labour Journal Vol.50, Anupama (2009) in her article "The need of Social protection to unorganised manufacturing sector in India" explained the term unorganised sector and need to provide essential social security to the workforce unorganised sector in the context of consequences of economic reforms. She has given various social security measures with reference to various states of India.
- "Welfare of unorganised workforce In India" a report submitted by Deepa Chandrasekhar, under the guidance of Prof. S.N. Ghosh, the report defines social security and examines various aspects of social security, its components and its features in organised and unorganised sectors.

Significance of Unorganised Sector

In Indian economy the contribution of unorganised Sector to GDP is about 50% in 2004-05 as per NCEUS estimations, as more than 90% of the total employment has been engaged in the unorganised sector of the Indian economy. Out of the unorganised sector workers about 65% to 70% workers are engaged in agricultural sector. It is observed that the unorganized sector in India suffers from a low productivity syndrome as compared to organised sector. The important features of unorganised sectors are low wages, and poor working and living conditions, excessive seasonability of employment, casual and contractual employment, typical production problems and work relations, absence of social security measures and welfare legislations, negation of social standards and worker's rights and denial of minimum wages. Due to lack of education skills and training. There are also poor human resources which add to vulnerability and weakens the bargaining power of workers in the unorganised sector. Given these essential characteristics provisions of social protection to the workers in the unorganised sector is due to the major challenges before policy planners.

Government Initiatives/Social Security Schemes

Social security is the protection which society provides for its members, through a series of public measures, against the economic and social distress that otherwise it would be caused by the stoppage or reduction in earnings resulting from sickness, maternity, employment injury, unemployment, invalidity, old age and death, the provision of medical care and provision of subsidies for families with children. The need to provide essential social security to the workforce in the unorganised sector has become urgent in the context of the consequences of economic reforms. Therefore, numbers of social security schemes are conducted by Central and State Govt. for the benefit of the unorganised workers. Some social security schemes are implemented by Central Govt. either directly or through insurance companies. Some legislation have been passed to setup welfare funds for housing, medical care, social security, education and recreational facilities to workers in mining, beedi making and production of

feature films (Cine workers). However, the legislations backed entitlements for unorganised sector are limited for workers in certain occupations. Some schemes are also implemented by Central Govt. through public sector insurance companies. Most of the Social Security benefits consists of life insurance, compensation for disability and some assistance for related problems. However, most of the beneficiaries of this programme may have been worker in the unorganised sector.

Social Security may be defined as the continuous economic support to a human being for his or her social well-being- at least in the earning years of his life. The focus of the social security is to enhance and protect people's capabilities to be adequately nourished, to be comfortably clothed to avoid escapable morbidity and preventable mortality. Therefore, we may understand the social security as the provision of benefits to households and individuals through public or collective arrangements to protect against low or declining standard of living arising from a number of basic risks and needs.

The National Social Assistance Programme, Central Welfare Fund Scheme, Social Security Schemes for Unorganised Sector Workers (2004), Universal Health Insurance Scheme and Schemes for handloom weavers were launched to cover the various benefits:-

1. **National Old Age Pension Scheme:** The applicant who is more than 65 years of age has no regular income from any sources, Rs. 75/- was given to beneficiary, have now been increased to Rs. 200/- p.m. The numbers of beneficiaries were 72.8 lacs and reported expenses were Rs. 195.66 crores.
2. **National Family Benefit Scheme:** This scheme was targeted at BPL households who suffered from the death of the primary breadwinner. The applicant should be in the age group of 18 to 65 years. A lumpsum financial assistance of Rs. 10,000/- is given to such family. It covers 2.11 lac persons and an expense reported is Rs. 80.62 Crores.
3. **Universal Health Insurance Scheme:** It was launched by four public general insurance companies in July, 2003. The persons below poverty line with a premium of Rs. 165/- for individual, Rs. 248/- for families of 5 persons, and Rs. 330/- for a family of seven, reimbursement of medical expenses up to Rs. 30,000/- and accident compensation up to Rs. 25000/-.
4. **Janashri Bima Yojana (2000):** This scheme is targeted at the urban and rural poor who live BPL. The premium is of Rs. 200/-, out of which Rs. 100/- would be paid by Central Govt. and balance Rs. 100/- is to be paid by individual himself or by State Govt.
5. **Varishta Pension Bima (2003):** This scheme is implemented for the workers in unorganised sector, whose age 55 years or more. The investor will get 9% return in the form monthly pension. The minimum and maximum monthly pension would be Rs. 250/- and Rs. 2000/- respectively. The scheme is launched by L. I. C. of India.
6. **Old age Pension Scheme:** This includes a minimum pension of Rs. 500/- p.m. of the age of 60 years of permanent disability and family pension in case of the death of the worker.

7. **Personal Accident Insurance:** This provision includes accidental provision of insurance of Rs. 1 lac.
8. **Unorganised Sector Workers Social Security Scheme (2004):** The scheme is available for unorganised and self employed workers drawing salary or wages of not more than Rs. 6500/- p.m. This scheme is financed by contribution at Rs. 50/- p.m. for the workers in the age group of 18 to 35 years. And Rs. 100/- p.m. for workers in the age group of 36-50 years. The contribution of employers is Rs. 100 p.m.
9. **National Maternity Benefit Scheme:** This scheme is meant for pregnant women in BPL households, up to two live births, lumpsum assistance of Rs. 500/- per beneficiary. This scheme was redesigned as Janani Suraksha Yojana, for BPL household women, and a cash benefit was given up to Rs. 1300/- in rural areas and up to Rs. 800/- in urban areas for antinodes care.
10. **Schemes for Handloom Weavers**
 - a) **New Insurance Scheme:** The United India Insurance Company launched the scheme which is financed by Central Govt. Rs. 60/-, State Govt. Rs. 40/-, and handloom weavers Rs. 20/- to share an annual premium of Rs. 120/-. The benefits include Rs. 1000/- in case of loss of dwelling due to natural calamities, Rs. 1 lac accidental death and reimbursement of hospital charges up to Rs. 2000/- etc.
 - b) **GIS:** Under this scheme an assured amount of Rs. 10000/- will be given.
 - c) **Pension Plan Scheme:** A sum of Rs. 1000/- p.m. is given to a master crafts person who is unable to work due to old age.
 - d) **Insurance for Powerloom weavers:** The workers between the age group of 18-60 years are insured with an income of Rs. 700/- p.m. The Central and the State Govt. equally share the annual premium of Rs. 120/- Benefits are given in case of natural death Rs. 10000/- and accidental death Rs. 20000/-.

The Unorganised Sector Workers' Social Security Act 2008

The act enables the Central Govt. to formulate welfare schemes for unorganised sector workers regarding life and disability cover, health and maternity benefits, old age protection and any other benefit decided by government. The act also enables the State government to formulate welfare schemes related to the provident fund, employment injury benefits, housing, education skill upgradation of workers, funeral assistance and old age homes etc.

Conclusion

From the above discussion, it is observed that the majority of workers in the unorganised sector in general are poor and vulnerable; their woes multiply when they have to face certain contingencies of life. It seems that the unorganised sector is heterogeneous in nature, including wide range of activities, workers in each sector face different kinds of problems. It is also realised that, with higher growth rate of social sector development and social security concerns of the labouring poor is increasingly being ignored.

There is a need of sector specific policies for unorganised sector workers. Whatever assistance is provided should be capability enhancing and should be provided on sustainable basis. There is an urgent need to put in position some old age income security to unorganised sector workers. For the welfare of the labouring poor, it is necessary to prompt the government to redesign and implement more effective policies and programmes for overall social sector development and for the social security of the working poor.

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CHALLENGES FOR TRANSFORMING THE INFORMAL ECONOMY IN INDIA



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Informal Sector and Employment Scenario in India

Jaywant Ramdas Bhadane

All industrial units as well as small, home based enterprises in informal sector are exposed to the inherent risks of free market competition by liberalization since 1991. This paper deals with the concept of informal and formal sector along with informal employment /workers and formal workers in India. Due to liberalization, there are losses of poor people in cities, small towns and even in rural India. These poor people provide services such as, trading in commodities, groceries, cosmetics, clothes, cleaning the shoes, hair cutting saloons etc. The poor men may be found on street corners in the parks or intersections. Out of these majority of people are self employed; They are running their own businesses, some of them are wage workers employed by informal operators, such as, construction workers, security guards, household help, drivers of cabs, garments workers, cobblers, beedi workers, agarbatti workers, drivers, dabbawalas, presswalas, and tea shops serving tea and cleaning utensils. Many are underpaid family workers. The legal status of these workers is inferior, compared to their work, which is hazardous.

Majority of women workers and child laborers are engaged in informal sector in India. The farmers are self employed in agriculture, which are included in informal sector. There are also informal workers in livestock, fisheries, forests, plantations food, beverages, tobacco, textiles, constructions, trade, mining, transport, domestic works and street vendors etc. Over all the condition of informal workers in India is worse and unprotected. The paper focusses on employment in India, in which employment trend survey discloses the information regarding total labour force including the actual workforce and unemployment in India from 1999-00 to 2009-10. The paper also deals with the sectoral distribution of employment in the sector like agriculture, manufacturing, trades & hotels and construction, which are the major sources of employment.

However, the paper gives total emphasis on the employment of informal sector and formal sector. The study is based on surveys, for which the researcher has used various tabulations, both physically computed and online. From the surveys conducted and data collected, it is observed that the people working in informal sector have very low income, have to work for more hours, no social security benefits, and living in slums or road corners. So that quality of employment is very worst. The paper also focusses on sectorwise total employment dividing into formal and informal sector. The paper also shows the size of informal sector workers by status, means self Employed, Regular Workers and Casual Workers and Concluded that

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the casual workers have been increased due to constructions sector in urban areas and due to MANREGA in rural area.

The researcher has made a comparative study of formal and informal workers during 1999-2000 to 2004-2005, in which he has studied agriculture sector, industry and service sector. The researcher has also collected the data from published survey rounds and shown in a particular table, the distribution of worker by sector, area and sex, in which he observed that the share of male and female workers in informal and also in the formal sector has increased from 1999-00 to 2004-2005. Hence, the present study explores that, in the country like India with huge population and such a huge informal sector may lead to increase in the problems of unemployment, poverty and inequality.

INTRODUCTION

The over helming majority of workers in India belong to the informal sector. Trade unions have made few attempts to formalize informal labour, with the notable exception of cases taken up to make contract workers permanent. There are lakhs of poor people in metropolitan areas, big cities, big and small town and the villages across India. They have public streets as their main place of work. These poor people are provided services, such as, trading in commodities, groceries, cosmetics, clothes or clearing the shoes, or hair cutting saloon. They may be found on street corners, in parks or at intersections. Out of this huge population, a number of people are self employed, who are running their own enterprises. Some of them are wage workers, employed by informal operators. Many are unpaid family workers. A few trade legal goods and services. The legal status of these workers is less important, but their conditions of work are hazardous. These people trade daily near the fast moving traffic in the square with the smoke, dirt and noise that is in the life of city people. If these people will be organised, they can improve their working conditions. The universal and most urgent complaint of informal workers is instability of employment. The impossibility of organizing and bargaining correctively meant of courage, that other urgent demands, concerning wages and benefits, working conditions, health and safety, paid leave and holidays and so on and so forth, could never be raised.

In India women workers are engaged in informal sector. A huge majority of child labours are engaged in unorganised sector. There are self employed farmers in agriculture in rural as well as semi-urban areas, are included in informal sector. There are also informal workers in allied sectors such as livestock, fisheries, self employed workers in forests and plantation workers. There is also big growth of informalisation in non agricultural sector in India. Most informal employment generating industries in manufacturing sector include food, beverages, tobacco, textile, chemicals, metals etc. Non manufacturing sector is highly dominated by informal sector. In this sector huge majority of workforce is engaged in only few sectors including construction, trade, mining, transport, domestic workers, street vendors etc.

The condition of informal work for lakhs of workers in developing country like India is objectively and completely worse, and unprotected. Lakhs of India's poor people, work Scanned with CamScanner, yet never receive more than Rs. 25 to 50 a day for their work. They face low

and uncertain incomes, high levels of hazard associated with their work and the work is not covered by social protections. So doubts create in researcher's mind that is India really a backward country.

1. Informal Sector

Informal labour has, in different instances, been viewed as labour engaged in urban small scale enterprises, as self employment, as labour engaged in "traditional activities", as wholly unskilled labour, and as labour whose use is not subject to any rules or norms. The informal sector consists of units that are unincorporated (i.e. not constituted as separate legal entities of their owners) private enterprises owned by individuals or households, produce goods or services for sale or barter and satisfy a number of criteria, such as, unregistered, small, proprietary or partnership basis, have unregistered employees with less than ten total workers and they do not maintain a complete set of accounts. An enterprise is unregistered when it is not registered under specific forms of national legislation e.g. factories or commercial acts, tax or social security laws, professional groups' regulatory acts. An enterprise is considered small when its size in terms of employment is below a specific threshold i.e. less than ten workers engaged, to be determined according to notional circumstances. The growth of formal employment in the country has been always less than that of total employment GDP of Country.

2. Informal Employment

Informal labour can be mainly categories as labour engaged in urban small scale enterprises, as a self employment. Labour engaged in traditional activities as completely unskilled labour. The labours are those, whose use is not subject to any rules and norms. Informal employment includes:

- (i) Employment in informal sector enterprises.
- (ii) Employers employed in their own informal sector enterprises.
- (iii) Contributing family workers, irrespective of whether they work in formal or informal sector enterprises.
- (iv) Members of informal producers cooperative.
- (v) Employees holding informal jobs in formal sector enterprises, informal sector enterprises or as paid domestic workers employed as households.
- (vi) Own account workers engaged in the productions of goods exclusively for won final use by their household, if considered employed given that two productions comprises as important contribution to total household consumption.

*Informal workers consists of those working either in the informal sector or households, excluding regular works with social security benefits provided by the employers and workers in the informal sector without any employment and social security benefits provided by the employers' (NCEUS)

As the definition of Informal Sector and Informal employment is different from country to country and there are wide variations in case of India also A detailed analysis has done by

NCEUS on 55th Round survey of Informal Non Agricultural Enterprises in 1999-2000, however, the above definition does not make any distinction between agricultural and non-agricultural enterprises. The concept of enterprise is used in India only, in the context of non-agricultural sector. Agriculture forms the largest section of informal sector in all the developing countries including India. It is suggested the each operational holding in the crop production, plantation, forestry, and animal husbandry and fishing activities may be considered as an enterprise for the purpose of applying definition of Informal Sector. The informal employment considers that the workers with informal jobs do not enjoy job security, work security and social security.

Objectives of Paper

1. To study the concept of informal sector and informal workers.
2. To study the number of informal workers in informal sector, percentage etc.
3. To study the importance of informal sector and informal employment.

Data Source

The study is based on published results of NSSO from time to time.

Employment in India

A country's size of employment is completely depending upon its development level. So when any country's production is expanded by which employment increases. During last 3-4 decades, production has increased in almost all sectors in India. Due to this development the level of employment has also been increased.

The employment trend surveys in India were undertaken by NSSO during July 1999 to June 2000 as a 55th round survey, in 2004-05 a 61st round survey and in 2009-10 a 66th round survey. The survey discloses the information regarding total labour force which includes the actual workforce and unemployment in the respective years.

(In Millions)	Labour Force, Work Force and Unemployment		
	1999-2000	2004-2005	2009-2010
Labour Force	406.84	470.14	469.87
Work Force	397.88	458.14	460.17
Unemployment	8.96	11.15	9.70

Source: Rangrajan Kaul, Where is the missing labour force, Economic & Political weekly, Sept. 24, 2011, PP-69.

From the above table it seems that the total labour force between 1999-2000 to 2004-05 has been increased by 63 millions. But during the year 2004-05 to 2009-10 the total labour force has been decreased by 3 lakhs (0.3 million) It is surprised to note that during these year the population has increased by 1.44% and Economic Growth Rate was 8.6% during 1999-2000 to 2004-05 the workforce has been increased by 61 millions. But during 2004-05 to 2009-10 the workforce has been increased only by one million. This may also be called as jobless economic growth. It is happened in India because India's economy has been a mixed economy that is based on public and private sectors. The mixed economic nature of India, even today, produces jobless economic growth.

Employment in Informal Sector

The informal sector surveys were conducted in 1999-2000, 2004-05 and 2009-10 as 55th, 61st and 66th round surveys and data was collected on necessary items for the identification of informal sector and informal workers. The people working in informal sector, have their income very low, they have to work for more hours than regular workers, there is no income as well as social security during the sickness they don't get paid leave, these people do not have any house, or they are living in slums or even on road corners. So that quality of employment is very worst of the people, who are working in informal sector.

Total Employment Sector-wise (In Million) 1999-2000

Sector	Informal workers	Formal Workers	Total
Informal	341.3 (99.6)	1.4 (0.4)	342.7 (100%)
Formal	20.5 (37.8)	33.6 (62.2)	54.1 (100%)
Total	361.8 (91.2)	35.0 (8.8)	396.8 (100%)
2004-2005			
Informal	393.5 (99.6)	1.4 (0.4)	394.9 (100%)
Formal	29.1 (46.6)	33.45 (53.4)	62.4 (100%)
Total	422.6 (92.4)	34.9 (7.6)	457.5 (100%)
2009-2010			
Informal	385.8 (99.42)	2.26 (0.58)	387.34 (100%)
Formal	42.14 (57.82)	30.74 (42.18)	72.88 (100%)
Total	427.22 (92.83)	33.00 (7.17)	460.22 (100%)

Source: GOI, Planning Commission, 12th Five year Plan 2012-17, Volume-III, PP-131.

It is observed from the above table, that in 1999-2000 out of the total employment, the employment in informal sector was 86.01%, in 2004-05 it is remained same but during 2009-10, out of total employment, the employment in informal sector has been reduced to 83.7%. However during 1999-2000 and 2004-05 out of total employment, the employment in formal sector was 13.9% but in the year 2009-10 it has been increased to 16.3%. During 1999-2000 the formal sector employment was 37.8%, which increased to 46.6% in 2004-05 and gone up to 57.8% in 2009-10.

Size of Informal Sector Workers by Status %

Status & Year	Rural %		Urban %		All %	
	Male	Female	Male	Female	Male	Female
S.E.						
1999-00	55.0	57.3	41.5	45.3	52.8	55.6
2004-05	58.1	63.7	44.8	47.7	56.5	58.9
2009-10	53.5	55.7	41.1	41.1	50.0	53.3
R.W.						
1999-00	8.8	3.1	41.7	33.3	14.0	7.3
2004-05	9.0	3.7	40.6	35.6	15.2	8.5
2009-10	8.5	4.4	41.9	39.3	17.7	10.1
C.W.						
1999-00	36.2	39.6	16.8	21.4	33.2	37.1
2004-05	32.9	32.6	14.6	16.7	28.3	32.6
2009-10	38.0	39.9	17.0	19.6	32.2	36.6

Source: EPW Research Foundation, India, A Pocket Book of Data Series 2012, PP-175

From the above table it is also seen that in 1999-2000 out of total employment about 91.2% were in informal sector, which has been increased in 2004-05 to 92.4% and in 2009-10 it is reached to 92.8%. It is clear from the above table that only 7% are working the formal sector. It is concluded from the above table that there is no increase in formal sector employment since 1999-2000. During 1999-2000 in formal sector 33.7 million, in 2004-05 33.4 million and in 2009-10 it is further reduced to 30.74 million people were working. It means that in formal entrepreneurs have employed more and more workers on contract basis.

From the above table, it seems that from 1999-2000 to 2004-2005 there was a change in the status of casual workers, that it has been decreased in rural and urban male and female, due to increase in self Employed people in above groups. However, in between 2004-05 and 2009-10 there has been an increase in casual workers of above all four status workers. The maximum casualisation has been increased in rural female, than the rural male. In 2004-05 the casual rural female workers' share was 32.6%, while in 2009-10 it is increased to share was 39.9% in 2004-05 the casual rural male workers share was 32.9% which increased to 38% in 2009-10. During 2004-05 to 2009-10 the workforce of casual workers have been increased because of construction sector in urban area and due to MANREGA in rural area.

Formal and Informal Sector Workers

The formal and Informal sector workers as per 55th round (1999-2000) and 61st round (2004-05) surveys were worked out and as per both the rounds, more than 86% of the employment was in informal sector.

Formal & Informal Workers (In Millions)

Sector	1999-2000			2004-2005		
	Informal	Formal	Total	Informal	Formal	Total
Agriculture	232.21 (97.70)	5.47 (2.30)	237.67 (100)	252.83 (97.65)	6.09 (2.35)	258.93 (100)
Industry	44.81 (69.05)	20.08 (30.95)	64.89 (100)	60.35 (70.4)	25.38 (29.06)	85.73 (100)
Services	65.62 (69.67)	28.57 (30.33)	94.20 (100)	81.72 (72.44)	31.09 (27.56)	112.81 (100)
Total	342.64 (86.36)	54.12 (13.64)	396.76 (100)	394.90 (86.32)	62.57 (13.68)	457.46 (100)

Note: Figures in the brackets indicate %

Source: NCOS 55th and 61st Round survey on employment and unemployment.

From analysis of the above table it is seen that, during 1999-2000, in Agricultural sector the informal workers were about 97.7% while it was marginally reduced to 97.65% in 2004-05. In case of industry, that share of the informal sector workers during the above two years were 69.05% and 70.4% respectively. The share of informal sector in the services however, increased from 69.67% in 1999-2000 to 72.44% in 2004-2005.

The above table shows the informal and formal sector workers by sector and sex in 1999-2000 and 2004-05. It seems that above 95% of the rural workers are informal workers, except male workers who are 0.37% less. As per 2004-05, 61st round survey 94.5% of female workers are informal workers as compared to 1999-00, it was 97.78%. In urban area also

Distribution of Workers by Sector, Area and Sex

Sector	Sex	Informal Sector		Formal Sector		Total	
		1999-2000	2004-2005	1999-2000	2004-2005	1999-2000	2004-2005
Rural	M	186.17 (94.63)	197.87 (90.33)	10.57 (5.37)	21.17 (9.67)	196.74 (100)	219.04 (100)
	F	101.71 (97.78)	117.21 (94.50)	2.31 (2.22)	6.82 (5.50)	104.02 (100)	124.03 (100)
	P	287.88 (95.72)	315.08 (91.84)	12.88 (4.28)	27.99 (8.16)	300.76 (100)	343.07 (100)
Urban	M	58.33 (75.7)	61.94 (68.52)	18.72 (24.3)	28.46 (31.48)	77.05 (100)	90.40 (100)
	F	15.33 (81.91)	17.88 (74.5)	3.43 (18.9)	6.12 (25.5)	18.96 (100)	24.00 (100)
	P	73.86 (76.93)	79.82 (69.77)	22.14 (23.6)	34.58 (30.22)	96.01 (100)	114.40 (100)
Total	M	244.50 (89.3)	259.81 (83.96)	29.28 (10.7)	49.63 (16.04)	273.78 (100)	309.44 (100)
	F	117.24 (95.33)	135.09 (91.26)	5.74 (4.67)	12.94 (8.74)	122.98 (100)	148.03 (100)
	P	361.74 (91.17)	394.90 (86.32)	35.2 (8.83)	62.57 (13.68)	396.76 (100)	457.46 (100)

Source: NSSO 55th and 61st Round Survey, Computed figures.

the share of female workers is higher (81.91%) than male (75.7%) in 1999-00 as against 74.5% and 68.54% in 2004-05 respectively. Out of the total workers in informal sector in rural area in 1999-2000 was 95.72%, however it has been reduced to 91.84% in 2004-05. Out of the total workers in urban area in informal sector in 1999-2000 was 76.93% as compared to 69.77% in 2004-05. It is also observed that in case of informal sector workers that the share of male and female workers in the formal sector increased over the years and also between 1999-00 and 2004-05.

The Indian Scenario

Indian economy is characterized by existence of vast majority of informal or unorganized labour employment. According to economic survey in 2007-08, there is significant growth in number of casual workers and declined in number of regular workers. The labour market of India is passing through tremendous transformation. There is growth of informal sector activities and low quality of employment. Workers organization become weak and decline in social security. Globalization is increasing the number of informal employment; workplaces are scattering and are fragmented.

Conclusions/Findings

While studying informal sectors and employment scenario in India, the following issues have been found.

1. The meaning of the concept informal sector and informal employment is much more appropriate in Indian context.

2. The number of workers in India across different industry groups in informal sector is fairly large.
3. The number of informal sector workers in 2009-10 was 385.08 millions in India contributing to 83.7% of the total workers.
4. It is observed that the informal sector workers and formal sector workers have been increased from 1999-00 to 2009-10.
5. It is also seen that the female workers in formal as well as in informal sector have been increased to certain extent.
6. It is observe that the informal sector workers in agriculture sector have been reduced vary slightly (0.05%) but in Industry and services informal sector workers have been increased by 20.84% and 18.61% respectively during 1999-00 to 2004-05.
7. It is observed that there is an increasing casualisation or increase in contract labour in the formal sector without any social security, or economic benefits in a matter of great concern for the policy makers.
8. It is a general case that huge majority of informal sector workers are still unorganised.
9. It is also seen that existing organisations of informal sector workers are continuously facing the challenges in various ways for sustaining themselves.
10. It is widely acknowledged that the informal sector in India suffers from a low productivity syndrome, compared to the formal sector; the prominent features of the sector are lower real wages and poor working or living conditions

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**STATE LEVEL SEMINAR
ON
CURRENT SCENARIO OF INDIAN ECONOMY**

Organised By

Maratha Vidya Prasarak Samaj, Nashik

ARTS AND COMMERCE COLLEGE, SATPUR, TAL. & DIST. NASHIK - 422 007.

DEPARTMENT OF ECONOMICS



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परकीय थेट गुंतवणूक आणि भारत : दशा आणि दिशा.

जयवंत भदाणे

अर्थशास्त्र विभाग प्रमुख,

कर्म.रामरावजी आहिर महाविद्यालय देवळा (नाशिक)

भारत हे वेगाने विकास करणारे राष्ट्र आहे. स्वातंत्र्यप्राप्तीच्या वेळी भारतीय अर्थव्यवस्था मागसलेली आणि अल्पविकसित होती. पंडित नेहरुंनी एका समर्थ आणि वैभवशाली भारताचे स्वप्न पाहिले. त्यादृष्टीने धोरणेही राबविली. नियोजनाच्या माध्यमातून विकासाचे रचनात्मक असे कार्यक्रम राबविले गेले. विविध क्षेत्रात भारत आत्मनिर्भर करण्याचे प्रयत्न झाले. सर्वच योजना यशस्वी झाल्या असे नाही. मात्र अपयश, अडथळे पार करीत भारताची विकासाकडे वाटचाल सुरुच राहिली. आज भारताची अर्थव्यवस्था ही जगातील पहिल्या १० अर्थव्यवस्थांमध्ये एक आहे. क्रयशक्तीच्या समानतेच्या निकषानुसार जगात भारताचा तिसरा क्रमांक लागतो. जागतिक बँकेने तर असे भाकित केले आहे की, २०१५-१६ मध्ये भारताचा विकास दर ७.५% च्या पुढे राहील आणि भारत चीनलाही मागे टाकणार आहे. ओतराष्ट्रीय नाणेनिधीच्या म्हणण्यानुसार गुंतवणूकीतील वाढ, आर्थिक निती, कच्च्या तेलाच्या कमी होणाऱ्या किंमती यामुळे भारताची विकासाकडे दमदार वाटचाल असणार आहे.

असोसिएटेड चॅम्बर्स ऑफ कॉमर्स अँड इंडस्ट्री ऑफ इंडिया (असोचेम) ने केलेल्या अभ्यासानुसार आर्थिक सुधारणांना वेग आला असून गुंतवणूकीतील अडथळे दूर झाले आहेत. रिझर्व्ह बँकही चालु खात्यावरील तूट कमी करण्यास सरकारला सहाय्य करीत आहे. चालु आर्थिक वर्षात देशातील परकीय वित्त संस्थांची गुंतवणूक थेट परकीय गुंतवणूकीपेक्षा जास्त राहण्याची शक्यताही असोचेमच्या अहवालात वर्तविण्यात आली आहे. परकीय देशातून भारतात जो पैसा गुंतविला जातो त्याला परकीय गुंतवणूक म्हणतात. ही गुंतवणूक परकीय संस्थात्मक गुंतवणूक आणि परकीय थेट गुंतवणूक या दोन प्रकारची असते. पहिल्या प्रकारात फक्त पैसा गुंतविला जातो, जो कधीही देशाबाहेर जाऊ शकतो. मात्र थेट गुंतवणूक ही विविध उद्योग प्रकल्पांमध्ये केलेली कायमस्वरूपी गुंतवणूक असते. ती अधिक फायदेशीर असते. या थेट गुंतवणूकीसाठी सरकारने प्रामुख्याने दूरसंचार, विमा क्षेत्र, हवाई वाहतूक, नैसर्गिक वायु, संरक्षण अशी क्षेत्रे खुली केली आहेत. उदारीकरण आणि जागतिकीकरण यामुळे गुंतवणूकविषयक मान्यतेच्या प्रक्रियेतील गुंतागुंत कमी झाली आहे. नवीन उद्योग, अधिक उत्पादन, मागणीनुसार पुरवठा, स्पर्धा, महागाईवर नियंत्रण या गोष्टी यामुळे शक्य होणार आहेत. उद्योगांचा विकास झाला म्हणजे रोजगार वाढेल. दारिद्र्य, बेकारी, बेरोजगारी कमी होईल, मागणी वाढेल आणि मंदी कमी होईल. संरक्षण, माहिती तंत्रज्ञान, दूरसंचार इत्यादी क्षेत्रांच्या विकासास चालना मिळेल.

२००८ ते २०१० या काळात जगभर मंदीची लाट जाणवली. युरोप, अमेरिकेतील शेअर्स मार्केट बरोबरच अनेक नामांकित कंपन्यांना याचा फटका बसला. अशावेळी भारत सरकारने थेट परकीय गुंतवणूकीसाठी उदारमतवादी धोरण राबवून आर्थिक विकासाचा संकल्प सोडला. भारतात परकीय कंपन्यांना उत्पादनात गुंतवणूक करण्यासाठी प्रोत्साहन दिले गेले. अस्तीत्वात असलेला उद्योग खरेदी करणे, त्याचा विस्तार करणे हा या गुंतवणूकीचा मूळ हेतू आहे. भारतात श्रमिकांची संख्या प्रचंड प्रमाणात आणि स्वस्तात उपलब्ध आहे. व्यापार वृद्धीसाठी कर सवलती दिल्या जातात. मालाची प्रतवारी करून तो ब्रँडिंग करून आकर्षक पॅकिंगमध्ये निर्यात केला जातो. त्यातून आर्थिक विकास साधला जात आहे. म्हणूनच देशाच्या अर्थव्यवस्थेला भक्कम व विकसित बनविण्यासाठी एफ.डी.आय. हा एक मार्ग आहे. अमेरिका, सिंगापूर सारख्या विकसित देशांनी एफ.डी.आय. चे धोरण फार पूर्वीच राबविले आहे. परकीय थेट गुंतवणूकीमुळे अमेरिकेत ५.७ दशलक्ष लोकांना विविध क्षेत्रात रोजगार संधी उपलब्ध झाल्या आहेत. जपान, इंग्लंड, फ्रान्स, जर्मनी, कॅनडा, नेदरलँड या देशातील विविध उद्योगांनी अमेरिकेत गुंतवणूक केली आहे. अमेरिकेत एफ.डी.आय. ला कायम प्राधान्य आहे. या परकीय गुंतवणूकीतूनच अमेरिकेत १३% कामगारांना वेतन दिले जाते हे देखील महत्वाचे. म्हणून अमेरिका याबाबत अव्वल स्थानी आहे. अमेरिकेपाठोपाठ चीनही दुसऱ्या क्रमांकावर जाण्याच्या प्रयत्नात आहे.

भारतातील परकीय गुंतवणूकीचे धोरण-

आर्थिक सुधारणांच्या कार्यक्रमाच्या सुरुवातीलाच १९९० पासून भारतात एफ.डी.आय. वर भर देण्यात आला आहे. नोकऱ्या, दूरसंचार क्षेत्र, बांधकाम क्षेत्र, संगणक सॉफ्टवेअर या क्षेत्रात एफ.डी.आय. चे प्रमाण वाढले आहे. हवाई सेवेत भारताने हे प्रमाण ४.९% वाढविले आहे. ब्रॉड कास्ट क्षेत्रात ७४%, मल्टी ब्रॉड रिटेलमध्ये ५१% तर सिंगल ब्रॉड रिटेलमध्ये हे प्रमाण १००% आहे. २००७ मध्ये १५१ देशांत अमेरिकेनंतर इंग्लंड, फ्रान्स यांचे एफ.डी.आय. स्टॉक ऍट होम मध्ये क्रमांक आहेत. भारताचा ३२ वा क्रमांक होता. तो २०१०

मध्ये ३२ व्या स्थानी आला. भारतात परकीय शेट गुंतवणूकीत मॉरिशसला मागे टाकून सिंगापूर अखिल स्थानावर असल्याचे दिसते. २०१३-१४ मध्ये भारतातील शेट परकीय गुंतवणूकीतील २५ % गुंतवणूक एकट्या सिंगापूरची आहे. जवळपास ५.१८ अब्ज डॉलर्सची गुंतवणूक सिंगापूरने केलेली आहे. भारतातील बंदरे, विमानतळ, महामार्ग आणि अन्य पायाभूत सुविधांच्या विकासासाठी मार्च २०१७ पर्यंत एक महागड अमेरिकन डॉलर्सची शेट परकीय गुंतवणूक अपेक्षित असल्याचे सरकारी सुत्रांकडून वेळोवेळी सांगितले जात आहे. पंतप्रधान नरेंद्र मोदी यांच्या विविध देशांतील दौऱ्यांमुळे, तेथील उद्योगपतींना, सरकारांना भारतात गुंतवणूक करण्याबाबत केलेल्या आवाहनामुळे एफडीआयचा ओघ मोठ्या प्रमाणात वाढला आहे. जपानने ३५ अब्ज डॉलर्सची गुंतवणूक करण्याचे मान्य केले आहे. द. कोरियाने १० अब्ज डॉलर्स, चीनने १० अब्ज डॉलर्स गुंतवणूक करण्याचे वकूल केले आहे. आफ्रिका परदेश दौऱ्यात मोदींनी गुगल, मायक्रोसॉफ्ट, फेसबुक यांच्याशी चर्चा करून गुंतवणूकीचे आवाहन केले आहे. आणि हे सर्व अधिकारी भारतात येऊनही गेलेत. मेक इन इंडिया च्या घोषणेमुळे इन ऑफ इंडिया विज्ञानेस च्या यादीत भारताचे स्थान वरच्या क्रमांकावर आले आहे. थोडक्यात मोदींनी गुंतवणूकीच्या दृष्टीने योग्य असे वातावरण देशात तयार करण्याचे जाणीवपूर्वक प्रयत्न केले आहेत. या प्रयत्नांची दाखल जागतिक बँकेनेही घेतली आहे. अमेरिका आणि चीनपेक्षाही भारतातील शेट परकीय गुंतवणूक वाढल्याचे प्रमाणपत्रच जागतिक बँकेने दिले आहे.

शेती क्षेत्रातील परकीय शेट गुंतवणूक

भारतातील शेती क्षेत्राचा वाटा (जीडीपी) १७% आहे. भारतातील ६०% लोक शेती व्यवसायात गुंतलेले आहेत. शेती उत्पादन करणाऱ्या शेतकऱ्यांना त्याचा फायदा वाढविण्यासाठी शेती क्षेत्रात एफ.डी.आय. चा उपयोग करून ग्रामीण भागातील शेतकरी वर्गाचे उत्पादन वाढून राहणीमान सुभारचे हाच कृषी क्षेत्रात एफ.डी.आय. आणण्याचा सरकारचा प्रयत्न आहे. त्यातून आर्थिक विकास साधणे हे त्यामागील धोरण आहे. आजची सत्य स्थिती ही आहे, की शेतीमाल उत्पादन करणाऱ्या शेतकरी वर्गाला त्याच्या कष्टाच्या ४०% मिळवत, तर मध्यस्थ आणि गिऱ्हाडकांना ६०% फायदा अशा विचित्र स्वस्थ्याचे शेतीमाल उत्पादनाचे गणित अस्तित्वात आहे. भारतात पाच ते सात टक्के भाव्याची नासाडी होते आणि १५ ते ३०% फळे आणि भाजीपाला उत्पादनाची नासाडी होते. १ एप्रिल, २०११ रोजी कृषी क्षेत्रासाठी एफ.डी.आय. चे विशेष धोरण बँक सरकारने घोषित केले. त्यानुसार परदेशी गुंतवणूकीचे भारतातील प्रमाण कमी झाल्याने धोरणात्मक बाबीत काही बदल करणे भारत सरकारला गरजेचे वाटू लागले. सकारात्मक बदल घडवून आणण्याच्या दृष्टीने एफ.डी.आय. द्वारे कृषी क्षेत्रात परकीय गुंतवणूकीस प्राधान्य देण्याचे धोरण आणि त्यानुसार बियाणे, वनस्पतींच्या लागवडीसाठी लागणारे साहित्य, फलोद्यान, फुलशेती, रोपे उत्पादन, पशू व दुग्ध व्यवसाय, मत्स्य व्यवसाय, अळिंबी उत्पादन अशा क्षेत्रात नियंत्रित वातावरणात उत्पादन करण्यावर भर देऊन परकीय गुंतवणूकीस चालना दिली जात आहे.

भारतात फळे व भाव्यासाठी शीतगुहाची सोय गरजेची असून, भाव्य माल साठविण्यासाठी गोदाम साखळी गरजेची आहे. ग्रामीण भागातील रस्ते, वीज, पाणी इत्यादी सुविधांत वाढ आणि सुधारणा करावी लागेल. सुधारित तंत्रज्ञान, पॉलिहाऊस मधील उत्पादन तंत्रज्ञान याबरोबरच अद्यावत दुग्धविकासाचे ज्ञान आणि त्याबरोबरचे मार्केट सुविधा, प्रतवारी, पॅकिंगचे ज्ञान आणि सुविधा या सर्व बाबींमध्ये आमूलाग्र बदल हाणे क्रमप्राप्त आहे. एफ.डी.आय. मुळे परदेशी कंपन्यांनी शेती क्षेत्रात गुंतवणूक केल्यास अशा प्रकारची तयारी असणे गरजेचे आहे. इतर क्षेत्रात एफ.डी.आय. मध्ये वाढ होत आहे. मात्र कृषी क्षेत्रात त्या प्रमाणात वाढ होणे कठीण जात आहे. सध्या परदेशी बियाणे कंपन्यांनी भारतात बियाणे विकणे सुरु केले आहे. शिक्षण क्षेत्रात परदेशातील संस्था गुंतवणूक करीत आहेत. कृषी क्षेत्रात परदेशी भांडवलदार, कंपन्या अगर संस्था फार विचारपूर्वक गुंतवणूक करतील हे सुध्दा तितकेच खरे आहे. कारण भारतातील शेती क्षेत्र मान्सूनच्या पावसावर अवलंबून आहे आणि बदलत्या हवामानानुसार मान्सून पावसाच्या वितरणात बदल होत आहेत. दिवसेंदिवस शेती क्षेत्र वेधवशाचे वनत आहे. अशा परिस्थितीत परदेशी गुंतवणूक काही उदात्तिक चाकोरीतूनच हाईल त्यात फार मोठे काही एकदम घडेल असे असणार नाही.

प्रादेशिक सरकारांना १५ टक्क्यांपर्यंत एफ.डी.आय.द्वारे गुंतवणूक करण्यास परवानगी देण्याचे आणि अन्नधान्य पुरवठ्यात १०० टक्के एफ.डी.आय.चक धोरण केंद्राने स्वीकारले आहे. संपूर्ण देशातील १८५.७ अब्ज डॉलर गुंतवणूकीत इतर राज्यांच्या तुलनेत महाराष्ट्र राज्य शेट परकीय गुंतवणूकीसाठीही हॉट डेस्टिनेशन ठरले आहे. एप्रिल २००० ते ऑक्टोबर २०१२ या काळात महाराष्ट्रात सर्वाधिक म्हणजे ६१.१३ अब्ज डॉलर एवढी परकीय गुंतवणूक झाली होती. कॅपिटल रीजन (एनसीआर) मध्ये ३५.४ अब्ज डॉलर, कर्नाटक- १०.२५ अब्ज डॉलर, तामिळनाडू- ९.६ अब्ज डॉलर, गुजरात- ८.५३ अब्ज डॉलर, आंध्र प्रदेश- ७.४१ अब्ज डॉलर तर पश्चिम बंगाल- २.०४ अब्ज डॉलर इतकी गुंतवणूक होती. या गुंतवणूकीचे प्रमाण एकूण एफडीआयच्या १९ टक्के इतके आहे. म्हणजेच महाराष्ट्र आणि एनसीआर या दोन भागांत निम्म्याहून अधिक परकीय गुंतवणूक झालीय. दोन्ही राज्यांत पायाभूत सुविधांत झालेली वाढ हे परकीय गुंतवणूक वाढण्यामागचेच प्रमुख कारण आहे.

कृषी सेवांमध्ये एफडीआय चा ओघ

गेल्या काही वर्षात देशातील कृषी सेवा क्षेत्रात परकीय थेट गुंतवणूकीचा ओघ वाढला आहे. २००० ते २०१५ या पंधरा वर्षांच्या कालावधीत कृषी सेवांमध्ये ८७४७.४ कोटी रुपयांची गुंतवणूक झाली आहे. एक डझनहून अधिक क्षेत्रात परकीय थेट गुंतवणूक करण्याबाबतचे नियम सरकारने शिथिल केल्यामुळे ४५ टक्क्यांनी जादा गुंतवणूक वाढण्याची शक्यता आहे. विशेषतः कृषी सेवा क्षेत्रातील एफडीआय गुंतवणूकीचा ओघ हा वस्त्रोद्योग, खाण आणि इलेक्ट्रॉनिक्स क्षेत्रापेक्षा अधिक असल्याचे नुकतेच केंद्रीय कृषी राज्यमंत्र्यांनी लोकसभेत एका लेखी उत्तरात सांगितले आहे. कृषीक्षेत्रात गुंतवणूक अधिक होत आहे. गेल्या काही वर्षात कृषी अवजारे निर्मितीत एफडीआयची गुंतवणूक ४१८.६५ दशलक्ष डॉलर एवढी आहे. कॉफी, चहा, रबर, वेलची, पामतेल आणि ऑलिव्ह लागवड आदीमध्ये १०० टक्के एफडीआय गुंतवणूकीला परवानगी देण्यात आली आहे. एफडीआयचा सर्वाधिक ओघ कॉम्प्युटर सॉफ्टवेअर, हार्डवेअर, टेलिकम्युनिकेशन आणि ऑटोमोबाईल या क्षेत्रात अधिक आहे. भारताच्या एकूण देशांतर्गत उत्पन्नात कृषी क्षेत्राचा वाटा २०११-१२ मध्ये १८.४ टक्के होता. २०१२-१३ व २०१३-१४ मध्ये तो १८ टक्के राहीला. २०१४-१५ या वर्षात एकूण देशांतर्गत उत्पन्नात त्यात काही प्रमाणात घट होऊन तो १७ टक्के राहीला आहे.

सप्टेंबर २०१४ ते सप्टेंबर २०१५ या कालावधीत परकीय थेट गुंतवणूक पुढीलप्रमाणे असून २०१४ च्या तुलनेत २०१५ मध्ये १३ टक्के वाढ झाल्याचे दिसते.

महिना व वर्ष	थेट गुंतवणूक दशलक्ष डॉलरमध्ये
सप्टेंबर २०१४	२६७८
ऑक्टोबर २०१४	२६५५
नोव्हेंबर २०१४	१५३७
डिसेंबर २०१४	२१६१
जानेवारी २०१५	४४८१
फेब्रुवारी २०१५	३२८८
मार्च २०१५	२११७
एप्रिल २०१५	३६०५
मे २०१५	३८५०
जून २०१५	२०५४
जुलै २०१५	२००७
ऑगस्ट २०१५	२२२०
सप्टेंबर २०१५	२८९७

स्त्रोत: औद्योगिक धोरण आणि प्रमोशन २०१५

एफ.डी.आय.चे प्रमुख फायदे

- १) ज्या देशात परकीय गुंतवणूक वाढते तेथे विकास वेगाने होतो.
- २) एफ.डी.आय. मुळे नोकरीच्या संधी वाढतात.
- ३) एफ.डी.आय. मुळे नोकरांना चांगला पगार देणे शक्य होते.
- ४) एफ.डी.आय. मुळे शेतकऱ्यांच्या निर्यातक्षम मालास चांगला बाजारभाव मिळणे शक्य होणार नाही.
- ५) एफ.डी.आय. मुळे शेतकऱ्यांचा टिकाऊ माल साठवला जाऊन त्या चांगला भाव मिळणे शक्य होईल.

संरक्षण क्षेत्र आणि एफडीआय:

संरक्षण क्षेत्रामध्ये १०० टक्के थेट परकीय गुंतवणूकीस परवानगी देण्याचा निर्णय घेऊन सरकारने एक चांगले पाऊल टाकले आहे. यामुळे मोठ्या शस्त्रास्त्रांचे आधुनिक तंत्रज्ञान भारतात येण्यासाठी नक्कीच मदत होईल. परंतु हे धोरण प्रत्यक्षात साकार होण्यासाठी या क्षेत्रात काम करणाऱ्या कंपन्यांना भारतात आणण्याचे यशस्वी प्रयत्न झाले तरच या मागचा उद्देश सफल होणार आहे. सध्या भारतात से यासाठी जी शस्त्रास्त्रे वापरली जातात त्यापैकी ७० टक्के शस्त्रास्त्रे आयात केली जातात. स्वातंत्र्य मिळून ६८ वर्षे झाली तरीही आपण

अत्याधुनिक शस्त्रास्त्रे अजूनही देशात तयार करू शकलो नाही. संरक्षण विषयक धोरण ठरवितांना आपण शस्त्रे देशातच तयार करण्याचे ठरवलेही होते त्यानुसार डीआरडीओ (डिफेंस रिसर्च डेव्हलपमेंट ऑर्गनायझेशन) कडून शस्त्रास्त्रांसंदर्भात संशोधन करून शस्त्रास्त्रनिर्मिती करण्यासाठी शास्त्रज्ञांची भरती करण्यात आली आणि शास्त्रीय संशोधनही सुरू झाले. परंतु इतक्या वर्षात डीआरडीओला कुठलीच मोठी शस्त्रे तयार करण्यात यश मिळालेले नाही. उदा. अर्जुन नावाचा रणगाडा ४० वर्षांपासून बनविण्याचे काम सुरू आहे. तसेच तीस वर्षांपासून तेजस नावाचे लढाऊ विमान बनवायचा प्रयत्न सुरू आहे. पण त्यातही अजूनही यश आलेले नाही. त्यामुळे भारताला आजही रशियाकडून रणगाडे आणि मिग विमाने आयात करावी लागतात. गेल्या २५ वर्षांपासून प्रयत्न करत असलेली अरिहत नावाची अणुशक्तीवर चालणारी पाणबुडीही अजून पाण्यात जायला तयार नाही.

म्हणूनच भारतात येऊन रणगाडे व विमाने निर्मिती करण्यासाठी परदेशी कंपन्यांना भाग पाडणे म्हणजे थेट परकीय गुंतवणूक असे म्हणता येईल. याचा अर्थ परदेशी कंपन्या भारतात स्वतःचे कारखाने सुरू करतील किंवा भारतीय कंपन्यांशी करार करून स्वतःचे तंत्रज्ञान वापरून एकत्रितरित्या ही साधने निर्माण करतील. यामध्ये पीएसयू (पब्लिक सेक्टर अंडरटेकॉग) ची, ऑर्डिनेन्स फॅक्टरीची, खाजगी क्षेत्रातील एल. एण्ड टी, किंवा टाटांची मदत घेतली जाऊ शकते. व्यवस्थापनासाठी भारतीय कंपन्यांची मदत घेता येऊ शकते. यासाठी २००१ साली भारत सरकारने २६ टक्के एफडीआय गुंतवणूक करावी असे धोरण ठरवले होते. म्हणजे एकूण गुंतवणूकीच्या केवळ २६ टक्के गुंतवणूक परदेशी असेल आणि उर्वरीत गुंतवणूक भारतीय असणार होती. परंतु सहा वर्षांनंतर जेव्हा याचा मागोवा घेतला तेव्हा एकाही परदेशी कंपनीने भारतात अशा प्रकारे गुंतवणूक करण्यास तयारी दाखवली नाही. तत्कालीन युपीए सरकारचा गैरसमज होता की, आपण २६ टक्के परदेशी गुंतवणूकीचे धोरण जाहीर करताच परदेशी कंपन्या इतक्यात भारतात गुंतवणूक करायला धावतील. त्यातच आपण जर परदेशी कंपन्यांना आपली शस्त्रास्त्रे निर्मिती करण्यासाठी परवानगी दिली तर आपल्या देशाच्या संरक्षणाला धोका निर्माण होईल अशी भितीही सरकारला वाटत होती. परंतु जर आपली ७० टक्के शस्त्रास्त्रे बाहेरूनच येतात तर मग त्यात धोका निर्माण होऊ शकत नाही का ? ही बाब सरकारने विचारातच घेतली नाही. या सगळ्या गोष्टी शिकण्यासाठी दहा वर्षे गेली आणि त्यामुळे गेल्या दहा वर्षात शस्त्रास्त्रे निर्मितीच्या दृष्टीने भारत प्रगती करू शकला नाही.

मोदी सरकारने संरक्षण क्षेत्रामध्ये १०० टक्के थेट परकीय गुंतवणूकीस परवानगी देण्याचा निर्णय घेऊन चांगली सुरुवात केली आहे. या निर्णयामुळे सर्व प्रकारच्या मोठ्या शास्त्रज्ञांचे आधुनिक तंत्रज्ञान जे भारता यायला हवे आहे ते येण्यासाठी नक्कीच मदत होईल. पण केवळ धोरण जाहीर करून बाहेर गुंतवणूकीसाठी रांग लागेल अशी अपेक्षा असेल तर ती चुकीची ठरणार आहे. धोरण प्रत्यक्षात साकार होण्यासाठी या क्षेत्रात काम करणाऱ्या कंपन्यांना भारतात आणण्यासाठी कसून प्रयत्न करावे लागतील. सध्या आपण ज्या परदेशी कंपन्यांकडून पाणबुड्या, विमाने, युद्धनौका विकत घेत आहोत त्यांना भारतात गुंतवणूक करण्यास प्रवृत्त केले पाहिजे. या प्रयत्नांना यश लाभले आणि भारतात येऊन या कंपन्यांनी आपली इंडस्ट्री उभारली व अत्याधुनिक तंत्रज्ञान आपल्या देशात आणले तरच या मागचा उद्देश सफल होईल.

अन्स्ट्रॉम यंग या संस्थेने केलेल्या जागतिक पाहणीत गुंतवणूक डेस्टिनेशन म्हणून भारतच पहिल्या क्रमांकावर असल्याचे स्पष्ट झाले आहे. या संस्थेने ७० देशांमधील मोठ्या नामवंत कंपन्यांच्या १६०० ज्येष्ठ अधिकाऱ्यांशी चर्चा करून या पाहणीचे निष्कर्ष प्रसिद्ध केले. सर्वात महत्वाची गोष्ट म्हणजे गुंतवणूकदारांना अमेरिका आणि चीनपेक्षाही भारत अधिक विश्वासाह वाटत आहे. त्यामुळे इंडिया ग्रोथ स्टोरी संपली असे मानण्याचे काहीही कारण दिसत नाही. या पाहणीनुसार दूरसंचार, मल्टिब्रँड रिटेल वाहनउद्योग, तंत्रज्ञान, लाईफ सायन्सेस आणि ग्राहकोपयोगी वस्तू अशा सर्व क्षेत्रात गुंतवणूकदारांना मोठा रस वाटतो आहे. त्यामुळे येत्या काही काळात लाखो कोटीची गुंतवणूक भारतात होऊ शकते.

संकटातच संधी असते, असे नेहमी म्हटले जाते. ते आपल्या आणि इतरांच्या बाबतीतही तेवढेच खरे आहे. गेल्या वर्षी-दोनवर्षात भारतीय अर्थव्यवस्थेला अनेक लहानमोठे हादरे बसले. शंभरबाजारात गुंतवणूकदारांचे लाखो कोटी रुपये बुडाले. त्यामुळे केंद्र सरकारच्या आर्थिक सुधारणाही मंदावल्या. या सर्वांचा परिणाम म्हणून, भारतीय कंपन्यांनी आपल्या मुख्य उद्योगावरच लक्ष केंद्रीत केले. विविध क्षेत्रांत विस्तारासाठी सुरू केलेल्या अनेक उद्योगांचे काम थांबवण्यात आले किंवा मंदावले. भारतात थेट गुंतवणूक करू इच्छिणाऱ्या उद्योगांना यामध्येच फार मोठी संधी दिसते आहे.

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प्रस्तावना:

पर्यटनाला सर्व जगात अगदी प्राचीन काळापासून महत्त्व दिले गेले आहे. प्रत्येक मालमाला पर्यटन हजेरवेदी वरून विकसित प्रत्येक माणसाची ती गरज आहे व ती जशी जमेल तशी ती भागवतो. जगातील अनेक देशांची अर्थव्यवस्था केवळ या सेवाक्षेत्रात पर्यटनावर आधारित आहे. एक संपूर्ण देश चालविण्याची क्षमता या क्षेत्रात आहे. भारतीय संदर्भातील हजेरवेदी वर्षाव क्षेत्रात आहे. भारताच्या भारतीय, चाण्यात एक समृद्ध इतिहासाचा सुगंध दरवळत आहे. भारताच्या भूमिने आणि इतरत्या साधनेने खरेच पर्यटकांना आपलेसं बरेले आहे. १५ व्या आणि १६ व्या शतकात भारतात अनेक दर्जावरी पर्यटक वेगवेगळ्या देशातून येत होते. अनेक परकीय प्रवासी बौद्ध धर्माच्या अभ्यासासाठी भारतात येत होते. (उदा. युआन च्वांग, फा-हियन). ब्रिटिशकाळात व्यापाराच्या सोयी शोधण्याबरोबरच या पर्यटकांना भारत देश कसा आहे, इतले लोक कामे आहेत हे बघण्याचे अवसरही होते. विविध पुराणकाळातूनही तीर्थयात्रेचे म्हणजेच पर्यटनाचे संदर्भ दिसून येतात. देवदर्शनाच्या निमित्ताने नवीन ठिकाणे, देशातून, तीर्थयात्रेची पर्यटकांना प्रवृत्ति करतात. मुळात कोणत्याही अर्थव्यवस्थेला पर्यटन आणि पर्यटक हे नेहमीच हजेरवेदी वरून येतात. पर्यटनामुळे विविध राज्यात सर्वे उपलब्ध होतात. हस्तकला, पारंपारिक कलाकुसर, आतिथ्य, व्यापार व उद्योगांना प्रत्येक मिळणवयाबरोबरच देशाला परकीय चलनाची मिळते.

पर्यटन आणि अर्थव्यवस्था:

पर्यटनामुळे आर्थिक विकासाला चालना मिळते. आंतरराष्ट्रीय सामंजस्य वाढते. वाहनपूरक, हॉटेल्स, बँकिंगच्या क्षेत्रात राज्याच्या संपूर्ण निर्माण होतात. याशिवाय अप्रत्यक्षपणे शेती, बांधकाम, पशुपालन, मासेमारी, वाहनपूरक, दुग्ध उत्पादने या क्षेत्रातही राज्यात उपलब्ध होतो. भारतातील पर्यटन उद्योग एकूण देशांतर्गत उत्पादनात ६.८ टक्क्यांचे योगदान देतो. परकीय चलन मिळवून देण्या हा विकास क्षेत्राचा उद्योग आहे. २०१४-१५ या वर्षात भारतातील पर्यटन आणि हॉटेल्सची उलाढाल सुमारे २८ लाख कोटींच्या इतकी होती. पुढील दहा वर्षात हीच उलाढाल ५८ लाख कोटीपर्यंत पोहचू शकते. या उद्योगात विविध स्तरात २ कोटीहून अधिक लोकं काम करत आहेत. आज आशिया खंडात चीननंतर भारतच पर्यटनाची दुसरी मोठी बाजारपेठ असून जगातील आसट्याने प्रगती करणाऱ्या पहिल्या २० पर्यटन केंद्रांमध्ये भारत ११व्या स्थानावर आहे. भारतीय पर्यटन उद्योग हा समुद्र सफरी, साहस पर्यटन, वैद्यकीय आणि स्वास्थ्य पर्यटन, क्रीडा पर्यटन, औद्योगिक सभा संमेलने, प्रदर्शने अशा विशेष सेवांसाठी प्रसिद्ध आहे. सन २००० मध्ये भारतात सुमारे २६ लाख परदेशी पर्यटक आले. २०१३ मध्ये हीच संख्या ६८ लाखांवर पोहोचली. २०१४ मध्ये भारतातूनही सुमारे १० लाख पर्यटक युरोपात गेले. परदेशातून येणारे पर्यटक हे प्रामुख्याने अमेरिका व इंग्लंड या देशातून येतात. त्याचप्रमाणे रशिया, जर्मनी, जपान, फ्रान्स, केनडा, मलेशिया इत्यादी देशांमधूनही मोठ्या संख्येने पर्यटक भारतात येतात. लोकांची ही गरज ओळखून पर्यटकांसाठी आज व्यावसायिक बनू लागले आहे.

पेट्रोलियम पदार्थ, दागिने आणि दळणवळण संसाधने यानंतर विदेशी चलन मिळविण्याचे पर्यटन हे चौथे साधन आहे. पर्यटनामुळे प्रादेशिक विकासाला चालना मिळालेली आहे. त्याचबरोबर देशादेशातील सामंजस्य वाढून एक-दुसऱ्याकडूनचे गैरसमज दूर होण्यासाठी पर्यटन आवश्यकच आहे. भारताच्या अर्थव्यवस्थेत पर्यटनाचे योगदान हे गरिबी निर्मुलन व तांत्रिक ज्ञानाच्या आदान प्रदानासाठी महत्वाचे आहे. २०१२ या वर्षात ६.६५ दशलक्ष विदेशी पर्यटकांनी भारताला भेट दिली. यातून भारताला ९४ हजार ४८७ कोटी रुपयांचे परकीय चलन मिळाले. १३ टक्क्यांच्या वार्षिक वाढीसह भारताला पर्यटनातून मिळणारे उत्पन्न २०१५ पर्यंत २६ बिलियन डॉलर इतके वाढू शकते असा असोचेंच या अंदाज होता.

पर्यटन एक करिअर:

आपला देशच नव्हे तर परदेशी फिरायला जाणं, तिपली ठिकाणे पाहणं ही गोष्ट काही नवीन राहिली नाही. मात्र परक ठिकाणे जायचं म्हणजे तिथे जाण्याची, राहण्याची, खाण्या-पिण्याची व्यवस्था असं सगळंच बघायचं लागतं. त्यामुळे एखाद्या ट्रेव्हल कंपन्यात ही जबाबदारी दिली जाते. त्यामुळे ट्रेव्हल आणि टुरिझमचा व्यवसाय प्रचंड प्रमाणात वाढला आहे. पर्यटन मार्गदर्शकांची संख्याही वाढते आहे. या क्षेत्राशी संबंधित अभ्यासानुसार बुकींग एजंट, टूर ऑपरेटर, गाईड, हॉटेलिंडे, कन्सल्टंट, बँकिंग सेवा अशा अनेक क्षेत्रात राज्यात

उपलब्ध होऊ शकतो. महत्वाचे म्हणजे भारतीय लोकांमध्ये रमलेली "अलिप्ता येते सर्व" ही प्रचलित भाषा कोणत्या भाषाभाषीतून आलेली आहे. पर्यटन व्यवसायातून देशाला परकीय चलन प्राप्त होऊ असल्याने देशाच्या अर्थव्यवस्थेला फायदा होऊ शकतो. पर्यटनाला चालना देण्यासाठी खाजगी व्यावसायिकांबरोबरच सार्वजनिक काही व्यक्ती, संस्था, सरकार, विद्यापीठ, विमानतळ, हॉटेल आणि कार्पेट सव्हीसेस, एयरलाईन्स आणि हॉटेल ही तर येथे पर्यटकांची निमणिल आवांतीही काही काळ करत. त्यांची संख्या मनुष्यांच्याची इथे गरज आहे.

भारतातील पर्यटनाचे महत्त्व

भारतात बर्फाच्छादित हिमालय, हिरवीगार जंगले, राजस्थानातील वाळवंट, काश्मिर असे समुद्र किनारी, समुद्र, जगातूनही त्याचप्रमाणे मुंबई, दिल्ली, अहमदाबाद, जयपुरसारख्या खोदीयादीच्या पौर्या काळापासून, विमानतळ, रेल्वे, वाहतूक यासाठी पर्यटन करत. काश्मिर, माउंटअबु, उटी ही पर्यटकांना भुरळ पाडणारी गिरिस्थाने भारताच्या दौःख्यातील समुद्राप्रमाणे आहेत. गोंयाच्या आर्थिक विकासात पर्यटन हाच महत्वाचा घटक आहे. महाराष्ट्रातील शमुद्रकिनारा तर पर्यटकांचे विशेष आकर्षण आहे. गोंयाच्या आर्थिक विकासात पर्यटन हाच महत्वाचा घटक आहे. महाराष्ट्रातील पाषाणातील अप्रतिम कलाविष्कार म्हणून प्रसिद्ध असलेल्या अजिंठा व वेरुळच्या लेखा, खजुराहो, जगदील खत काश्मिरातील एक असलेला ताजमहाल, हैद्राबाद, मैसूर, बडोदा, इंदूर ही ऐतिहासिक शहरे, सोमनाथ, कोणकरी पेट्रे, सांचीचा स्तूप, अमृतसरचे सुवर्णमंदिर, राजस्थानातील राजबाडे, जम्मू- काश्मिर, केरळ व कोकणाचे निरर्ग सौंदर्य हे सर्व पर्यटकांना आकर्षित करतात. भारतात येणाऱ्या परदेशी पर्यटकांपैकी जर्मन पर्यटकांना प्रामुख्याने समुद्रकिनारी आकर्षित. तर इंग्लिश आणि फ्रेंच आनंदी होतात. भारतात येणाऱ्या परदेशी पर्यटकांपैकी जर्मन पर्यटकांना प्रामुख्याने समुद्रकिनारी आकर्षित. तर इंग्लिश आणि फ्रेंच पर्यटकांना प्राचीन शिल्पांचे आकर्षण असते. जपानचे पर्यटक बौद्धकालीन वास्तूंना भेटी देतात. भारतात येणाऱ्या परदेशी पर्यटकांपैकी उत्तर भारतात ४९ टक्के, पश्चिम भारतात २९ टक्के, दक्षिणेकडे १८ तर पूर्वेकडे ४ टक्के पर्यटक विभागले जातात. भारतातील काही समुद्र पर्यटन, मेडिकल टुरिझम, इको टुरिझम, कृषी पर्यटन, आध्यात्मिक पर्यटन, सहस्री पर्यटन, ऐतिहासिक पर्यटन हेही महत्वाचे आहेत.

पर्यटन व्यवसाय रोजगारासाठी महत्वाचा आहे. यात हॉटेल्स, उपहारगृहे, वाहतूक, मार्गदर्शक या क्षेत्रांतून मोठ्या प्रमाणावर रोजगार मिळतो. त्याचप्रमाणे पर्यटकांच्या मागणीनुसार विविध कलाकुसरीच्या वस्तू, भरतकाम व हस्तकाम, फुले, फुले यातूनही रोजगार उपलब्ध झाला आहे. महत्वाचे म्हणजे पर्यटन स्थळांच्या विकासासाठी रस्ते, रेल्वे, इमारती, विमानतळे व बोधकाने केली जातात त्यातही अनेकांना रोजगार उपलब्ध झालेला आहे. स्थानिक आणि परदेशी पर्यटकांच्या विविध स्थळांच्या भेटेमुळे निर्माण होणाऱ्या रोजगाराचे महत्त्वही काही कमी नाही. म्हणजेच पर्यटनस्थळातील निम्मापेक्षा अधिक लोकसंख्या प्रत्यक्ष अस्तित्वातल्या पर्यटनाशी संबंधित रोजगारात गुंतलेली आहे.

वैद्यकीय आणि स्वास्थ्य पर्यटन:

वैद्यकीय आणि स्वास्थ्य सेवेकरिता अनेक परदेशी नागरीक विशेषतः मध्य पूर्व अशिया खंडातून आणि क्वातोल इत याकरिता आकर्षित करत आहेत. वैद्यकीय पर्यटनात दरवर्षी सुमारे ३० टक्के वाढ होत आहे. २०१५-१६ मध्ये या क्षेत्राची उलाढाल सुमारे साडेचार पाच लाख कोटींच्या घरात जाण्याचा अंदाज आहे. भारताच्या सांस्कृतिक व ऐतिहासिक स्थळांना भेटी देणाऱ्यांबरोबरच पर्यटक भारतातील प्राचीन आयुर्वेदिक उपचार घेण्याच्या हेतूने अथवा कृषी पर्यटनासाठी भारतात येतात. त्याचप्रमाणे योगाभ्यास किंवा योगसाधनेसाठीही परदेशी पर्यटकांची भारताला पसंती आहे. अमेरिकेसारख्या विकसित राष्ट्रात वैद्यकीय उपचार प्रबंध म्हणून घेतल्याने अनेक अनिवासी भारतीय भारतात आपल्या नातलागांना भेटण्याच्या निमित्ताने येऊन वैद्यकीय तपासण्या व उपचार करून घेत आहेत.

कृषी पर्यटन:

१६ मे हा दिवस जागतिक कृषी पर्यटन दिन म्हणून सर्वत्र साजरा केला जातो. "कृषी पर्यटन" ही एक नवीन संज्ञा किंवा संकल्पना मूळची ब्राझील, ऑस्ट्रेलिया, न्यूझीलंड या देशांमधील आहे. इटली, जपान, कॅनडा व युरोपीय देशांमध्येही कृषी पर्यटन लोकप्रिय आहे. भारतासारख्या कृषीप्रधान देशात कृषी पर्यटन ही संकल्पना सध्या चांगलीच रुजू लागलेली आहे. यामध्ये पर्यटक आणि कृषक यांचे एकत्रित सांगड घातली जाते. जागतिक पर्यटन आणि प्रवास परिषदेच्या अहवालानुसार या व्यवसायाने भारतात १८.४ दशलक्ष रोजगार उपलब्ध करून दिले आहेत. या माध्यमातून राष्ट्रविकासासाठी आणि विशेषतः ग्रामीण भागातील रोजगारक्षमतेच्या विकासासाठी मदत मिळाली आहे. भारतीय शेत्याचे जागतिक महत्त्व आणि तिची वैविध्यता यामुळे बहुसंख्य परदेशी पर्यटकांची याकडे आतर्क कृषी पर्यटन

केटाकडे वाटू लागली आहेत. भारताच्या कलाकोपन्यात आज कृषी पर्यटन केंद्रे वहरू लागली आहेत. शेती करता करता पुरवठा व्यवसायातून चार पैसं कमावण्याची संधी या व्यवसायातून शेतकऱ्यांना मिळत आहे. कृषी पर्यटनाचे भविष्यातील फायदे बहुआयामी असणार आहेत. आज शेतीमालाच्या दराबाबतच्या अनिश्चिततेमुळे शेतकऱ्यांना उत्पादन खर्चही मिळत नाही. अशा परिस्थितीत प्रयोगशील शेतकऱ्यांनी कृषी पर्यटन व्यवसाय नियोजनबद्ध आणि व्यवस्थापन तत्वाचा अवलंब करून सुरु केला आहे. बांधावरून पर्यटक घाईकांना ताजा भाजीपाला, फळे, फुले, स्थानिक कलाकारांनी तयार केलेल्या कलाकसरीच्या वस्तू, महिला वस्त्र गटांची उत्पादने यामागे कृषी प्रदर्शन केंद्रे ही सक्षम बाजारपेठ निर्माण केली आहे.

शहरातील भावपळ व तणावपूर्ण दिनचर्याला कंटाळलेल्या पर्यटकांच्या मरगळलेल्या मनाला व शरीराला गावातील व शेतकरी प्रदूषणमुक्त निरव शांततेचा, रात्रीच्या शीतल चांदण्याचा, पहाटेच्या धुक्याचा व गारव्याचा, पानांवरील दबबिंदूंचा, उषःकालीन रंगांच्या उधळणीचा, पक्षरांच्या किलबिलाटाचा, मातीच्या सुगंधाचा, पानांच्या सळसळीचा तसेच नदीकाठावर सकाळी बसण्याचा, मन उत्कृष्टित करून नैराश्य, ताणतणाव दूर करणारा अनुभव येतो. त्यामुळे या लोकांना ग्रामीण भागाविषयी ओढ वाटू लागली आहे. ग्रामीण खाद्य संस्कृतीचा परिचय या मंडळींना होत आहे. चमचमीत पदार्थ आणि ग्रामीण चव असलेले जवण हे प्रमुख आकर्षण असते. यामध्ये विविध घान्य प्रकारची भाकरी, पुरणपोळी, विविध भाज्या, बाग्याचे भरीत, मिरचीचा खड्डा, कुळदाचे शेंगोळे, पाट्या वरवंट्यावर वाटलेल्या मसाल्याची चुलीवरची भाजी, चुलीवरच्या भाकरी त्यांच्यासमोरच बनवून मिळतात आणि गवताने साकारलेल्या किवा शेणाने सारवलेल्या अंगणात, आमराईत, हिरव्यागार झाडाखाली माचणीसारखी व्यवस्था करून भोजनाची व्यवस्था केलेली असते. कृषी पर्यटनासमोरही अनेक आव्हाने व समस्या आहेत. शेतकऱ्यांचा याविषयी सखोल अभ्यास नाही. ज्ञानाचा अभाव, संवाद कौशल्य व व्यावसायिक दृष्टीकोनाचा अभाव, आवश्यक त्या मुलभूत सोयीसुविधांच्या विकासासाठी अपुरे भांडवल, पर्यटकांच्या सुरक्षेचा प्रश्न, त्यासाठीची यंत्रणा, पर्यटकांचे साहित्य सुरक्षित ठेवण्याची व्यवस्था नसते. खरं म्हणजे आदरातिथ्य व स्वच्छता हेच या व्यवसायाचे भांडवल आहे. परदेशातून किवा शहरातून आलेल्या पर्यटकांना शेती व्यवसाय व ग्रामीण जीवनशैलीविषयी जाणून घेण्याची उत्सुकता असते. मात्र पर्यटकांनी विचारलेल्या या प्रश्नांकडे लक्ष दिले जात नाही. “आज चांगली सेवा दिली तर उद्याच्या उत्पन्नाची खात्री आहे” ही भावना राजविणे आवश्यक आहे. शहरातील गरीब रोखायची असेल तर पर्यटन, लोककला, आदिवासी संस्कृती यांचा विकास आणि नैसर्गिक साधनसंपत्तीची जोपासणा हे त्यावरील उत्तर आहे.

सेक्स टुरिझम:

बाजाराकरणाचा परिणाम म्हणून नवीन युगाशी नाते सांगणाऱ्या सेक्स टुरिझमचाही अतिकडे उदय झाला आहे. आर्थिक विकास आणि सुखता यांच्यासोबतच देहविक्रय आपोआपच फोफावल्याचे साधारण चित्र सर्वत्र पहायला मिळते. संयुक्त राष्ट्रांच्या जागतिक पर्यटन विषयक संस्थेने सेक्स टुरिझम या शब्दाची व्याख्या करण्याचा प्रयत्न केला आहे. त्यानुसार “कुणीतरी पर्यटनाच्या नावाखाली देशातर्गत किवा परदेशातून काही लोकांना नियोजितपणे पर्यटनासाठी आमंत्रित करणे आणि ज्या ठिकाणी हे पर्यटक पोहचणार आहेत त्याच ठिकाणी त्यांनी तेथील काही व्यक्तींशी व्यावसायिक शारीरिक संबंध जुळवून देण्याची प्रक्रिया म्हणजे सेक्स टुरिझम होय”. या व्याख्येमध्ये विविध व्यक्तींशी व्यावसायिक शारीरिक संबंध जोडण्याची प्रक्रिया महत्वाची आहे. कारण यामध्ये बाल-लैंगिक संबंध पर्यटन, शिवायी शारीरिक पर्यटन तसेच सर्वांगीण पर्यटन तसेच कामक्रिडांना वाव देणारे पर्यटन याचा समावेश होतो. संस्कृती आणि परंपरा यांच्याशी तसेच धार्मिक स्थळांशी सेक्स टुरिझमचा संबंध आहे. मंदिरे किवा प्रार्थनास्थळे यांच्या आजूबाजूला वाढलेला वेश्या व्यवसाय आपल्याला हेच स्वीकारायला लावतो की, धर्म, धर्माचे अवडंबर आणि सोपस्कार पूर्ण झाल्यावर शरीरधर्म इतका उफाळून येतो की, एक गरज म्हणून बहुतेक धार्मिक स्थळांच्या आजूबाजूला किवा बिनासायास लवकर पोहचता येईल अशा ठिकाणी वेश्याव्यवसाय संपादित झाल्याचे आणि वाढल्याचे दिसते. याबाबत सीबीआयचे संचालक अश्विनीकुमार यांनी वर्षभरापूर्वीच अहवाल दिला होता. उदाहरण म्हणून घ्यावयाचे झाल्यास महाराष्ट्राच्या संस्कृतीची आणि परंपरेची मक्तेदारी वाहणाऱ्या शनिवारवाड्याच्या मार्गे शतकापूर्वी जेव्हा बावळखणी हा भाग वसविण्यात येत होता. तेव्हाच महाराष्ट्राने राजकारण आणि कामजीवन यांचा संबंधच जणू काही स्वीकारला. शनिवारवाड्यातून घेऊन आणि गुप्तपणे बुधवार पेठेतल्या तेव्हाच्या बावळखणीमध्ये जाऊन गाणे-बजावणे आणि मादक जीवनाचे सर्व उपभोग घेण्याची असलेली व्यवस्था नंतर राज्यातील इतरही शहरांमध्ये वाढत गेली. त्यामुळेच डान्स बारच्या नाकाखाली सेक्स टुरिझम प्रचंड प्रमाणात वाढला आहे हे कळल्यामुळे सरकारने त्याबरोबरच कडक पावले उचलली आहेत. परंतु ज्या मुली बारमध्ये केवळ डान्स करून कोट्यावधी रुपये हातूंतून हातूंतून करणे भाग पडले आहे. अशा आशयाच्या अनेक बातम्या वाचायला मिळतात.

सेक्स पर्यटनासाठी होणारी प्रचंड उलाढाल आणि त्यासाठी येणारा खर्च त्या-त्या देशातील सामाजिक, आर्थिक व राजकीय परिस्थितीबरोबरच त्या देशांमध्ये वेश्या व्यवसाय नियंत्रीत करणारे कायदे कशा प्रकारचे आहेत यावर अवलंबून असतो. भारतात अजिंक्य मानवी वाहतूक प्रतिबंधक कायद्यात वेश्याव्यवसाय बेकायदेशीर आहे असे स्पष्टपणे कुठेही नमूद केलेले नाही. पण विशिष्ट परिस्थितीत किंवा पार्व्वभूमिवर वेश्याव्यवसाय बेकायदेशीर असल्याचे कायदा म्हणतो. देशात अनेक स्वीया रोजगार उपलब्ध नाहीत म्हणून स्वतःहून देहविक्रय करायला तयार होतात. यातून त्यांचे पुनर्वसन कावे अशा योजना नाहीत. चंगळवाद आणि भौतिक उपयोगामुळे तरुणाईच्या गरजा वाढलेल्या आहेत. आई-वडिल सर्व आर्थिक गरजा पूर्ण करू शकत नाही हे लक्षात आल्यावर अनेक जण स्वयंचे पॉर्टाईम शरीरविक्री करतात. सुशिक्षित, उच्चशिक्षित आणि प्रतिष्ठित कुटुंबातील मुला-मुलींच्या टोळ्या मज्जेसाठी सेक्स टुरिझमला सहभागी होत आहेत. बालकामगार म्हणून लहान मुलांचे शोषण केले जाते. त्यांना बालवेश्याव्यवसायाकडेही ढकलले जाते. परदेशातील अनेक पर्यटक काही भोळसट अधश्रद्धा घेऊन भारतात येतात. लहान बालकांशी संभोग केल्याने एचवायव्ही किंवा एडसारखे रोग दुरुस्त होतात असा अनेकांचा गैरसमज आहे. बाललैंगिक संबंध पर्यटन हा प्रकार “चाईलड सेक्स टुरिझम” मध्ये समाविष्ट होऊन अजिंक्य ही आकडेवारीही धक्कादायक आहे. यात भारतातील किती आणि महाराष्ट्रातील किती हे सांगता येत नसले तरी, महाराष्ट्रात हे प्रकार होतात याचा पुरावा म्हणजे डॅकेल ग्रॅड आणि त्याच्या मित्राला अशाच स्वरूपाच्या गुन्ह्यात मुंबई उच्च न्यायालयाने जकीच शिक्षा सुनावली आहे. स्वीया व पुरुष दोघेही सेक्स टुरिझम मध्ये सहभागी होतात ही वस्तुस्थिती आहे. त्यांच्या म्हणण्यानुसार इतरांसोबत सेक्स केल्याने आमच्या मूळच्या संबंधांमध्ये असलेल्या कमतरता दूर करण्याचा मार्ग आम्हाला सापडतो. चुकीच्या गोष्टीचे समर्थन काही लोक प्रभावीपणे करताना दिसतात. पण सेक्स टुरिझम स्वीकारावेच लागेल. यामधील स्त्रिया व मुली किंवा पुरुषही स्वतःच्या मज्जेने सहभागी होत असल्याने कायद्यानुसार कारवाई करता येत नाही. थोडक्यात “वापरा आणि विसरा” अशा मानवी पावनां कोरडेपणा आणणारा हा प्रकार धोकादायक आणि चुकीचाच आहे. मानवी हक्कांचे उल्लंघन करणारा सेक्स टुरिझम हा शोषण आणि दमन यावर आधारित व्यवसाय बंद व्हावा अशी जगातील मानवी हक्क संघटनांची मागणी आहे. त्यामुळे त्याचा केवळ वरवर विचार न करता मूळतूनच या विषयाचा विचार होणे आवश्यक आहे.

समासोप:

पर्यटनामुळे अनेक पर्यावरणात्मक समस्या निर्माण झाल्या आहेत. त्यात प्रमुख रस्ते, नदी आणि सागर किनारे यांच्या बाजूने होणारे बांधकामे झाली आहेत. जंगलतोड, पर्वत उतारावरील उत्खनन यामुळे पर्यावरणाचा न्हास झाला आहे. शहरात गजबजाट वाढला आहे. वाहतूकीचे प्रश्न आहेत. किनारपट्टीच्या प्रदूषणात वाढ झाली आहे. प्लॅस्टिक बाटल्या, सांडपाणी समुद्रात टाकले जात असल्याने किनाऱ्यावरचौ जैविक विविधता नष्ट होत चालली आहे. दहशतवादी कारवायांमुळे जम्मू-काश्मिरचा पर्यटन व्यवसाय धोक्यात आला आहे. करारबद्ध पर्यटकांमुळे अनेक सांस्कृतिक समस्या निर्माण झाल्या आहेत. उदा. भारतात (प्रामुख्याने गोव्यात) येणारे पर्यटक हे प्रामुख्याने युरोप खंडातील असतात. ते वाहयात वृत्तीचे, वर्णभेदी, राष्ट्रवेडे, मद्यपी, हिंसक वृत्तीचे असतात. त्यामुळे त्यांच्यातील नानावस्था, रेकपाटया, वेश्याव्यवसाय, अंमली पदार्थांचे सेवन यामुळे स्थानिकांमध्ये असंतोष आणि तणावपूर्ण वातावरण निर्माण होते. अलीकडे महिलांवरील अत्याचाराचे प्रमाणही बरेच वाढले आहे. या अत्याचाराच्या घटनांमधून परदेशी स्त्री पर्यटकही सुटलेल्या नाहीत. त्रिवाय परदेशी पर्यटकांची लुबाडणूक करणे, त्यांना नाहक त्रास देणे अशा घटनांमुळे पर्यटकांमध्ये असुरक्षिततेची भावना वाढीस लागली आहे. राजधानीसारख्या ठिकाणी ५१ वर्षीय डॅनिश महिलेवर बलात्कार झाल्यामुळे भारताची प्रतिमा डागाळली जात आहे.

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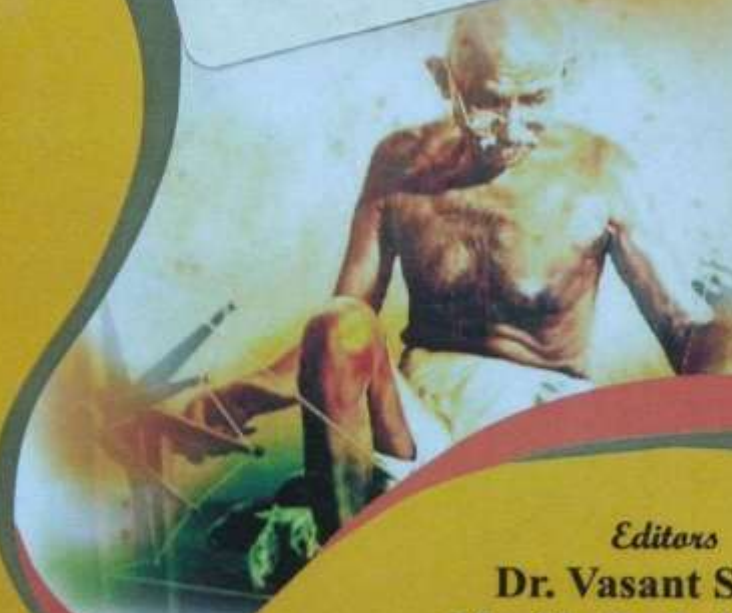
RELEVANCE OF GANDHIAN THOUGHTS

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PART I

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"Live as if you were to die tomorrow.
Learn as if you were to live forever."



"A man is but the product of his thoughts.
What he thinks, he becomes."



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Relevance of Gandhian Thoughts on Economic Development in Modern Times

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Introduction: To quote Sam Pitroda, "While the twenty-first century has been defined by globalization, free markets, privatization, liberalization, it has also been marked by violence, extremism, inequity, poverty, and disparity. Amidst all this, if one poses the question of relevance of Gandhiji to our age, one is struck by an astounding need for him for our times. Gandhiji's ideals... and leadership hold an extremely relevant moral and social mirror to our society." Thus, the Gandhian model and the modern economy seem to be getting closer to each other. Gandhiji did not belong to an era, or an age. He belongs to the humanity for eternity.

In India, economic development has been mostly confined to the urban conglomerates. In the process, the rural India that comprises 700 million people has been given short shrift. Gandhiji's philosophy of inclusive growth is fundamental to the building of a resurgent rural India. He believed in "production by the masses" rather than in mass production, a distinctive feature of the industrial revolution. It is surprising, even paradoxical, that these days Gandhian philosophy should find increasing expression through the most modern technology! Now, it is possible to establish small-scale and medium-scale factories in smaller towns and remote corners of the country, thanks to the phenomenal innovations in communication and information technologies. This article tries to present the overall socio-economic thoughts of Mahatma Gandhi as an origin of alternative development and relevance of his views on modern economic development.

The Basic Tenets of Gandhi's Economic Views: Today the global economy with the free market as its mantra is in a state of severe crisis. The political leadership, thinkers and intellectuals are all searching for the 'right model' of economic development. Does Gandhian philosophy provide an insight into how to manage the economic system? The global financial and economic system is in 'crisis mode'. Well-known companies and banks of USA are declaring themselves as bankrupt, one by one. It is feared that the economy may slide down to the days of 'Great Depression'. In this context, it is worthwhile to have a look at

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the economic thoughts of Gandhi. His economic thought is imbibed in his overall philosophy. His approach is holistic and aims at the socio-economic reconstruction of society.

Gandhi had an innate sympathy for the poor and deprived. This coupled with a direct observation of the predicament of the poor and the oppressed both in India and in South Africa. He believed that the high capitalist endeavors were at the root of all suffering, and that business without ethical considerations was fundamentally evil. This led to discrimination, oppression and exploitation. Gandhi also held that there is enough in this world to feed and clothe all. However, there is poverty and deprivation because one group of people thrives on the labor put in by others. He strongly believed in the ethics of hard work and that one is entitled to take from the system only as much as he is capable of producing. This according to Gandhi was the only way to fight poverty and to disarm the world of all its economic woes.

Gandhiji strongly advocated that above mentioned are necessary social inputs without which economic growth is not possible. In simple words, in Gandhiji's schemes of thoughts, the non-economic components of economic development are perhaps more important than strictly economic concepts. Reconstruction of village economy based on 'Gram Swaraj' is the pillar of economic development. In his vision, each village is a totally autonomous and self-sufficient unit which will be totally self-reliant in fulfilling the basic needs. A cluster of mutually dependent villages forms the basis of economic order. In Gandhiji's vision of *Gram Swaraj*, human beings will be most important, labour will be given due importance, there will be decentralization of power and owners of property will consider themselves as trustees. The most unique feature of Gandhi's economic model was he wanted to turn the entire flow of profits from the pockets of the big industrialists to the workers. The consumer should, he believed, not only be concerned with acquiring high quality, inexpensive products, but also consider which sections of society are profited by his investment.

Gandhi on Swaraj, Swadeshi and Trusteeship: Gandhiji argued that, the industrialization and globalization of the economy is a disaster for India. The economy was meaningful to the extent that it opened out the possibility of well-being for all people. That implied a system of production, of distribution and consumption defined by the essential needs of most deprived people in the society with the aim of supporting the highest values of human life. His understanding of the path to *sarvodaya* was through a village economy which maximized the powers of the traditional Indian handicrafts and only employed modern machines that allowed for a production by the masses. The three

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concepts so central to Gandhi's economic idea. *Swaraj* is political and economic independence but also the liberation of the human being from all systems and ideologies which would undermine human dignity.

About *swadeshi*, Gandhi's vision of a free India was not a nation-state but a confederation of self-governing, self-reliant, self-employed, people living in village communities. Maximum economic and political power - including the power to decide what could be imported into or exported from the village - would remain in the hands of the village assemblies.

Trusteeship provides a means of transforming the present capitalist order of society into an egalitarian one. It does not recognize any right to private ownership of property except in as much as it may be permitted by society. Gandhiji criticized the capitalist system because it is based on ownership of the means of production and other property. He argued that unlimited wants, greed, fear etc. arise from capitalist property relations. Gandhiji advanced a theory of trusteeship as an organizational structure under which production could be organized, instead of large industrial houses where economic power was concentrated in the hands of a few and were inherently exploitative. Gandhiji declared him to be a socialist and repudiated the concept of private ownership of property. But he was opposed to the use of violence or hatred to bring about social change. He wanted to do it by moral force and persuasion. The objective is to create a non-violent non-exploitative property relationship.

Every economy aspires to attain the growth by various means namely capitalism, socialism or mixed. But India the second largest developing nation liberalized globalized and privatized its economy in order to solve various difficulties while diluting the socialism. Can the Gandhian economic idea of *swaraj*, *swadeshi* and trusteeship be better than the pro-rich policies? This entire dilemma can be put to an end by implementing Gandhian thought of economics or by going global. It's time to determine the ideal economic policy in contemporary India or Globalized. In short, what Gandhi had realized through intuition, many world famous thinkers later advocated after being a witness to the process of how Capitalism unfolds itself. Gandhiji died in the year following India's Independence. The ruling class of Independent India neither had the conviction nor courage to walk on the path shown by Gandhi. Though India initially followed the principle of mixed economy, after eighties, India embraced Capitalism and is now engulfed by forces of Globalization. The rich have become richer and poor have become poorer, all over the world. One may ask, "Is Gandhi relevant, even now?" The answer is, more so, than ever before. He

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taught us how to reclaim our freedom from the state by giving us the concept of 'Satyagraha'. His economic thought centers on sustainable growth focus on man against machine, and reducing economic inequality. These are answers to the problem of Global Warming and lead us to 'inclusive growth' which has become a buzz word. His approach and concepts are the only solution if the mankind wants to survive.

India's New Economic Reforms: India's Economic Reforms 1991 aim at reducing the extent of Government controls over various aspects of the domestic economy, increasing the role of the private sector, redirecting scarce public sector resources to areas where the private sector is unlikely to enter, and opening up the economy to trade and foreign investment. Fiscal stabilization was given the highest priority. The current account deficit was high. The Central Government fiscal deficit had reached a peak level of 8.4% of GDP in 1990-91. The first year of the reforms saw a substantial reduction in the Central Government fiscal deficit from 8.4% of the GDP in 1990-91 to 5.9% in 1991-92 and further to 5.7% in 1992-93. Custom duties were lowered. Excise duties on domestic manufactured goods were charged at varying rates on different commodities. The high reserve requirements e.g. the statutory liquidity ratio (SLR) and the cash reserve ratio (CRR) were reduced. These are the crisis management reforms. From 1991 till today, the fundamentals of the economy have indeed changed dramatically and four important data points illustrate that well, import duties cut from 78% to 7%, gross non-performing assets have come down from 26% to 2.5%, 900-1,000 products were earlier reserved for the small-scale sector that made economies of scale and large capital investments impossible.

Gandhian Ideology in Recent Times: The Gandhian ideology, whose main focus is on welfare and dignity of the individual, provides us a broad framework into the new philosophy of economic development that we need today. We may summarize the Gandhian principles:

1. The economic system should be so organized that every individual has an opportunity of getting gainful employment, so that he can buy his own bread and essential means of living.
2. Gandhiji was opposed to mindless industrialization as it displaces labour and causes unemployment.
3. Gandhiji supported rural-centric development with agriculture and small scale industries getting pride of place, as this is the only way the unemployment problem can be solved in a labour abundant country like India.

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4. Gandhiji believed in the decentralised development model as this helps the fruits of development reach everyone and promotes equality and social harmony.

5. Gandhiji was opposed to conspicuous consumption and luxurious living. He wanted people to have minimum needs and lead a simple life.

The Ethical Basis of Gandhian Economic Thought: Against this backdrop of Gandhian philosophy analyzed in the introductory section of our study, let us try to examine the basic principles of Gandhian economic thought in the light of the emerging trends of the present millennium with special reference to his doctrine of Trusteeship and its relevance to 'Corporate Social Responsibility', a specialized field in Human Resources. Gandhi accepted the ethical orientation to economics which is explicitly stated by him thus: "I must confess that I do not draw a sharp or any distinction between economics and ethics. Economics that hurt the moral well being of an individual or a nation are immoral and therefore sinful". True economics never militates against the highest ethical standard, just as all true ethics to be worth its name must at the same time be also good economics. As we read Gandhi's thought, we find that he laid emphasis on "village-oriented economy and on a simple way of life, and on a co-operative socio-economic texture".

Conclusion: Gandhi's economic ideals, much like everything else in his life, were governed by ethical and moral considerations. His stress on rural economy and emphasis on a simple life, coupled with his concern for universal well-being formed the foundation of his unique views on economics. Gandhi's economic models were based largely on his understanding of the Indian situation. However, it should be stressed that Gandhi himself believed that the model could be employed on an international scale as well. It should be remembered that Gandhi's economic models are particularly humanitarian in nature and for him no economic model is worth implementation unless it aims towards the general well-being of mankind.

Gandhiji was pragmatic and expressed views in the context of India's conditions at the time prevailing during the British Raj. If we properly understand Gandhian philosophy, we will find that it is very much relevant today, when the world is facing a severe crisis due to mass poverty and unemployment, side by side with conspicuous consumption and exploitation of natural resources.

Gandhiji is not only a national figure but also an international figure as well as a philosopher who influenced many including these Nobel

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Leaders for Peace – Martin Luther King, Nelson Mandela, Dalai Lama, Aung San Suu Kyi, and Barack Obama. Gandhi remains relevant not only now but in future and as long as civilization exists. People have to live with peace and prosperity. They have to live with fraternity and brotherhood and which is possible only through Gandhi's principles of non-violence, peace and love.

Gandhiji defines himself as, "My life is my message".

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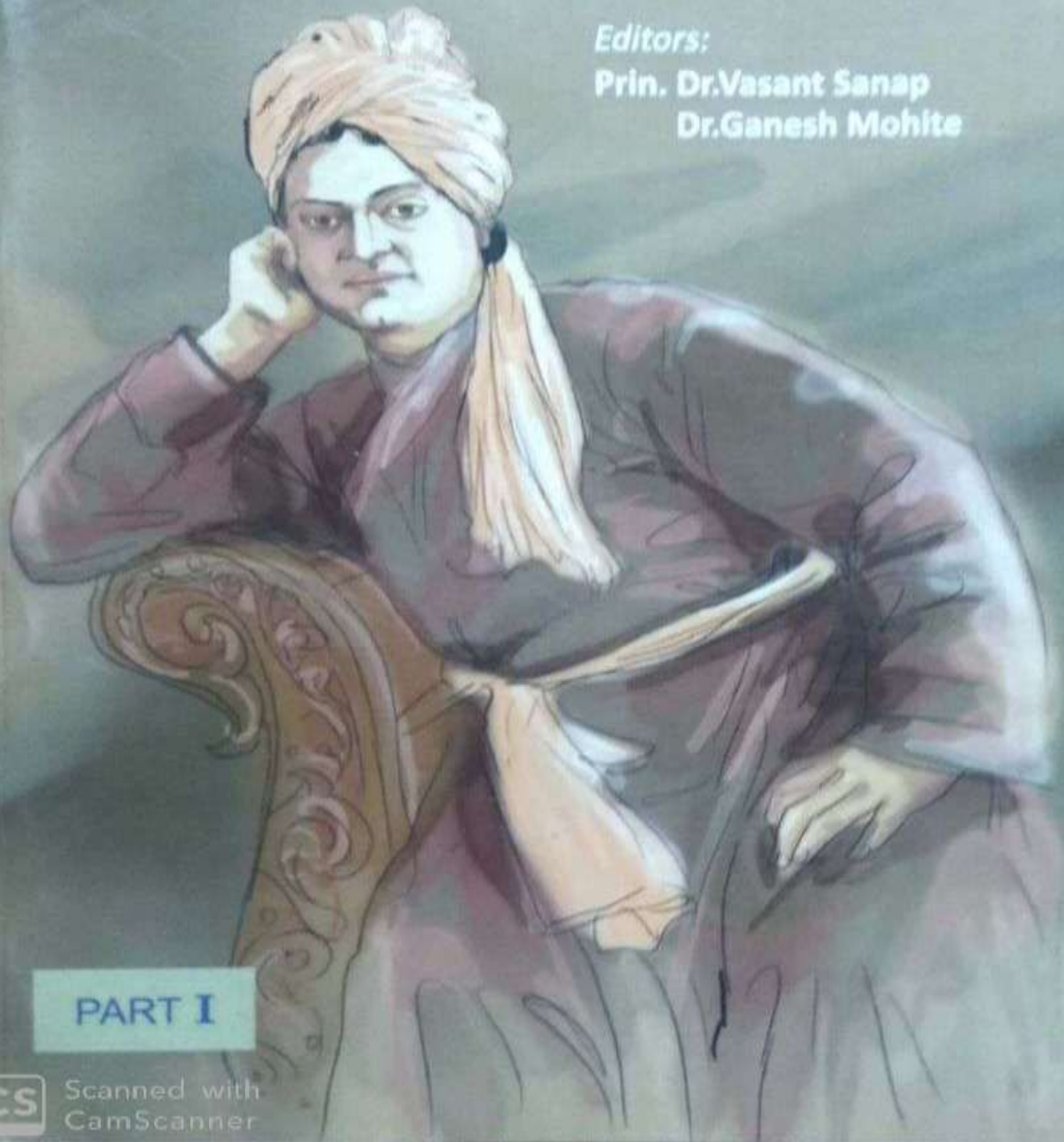
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Relevance of
Swami Vivekananda's
Thoughts in 21st Century

Editors:

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Dr.Ganesh Mohite



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The Role and Relevance of Swami Vivekananda's Man Making Education in Present Scenario

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"You see, no one can teach anybody, the teacher spoils everything by thinking that he is teaching. Thus Vedanta says that within man is all knowledge even in a boy it is so and it requires only an awakening, and that much is the work of a teacher. We have to do only so much for the proper use of their hands, legs, ears, eyes etc. and finally everything will become easy". -- Swami Vivekananda

Introduction: Swami Vivekananda (1863-1902) is well-known to the world as the patriot-saint of India. He is also known as the symbol of vigor, as a social reformer, as a religious leader, as a philosopher and so on. But he was an educationist who propounded original ideas on education, for ensuring an educational renovation from the height of his unquestioned love for country and humanity. He had never taught in School, College, or a University, but he was a teacher par excellence. It is said that, 'a poor teacher tells, an average teacher explains, a good teacher demonstrates and a great teacher inspires'. Swami Vivekananda was a great teacher and also a great educationist. There has been umpteen numbers of researches of very high quality on his thoughts on education. Erudite scholars and thinkers across the globe have expressed their views on Swamiji's concept of education. Here we shall make an assessment of the relevance of his thought in the modern education system. It will clearly bring out the role and relevance of Swami Vivekananda's man making education in the present scenario.

Swamiji's views on education are revolutionary and can change the nation drastically. Through the life and teachings of Swamiji we come to understand the teachings and message of Sri Ramakrishna. It was Swami Vivekananda who interpreted the life of his *Guru* and spread its unique relevance for the entire modern world. The important point of note is Swami Vivekananda's insistence on individual liberation as a priority over the efforts to 'do well to the world'. The idea is to strive for special state or plane of consciousness that would lead a person to realize his or her true nature. Achieving such exalted state of altered consciousness forms the basis for human actions. In this paper, which

purports to expound and analyze Vivekananda's views on education, an endeavor has been made to focus on the basic theme of his philosophy, viz. the spiritual unity of the universe.

Swami Vivekananda on Education: Swamiji shows a good connection between education and culture. Here, He expresses his views on education. Swamiji points out that the defect of the present-day education is that it has no definite goal to pursue. A Sculptor has a clear idea about what he wants to shape out of the marble block; similarly, a painter knows what he is going to paint. But a teacher, he says, has no clear idea about the goal of his teaching. Swamiji attempts to establish, through his words and deeds, that the end of all education is man making. Nearly a hundred years ago Swami Vivekananda showed the close connection between culture and education. Wherever there is a great culture, you will find behind it, a highly developed system of education. Ancient India could produce a great culture because it developed a wonderful system of education. According to Swamiji, the basic purpose of education is the total development of human personality. Everyone is endowed with certain capacities, which remain dormant, although in a potential form. In one place, he puts: "Education is the manifestation of the perfection already in man". Swamiji believed education is the process by which these inherent potentialities in human personality manifest themselves in completing his or her total development. The total development of human personality includes intellectual and moral development. Most of the present day school and college curriculum only aim at intellectual development. We have to remember that the basis of Swamiji's philosophy is *Advaita* which preaches unity in diversity. Therefore, man making for him means a harmonious development of the body, mind and soul.

According to Swami Vivekananda the education policy should be down to earth. The education should bring out the change in the citizen's life. Swamiji said, "To me the essence of education is the concentration of mind, not just collection of facts." He had further said, "The education which does not help the common mass of people to equip themselves for the struggle for life, which does not bring out strength of character, a spirit of philanthropy, and the courage of a lion- Is it worth its name?" Swamiji has clear cut ideas about education in his mind. He expressed his views on education clearly.

Swamiji quotes, "the education that you are getting now has some good points, but it has a tremendous disadvantage which is so great that the good things are all weighed down". In the first place it is not a man-making education, it is merely and entirely a negative education. A

negative education or any training that is based on negation is worse than death. The child is taken to school, and the first thing he learns is that his father is a fool, the second thing that this grandfather is a lunatic, the third thing that all his teachers are hypocrites, the fourth that all the sacred books are lies. By the time he is sixteen, he is a mass of negation, lifeless and boneless. And the result is that fifty years of such education has not produced one original man in the three Presidencies. Every man of originality that has been produced has been educated elsewhere, and not in this country or they have gone to the old universities once more to cleanse themselves of superstitions.

Swami Vivekananda's Procedure of Education: Vivekananda's method of education resembles the heuristic method of the modern educationists. In this system, the teacher invokes the spirit of inquiry in the pupil who is supposed to find out things for himself under the bias-free guidance of the teacher. Just as in the case of a plant, one cannot do anything more than supplying it with water, air and manure while it grows from within its own nature, so is the case with a human child. Swamiji lays a lot of emphasis on the environment at home and school for the proper growth of the child. The parents as well as the teachers should inspire the child by the way they live their lives. Swamiji recommends the old institution on *Gurukula* (Living with the preceptor) and similar systems for the purpose. In such systems, the students can have the ideal character of the teacher constantly before them, which serves as the role model to follow. Although Swamiji is of the opinion that mother tongue is the right medium for social or mass education, he prescribes the learning of English and Sanskrit also. While English is necessary for mastering Western Science and technology, Sanskrit leads one into the depths of our vast store of classics. The implication is that if language does not remain the privilege of a small class of people, social unity will march forward unhampered.

Swamiji brings forth his scheme of education in a very clear manner. He, in his scheme of education, meticulously includes all those studies, which are necessary for the all-around development of the body, mind and soul of the individual. These studies can be brought under the broad heads of physical culture, aesthetics, classics, language, religion, science and technology. To Swamiji, the culture values of the country should form an integral part of the curriculum of education. The culture of India has its roots in her spiritual values. The time-tested values are to be imbibed in the thoughts and lives of the student's through the study of the classics like *Ramaynas*, *Mahabhartas*, *Gita*, *Vedas* and *Upanishadas*. This will keep the perennial flow of our spiritual values

into the world culture. Education, according to Swamiji, remains incomplete without the teaching of aesthetics or fine Arts. He cites Japan as an example of how the combination of art and utility can make a nation great.

Swami Vivekananda's Views on Women Education: Another important aspect of Swamiji's scheme of education is Women's education. He realized that if the women of our country get the right type of education, then they will be able to solve their own problems in their own way. The main objective of his scheme of female education is to make them fearless, strong, and conscious of their dignity. He observes that although men and women are equally competent in academic matters, yet women have a special aptitude and competence for studies relating to home a family. According to Swamiji – "The real strength or 'Shakti' of a country are its women". His idea of women's education included fostering ideal daughters, ideal wives, and ideal mothers and of course building ideal nation and humanity. He strongly advocated that schools should be established for girls and educational centers for women. Thus, he visualized women as true partner of all-inclusive social development. Advancing his thoughts on women education, much work has been done in the field of women's education after independence in India. The education policy adopted by the Government of India for equality of opportunities for the women education and empowerment has been saturated by Vivekananda's urge for women education.

Present Man Making Education in India: The UNESCO Commission recommended four pillars of learning- Learning to know, learning to be, Learning to do and Learning to live together. Let us analyze the relevance of Swamiji's thoughts on the basis of these four pillars of learning. As per recently concluded census 2011, Literacy rate in India has shot significantly from 64.08 to 74.04%. About 110 million women literates added in the recent decade compared to 107 million men literates, so gap between men literates and women literates also reduced. Today we live in the twenty first century. It is an age of inventions and makes innovations. So, what do you want from education system: to make you just a 'literate' or an 'Educated'. The very word education is derived from the word "Educative" which means "to bring up". Today's education produces only money making machines. The moral values are getting eroded. Social fabric is getting weakened. We are imparting theoretical knowledge based education. We have to make the children more aware of socialness. Even the information being given is very much non uniform in all the states. Due to lack of proper implementation it is now becoming very misleading.

But, if we see the current scenario there is a rampant corruption, crime, unlawful activities, exploitation taking a toll on India. Then how can we boast about our literacy rate when this has failed to achieve the basic purpose of empowered society which we wish to achieve; it's the fault in our education system and hence its badly need a reform. Our education is making us read, write and speak. We are capable of reading the statutory warning "smoking is injurious to health" written on the cigarettes packets. But we are incapable of understanding it.

Swami Vivekananda's Educational Philosophy: Swamiji's educational philosophy is still relevant in Modern India. In true with the educational philosophy, he defines education as "the manifestation of the perfection already in man." The aim of education is to manifest in our lives the perfection, which is the very nature of our inner self. This perfection is the realization of the infinite power which resides in everything and every-where-existence, consciousness and bliss. After understanding the essential nature of this perfection, we should identify it with our inner self. For achieving this, one will have to eliminate one's ego, ignorance and all other false identification, which stand in the way. We need the education which provides bread and butter. It should be useful for the further generation to lead their life. From Swamiji's writings, speeches and practices of his own life the following ideas on education can be deduced: 1. Education is based on development of inner potentiality. 2. Education is man making. 3. Education is the training of the intellect and spiritual training of the learners. 4. Upliftment of masses is also an emergent dimension of education. 5. Education is "by which character is formed, mind of strength is increased, and by which one can stand ones leg" 6. Education is a tool for social development. 7. The social progress is possible through mass education and woman's education. 8. Democracy is the best form of Government implying freedom which is inseparable from responsibility, the sources of which are morality, philosophy, law and other social factors.

Swamiji thinks that education is not only getting knowledge but it also means to train the children. He is a staunch champion in education. Freedom is the first requirement for self development. The child should be given freedom to grow according to his own nature. The teacher should not exert any type of pressure on the child. The child should be helped in solving his problems himself. The teachers should have an attitude of service and worship. Education ultimately aims at realization. It is a means of a sorority of mankind. By his philosophy of education, Swamiji thus brings to home the education is not a mere accumulation of information but a comprehensive training for life. To

quote him: "Education is not the amount of information that is put into your brain and runs riot there undigested, all your life." At present, women and children in India today are living under deplorable conditions. They are deprived of everything such as education, clothing and social status. Trust low, a news service run by Thomson Reuter, has ranked India as the worst G20 country in which to be a woman is just like a curse. Female feticide, domestic violence, sexual harassment, emotional abuse, inadequate healthcare, inequality, dowry deaths, rape and other forms of gender-based violence and neglect constitute the reality of most girls and women's lives in India. Rape is one the most common crimes against woman and is seen as "National problem" in India.

Conclusion: Swamiji's views on education are still useful in modern India. He brings out his scheme of education in clear cut terms. Swami Vivekananda had famously said, "Come out into the broad open light of day, come out from the little narrow paths, for how can the infinite soul not content to live and die in small ruts? Come out into the universe of Light. Everything in the universe is yours, stretch out your arms and embrace it with love. If you ever felt you wanted to do that, you have felt God". We must have education for life building, man making, character making and assimilation of ideas. The exposition and analysis of Swamiji's scheme of education brings to light its constructive, practical and comprehensive character. He realizes that it is only through education that the uplift of masses is possible. The right to education for everyone, guaranteed by the Constitution of Vivekananda's dream, but it is still a far cry from its goal. His idea of continual, or lifelong, education, however, has been adopted in many countries already. To refer to his own words: "Traveling through many cities of Europe and observing in them the comforts and education of even the poor people, there was brought to my mind the state of our own poor people and I used to shed tears. When made the difference? "Education" was the answer I got". Finally to end, I conclude by quoting: "So, inspired by him, let us go forth and learn not only how to read well the book of Nature, but how to write something new, different, and significant". Swamiji's life is a still a fountain to the youths of India and to the entire modern world.

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Special Issue

IMPORTANCE OF MARKETING



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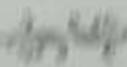
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RECENT TRENDS IN MODERN MARKETING

Jeyam Bhaskar



"Visual marketing does not just sell a product or service, it sells an experience around your business".

Rebekah Radice

INTRODUCTION :

Marketing plays a vital role in a business. The success of the company or business can be achieved through effective marketing. The objectives of any marketing are creating new customers or sustain existing customers. It is a mission of the company to create awareness of a company. Services or products are introduced to the mass market by using various marketing techniques. A marketer should learn how to discover and develop new marketing ideas of their business. The Internet is an increasingly expanding medium of interaction that has virtually eliminated geographical boundaries and overcoming previously existing obstacles of global business. It can be considered to be an accidental mega market born out of technology and that of economic needs. The boom in computer, telephone, television and mobile technologies has had a major impact on the way businesses produce and market their products. Digital marketing evolves at a rate unlike any other industry. E-marketing is an alternative word for internet marketing. This is form of targeted marketing, to promote products or services through internet. There are number of kinds such as e marketing.



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While traditional marketing casts a wide net in hopes that some will buy a

product, e-marketing goes directly for consumers who are already looking for it. Traffic reminds marketers that, although e-marketing is very low risk, it is also more competitive thanks to globalization. Because so many marketers are online, increased competition results in a significantly lower profit margin for all products sold. Traffic also notes that security and privacy issues can be an issue for online marketers, which may lead to consumer trust issues for e-commerce sites. This article shows that, methods of marketing have change a lot. Essential elements of e-marketing, e-marketing is a newer concept introduced by the companies in India and has started gaining its importance in 21st Century.

WHY IS E-MARKETING IMPORTANT?

E-marketing is important for any business because it is what brings in the necessary client base to help the business grow. It is also important because it can be used as a way to build brand recognition and expand a business to different locations. While many people think that e-marketing is basically advertising, it is actually much more complex. Advertising is a part of e-marketing, but it is only a small piece. E-marketing can also include being involved in the community, providing customer support, and planning a media or public relations strategy. Determining prices for products or services, performing market research to determine how best to reach potential clients, and developing sales strategies also fall under marketing. Another reason that marketing can be so important to a business is that it is what builds the relationship between the business and its customers. While advertising can be what brings the customer in the door, marketing and brand recognition are what keep them coming back. Marketing can also help attract the best employees to a company, which can also help strengthen the company's relationship with its clients. Companies that rely on public funding can also use marketing to raise funds and increase visibility in the community.

ESSENTIAL ELEMENTS OF SUCCESSFUL E-MARKETING-

E-marketing is a wide field including practically everything related to the internet. E-marketing is one of the fastest growing mediums. Internet has become number one marketing channel in the UK and the USA. Successful e-marketing starts with a functional website. Having a poor website makes the marketing process unproductive. Each business owner desires to get the right kind of visitors to his company's website. Keywords are those magical terms that correspond to products

or services description. Keywords are aimed to match the search query to the service provider. People who search information about a product or service via Google are more interested in your services as they wanted to receive information about a specific item. In order to achieve maximum results the keywords must be chosen correctly. The aim of the keywords is to create a landing page that corresponds to a specific term and offers the information searched by the users.

Optimization is necessary to bring the right kind of visitors to your page. Optimization is highly valued due to the reliability of organic search results and high traffic volume. Optimization is divided into onsite and offsite optimization. Onsite makes the navigation easier and creates relevant content. Offside is mainly done to create external links as Google consider high value links when ranking the page. Optimization is mostly considered free advertising as there is no direct cost. There are lots of e-marketing agencies that offer SEO services. It's important to know at least the basic points of optimization otherwise you can risk with your webpage reputation and position in Google.

Blogging creates trust, active discussion, image and reputation. Blogs are easily sharable via social media creating a buzz effect. Content marketing is another topic that needs your attention. The aim of e-marketing is usually conversion. Even if a website has great functionality and other qualities a weak content may cost you a sale. E-marketing is quite often related to sociality; it's interactive and creates active relations between the company and clients. Studies have shown that it's easier for clients to interact with a company via social media, they get more attention and their problems are solved faster.

The most popular of them is Facebook that celebrated lately the crossing of one billion active user's limit. It's understandable why marketers direct their social media strategy mainly to Facebook. Twitter is the second most popular channel besides Facebook. Twitter has about half as much users as Facebook. It's highly recommended for businesses that host events or organize seminars. Google+ is another social media channel that offers innovative features useful for businesses who organize events. LinkedIn is mainly useful for B2B companies for networking. As you can see, social media reaches far beyond Facebook, you just need to find the right one(s) for your business.

IMPACT OF INTERNET ON MARKETING:

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The boom in direct and database marketing, the dawning of electronic commerce, new ways to automate sales force management and the sudden blossoming of the World Wide Web all suggest that the discipline is under pressure to redefine itself. The challenge facing the companies today is how to take strategic advantage of these opportunities to build more desirable products and services, build brand equity and increase revenues and profits. The internet represents new opportunities for marketers and sales people because it provides a wide reach for all marketing efforts conducted on it. International markets can be opened up at low costs. With the advent of the Internet there can be continuous customer support. Services can be made available through interactive e-mail systems on the net. This saves time and money.

RECENT TRENDS IN MODERN MARKETING

Online shopping in its early stage was a simple medium for shopping with fewer options. The users can just place an order and pay cash on delivery. But in the last few years this field has been renovated to a high extent and hence fascinates many customers. Today, the online shopping has become a trend in India and the reason behind the adoption of this technique lies in the attractive online websites, user-friendly interface, bulky online stores with new fashion, easy payment methods, no bound on quantity & quality, one can choose the items based on size, color, price, etc.

Despite being a developing country, India has shown a commendable increase in the e-commerce industry in the last couple of years, thereby hitting the market with a boom. Further, the addition of discounts, coupons, offers, referral systems, 30 days return guarantee, 1-7 days delivery time, etc. to the online shopping and the E-Market have added new flavors to the industry. Digital marketing evolves at a rate unlike any other industry. Over the past year alone we have seen radical changes in everything from online advertising to website design.

1) More websites will go responsive.

As the owner of a digital marketing company, the number one hesitation I hear from companies looking to redesign their websites is that they don't want to be obsolete in a year. Who can blame them for being worried? Technology continually changes the marketing world.



2) SEO will continue its shift to content marketing.

Search Engine Optimization isn't dead, it's just grown up. What was once seen as a shady, manipulative practice is now evolving into what many marketers are calling "Content Marketing". This is because as the search engines algorithms become more advanced, they are constantly able to filter what content is trying to game the system and what is genuinely useful for the end user.

3) Video will become a much bigger content platform.

YouTube continued to dominate the web; video proved that it was a key player as a content platform. This goes to show that as the internet continues to advance, so will the ways that we consume content.

4) Design and speed will be a necessity.

As we watch the web mature, the websites that "win" are not just those that provide the best content but ones that do so in the most effective and efficient way possible. This means that the way that your site is designed and how quickly it loads play a key factor in whether the visitor becomes a lead.

FUTURE IN E-MAIL MARKETING

E-mail marketing is on the precipice of exiting change right now. This is a new-world order and many are going to sink or learn to swim again. To the uninitiated, email marketing might seem like a dying art thanks to the unrelenting explosion in social media. While it is true that social is a game changer, it is equally true that email-based marketing delivers in areas that its 140 character cousin cannot. One report also said that 90 per cent of businesses believed that email marketing was either 'important' or 'very important' to their marketing strategy.

However, the rules are changing and this is not the time for complacency. Consumers are demanding new heights of relevant, immaculately presented content – with the emphasis being placed on 'relevant'. Strategies will need to remain as fluid and dynamic as the market that they operate in. Only the most responsive marketers are going to be able to take advantage of the quickly changing landscape.

CONCLUSION :

Successful e-marketing is a holistic strategy based on combined marketing activities. Having a well optimized webpage alone does not help if the content is

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poor. Neither doesn't work a great website that is impossible to find. Internet offers so many opportunities for marketing and the best results are achieved as synergy of different activities. The benefits of e-marketing or Internet marketing include convenience, increased reach, personalization, improved customer relationships, lowered marketing costs and an established social presence online.

While traditional marketing casts a wide net in hopes that some will buy a product, Internet marketing goes directly for consumers who are already looking to buy. Traffic reminds marketers that, although e-marketing is very low risk, it is also far more competitive thanks to globalization. Because so many marketers are online, the increased competition results in a significantly lower profit margin for all products sold. Traffic also notes that security and privacy issues can be an issue for online marketers, which may lead to consumer trust issues for e-commerce sites. The 5 points brought out are the most basic ones to achieve a successful e-marketing strategy. Keep the eyes opened and look for opportunities the internet has to offer for business.

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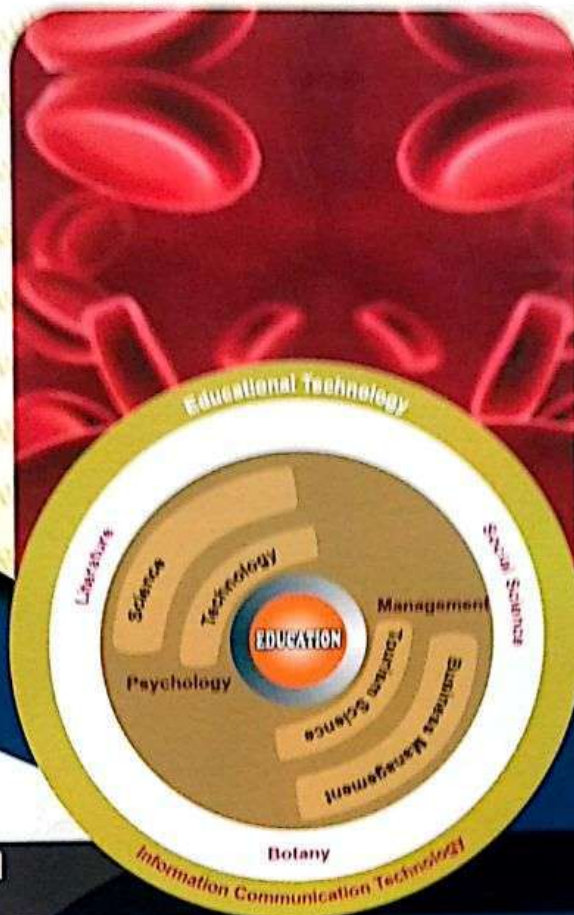


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Introduction: Today, the way of learning is being changed slowly from traditional methods to modern ones. Teacher oriented methods to student's oriented methods. The student oriented method is used on the intensive participation of students on the Teaching-Learning process supported by latest available information Technology. Over the past few years, there has been a huge investment in information and communication technology in the teaching and learning process in this context. Mobile Technologies, including smart phones and tablets emerges an immense tool associated with different methods and strategies. M-technologies are technological tools and now a days, a very representative number of so-called "digital generations" work and use them on day to day in recreational and educational activities. Today's students are techno savvy. They get more engaged and really thrive when they are using mobile devices in the classroom. There is a undergoing a radical change in the way they communicate and act, since many activity sectors in agriculture, education, industry, finance, healthcare etc. are adopting the use of mobile technology to deliver various services. Education is a continuous, complex, dynamic and life long process, now a day technology occupies the prominent place in teaching learning processes. The purpose of M-Technology is to improve the effectiveness of teaching-learning process in formal or informal setting as a solid scientific principle. This paper deals with impact of mobile technology over the teaching learning process in general and the technology which is supported in our teaching and learning. The aim is set to find out how students are improving their studies with the help of available latest information technology materials and to know awareness of students towards the usage of advanced teaching learning materials.

Impact of Mobile on the Teaching Learning programme: Education is a tool to develop humankind in many ways. Therefore, education is being given to students by different methods. The aim of any method is to make the learning process most effective. The recent trend is more from a teacher centered to student centered instruction. Teacher can use computers to manage the whole institutional process from lesson plan to evaluation of student's performances. Refresher and Orientation courses and workshops on the effective teaching with modern available information technology are useful only when they have been learned and implemented in the real class room. The number of mobile internet users in India are estimated to reach around 420 million by June 2017 with the rural India growing at a much higher rate than urban India says a published by Internet and Mobile Association of India (IAMAI) & market research firm NIELSEN. According to a report titled Mobile Internet in India 2016, there were 389 million mobile internet users in India as on December 2016.

Importance of M-Technology in Classroom: M-Technology is powerful and it can be used in several great ways to make teaching and learning powerful. What can be done and what cannot be done is limited basically by the creativity of the user. So, the more creative and innovative we get, the more results we'll see with using technology in class. However, I will provide a few examples just to help you get an idea of what an effective use will look like. Use of audio recording. Students often require personal and quality feedback on the work they turn in. Lecturers can make use of the audio recording feature built into most Smartphones to provide these personal any yet quality feedback to all students. Research has proven that students not just liked feedback given this way, but even preferred it. Today's

students have grown up with technology as the air they breathe, are used to being wired 24/7, are comfortable multi-tasking in multi-media, and bring very different expectations to the classroom as a result. The physical boundaries of the classroom and time for learning no longer prevail because the content is ubiquitous, students can communicate with teachers, other students and anyone else to satisfy their need for knowledge using the new generation of mobile devices, digital media players, Smartphone's, personal digital assistants, and tablet computers. Students are confident that with their mobile devices, they will not be stranded and will be able to find anything they want to find, right at the time they need it. Whether is general information on the internet or its information related to their subject, the mobile device helps students achieve it faster?

Benefits of M-Technology: M-Technology is a social rather than technical phenomenon of people on the move, constructing spontaneous learning contexts and advancing through everyday life by negotiating knowledge and meanings through interactions with settings, People and technology. It is perhaps the fastest growth area in the whole field of ICTs in education. It covers any form of learning that is mediated through a mobile or, more precisely, mobile handheld, device. Many Higher Education Institutions are implementing Mobile learning to provide flexibility in learning. Using mobile devices to reach students will benefit higher education by increasing enrolment and having a broader student population, since students in different age groups will be able to access course materials anywhere and anytime.

Some students are from rural area, the student knowing how to appropriately use mobile devices is an important aspect in this increasingly connected world and they can be update. Having mobile devices in the classroom allows students instant access to the latest news, information, statistics, etc. Virtually every question they have is at their fingertips, keeping them connected with what's going on around them and ensuring they are always well informed with the most up to date information on the contrary, Textbooks can't provide students with the latest information like a mobile devices can. Also having digital textbooks on their mobile devices keeps students more organized and gives them easy access to their materials. No one likes lugging around big textbooks. Many digital textbooks are constantly updated and often more vivid, helpful, creative and a lot cheaper than those old heavy books.

M-Learning as Meaningful learning that occurs through the use of wireless handheld devices. Students are always on the go and have activities according to the context in which they are teaching and learning environment using mobile devices provide opportunities for innovation. The Teaching Learning Process, in which students have an active role and teachers and students interact in a collaborative way, the construction of knowledge is facilitated, mobile application help coordinate learning resources and students, any may also help to improve the educational activities. Having those learning apps, digital textbooks, etc, on mobile devices allows them to get in extra studying and learning in during downtime. They can carry their books and notes with them at all times and have instant access to materials. If students are really excited and engaged in learning inside of the classroom, they are likely to continue learning outside of the classroom and they can do so with M-Technology. It is remarkable how mobile technology can transform education into something more enthralling and engaging then you could have ever imagined.

Using M-Technology in an effective way: By Practice, I start every academic year by asking my students if they have a Smartphone. I ask them how many of them use SMS text to communicate. To their surprise, I then tell them to take out their phones and leave them on the bench, because we have to use Whatsapp for communicating curriculum issues related to subject. Sometimes I try to work in problems to solve or I share apps or learning tricks utilizing various technologies. Anecdotally, I have found that by teaching and learning through mobiles, students have become more engaged in my class.

I supply various notes of my subject by PDF form on student's mobile phones. At that time I used e-mail or WhatsApp medium. I give some relevant clips regarding the subjects on mobiles. I experienced that such clips are beneficial for the students everywhere, every time. Students also come in wanting to share new technologies and resources they have found that have helped them learn. So M-Technology is really important in the life of students.

Conclusion: Over the past decades, it has been recognized the added value of the use of technological tools in the classroom and since then, efforts have been made by different stakeholders in the field of education, including scientific community and governments in order to generalize its use and consequently improve the Teaching Learning Process. There are several more ways by which both students and teachers can creatively use M-Technology in the classroom. Again, technology is powerful and its benefits go beyond just making our work efficient. It can increase productivity and help us achieve greater results in our work, thereby making us effective. It clearly shows that there are many advantages and disadvantages for M-Technology and traditional learning. But M-Learning has more benefited than traditional learning. All teachers have to be requested for teaching to be made effective by using available information technology materials. It is noticed that the role of educational administration and management in the educational instructions. To sum up, Bill Gates says that, "Technology is just a tool. In terms of getting the kids working together and motivating them, the teacher is most important". In this way, we can prove that modern technology is very pertinent tool in calculating education.

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भारतीय शेती आणि स्वामीनाथन आयोग

जयवंत भदानी

कर्म, रामरावजी आहिर महाविद्यालय, देवळी

प्रस्तावना:

कृषी प्रधान भारताची १९० ते १९५० टक्के लोकसंख्या ही शेतीवर अवलंबून आहे. एकूण राष्ट्रीय उत्पन्नात शेतीचा वाटा निव्वसीस घटत असून तो आज १५ टक्क्यांच्या आसपास आहे. शेतीतल्या विविध प्रयोगांनी एकूण उत्पन्नात वाढ झालेली दिसत असली तरी योजना निर्मितीचा प्रश्न गंभीर बनला आहे. शेतमाळाचे उत्पादन वाढवणे म्हणजे विकास आणि उत्पन्न किती टक्कांनी वाढले याची मान्यता म्हणजेच शेतीचा विकास झाला असे काहीसे त्रिभूत आज दिसते आहे. परंतु देशाच्या अन्नधान्याची गरज पूर्ण करण्यासाठी बाळगणाऱ्या शेतीतून निव्वळ उत्पन्न किती मिळाले? याचा विचार कृषी विकास या संकल्पनेत येत नाही. सादृष्टीने विचार करण्यासाठी, शेतकऱ्यांच्या विकासासाठी, त्यांच्या उत्पन्नात वाढ करण्यासाठीच्या प्रयत्नांना, प्रवृत्तींना आणि कृतींना गती देण्यासाठी स्वामीनाथन आयोगाचे महत्त्व वादातीत आहे. कृषी विकास व शेती सुधारणांसाठी आजपर्यंत अनेक अभ्यासगट, कृतीगट, समित्या व तज्ज्ञांची नियुक्ती झाली. या सर्वांनी शेकडो- हजारो पानांचे अभ्यासपूर्ण अहवाल सरकारदरबारी सादर केले. अनेक शिफारशी केल्या, पण पुढे काय? हा प्रश्न मात्र सुरुला नाही.

भारतीय शेती: स्वातंत्र्यपूर्व काळ: शेतीचा शोध हा मानवाच्या स्थिर जीवनाची खरी सुरुवात आहे. मानवाने केवळ अनुभव व तर्कश्रुतीतून अन्ननिर्मितीचे तंत्र शोधून काढले. पोषणमूल्य असलेल्या व्याख्यातूनच पेरणीसाठी बियाणे उपलब्ध केले. पशुपालनाचा शोध मना. शेतीमुळे मानवी जीवनात आमुलाग्र बदल झाले. मातीचे राख्य टिकवून ठेवणे, पिकांची जैवविविधता आणि स्थानिक स्थितीशी सुसंगत अशा बियाण्यांचा वापर हे भारतीय शेतीचे तीन आधार होते. पाणी, माती, जंगले यांचे जतन केले जाई. प्रागवनाची आवतळ्यांची संकल्पना शेतकरी सामूहिक पद्धतीने राबवित. शेतीतील ईश्वर वाढविणे, जमिनीतील ओलावा टिकवून ठेवण्याच्या पद्धती. नि-जारत पावसात घ्यावयाच्या पिकांची माहिती शेतकऱ्यांना होती.

जिल्ह्या मीठ कुक्काड घडला तरी मनुष्याला होत नव्हतो. हिरतश राजवटीपूर्वी शेतात काय पिकवायचे याचे स्वातंत्र्य शेतकऱ्यांना होते. ब्रिटिशने मात्र शेतकऱ्यांच्या स्वातंत्र्यावर बंधने आणली. जमिनीवर या कुक्काड्याकडे यात शेतकऱ्या लावली. अन्वयान्याच्या पिकादेखली काढून, उन्हा, तसद्याया अशा नगदी पिकांचे सक्ती केले जाऊ लागली. यामुळे शेतकऱ्यांचे आर्थिक नुकसान तर झालेच पण अन्वयान्याची उपाई निर्माण झाली. माच काळात सायकार व कर्मोतदनीया उदय झाले आणि शेतकऱ्यांची मूट नूट झाली. पोक येथी अथवा न येथी शेतकऱ्या घडकडने येणून केला जात होता. शेतकरी कर्मवाजरी होत गेले. त्यांच्या जमिनी सायकाराच्या दाब्यात गेल्या. शेतकऱ्यांची हिजमज्ज्य नूट झाली आणि गतिबोत प्रचंड वाढ झाली. शेतकऱ्यांना प्रसोबाया गुलामांतून बाहेर काढण्यासाठी अनेक साधने झाले. आज मात्र नवकामाच्या गुलामांतून शेतकऱ्यांना बाहेर काढण्यासाठी कोणते आणि कसे साधने बनविले जाता प्रश्न शेतकऱ्यांमुळे आहे.

मानवीय शेताः स्वातंत्र्यातून काढी. स्वातंत्र्य मिळाले तेव्हा देशात अन्वयान्याची सत्ता होती. कुक्काड्यांही त्यात भर पडली. ब्रिटिशच्या अत्यंत कटन कृषी पिकांना प्रोत्साहन दिले गेले. १९६६ च्या हस्तांतरात शेतांचे तसे बदलले. अधिक उत्पादन देणारी विभाग, यंत्रे संकलित बाण रोखले गेले. रासायनिक खतांचा वापर वाढला. नुसत्याला गव्हा आणि तांदूळ या दोन नसल्याच्या धान्य पिकांसमूह हस्तांतराची नुकदात झाली. उत्पादनात वाढ झाली. निर्यात वाढली हे हस्तांतराचे च्या होय.

हस्तांतरातला अन्वय ५० वर्षे पूर्ण झालेत. २०२२ मध्ये देशाच्या स्वातंत्र्याचा ७५ वा वर्षाचा दिन साजरा होईल. तोपर्यंत शेतकऱ्यांचे उत्पन्न दुप्पट करून देण्याची सरकारने घोषणा केली आहे. अन्वय वाढत तर नाहीं मात्र सतत डोळ्याच्या जमिनीचे प्रमाणही घटत आहे. त्यातच आधुनिक विद्याभ्यास सरकार अनुमती देत नाही आणि तसेही सरकारने शेतकऱ्यांना दुप्पट उत्पन्नाचे आश्वासन दिले आहे. यलातही अनेक अन्वयसरट, मंत्रालय, कार्यसमित्या नेमल्या गेलीत. अनेक अहवाल येतात, मोठडी इतली शिफारशी होतात. पण अन्वयकऱ्यांचे काय? आजचा शेतकरी आधुनिक शेताचा गुलाम आहे. अन्वयान्याचे उत्पादन करी वाढले असले तरी देशातूने योग्यमुल्याचे मीठे आवात उभे आहे. कृषोपणाचा प्रश्न मेडसावत आहे. सुधान्त तंत्रज्ञानामुळे पिक निा अधिक रासायनिक खते, कीटकनाशकांचा वापर झाल्याने जमिनीतल इतर पोषकद्रव्यांचे नुकसान निर्माण झाली आहे. सौंदर्य खतांच्या अन्वयवासांमुळे जमिनीचे

आगेष धोक्यात आले, शेतातला भाडवनी खर्च दिवसांदिवस वाढत गेला मात्र उत्पादन वाढले नाही. शेतमालाचे भाव वाढले नाहीत. शेतकरी अन्वयान्य पिकादेखली काही प्रमाणात नगदी पिकांकडे वळले. बहुतेक पोक पद्धतीत उत्पन्नात जो सुरक्षितता होती तो कमी झाली. शेतांतून नसा कमी झाला. शेतकरी कर्मवाजरी झाले, घेऊंवर कर्मकेड न झाल्याने आत्महत्या करायला प्रवृत्त होऊ लागले. रसायनांच्या आंतरिक वापरामुळे, जमिनीची धूप झाल्यामुळे पाण्याची पातळी खाल गेल्याने जमिनीच्या सुपकाले घट झाल्याने जो पंजाब प्रांत तंत्रज्ञानाच्या वापरात आणि उत्पादन वाढीत आघाडीवर होता तेथे पिण्याचे पाणीसुद्धा दुर्भित झाले आहे. गावागावात कॅन्सरसारखा आजार वाढतो आहे. धोक्यात तंत्रज्ञानाने शेतकऱ्यांचे भले झाले का? हा खरा प्रश्न आहे. आज संसदेमध्ये निम्न्याहून अधिक खासदार स्वतःला शेतकरीपुत्र असल्याचे सांगतात. पण शेतकऱ्यांसाठी कायदेकानून तयार करण्यासाठी त्यांच्या पुढाकार नसतो. सरकारकडे कंपन्यांना, उद्योगांना द्यायला येता आहे. मात्र शेतकऱ्यांना सधुरीचा सल्ला दिला जातो. शेतकरीपुत्र असणारे खासदार व मंत्री आंतरराष्ट्रीय बाजारात शेतकऱ्यांचे हित मोलभावले विकत आहेत, पण त्यांना विचारणारे कोणी नाही. हो खरी शेतकरीतिका आहे.

स्वानेतायन आयोगः शेतां व शेतकऱ्यांच्या विविध प्रश्नांवर तांडगा काढण्यासाठी हरितक्रांतीचे प्रणेते डॉ. एम.एस.स्वानेतायन या प्रचंड अभ्यासू व्यक्तींच्या अध्यक्षतेखाली १८ नोव्हेंबर २००४ रोजी राष्ट्रीय शेतकरी आयोगाची स्थापना करण्यात आली. अन्नसुरक्षा आणि पोषण याबाबत नियोजन करणे, उत्पादन व नसण्याचे प्रमाण या निकषांवर शेतांची व्यवस्था करणे, शेतां पतपुरवठ्यात वाढ करणे, कोरडवाहू शेतकऱ्यांच्या योजना राबविणे, शेतमालाची गुणवत्ता व किंमत यांचे जागतिक बाजाराशी संगड घालणे, पर्यावरण व जीवसंस्थांचे जतन व संवर्धन आणि किमतीतल चढउतारांचा शेतांवर कमीतकमी परिणाम होईल अशी योजना उभी करणे. हो या कृषक आयोगाची उद्दिष्टे होती. सत सदस्यांच्या या आयोगाने २००४ ते २००६ या काळात एकूण ६ अहवाल सादर केले. शेवटचा अहवाल ४ ऑक्टोबर २००६ रोजी सादर केला. या अहवालात आयोगाने शेतकऱ्यांच्या दुरावस्थेची कारणे, त्यावरील उपाय, सुधारणा व शिफारशी सुचविल्या. आयोगाने सुचविलेल्या सुधारणाः सिलिंगप्रमाणे आंतरिक आणि उपकाऊ नसलेल्या जमिनीचे फेरवाटप करणे. वागायती समित्या आणि वनक्षेत्राचा वापर उद्योगांसाठी करण्यास प्रतिबंध करणे. गवताळ जमिनीवर चराईचे अधिकार आणि वनसंपत्ती अधिकार आदिवासी

आणि पशुपालकना देणे. पर्यावरण आणि खनिज संपत्ती यांच्या अभ्यासातून जमिनीच्या योग्य वापरासाठी वैज्ञानिक समिती निर्माण करणे. शेती खरेदी करताना कोण कशासाठी आणि किती जमीन खरेदी करतंय याचे नियमनासाठी येवणा उभारणे अशा अनेक सुधारणा स्वाामीनाथन आयोगाने सुचविलेल्या आहेत.

आयोगाने सुचविलेल्या उपाययोजना: शेतीसाठी पुरेशा आणि कामयमस्वरूपी पाण्याची व्यवस्था करणे. पावसाच्या पाण्याचा जास्तीत जास्त वापर, जलस्रोत पुनर्भरणाची सक्ती करणे. सिंचनासाठी भूजलपातळीत वाढ करण्यासाठी जास्तीत जास्त निधीची तरतूद करणे. शेतकऱ्यांना माफक दरात आरोग्य विमा उपलब्ध करून देणे आणि प्राथमिक आरोग्य केंद्र सक्षम करणे. आवश्यक माहिती शेतकऱ्यांना सहज उपलब्ध होण्यासाठी गावागावात माहिती केंद्रे स्थापन करणे. सुसंगतपुरवठाच्या योजना सक्षम कराव्यात आणि त्याचा आवाका तंत्रज्ञान, बाजारपेठ आणि व्यवस्थापन क्षेत्रात वाढवावा. उच्च प्रतियेच्या बियाण्या आणि इतर पूरक बाबींचा योग्य वेळेला, योग्य ठिकाणी आणि परवडणाऱ्या दरात पुरवठा करावा. शेतमालाच्या आयातीवर आयातशुल्क लावण्यासाठी त्वरीत उपाययोजना कराव्यात. आत्महत्या करण्याची प्रवृत्ती किंवा लक्षण इतर माणसांना समजण्यासाठी, उपाययोजना करण्यासाठी जनजागृती मोहीम राबवावी. शेतीची उत्पादकता वाढविण्यासाठी सिंचन, पाण्याचा निचरा, जमिनीचा पोत आणि गुणवत्ता सुधारणे, भूजलपातळी वाढविणे, जलस्रोत रक्षण, संशोधन आणि शेतमालाच्या वाहतुकीसाठी प्रामाणिक रस्ते या शेतीशी निगडित पायाभूत सुविधांमध्ये जास्तीत जास्त भूतलापूक करणे. मातीची गुणवत्ता टिकवून राहण्यासाठी माती परीक्षण प्रयोगशाळांची उभारणी करून सूक्ष्म पोषण द्रव्यांची तपासणी करण्यासाठी व सल्ला देण्यासाठी सुविधा निर्माण करणे.

स्वामीनाथन आयोगाच्या शिफारशी : स्वामीनाथन आयोगाने किमान आधारभूत किमतीच्या पध्दतीत सुधारणा करून शेतकऱ्यांना पीक उत्पादन खर्च अधिक ५० टक्के नफा मिळेल इतका हमीभाव, आधारभूत किंमत लागू करण्याची पध्दत रद्द करून गहू आणि इतर अन्नधान्या वगळता इतर पिकांना आधारभूत किंमत मिळण्याची व्यवस्था करावी, बाजाराच्या चढ-उताराप्रामुन शेतकऱ्यांचे संरक्षण यदाय म्हणून धूल्य स्थिरता निधीची उस्थापना करावी, आंतरराष्ट्रीय बाजारातील किमतीच्या दुष्परिणामांपासून संरक्षण करण्यासाठी आयात होणाऱ्या शेतमालाला कर लावावा, दुष्पन्ना आणि इतर आपत्तीपासून बचावासाठी पृथ्वी आपत्काल निधीची उस्थापना करावी, कृषी कर्जपुरवठा प्रमाणीचा

विस्तार करावा, पीक कर्जांवरील व्याजदर ४ टक्के असावा, शेतकऱ्यांना कर्जाचे नियमन करावे, महिलांना किसान प्रॅक्टिस्ट फांडे, हवामान स्थिती असलेल्या क्षेत्रांमध्ये नैसर्गिक संवत्तयाच्या कळी पुरवठ्यासाठी शेड्मार्गेत गैरसंस्थात्मक कर्जासह सर्व कर्जांची वसुली स्थानिक तळावरील व्याज माफ करावे, कमी हप्त्यांचा पीकवैयमा, मातीचा सुरक्षेचे जाळे, नुस शेतकऱ्यांना स्वास्थ्य विम्याची तरतूद, वाढले दरात बियाणे व यंत्रसामग्री घ्यावी, शेतीला सातत्याने सोयन आणि जीवपुरवठा करावा, पणन व्यवस्थेत सुधारणा करावी या प्रमुख शिफारशी केल्या आहेत.

स्वामीनाथन आयोग शिफारशी आणि वास्तव: स्वामीनाथन आयोगाच्या शिफारशी आहेत. त्यातील बऱ्याचशा १०० वर्षांपूर्वी रागवें गुरू महाराजांनी आपल्या संस्थानात राबविल्या होत्या. १९०० मध्ये राधानगरीसारखे मोठे धरण बांधण्याचे काम सुरू केले. शेतकऱ्यांना बी बियाणे, शेती अवजारे, बेल खरेदीसाठी कर्जपुरवठा केला. स्व. यशवंतराव चव्हाण, चसंतराव पाटील, चसंतराव नाईक व शहा पवार यांच्या शेती धोरणावर शाहू महाराजांच्या कृषी धोरणाचा प्रभाव स्पष्टपणे जाणवतो. डॉ. स्वामीनाथन यांनी केलेल्या काही शिफारशांचे अंमलबजाणी करण्यात आल्याचे सांगितले जाते. त्यात, शेतकऱ्यांचे खर्च घजा जाऊन उत्पन्न सरकारी कर्मचाऱ्यांप्रमाणे असावे- या शिफारशीच्या बाबत सरकारी कर्मचारी हा नोकर आहे. त्याच्या कामाचे स्वरूप, मिळणाऱ्या सुविधा, हक्क व जबाबदाऱ्या पूर्णतः वेगवेगळ्या आहेत. कर्मचारी संघटित आहेत. शेतकरी हा स्वतः मालक आहे, तो संघटित नाही. त्याचे जीवन बऱ्यापैकी निसर्गावर व अनियंत्रित बाजारपेठेवर अवलंबून आहे. त्यामुळे ही शिफारस व्यवहार्य वाटत नाही. शेतमालाचा हमीभाव उत्पादन खर्च वगळता ५० टक्के नफा धरून असावा ही शिफारस योग्य असली तरी सुध्दा उत्पादन खर्च दर हेक्टरी उत्पादन, सींचन सुविधा, मजुरी, वापरलेले तंत्रज्ञान यावर ठरते. हरियाणा, पंजाब व महाराष्ट्राची तुलना केल्यास महाराष्ट्रातील हेक्टरी उत्पादन खूप कमी व खर्च जास्त आहे. कृषी आपत्काल निधीची कार्यवाही करताना मोठा निधी लागणार आहे. बी-बियाणे परवडणाऱ्या दरात उपलब्ध करून घ्यावीत म्हणजे परवडणारा दर कसा ठरविणार. तरीही राबविलेल्या दरात ही सुविधा उपलब्ध करण्यात आली आहे. स्वामीनाथन आयोग व कृषी विकास: अमेरिकेसारख्या विकसित देशात केवळ २८ टक्के लोकसंख्या शेतीवर अवलंबून असतानाही शेतकऱ्यांना योग्य तो हमीभाव व लाईफ सपोर्ट सिस्टीम अमेरिकेने उपलब्ध करून दिल्याने तेथील शेतकरी सधन बनला आहे. भारतीय

शेती प्रयोगशाळा बनायला हवी, रोजगार निर्माण होण्याच्या दृष्टीने अहवालाची मांडणी करण्यात आली आहे. भारतीय शेतीपुढे सततचे काही प्रश्न आहेत. त्यातील शेतमालाच्या किंमती, किंमत घोरण आणि उत्पादनाशी संबंधित प्रश्नांचा विचार करता, सध्या शेतमाल विकताना शेतकऱ्यावर अनेक बंधने आहेत. उदा. निर्यात बंदी, व्यापाऱ्यांनी साठा करण्यावर बंधने, फॉरवर्ड मार्केटवर बंदी यामुळे शेतकऱ्याचा माल वेळेवर विकत घेतला जात नाही. सरकार घेऊ शकत नाही, किंमती कोसळतात, शेतकरी भीकेस लागतो, आत्महत्या करतो, यासाठी शेतमाल विक्रीवरील बंधने रद्द झाली पाहिजेत. सर्व देश म्हणजे एकच बाजार या दृष्टीने विचार व्हायला हवा. निर्यातीची परवानगी द्यावी. चीज व पाण्याचा काटकसरीने वापर केल्यामुळे शेतकऱ्यांना कितपत फायदा झाला याचाही अभ्यास झाला पाहिजे. शेतीत अत्यल्प संशोधन झाले आहे किंवा संशोधनाकडे दुर्लक्ष झाल्याने आपण खूप मागे पडलो आहोत. भारतीय शेतीची दरहेकरी उत्पादकता इतर देशांच्या मानाने खूपच कमी आहे. उदरनिर्वाहासाठी शेती करणाऱ्यांची संख्या कमी करण्याच्या संदर्भात डॉ. बाबासाहेब आंबेडकर १०० वर्षांपूर्वी म्हणतात की, विंगरशेती क्षेत्रामध्ये रोजगार निर्मिती करून शेतीवरील गर्दी कमी केल्याशिवाय भारतीय शेती आणि शेतकऱ्यांना तरणोपाय नाही. औद्योगिकीकरण हाच शेती विकासाचा प्रभावी मार्ग आहे.

भारतात आर्थिक उदारीकरणाचा सुरुवात होऊन २५ वर्षांचा काळ लोटला आहे. शेतकरी वगळता सर्वच समाजघटकांना आणि व्यवसायांना उदारीकरणाचा लाभ झाला. शेतकरी मात्र लोकनियुक्त सरकारांचा गुलाम आहे. म्हणायला देशात लोकशाही आहे, बहुमताचे सरकार आहे, शेतकरीही बहुमतातच आहेत, मात्र लोकशाहीत शेतकऱ्याची अवस्था एका नोकरासारखी आहे, त्याला तलाठ्यासमोर हात जोडावे लागतात, बँक अधिकाऱ्याच्या खोलीबाहेर भिकाऱ्यासारखे ताटकळत बसावे लागते, तहसील कार्यालयात कामांसाठी टाचा घासत फिरावे लागते. म्हणजेच आज शेतकरी स्वतंत्र भारताचा नागरिक नाही तर राजाच्या दयेवर चालणाऱ्या प्रजेच्याच अवस्थेत आहे. आजही जीवनावश्यक वस्तू कायदा लागू आहे. शेतीच्या कोणत्याही व्यापारात सरकार केव्हाही निर्वंध घालू शकते. निर्यातीवर बंदी, जादा दराने आयात, शेतमाल साठवणूक व विक्रीवर बंदी, वायदेबाजारावर बंधने, लेव्हीची पद्धती हे सारे सुरुच आहे. प्रश्न निर्माण होतो तो म्हणजे उत्पादन खर्चापेक्षा कमी भाव मिळूनही शेतकरी जगतो कसा? शरद जोशी म्हणतात शेतकरी स्वतःचे भांडवल खाऊनच जगत असतो. आपली जमीन, कार्यशक्ती, जनावरे तो कणाकणाने खात असतो.

कुठल्याही आर्थिक अडचणीत त्याला कर्ज काढल्याशिवाय पर्याय नसतो. शेती उत्पादनखर्च भरून निघत नसल्याने फायदा होईल कर्ज फिटेल हे केवळ स्वप्न ठरते. शेतकरी कर्जात जगतो व कर्जात मरतो.

संदर्भ:

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Agriculture is the backbone of indian economy. Seventy percent propulation of the country depends on the indian agriculture. However the share of agriculture in national income is reduced day by day. The present scenario of indian agriculture shows that this sector is plagued by several problems. The new agriculture policy of india offers ample opportunities. The main purpose of proposed seminar is find ways to solve these problems by means of discussion exchange of thoughts and ideas. The seminar will provide an appropriate forum to have deliberations on different topics related to the recent and emerging fields in various disciplines of agricultural Economics.



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शेतकऱ्यांची कर्जमाफी: एक चिंतन

जयवंत भदाणे व कृषीसेवक मुरलीधर बच्छाव
कर्म.रामरावजी आहरे कला, विज्ञान व वाणिज्य महाविद्यालय
देवळा, ता.देवळा, जि.नाशिक

प्रस्तावना:

भारतातीलच नाही तर जगातील अत्यंत पुरातन व्यवसाय म्हणून शेती व्यवसाय केला जातो. जगातील २/३ लोकांचा तर भारतातील ६८ टक्के लोकांचा शेती हाच मुख्य व्यवसाय आहे. शेतीचा शोध हा मुळातच शिकार आणि अन्न गोळा करण्यासाठी वणवण भटकण्यापेक्षा एका जागीच अन्न मिळविण्याची सोय म्हणून मानवाच्या इतिहासातील एक महत्वाचा टप्पा होता. शेतीचा शोध साधारणतः दहा हजार वर्षांपूर्वी मध्यपूर्वेकडील सुपीक भागात लागला. शेतीचा शोध स्त्रियांनी लावल्याचे मानले जाते. भारतीय शेतीलाही किमान साडेसहा हजार वर्षांचा इतिहास आहे. सुरुवातीच्या काळात नैसर्गिक संसाधने, माती, पाणी, झाडे, जंगले यांच्या जतन व संवर्धनाची जाणीव लोकांना होती. जंगलांचा शेती उत्पादनासाठी असलेला संबंध माहिती असल्यामुळे सामूहिक पध्दतीने पाणी व जंगलांच्या जपणूकीसाठी कामे केली जात होती. अनुभवजन्य उत्पादन पध्दती होती. सर्वत्र आर्थिक सुबत्ता होती. ब्रिटिशांची सत्ता येईपर्यंत शेतीत काय व कसे पिकवायचे आणि येणाऱ्या उत्पादनाचा विनिमोग कसा करायचा याचे निर्णयस्वातंत्र्य शेतकऱ्यांना होते. जुनाट तंत्र असूनही समूहशेतीच्या माध्यमातून मोठ्या प्रमाणात उत्पादन घेतले जाई.

शेती हे प्राथमिक क्षेत्र असून यातूनच इतर क्षेत्रांचा विकास झाला आहे. स्वातंत्र्यप्राप्तीनंतर या क्षेत्रासमोर वाढलेल्या लोकसंख्येला पुरेशा अन्नपुरवठ्याची समस्या, दुष्काळ, अतिवृष्टी अशा समस्या निर्माण झाल्या. हरितक्रांतीने उत्पादन तंत्रात काही बदलही झाले. मात्र आवश्यक ती प्रगती न झाल्याने शेतीक्षेत्रात समस्या वाढतच गेल्या. शेतीसाठी विविध मार्गाने भांडवलपुरवठा करण्याचा प्रयत्नही झाला. रॉयल कमिशनने म्हटल्याप्रमाणे भारतीय शेतकरी कर्जात जन्म घेतो, कर्जात वाढतो, कर्जात मरतो आणि वारसावर त्याचा भार ठेऊन जातोड आणि आजही तेच चित्र आहे. शेतकरी उत्पादन, उपभोग, शेतीविकास,

अनुत्पादक, आकस्मिक अशा वेगवेगळ्या कारणांसाठी कर्ज घेतो अशा कर्जाचे काळानुसार, उद्देशानुसार, तारणानुसार कर्जदात्यानुसार प्रकार आहेत. घेतलेल्या कर्जाची परतफेड करायला शेतकऱ्यांपुढे अनंत अडचणी आहेत. त्यात शेतीव्यवसायातील अनिश्चितता, सावकारांची शोषण नीती, सरकार व सहकाराचे पुरवठे धोरण, रुढी-परंपरा, उत्पादनातील सातत्य, वंशपरंपरागत कर्ज, प्राचीन उद्योगांचा जहास, विपणनातील दोष, पशुधनाची समस्या अशा विविध समस्यांमुळे शेतकऱ्यांची कर्जवाजारीपणाची समस्या अधिक गंभीर झाली आहे. सत्तेत नसलेले सर्वच राजकीय पुढारी, नेते शेतकऱ्यांचे कर्जमाफी मिळाली पाहिजे, नव्हे त्यांचा सातवारा कोरा झाला पाहिजे असे सतत म्हणत असतात. मात्र शेतकऱ्यांच्या या अवस्थेलाही तेच लोक आणि त्यांची धोरणे कारणीभूत आहेत. म्हणून शेतकरी वेळोवेळी रस्त्यावर उतरून कर्जमाफी, शेतमालाला भाव यासाठी आंदोलन करून आपल्या अस्तीत्वाची लढाई लढतो. महाराष्ट्रात आलेक कर्जमाफीबाबत मोठ्या प्रमाणावर आंदोलन झाले. ऐतिहासिक संघर्श झाला. सत्ताधाऱ्यांची धारणा होती की, पाऊस पडला कोह आंदोलन थांबेल. मात्र सरकारचा अपेक्षाभंग झाला आणि नाक मुठीत घेऊन कर्जमाफीची घोषणा करावी लागली.

महाराष्ट्रातल्या शेतकऱ्यांना ३४ हजार कोटीची कर्जमाफी घोषणा झाली. राज्यातील ९० टक्के शेतकऱ्यांना या कर्जमाफीचा फायदा होईल आणि ज्या शेतकऱ्यांवर दीड लाख रुपयांपर्यंतचे कर्ज आहे त्यांचे कर्ज सरसकट माफ करण्यात येईल. उर्वरीत शेतकऱ्यांच्या कर्जाकडे दीड लाख रुपये राज्य सरकारचा वाटा असेल असे स्पष्ट करत मुख्यमंत्र्यांनी या योजनेला छत्रपती शिवाजी महाराज कृषी सन्मत् योजनाड असे नावही दिले. नियमित कर्ज भरणाऱ्या शेतकऱ्यांमध्ये २५ हजार रुपयांचे अनुदान मिळणार आहे. आजवरच्या काळात महाराष्ट्रातील ही सर्वात मोठी कर्जमाफी म्हणून सरकारने आपले फर्जे थोपटून घेतली आहे. काही शेतकऱ्यांना कर्जमाफीचा लाभही झाला आहे आता प्रश्न आहे तो यातील काही कायदेशीर बाबींचा व मुद्यांचा सात-बारा म्हणजे काय?

७/१२ उतारा म्हणजे जमिनीचा एक प्रकारचा अरसाच कारण हा उतारा वाचून प्रत्यक्ष जमिनीवर न जाता त्या जमिनीचा संपूर्ण अंदाज आपल्याला बसल्याजागी मिळू शकतो. महाराष्ट्र शासनाच्या महाराष्ट्र जमीन महसूल कायदा १९६६ अंतर्गत शेतजमिनीच्या हक्कांबाबत विविध नोंदी ठेवल्या जाताना, गावठी शेतजमिनीच्या हक्कांबाबत विविध नोंदी ठेवल्या जाताना, गावठी वेगवेगळी नोंदणीपुस्तके असतात. या पुस्तकांमध्ये कुळाचे मालकी हक्क, शेतजमिनीचे हक्क, त्यातल्या पिकांचे हक्क, कर्जाबाबतचा व इतर अधिकाराबाबतचा तपशील असतो. गाव नमुना नं. ७ आणि नं.

१२ मिळून जो उतारा तयार होतो तोच ७/१२ उतारा असतो. जो प्रत्येकबला
ज्यावर असा पाहिजे आणि जाणीवपूर्वक समजूनही घेतला पाहिजे.

प्रत्येक खातेधारकास म्हणजे जमीनधारकास आपल्याकडे
मिळी, कोणती व कुठे जमीन आहे हे या उताऱ्यावरून कळू शकते.
या नमुना ७ हे इतर अधिकार पत्रक आहे. यावर वरच्या बाजूला
गावाचे नांव, गट क्रमांक, उपविभाग क्रमांक, भू-धारणा पध्दती,
जमिनीसंबंधी नांव, खाते क्रमांक, शेतीचे स्थानिक नाव, लागवड योग्य
क्षेत्र, पट्टे खराब क्षेत्र, आकारणी, कुळाचे हक्क, तसेच सरकार किंवा
बँकने दिलेल्या कर्जाचा बोजाही याच उताऱ्यावर इतर अधिकारात
लेखलेला असतो. तर गाव नमुना १२ हे पीकपाहणी पत्रक असते.
यात वर्ष, हंगाम, पीक, पिकाखालील क्षेत्र, जलसिंचनाचे साधन इत्यादी
तारीखीन खालच्या बाजूला लिहिलेला असतो. जमिन व महसूलाच्या
जावस्वपनासाठी प्रत्येक गावच्या तलाठी कार्यालयात हे नमुने असतात.
साधारणपणे दर १० वर्षांनी ७/१२ पुस्तके नव्याने लिहिली जातात.
सातबारा कोरा म्हणजे काय?

७/१२ वर इतर हक्कात कोणत्या नोंदी आहेत हे काळजीपूर्वक
पहिले पाहिजे. कर्ज, तगाई रक्कम व कर्ज देणाऱ्या संस्थेचे नाव
सावर असते. शेतकऱ्याला जर शहरीकरणांमुळे किंवा स्वतःच्या
राजेनुसार जमीन विकण्याची आवश्यकता असल्यास प्रांत अधिकारी
याची परवानगी घ्यावी लागते आणि त्यावरच्या इतर अधिकारातल्या
कर्जाच्या नोंदी रद्द करून फेरफार नोंद घालावी लागते. म्हणजेच कर्जाची
परतफेड झाल्याशिवाय संबंधित संस्था त्यासाठीचा ना-हरकत दाखला
देत नाही. यासाठीच जर कर्ज पूर्णपणे माफ झाले म्हणजे सरकारने
संबंधित संस्थेच्या कर्जाची परतफेड केली तरच सात-बाज्यावरच्या
कर्जाच्या नोंदी रद्द होणार आहेत. म्हणजे सातबारा बोजारहित होईल
यावर अर्थ कोरा होईल असे मानले जाते. आणि यासाठीच शेतकरी
जोडोत्तर करीत आहेत.

पीक कर्ज म्हणजे काय?

शेतीच्या अर्थकारणात जून हा सर्वात महत्वाचा महिना
असतो. जून महिन्यात पावसाला सुरुवात होते असे मानले जाते.
त्यामुळे जमिनीची मशागत, बियाणे, खते, मजुरी यासाठी शेतकऱ्याला
जोडोत्तर घेणे आणि सहकारी संस्थांकडून पीक कर्ज दिले जाते.
शेतकऱ्यांना दिले जाणारे पीककर्ज हे सर्वात कमी दिवसात म्हणजेच
किमान १२ महिन्यांच्या आत परतफेड करावे लागते. ३ लाखापेक्षा
कमी कर्ज घेणारे आणि मुदतीच्या आत कर्जाची परतफेड करणाऱ्या
शेतकऱ्यांना व्याजवात सवलत किंवा सूट दिली जाते. मुदतीनंतर या
कर्जाचा नियमित व्याजदार असतो. जमिनीचे क्षेत्र कितीही असले तरी
३ लाख पीक कर्जासाठी हा नियम लागू होतो. म्हणजेच जास्त जमीन

असलेले शेतकरी खूप कर्ज काढतात आणि कर्जमाफी मागतात असे
जर कुणी म्हणत असेल तर ते चुकीचे आहे. कर्ज हे हेक्टरावर उरते,
त्याचप्रमाणे जमिनीवर काय पेरले आहे यावरही अवलंबून असते.
म्हणजे कापसाला हेक्टरी ३० ते ३५ हजार फळबागांना ६० ते ८०
हजार पीक कर्ज दिले जाते. त्यातही ते ३ लाखचे वर गेले तर व्याजदरात
सूट दिली जात नाही. ठिबक सिंचन, पाईपलाईन, विहीर खोदणे, फार्म
हाऊस बांधणे अशा कामांसाठी घेतलेले दीर्घ मुदतीचे कृषीकर्ज हे
पीक कर्ज म्हणून गणले जात नाही. यासाठीचा व्याजदार जास्त असतो.
त्यात शेतकऱ्यांना सूट नसते. यात प्रसंगी थोडीफार तफावत असू
शकते मात्र पीक कर्ज हे शेतकऱ्यांना वारेमाप मिळत किंवा त्यासाठी
कोणतेही नियम नाहीत असे मुळीच नाही.

कर्जमाफी म्हणजे काय?

सरकारने जाहीर केलेल्या ३४ हजार कोटीच्या कर्जमाफीमुळे
८९ टक्के शेतकऱ्यांपैकी ३६ ते ३८ लाख शेतकऱ्यांचा सातबारा
कोरा होणार आहे. कर्जमाफीचे निकषही सूटसुटीत आहेत. यात आजी-
माजी मंत्री, विधानसभा-विधानपरिषद सदस्य, पंचायत समिती सदस्य,
नगरसेवक, जेसीबी बाळगणारे कंत्राटदार, केंद्र-राज्य सरकारी कर्मचारी
आणि सरकारकडून अनुदान घेणाऱ्यांना या कर्जमाफीचा लाभ मिळणार
नाही. त्याचप्रमाणे शेतीव्यतिरिक्त इतर करपात्र उत्पन्न असलेल्यांनाही
या कर्जमाफीतून वगळले आहे. म्हणजेच प्रत्यक्ष गरजवंत शेतकऱ्यालाच
कर्जमाफी मिळणार आहे. महाराष्ट्रात शेतीचे धरटी कर्ज रुपये ५४,७००
म्हणजे इतर राज्यांच्या तुलनेत कमी आहे. कर्जमाफी देताना कोणताही
घोटाला होणार नाही याकडे सरकार काटेकोर लक्ष देणार आहे. बँकांनाही
दक्ष रहावे लागणार आहे. या कर्जमाफीमुळे नियमित कर्ज भरत
असलेल्या शेतकऱ्यांनाही कर्जाच्या रकमेवर २५ टक्के मदत मिळणार
आहे. ३० जून २०१६ ही कर्जमाफीची अंतिम मुदत असणार आहे.
आणि २०१२ ते २०१६ या दुष्काळी वर्षातीलच थकबाकीदार यात
गृहीत धरले आहेत. सरकार वापेक्षा आणखी बोजा सहन करू शकत
नसल्याने पुढील वर्षाची कर्जमाफी दिलेली नाही.

सरसकट कर्जमाफी म्हणजे काय?

ऐतिहासिक अशा शेतकरी संपानंतर राज्य सरकारने हा,
ना, ना करत सरसकट कर्जमाफी करून शेतकरी संप तर थांबवला
आहे. सरसकट, घत्तवतःड आणि घनकाण्ड या तीन शब्दांवरून
विरोधाकांसह सोशल मिडियानेही सरकारवर टीका केली आहे. कारण
सरसकट कर्जमाफी याचा अर्थ आजही शेतकऱ्यांना उमगलेला नाही.
सरसकट म्हणजे आधी सरकारने ५ एकरांपर्यंतच्या शेतकऱ्यांची
कर्जमाफी केली होती. परंतु पश्चिम महाराष्ट्रात लँड होल्डिंग कमी
असल्याने अधिक उत्पादन तर विदर्भ-मराठवाड्यात लँड होल्डिंग

जास्त असते आणि उत्पादन कमी असते असे निदर्शनास आणून दिल्याने सरकारने सरसकट कर्जमाफीत एकरांची किंवा जमिनीची मर्यादा नसेल आणि सर्व शेतकरी कर्जमाफीसाठी पात्र असतील असे ठरविले. परंतु चतुःश्रुत म्हणजे सरसकट कर्जमाफी देण्याचे ठरले आहे. सर्व कर्जांचा तपशील गोळा करून मंत्रीमंडळापुढे प्रस्ताव आणला जाईल. चारशेही संमिती नेमली जाईल. संमितीत सरकारचे मंत्री, सरकारी अधिकारी, शेतकऱ्यांचे प्रतिनिधी, विविध राजकीय पक्षांचे नेते संयुक्तरित्या विचारविनिमय करून धनकषड म्हणजेच अडी ठरविल्या जातील. थोडक्यात काय तर कर्जांची मर्यादा ठरवणे म्हणजे निकष ठरवणे होय. चतुःश्रुत आणि धनकषड हे शब्द टाकण्याचे कारण खऱ्या अर्थाने पात्र असणाऱ्यालाच कर्जमाफी मिळावी हेच आहे. कर्जमाफीची मर्यादाच न ठेवल्याने जिरायती शेतकऱ्यांना त्याचा लाभ मिळणार आहे.

स्वामीनाथन आयोग:

स्वामीनाथन आयोगाच्या काही शिफारशी शेतीस पूरक, मारक व अंमलात आणता न येणाऱ्या आहेत. यातील राष्ट्रीय भूमी पीक वापर सल्लागार मंडळ, सामाजिक अन्नधान्य पेट्या, अन्न हमी कायदा, गहू तांदुळ यांशिवाय इतर पिकांनाही हमीभाव लावणे म्हणजे सरकारी एकाधिकारास चालना देणे, शेतमाल भाव स्थिरीकरण निधी, बचतगट, शेतकऱ्यांना सरकारी नोकरींसारखे खेत मिळवून देणे हे पुढे अंमलात आणता येणे अशक्य आहेत. अन्नसुरक्षा व अन्नहमी यामुळे धष्ट व अकार्यक्षम अन्न महामंडळ वाढविण्याचे काम होईल. रोजगार हमी आणि स्वस्त धान्य योजनेमुळे शेतीला मजूर मिळणे कमी होईल याचा विचार झालेला नाही. आज शेतमालाला जास्त किंमत देण्याची मागणी झाल्यावर सरकारकडून आर्थिक खोजा निर्माण होतो असे सांगितले जाते. शेतीमध्ये पैसा मिळत नाही, मालाला किंमत नाही मग शेतकऱ्याने शेती करायची तरी का? शेतीमध्ये किती उत्पादन झाले यापेक्षा शेतकऱ्याचे उत्पन्न किती वाढले यावरच शेतीचा किती विकास झाला हे ठरविले पाहिजे. शेतकरी समाधानी झाला तरच देशाचा विकास होईल. केवळ उद्योजकांचे भले करून विकास होणार नाही. उद्योगधर्जाच्या धोरणात शेतकऱ्यांना मरायला सोडून देणे योग्य होणार नाही. शेतकऱ्याच्या विकासासाठी शेतीची धोरणे बदलली पाहिजेत. तरच परिस्थिती नियंत्रणात येऊ शकते. अन्यथा चांगले पिकवूनही हाती काहीच लागत नाही, हे अनुभवल्यावर शेतीमधून नाईलाजाने बाहेर पडणाऱ्या निरास तरुणांचे प्रमाण अधिक येणारे वाढणार आहे. आणि देशापुढील हे सर्वात मोठे संकट ठरणार आहे.

भारतात आर्थिक उदारीकरणाचा सुरुवात होऊन २५ वर्षांचा काळ होतला आहे. शेतकरी वगळता सर्वच समाजघटकांना आणि

ज्यवसायांना उदारीकरणाचा लाभ झाला. शेतकरी मात्र लोकांमधून सरकारीचा गुलाम आहे, म्हणायला देशात लोकशाही आहे, बहुमत सरकार आहे, शेतकरीही बहुमताराचे आहेत, मात्र लोकशाहीन शेतकऱ्यांची अवस्था एक नोकरीसारखी आहे, त्यांना तत्वाजुसमते हात जोडावे लागतात, बँक अधिकार्याच्या खोलीबाहेर भिडणाऱ्यासारखे ताटकळत बसावे लागते, तहसील कार्यालयात कामगारही टाचा पावत फिरावे लागते. म्हणजेच आज शेतकरी स्वतंत्र भारताचा नागरिक नाही तर राजाच्या दयेवर चालणाऱ्या प्रजेच्याच अवस्थेत आहे. जावही जीवनावश्यक वस्तु कायदा लागू आहे. शेतीच्या कोणत्याही व्यंगान सरकार केव्हाही निबंध घालू शकते. निर्यातीवर बंदी, जादा द्यावे आयात, शेतमाल साठवणूक व विक्रीवर बंदी, वायदेबाजारावर बंधने, लेव्हीची पध्ती हे सारे सुरुच आहे. प्रश्न निर्माण होतो तो म्हणजे उत्पादन खर्चापेक्षा कमी भाव मिळू नही शेतकरी जगतो काही? शर जोशी नेहमी म्हणत, शेतकरी स्वतःचे भांडवल खाऊनच जगत असतो. आपली जमीन, कार्यशक्ती, जनावरे तो कच्चाकच्चा खात असतो. कुठल्याही आर्थिक अडचणीत त्याला कर्ज काढल्याशिवाय धन्य नसतो. शेती उत्पादनखर्च भरून निघत नसल्याने फायदा होईल काय फिटेल हे केवळ स्वप्न ठरले. शेतकरी कर्जात जगतो व कर्जात मरतो.

समारोप:

भारतात १९७१-७७ मध्ये इंदिरा गांधींनी सावकारी कर्ज माफ केले होते. लाखों लोकांनी एक पैसाही न देता आपल्या गळत ठेवलेल्या वस्तु, सोने, भांडी-कुंडी परत घेतली. परंतु शेतकरी व आदिवासी प्रामाणिक होता. त्यांनी काही व्याज भरून आपल्या वस्तु सोडवून नेल्या. इतका प्रामाणिकपणा शेतकऱ्यांजवळ आहे. कर्ज बुडवण्याची दानत त्याची निश्चिंतच नसते. मात्र राज्यकर्त्यांनी लोकांना चाईट सवली लावल्या आहेत. पैसे घ्या पण भर नका. त्यापुढे आज जिल्हा बँक काही अंशी डब्याईस आलेल्या आहेत. पाचवट रिझर्व्हे बँकेने मटलेच आहे की कर्ज बुडवोगीरी आम्ही त्यांना भिकवतो. केलेवर कर्ज घेऊन फेडले तर त्या शेतकऱ्यावर भार राहत नाही. परंतु आम्हीच सांगतो तुम्ही कर्ज भरू नका, माफ होईल. पैसे भरण्याकडे बँकेत गेलेला शेतकरी यामुळे मार्गे फिरतो आणि थकवाकरीदार बनतो. याआधीच्या महाराष्ट्र सरकारने ७ हजार कोटींची कर्जमाफी दिली होती. मात्र चतुःश्रुत आणि धनकषड नसल्याने परिष्कृत महाराष्ट्रात शेतकऱ्यांनीच कर्जमाफी उकळली आणि विदर्भ मराठवाड्यातील शेतकऱ्यांनी खरी कर्जमाफी मिळूच शकली नाही, असा दावा केला जातो.

उत्तरप्रदेश सरकारने पहिल्याच मंत्रीमंडळ वेळीत १ लाख रुपयांपर्यंतच्या कर्जास माफी दिल्यानंतर खऱ्या अर्थाने महाराष्ट्रातील कर्जमाफीचा विषय शेतकऱ्यांसह विरोधकांना मिळाला. २०१२-२०१६

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मा काळात वृष्काळ आणि नापिकीमुळे शेतकरी कर्जफेड करू न
शकल्याने अशा शेतकऱ्यांना कर्जाच्या खाईतून बाहेर काढण्यासाठी
सर्वाधिक कर्जमाफी दिली आहे. सुरुवातीला शेतकऱ्यांना १० हजार
तात्पुरते दिले, शेतकऱ्यांचे मध्यम मुदतीचे कर्ज, पुनर्गतीत कर्ज, थकीत
कर्ज असे सर्वकाही माफ होणार आहे. त्यासाठी राज्य सरकारच्या
तिजोरीवर बोजा पडणार आहे, त्याकरिता काही आर्थिक तरतूदही
करण्यात आली आहे. शेतकऱ्यांना स्वयंपूर्ण करण्यासाठी कृषी सन्मान
योजनाही आणली आहे. आज जिकडेतिकडे शेतकरी कर्जमाफी
मिळण्यासाठी ऑनलाईन अर्ज भरण्यासाठी कागदपत्रांची जुळवाजुळव
करीत आहेत. शेतकऱ्यांच्या कर्जमाफीच्या निर्णयाचे श्रेय संपाचे हत्यार
प्रथम उपसणाऱ्या पुणतांबेकरांना द्यावे, राज्यातील शेतकऱ्यांना, शेतकरी
नेत्यांना द्यावे की विरोधी पक्षाला द्यावे हा श्रेयाचा मुद्दा सोडला तर,
राज्य सरकारच्या तिजोरीवर मोठा बोजा पडणार असला तरी तो
सहन करून शेतकऱ्यांच्या पाठीशी ठामपणे उभे राहण्याचे राज्य सरकारने
दिलेले आश्वासन लवकर पूर्णत्वास जाईल आणि खऱ्या अर्थाने
कृषीसन्मान होईल हीच आशा करू या.





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Why is Literature Reviews Important?

Jaywant Bhadane
K.R.Aher College Deola

Introduction:

Hundreds and thousands of research papers are published every year, but only a few have a lasting impression on the academic world. The results of the research are important. The literature review is an integral part of the entire research process and makes a valuable contribution to every operational step. The importance of the literature search and review is that your research proposal will be so easy to write once you have done this. Reviews of previous literature in a thesis or research paper are not summaries of every article you have read, but rather an exposition of the existing knowledge and reasoning which led you to believe that what you did was worth doing in the way that you did it, written so as to convince the reader of these things. Writing about the literature is not just part of "what you have to do", it is a valuable way to learn the literature, to get it "off the page and into your head". And that is essential if you are to be able to think critically about your field. The literature review analyzes relationships and connections among different works. This differs from an annotated bibliography which provides a list and brief description of articles, books, theses, and other documents. The literature review should not merely list and summarize one piece of research after another.

Through analysis of major works and subsequent scholarship the lit review lays out the evolution of scholarship on a topic and establishes a context for further research. This will help you to establish why the topic is important and place your research in a theoretical context. A literature review will help you to avoid redundancy in your own research and to identify new problems, possibilities for further research, and to expand upon or ask new questions. The literature review

allows you as a researcher to enter into an ongoing conversation with other scholars and researchers. Your literature review will demonstrate the depth and relevance of your reading; you're understanding of where your research fits in within your discipline; and scope for future research. A literature review helps you create a sense of rapport with your readers so they can trust that you have done your homework. As a result, they can give you credit for your due diligence: you have done your fact finding and fact checking mission, one of the initial steps of any research writing.

Purpose of Literature Review:

In general, the literature review should:

- provide a context for the research
- justify the research
- ensure the research hasn't been done before (or if it is repeated, that it is marked as a "replication study")
- show where the research fits into the existing body of knowledge
- enable the researcher to learn from previous theory on the subject
- illustrate how the subject has been studied previously
- highlight flaws in previous research
- outline gaps in previous research
- show that the work is adding to the understanding and knowledge of the field
- help refine, refocus or even change the topic

Reviewing literature can be time consuming, daunting and frustrating, but is also rewarding. Its functions are: Bring clarity and focus to your research problem. Improve your methodology, Broaden your knowledge and Contextualize your finding.

Procedure for reviewing the Literature:

To effectively search for literature in your field of enquiry, it is imperative that you have in mind at least some idea of broad subject area and of the problem you wish to investigate, in order to set parameters for your search. Books and Journals are the sources of next compile a bibliography for this broad area. Search for books in your area of interest, prepare final list, locate these books in the libraries or borrow from other sources. Neither examines their content, if

contents neither are nor found to be relevant to your topic, delete it from your reading list. Journals provide you with the most up to date information, even though there is a gap of two to three years between the completion of a research project and the publication in journal. As with books, you need to prepare a list of journals for indentifying literature relevant to your study. This can be done as follows:

Locate the hard copies of the journal that are appropriate to your study, use the internet, look at the index of research abstracts in the relevant field to indentify and read the articles. Whichever method you choose, first identify the journals you want to look at in more detail for your review of literature. Select the latest issue, examine its content pale to see if there is an article of relevance to your research topic. If you feel a particular article is of relevance to you, read its abstract, If you think you are likely to use it, photocopy or prepare a summary and record it for reference for later use.

After indentifying books and articles as useful, the next step is to start reading them critically to pull together themes and issues that are associated. If you do not have a theoretical framework of themes in mind to start with, us separate sheets of paper for each article or book. Once you develop a rough framework, slot the findings from the material so far reviewed into that framework, using a separate sheet of paper for each theme of that framework. As you read further, go on slotting the information where it logically belongs under the theme so far developed. You may need to add more themes as you go.

Writing up the literature reviewed:

In order to comply with the first function of literature review i.e. to provide theoretical background to your study: list the main themes that have emerged while reading literature. Convert them into subheadings. These subheadings should be precise, descriptive of the theme in question, and follow a logical progression. Now, under each subheading, record the main findings with respect to the theme in question, highlighting the reasons for and against an argument if they exist, and indentify gaps and

issues.

In order to comply with the second function of literature review, i.e. contextualizing the findings of your study: requires you to very systematically compare your findings with those made by others. Quote from these studies to show how you findings contradict, confirm or add to them. It places you findings in the context of what others have found out. This function is undertaken when writing about your findings i.e. after analysis of your data.

Tips on Organizing Material for a Review:

Find similarities and differences between studies at different levels, e.g. philosophy, epistemology, morality, methodology, methods, types of data, data analysis and interpretation. The bibliography should give a clear, complete description of the sources that were used while preparing the report. It is an alphabetical list as per the author's surname name of two initials, title, edition, place of publication, publishers, date on title page or copyright date.

Conclusion:

The literature review will help you compare and contrast what you are doing in the historical context of the research as well as how your research is different or original form what others have done, helping you rationalize why you need to do this particular research. A literature review in any field is essential as it offers a comprehensive overview and recapitulation on the given scholarship from past to present, giving the reader a sense of focus as to which direction your new research is headed.

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DR. BABASAHEB AMBEDKAR'S IDEA OF MODERN INDIA

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"I know today we are divided politically, socially and economically. We are in warring camps and I am probably one of the leaders of a warring camp. But with all this I am convinced that, given time and circumstances, nothing in the world will prevent this country from becoming one, and, with all our castes and creeds. I have not hesitation in saying that we shall in some form be a united people"

- Dr. Babasaheb Ambedkar

Introduction:

Dr. Babasaheb Ambedkar was born in an untouchable caste which was deprived of all social, educational, religious and political rights. In spite of this he is counted among some of the most educated persons of the world. He had high degrees from America, England and Germany. He was very much devoted to the reconstruction of modern India; He was really a maker of Modern India. Our nation will ever remain indebted to him for his great contribution towards industrialisation and modernisation of our country

Dr. Babasaheb Ambedkar has been called as the 'Father of Indian Constitution', and found economics closest to his heart. He was a versatile person. His thirst for knowledge, his passion for books and his erudition were unique. He was a distinguished trained economist, eminent educationist, political thinker, and champion of economic planning, social reformer, social scientist, and advocate of state socialism, crusader for social justice, social revolutionary, a great parliamentarian and an eminent national leader. His ideas were immensely influenced by Ranade, Gokhale and Lohia. He was genius and profound scholar, an eloquent speaker, a powerful debater, an eminent jurist and champion for the cause of unprivileged. In brief, he was rare specimen of bosom in the dust.

Dr. Ambedkar's contribution to economic thought is very important. He highlighted some issues and options in respect of socio-economic condition of people in India. He has expressed his economic thoughts, on agriculture, currency, finance system, insurance, education, industrialization, mixed economy, socialism and economical disparity etc. His economic thoughts are relevant even today. The present paper is organized into three parts. The first part throws light on Ambedkar's view on Indian Agriculture Development and Land Reform, the Second part on Currency problem and ideas of democracy and the third part on other related economic issues.

The Objectives of the Present Paper:

1. To understand Dr. Ambedkar's view on Indian Agriculture Development.
2. To know the ideas of Land Reforms of Dr. Ambedkar.
3. To study Currency Problems.
4. To discuss the ideas of democracy.
5. To discuss the economic thoughts of Dr. Ambedkar.
6. To understand the Vision and Mission of Dr. Ambedkar.

Research Methodology:

Present research paper is based on secondary data as prepared and analyzed as also obtain from various books, treatise, annuals, various articles, references, journals, bulletin, Government publication and other published materials.

Dr. Ambedkar's views on Indian Agricultural Development:

Dr. Ambedkar had made in-depth study of Indian Agriculture. His thoughts on agriculture are found in his article 'Small Holding in Indian and their remedies' (1917) and he also proposed state ownership of agriculture and collective farming in his book 'Status and Minorities' (1947) as a soundest remedy for the problems of



Indian agriculture and fostering industrialization, and his other writings. The reforms suggested by him are included in the manifesto of the 'Swatantra Majdur Paksha' and the Scheduled caste federation. He recognized that a small subdivided and fragmented holding of land is acute problem of Indian agriculture associated with many evil affects.

Dr. Ambedkar was of the opinion that if agriculture has to be treated as economic enterprise then, by itself, there could be no such thing as small or large. To a farmer a holding may be small or large, depending upon other factors at his disposal. Mere size of the land is empty of all economic connotations and hence it could not be said that a large holding is economic holding while a small holding is uneconomic. Thus small farm may be economic as well as large farm, for economic or uneconomic does not depend upon the size of the land but upon the due proportions among all the factors including land. The size of the holding should be allowed to change in response to changes in the equipment, a farmer has to make it economic holding ensuring efficient cultivation and hence size of a holding can be made a large holding but not an economic holding.

According to Babasaheb, the problem of small holdings was not fundamental but was derived from the parent evil of maladjustment in the social economy. In his view, industrialization of India was the most appropriate remedy for its agricultural problems as it would reduce the surplus labour in agriculture. He was the first person to raise his voice against Khoti system. In Khoti system, unlike Rayatwari system, there is a middle man between farmer and Government. Under this system, the Khoti was obliged to collect revenue from the tenants and pay a certain part of it to Government. On 17th September, 1937 Babasaheb introduced in Bombay Legislative Council a bill seeking the abolition of the Khoti system. By introducing this bill, Babasaheb sought to put an end to the exploitation of the actual tillers of the land and established a direct relationship between the tillers and the Government.

Even today, Dr. Ambedkar's economic thoughts have significance and relevance in the sense that he wanted economic planning and schemes in the largest interests of the populace. In his view the traditional village economy, as it is based on agriculture was the root cause of the pitiable conditions of the weaker and backward communities. Even today the big landowners exploit the uneducated and the unemployed people, they keep them engaged in work for long hours on meager wages. So, Babasaheb stood for a drastic change in the agriculture system of the country.

Dr. Ambedkar's views on Land Reforms:

Dr. Ambedkar's main concerns were the nature of land holdings, especially their fragmentation and division into unproductive and economically in viable structure. He criticized the existing definition of economic holding which was defined from the point of view of consumption rather than that of production. He remarked, "Any definition, therefore, that leans on consumption mistakes the nature of an economic holding which is essentially an enterprise in production. What is more important for the purpose of production is the process of combining the factors of production." The basic problem of Indian agriculture is that, it is unable generate surplus which ultimately led to scarcity of capital. This resulted in the inefficient use of resources, surplus labour and superfluous employment which by raising the cost of production culminated in low agricultural productivity. Thus the process of overall economic growth gets adversely affected. Babasaheb was of the opinion that the process of consolidation of holding could eradicate the ill-effect of uneconomic holding and usher in the progress of the cultivators. He favored successful growth of industrialization and described that how agriculture is improved by the reflex effect of industrialization. He puts it in the following words: "Industrialization facilitates consolidation. It is a barrier against future subdivision and consolidation."

Dr. Ambedkar stresses the requirement for thorough going land-reforms, nothing that smallness or largeness of an agricultural holding which is not determined by its physical extent alone but by the intensity of cultivation as reflected in the amounts of productive investment made on the land and the amounts of all other inputs used, including labour. The productivity of agriculture is related to not only with the size of holdings but also with other factors such as capital, labour and other inputs, therefore first of all the concept of "Idea of economic holding should be made clear". If capital labour etc. are not available in adequate and quality even a large size holding



may become unproductive, or its productivity may be low on the other hand small sized holding becomes more productive if these resources are available in plenty.

Agriculture should be pressed as an enterprise, occupation and not merely as a means of livelihood. Efforts should be made to provide capital and other resources to agriculture to increase its productivity instead of increasing the size of holding. Here lies the real problem of agriculture utilization of increasing labour and unproductive disguised unemployment. As remedies to solve this problem, Babasaheb suggested 1. Co-operative of collective farming, 2. Economic holdings 3. Provision of other sources of production. 4. Transfer of surplus labour from agriculture to industry. 5. Abolition of 'Khoti System in Agriculture' 6. Protection to tenants and tillers. 7. Control and regulation of private money lenders the pass book to every debtor with entries of loan. According to Dr. Ambedkar centralization of economic power and agriculture land is the root cause of all other forms of exploitation. In this way, Dr. Ambedkar's thoughts on agriculture laws and reforms are relevant even in present circumstances. As the existing laws and reforms such as land ceiling Act, Minimum wages Act, Distribution of surplus land etc. are not effective but which are essential to reconsider them in the context of Dr. Ambedkar's perspective.

Dr. Ambedkar's views on Currency Problem:

Dr. Ambedkar was the symbol of knowledge. His contribution in 'Currency reform' is quite noteworthy. His writings on currency problems constituted in his book "The Problem of the rupee" and his evidence before the Hilton Commission in 1926. He brought a new perception on the monetary issue. Babasaheb stated "It is much better to introduce a currency system which will do away with the exchange standard and also the gold standard reserve". According to Babasaheb the pure gold standard comprises use of gold in some form convertible standard; paper money is also issued in addition to gold coins and is pledged to be redeemable in gold. In contrast under the gold exchanged standard the medium of exchange comprises only paper money which is kept exchangeable at fixed rates with gold and authorities back it up with foreign currency reserves of such countries as on the gold standard.

Dr. Ambedkar argued that the gold exchange standard does not have the stability of the gold standard. Under the gold standard, additions to the supply of currency are so small that stability is not affected. On the other hand, under the gold exchange standard additions are dependent upon the will of the issuer and can be augmented to such an extent that stability could be jeopardized. According to Keynes gold standard is a hard standard and it ties mankind to the wheel of nature whereas gold exchange standard allows an escape from this frigidity. Dr. Ambedkar argued that gold exchange standard economizes on gold because economizing of gold raises its supply there by lowering its value and as a depreciating commodity; it then becomes unfit to that extent to function as a standard of value. In his evidence before the Royal Commission on Indian currency and finance 1925 Babasaheb proposed the following steps for the reform of Indian currency:

- i. Stop the coinage of rupees by absolutely closing the mints to the government as they are to public.
- ii. Open a gold Mint for the coinage of a suitable gold coin.
- iii. Fix a ratio between the gold coin and the rupee.
- iv. Rupee not to be convertible in gold and gold not to be convertible in rupee, but both to circulate as unlimited legal tender at the ratio fixed by law.

In a gold exchange standard, the coinage is manipulated by the government to keep it at par with the value of gold. Babasaheb asked; was the job of currency management only important for the amount of gold it will procure in the external market? Obviously not, because "what really concerns those who use money is not how much gold that money is worth, but how much of things in general that money is worth".

Dr. Ambedkar's Idea of Democracy:

Dr. Ambedkar was its chief architect of the Indian Constitution. He had also drafted the far-reaching Hindu code bill to liberate vast majority of women and finally resigned from union cabinet when this bill was not passed by the Parliament. Dr. Ambedkar was very much conscious of the social and economic inequalities which lifted the national consciousness of the Indian people. He said, "We must make our political democracy



a social democracy as well. Political democracy very much depends upon social democracy because political democracy cannot last unless there lies at the base of it social democracy". Dr. Ambedkar thinks of democracy from the viewpoint of practical life. He belongs to the much realistic school of political scientists. He was not bothered about the principles and theories of political study. During the national improvement, his only aim was to have justice and freedom for the people in the actual sense. He aspired for having a government of the people, for the people and by the people. According to Dr. Ambedkar, democracy means no master, no slavery, no caste, no threat and no violence. He wants freedom of thoughts and a choice and capacity to live and let live, which in his conscience, would be the right path towards democracy. He says "Democracy is a actual mode of associated living. The roots of democracy are to be searched only in social relationship, in terms of the associated life between the individuals who form the society". According to Dr. Ambedkar, the actual aim of democracy is essentially need for the interest of society as a whole, and not for any particular class, group or community. Therefore, Dr. Ambedkar, while speaking on "conditions precedent for the successful working of Democracy", at one event emphasized that, "The very first condition precedent for the successful working of democracy is that there must be no excessive unfairness in the society. There must not be any destitute or oppressed class. There must not be any suppressed class. There must not be a class which enjoys all the privileges and a class which has got all the burdens to carry. Such a thing, such an organization of society has within itself the germs of a bloody revolution and perhaps it would be very impossible for democracy to cure these germs." To Dr. Ambedkar, real democracy is opposed to the suppression of minorities. The suppression and exploitation of minorities in any form is the negation of democracy and humanism. If suppression is not stopped, then democracy degenerates into tyranny. He said, On the 26th of January 1950, we are going to enter into a life of contradictions. In politics we will have equality and in social and economic life we will have inequality. In politics we will be recognizing the principle of one man one vote and one vote one value. In our social and economic life, we shall, by reason of our social and economic structure, continue to deny the principle of one man one value. How long shall we continue to live this life of contradictions? How long shall we continue to deny equality in our social and economic life? If we continue to deny it for long, we will do so only by putting our political democracy in peril. We must remove this contradiction at the earliest possible moment or else those who suffer from inequality will blow up the structure of political democracy which this Assembly has so laboriously built up.

Dr. Ambedkar as an Economist:

Dr. Ambedkar was an economist par excellence and his work in this field had laid the foundation for the country's central bank, Reserve Bank of India. He planned India's first river valley project to generate power and irrigation facilities. Dr. Ambedkar was among the most outstanding intellectuals of India in the 20th century in the true sense of the word. He was an economist by his basic training. His career was characterized by two distinct phases; the first one up to 1921 as a professional economist contributing scholarly books and the second one as a political leader thereafter until his demise in 1956, during which he made path breaking contributions as a champion of human rights for the untouchables. He wrote three scholarly books on economics: 1) Administration and Finance of the East India Company, 2) The Evolution of provincial Finance in British India, and 3) The problem of the Rupee: Its Origin and Its Solution. The first two represent his contribution in the field of public finance. The first one evaluated finances of the East India Company during the period from 1792 through 1858 and the second one analyzed the evolution of centre-state financial relations in British India during the period 1833 to 1921. The third book his magnum opus in economics, it is a seminal contribution to the field of monetary economics. In his views on crucial issues pertaining to economic development, Babasaheb comes across as a radical economist who would have staunchly opposed the neoliberal reforms being carried out in India since the 1990s. He believed that the fundamental cause of India's backward economy was the delay in changing the land system. The solution was democratic collectivism that entailed economic efficiency, productivity and overhauling the village economy. He said he would wipe out elements of economic exploitation and social injustice. He did not want landlords, tenants, or landless labour, His idea of economic realism sought both freedom and welfare.



Conclusion:

Dr. Ambedkar was a great social reformer and a philanthropic figure in Modern India. *Throughout his life, he worked for the upliftment of outcastes. Babasaheb was a visionary person. He was blessed with a great intelligence and foresight. He was a main pioneer of 'Indian Constitution'. He was "a symbol of revolt" and one of the front ranking nation builders of modern India. Yet, he was the chief architect of Indian Constitution. There is no doubt that Ambedkar's contribution to the Indian economic thought has been varied and diverse. As well as multi-dimensional, Babasaheb viewed agriculture as an enterprise and not only as a means of subsistence. Hence he suggested agricultural and land reforms some of which have been implemented after independence except nationalization of agriculture. His contribution to India's currency and public finance is valuable. He approached and examined the problems with such foresight that his analysis and treatment of some of them is very much relevant even today. He believed that it was the most satisfactory development known to mankind and that it could be established in India. Ideas of Babasaheb are very useful in recent time. However, Dr. Ambedkar's greatest and least known contribution was to be able to stretch the idea of the nation-state to include India's vast diversity of people, cultures and their differing aspirations. For him, nation is a philosophical entity with shared dreams as its central theme. In the words of Nobel Laureate Gunnar Myrdal, "All over the world, the memory of B. R. Ambedkar will live forever as a truly great Indian in the generation which laid down the direction of independent India". Dr. Babasaheb Ambedkar Says, "We are Indians, firstly and lastly".*

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Recent Trends in Banking Sector

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या अंकाचे सर्व अधिकार प्रकाशकांनी राखून ठेवले आहेत. प्रकाशक, संपादक यांच्या लेखी पूर्वपर
 शिवाय यातील लेखांचे पुनर्प्रकाशन करता येणार नाही. या विशेषांकातील लेखांतून/संशोधन निबंधांतून
 झालेली मते ही त्या संबंधित लेखाच्या लेखकांची वैयक्तिक मते आहेत, त्याच्याशी संपादक, प्रकाशक
 अशातीलच असणे नाही. लेखांच्या मूळ स्वामित्व हक्काविषयीची (कॉपी राईट्स संदर्भातील) सर्वस्वी जबाब
 संबंधित लेखकांची आहे.



Demonetization & Its Impact on Banking Sector

Dr. Jaywant Bhadane
K.R.Aher College Deola

Introduction:

The main reasons for demonetization are to tackle black money in the economy, to lower the cash circulation in the country this "is directly related to corruption in our country, and to eliminate fake currency and dodgy funds which have been used by terror groups to fund terrorism. Banks are core part of any economy. They channelize the money for the smooth functioning of different sectors. Initiative of green banking has made the banks to transform conventional banking services into modern ones. The products and services are offered through electronic devices with the help of internet. Surgical strike on black money called 'demonetization' brought enormous changes in all the sectors of the economy. Banking can be defined as the business activity of accepting and safeguarding money owned by other individuals and entities, and then lending out this money in order to earn a profit. Banks are not exception to the influence of demonetization and brought vibrations in the operations as well as products and services of banks. It created greater demand for digital banking services where cashless transactions are prioritized. Day to day operations of banks are affected and led to liquidity management a difficult task. The exchanging of banned currency notes eroded the quality of service.

Demonetization has disturbed the bank operations and made the employees to work under unconditional stress with the extended working hours. Most of the banks were unable to discharge other banking services effectively while exchanging the banned currency notes. The banking services these days include issuance of debit and credit cards, providing safe custody of valuable items, lockers, ATM services and online transfer of funds across the country / world. Hence, the present study highlights the post demonetization effect on banks and their operations.

Objectives of the Study:

1. To determine the Impact of demonetization.
2. To study the influence of demonetization on Banks operations.
3. To find out the negative impacts of demonetization.
4. To determine the benefits of Cashless Economy.

Methodology of the Study:

The study is based on secondary sources of data. It includes available published literatures such as books, journals, articles, newspapers and relevant websites. The study tries to look at the extent of demonetization influence on normal banking operations and benefits of cashless economy.

Impact of Demonetization in Banking Sector:

Demonetization helped reduce black money, corruption and terrorism in India. Number of people mind the inconvenience faced through demonetization. The decision results in more transparency in the Indian real estate industry. Housing prices may witness a downfall restoring demand in the housing segment. There was an impact on the workload of the bank employees increased a lot. They had to work overtime. The cash flow in banks decreased after

demonetization. There was not much currency in circulation after demonetization thus the government had restricted the withdrawal amount. The use of online banking increased after demonetization due to decrease in the circulation of currency and long queues outside ATM and bank branches people started using online banking. Limiting ATM withdrawals will encourage cash less card payments across the country. Interest rates: There should be a rise in bank interest rates. The functioning of ATM has increased because more and more people are using the ATM to withdraw their cash and they are using it a number of times to fulfill their cash requirement because of the withdrawal limit. At the end of today the numbers of customers in the branches have increased. We have seen long queues of people outside bank branches and ATM. Tracking of money is made easy as the exchange only available by producing valid identity proof like AADHAR Card, PAN Card and Election Card. More than 60% people believe that there was an impact of demonetization on the banking sector. The new digital laws step forward and bring more and understand the safety of digital banking

Negative Impacts of Demonetization:

Demonetization has brought some operational issues to banks. It has disturbed employees, operational costs and profitability. People, who are in village, remote areas would not that much aware of demonetization, might not be able to exchange their money. Banks have lost one per cent discount charge from merchants on every card transaction. Banks have focused on the exchange of currency notes. They were not able to sell loan products. This has reduced the lending activities. During demonetization, the business of certain small or medium - sized enterprises had declined 50-80 per cent. Consequently, they could default in their installments due to the banks. This has led to growth in NPA's. Farmers who don't have an account in banks won't be able to change their whole cash into new currency as there are limits imposed. Bank employees were kept under pressure and overtime working. It has depressed them and brought imbalance in life style. The continuous notifications from RBI and the absence of money banks have faced the fury of customers. Poor people who work on daily wages won't be able to get their wages as there is shortage of cash. Bank staff was helpless when they did not receive enough cash to meet the demand for cash. Frequent changes in regulations and voluminous old notes have made the staff to handle customers with a smile and overtime without extra salary. If somebody and couple who's has left his family was against their marriage without any identity proof won't be able to change their money, and will be left with nothing but paper in their hand. On the other hand, India's larger and new age companies will have no problems in making the switch to Rs 2,000 notes.

Benefits of Cashless Economy:

Reduce tax avoidance and money laundering thanks to the higher traceability of all the transactions. It will curb generation of black money. Will reduce real estate prices because of curbs on black money as most of black money is invested in Real estate prices which inflates the prices of Real estate markets. In Financial year 2015, RBI spent Rs 27 billion on just the activity of currency issuance and management. This could be avoided if we become cashless society. It will pave way for universal availability of banking services to all as no physical infrastructure is needed other than digital. There will be greater efficiency in welfare programmes as money is wired directly into the accounts of recipients. Thus once money is transferred directly into a beneficiary's bank account, the entire process becomes transparent. Payments can be easily



traced and collected, and corruption will automatically drop, so people will no longer have to go to collect what is rightfully theirs. There will be efficiency gains as transaction costs across the economy should also come down. 1 in 7 notes are supposed to be fake, which has a huge negative impact on economy, by going cashless, that can be avoided. Hygiene-Soiled, tobacco stained, notes full of germs are a norm in India. There are many such incidents in our life where we knowingly or unknowingly give and take germs in the form of rupee notes. This could be avoided if we move towards Cashless economy. In a cashless economy there will be no problem of soiled notes or counterfeit currency. Speed and satisfaction of operations for customers, no delays and queues, no interactions with bank staff required. A Moody's report pegged the impact of electronic transactions to 0.8% increase in GDP for emerging markets and 0.3% increase for developed markets because of increased velocity of money.

An increased use of credit cards instead of cash would primarily enable a more detailed record of all the transactions which take place in the society, allowing more transparency in business operations and money transfers. It is improvement in credit access & financial inclusion, which will benefit the growth of SMEs in the medium/long run.

Conclusions:

Demagnetization is a tool used by government to fight against corruption and black money. At the same path, it has brought changes in all the corners of the economy. Demonetization has badly affected the banks. Banned denominations were ploughed back and allowed the citizens to exchange with the banks. While exchanging, it disturbed temporarily and influenced its regular operations. Though it affected to a greater extent, it has paved the economy to grow in the years to come. People have faced inconvenience because of demonetization and they are not happy with it. Banks will have to first develop a comprehensive distribution system that will enable customers to touch them at multiple points. Banks must also create performance measurement systems to assure the mix products and services they offer are beneficial to both the customer and the bank.

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PHYSICO-CHEMICAL ANALYSIS OF WATER IN WELLS AND TUBE WELLS FROM DEOLA TAHSIL.

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ABSTRACT

The present work deals with the study of physico-chemical analysis of water sample collected from wells and tube wells of selected villages in Deola tahsil of Nasik District. Normally the tube wells go as deep as 400 feet. The results obtained from the study revealed that the drinking water quality or status of the wells and tube wells remained unsafe during the study period. The present study demonstrates application of water quality management in estimating the quality of the wells and tube wells water, which appears to be promising in the field of water quality management.²

00

References: 04

Table : 01

KEYWORDS: Water quality, Physico-chemical parameters.

Introduction

Water covers 71% of the Earth's surface, and is essential for all known forms of life. Only 2.5% of Earth's water is fresh water, and 98.8% of this water is in ice and groundwater. Surface water, whether in the atmosphere, on the ground surface, or under the ground, contains dissolved minerals and gases as a result of its interaction with the environment. Here, minerals in rocks, organic matter, and living organisms. Reservoirs are one of the most important water resources used for drinking supply and irrigation. The colour of water depends on the ingredients mixed in it. Turbidity may be due to organic and inorganic constituents. Organic materials may harbor microorganisms. Turbid conditions may increase the susceptibility for waterborne disease. A changing in a stream can be an indicator of environmental pollution. As per IS pH of drinking water should be in the range of 6.5 to 8.5. In hard waters, salts are chemical compounds composed of anions such as carbonates, bicarbonates, sulphates and nitrates (primarily in surface water) and cations such as potassium, magnesium (Mg), calcium (Ca) and sodium (Na)¹. If there are additional inputs of suspended solids to the system, the balance is disturbed and detrimental effects may be seen. A high TDS would indicate poor water quality and could have difficulty in sustaining many aquatic lives. Water is mankind's most precious resource, and one of the most important necessities for existence of Human. Unfortunately it is often contaminated with impurities such as organic, inorganic chemicals and microorganisms. Over 80% of Infectious Diseases are caused by Water

Borne Contaminants. Without good water supplies people can cause to all types of illnesses, the majority of which can take lives. All this has prompted to undertake this research.

Materials and Methods

Deola is a tahsil place located at distance of 75 Km from Nasik district. All selected villages are having water supply facility, but majority of the people live in farm and uses water from wells and tube-wells for drinking and irrigation. Contaminants that may be in untreated water include microorganisms such as viruses and bacteria; inorganic contaminants such as salts and metals; organic chemical contaminants from pesticides and herbicides. Water quality depends on the local geology and ecosystem, as well as human uses such as sewage dispersion. The complexity of water quality as a subject is reflected in the many types of measurements of water quality indicators. The Water Samples were collected randomly from five different stations in Polythene bottles in November 2010 to October 2011. The Water samples were brought into laboratory for the estimation of various physicochemical parameters like pH, DO, TDS, Total Hardness, Calcium, Magnesium, Sodium, Chlorides, Alkalinity and Nitrate were estimated in the laboratory by using standard methods^{1, 2, 3 and 4}. The parameters for water quality are determined by the intended use. Work in the area of water quality tends to be focused on water that is treated for human consumption, or in the environment. Water samples collected from five different stations, preserved, transported and analyzed in laboratory¹⁻⁴.

Results and Discussion

As per IS pH of drinking water should be in between 6.5 to 8.5. If the pH of water goes below 6.5 above 8.5 leads to harmful effects. In present study it is observed that, the pH of water remained alkaline throughout. Maximum pH (7.73) found in water sample collected from Umrane and in lower order in Bhaur (7.54), Pimpalgaon (7.45) and Khuntewadi (7.15) while minimum (7.11) in Meshi. The total dissolved solids (TDS) in water consist of inorganic salts and dissolved

water samples collected from Pimpalgaon, Meshi and Khuntewadi were lower in order shows 122mg/l, 106mg/l, 100 mg/l respectively. The lowest CaCO_3 value found in sample collected from Bhaur is 18.7 mg/l, highest magnesium value was found in a sample collected from Umrane which is 38.2 mg/l, but the water samples collected from Meshi, Khuntewadi and Bhaur are in order showed that 18.6mg/l, 13.6mg/l, 5.2 mg/l respectively. The lowest Mg value found

Table 1. Physico-chemical parameters of water samples from study area.

Parameters	Collection stations					Mean	Standards for Domestic water	
	Umrane	Meshi	Bhaur	Khuntewadi	Pimpalgaon		BIS	WHO
pH	7.73	7.11	7.54	7.15	7.45	7.39	6.5-8.5	6.5-9.2
Dissolved solids (DS) ppm	2385	615	390	795	409	918.8	500	500
Total Alkalinity (TA)	Traces	Traces	Traces	Traces	Traces	-	-	-
Total Hardness (TH) mg/lit	716	184	117	238	25	256	300	500
Calcium (Ca)	143	100	187	106	122	131.6	75	100
Magnesium (Mg)	38.2	18.6	5.2	13.6	4.3	15.98	30	150
Chloride (Cl) mg/lit	1370	85.2	56.8	347.9	113.9	394.76	250	500
Sodium (Na) mg/lit	210	75	65	90	85	121	200	150
Dissolved O ₂ (DO) mg/lit	3.9	6.5	10.4	6.1	7.0	6.78	-	-

materials. The highest Dissolved solids value is found in a water sample collected from Umrane which is 2387mg/l, while the water samples collected from Khuntewadi, Meshi are lower in order i.e 795, 615, 409 mg/l respectively. The lowest TDS value found in sample collected from Bhaur showed 390 mg/l. The highest phosphates alkalinity of CaHCO_3 found in Umrane sample water (14.4mg/l), lowest in Khuntewadi water sample (6.8mg/l) and other decline in order. The highest total hardness as CaCO_3 is found in a water sample collected from Umrane which is 716 mg/l. The water samples collected from Khuntewadi, Meshi and Bhaur are in lower order 238mg/l, 184mg/l, 117 mg/l respectively. The lowest CaCO_3 value found in sample collected from Pimpalgaon showed 25 mg/l. The highest Calcium value was found in a water sample collected from Umrane village which was 143 mg/l, but the

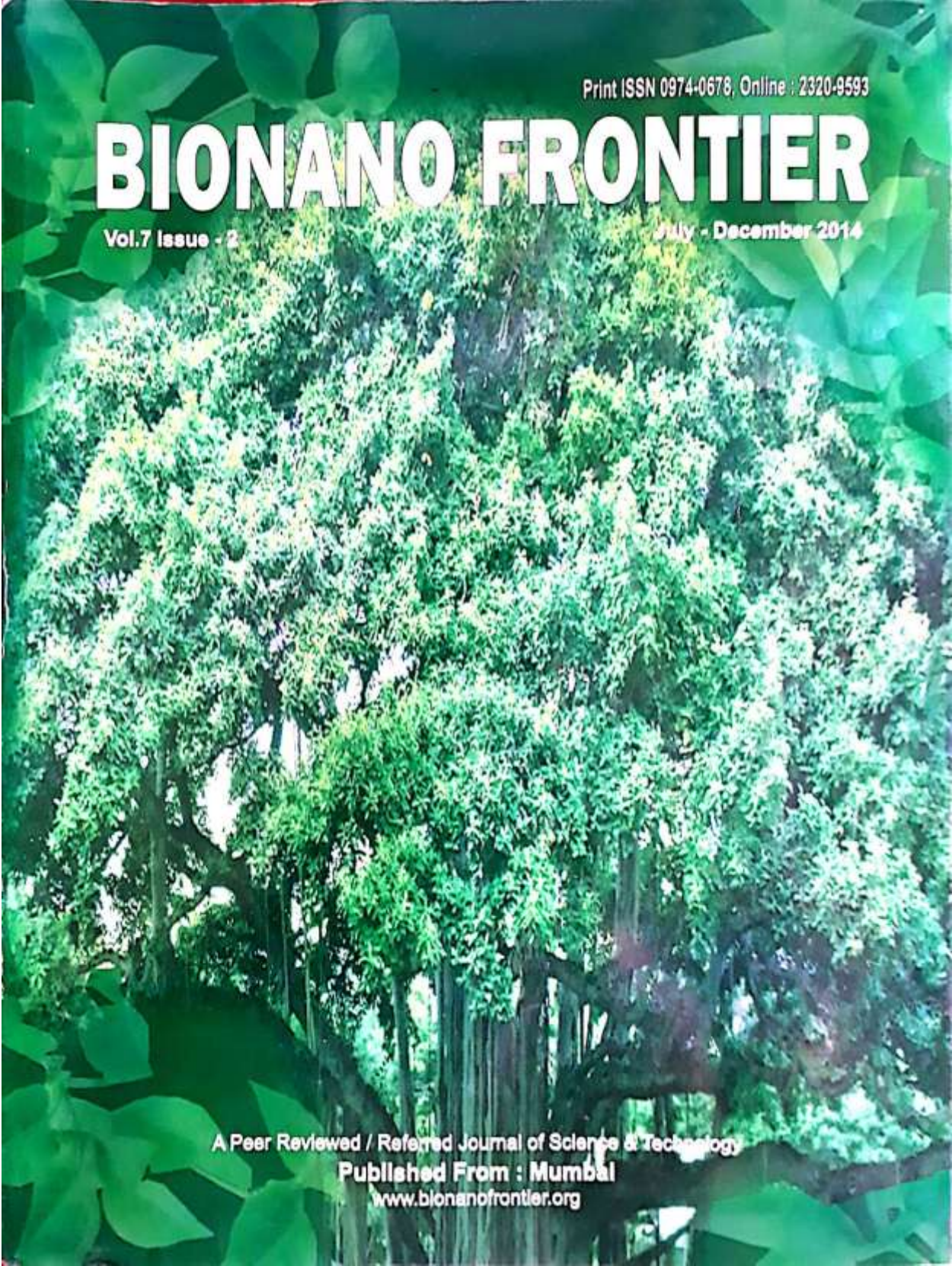
in sample collected from Pimpalgaon is 122 mg/l. Chloride in water may be considered increased by treatment processes in which chlorine or chloride is used. The highest Chloride value was found in a water sample collected from Umrane village which is 1370 mg/l, but the water samples collected from Khuntewadi, Pimpalgaon and Meshi are lower in order shows that 347.9, 113.9, 85.2 mg/l respectively. The lowest Chloride value found in sample collected from Bhaur is 56.8 mg/l. Sodium (Na) is an essential element required for normal body function including nerve impulse transmission, fluid regulation, muscle contraction and relaxation. However, in excess amounts, sodium increases the individual risk of hypertension, heart disease and stroke. The highest sodium content was found in a water sample collected from Umrane village which is 210 mg/l but the water samples collected from Khuntewadi

gaon and Meshi are lower in order and 90, 85 and 75 mg/l respectively. The Na value found in sample collected haur which was 65 mg/l. Dissolved O₂ tial for aquatic life. A low DO (less ig/l) would indicate poor water quality s would have difficulty in sustaining ensitive aquatic lives. The highest of dissolved O₂ was found in a water

sample collected from Bhaurwhich was 10.4 mg/l and the water samples collected from Pimpalgaon, Meshi and Khuntewadi were lower in order shows that 7.0, 6.5 and 6.1 mg/l respectively. Lowest amount found in sample water of Umbrae is 3.9 mg/l. So the water from the collection centers is fit for drinking purpose.

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PHYSICO-CHEMICAL ANALYSIS OF WATER SUPPLY SCHEME RESERVOIR, KISHOR SAGAR, OF DEOLA TAHSIL, MAHARASHTRA

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ABSTRACT : Reservoirs are one of the most important water resources used for water supply and irrigation. The colour of water is depends on the ingredients mixed in the water. Turbidity may be due to organic and/or inorganic constituents. Organic particulates may harbor micro-organisms. A changing pH in a stream can be an indicator of increasing pollution. As per ISI, pH of drinking water should be in the range of 6.5 to 8.5. In natural water, salts and chemical compounds comprised of anions such as Carbonates, Chlorides, Sulphates, Nitrates and cations such as Potassium (K), Magnesium (Mg), Calcium (Ca) and Sodium (Na). In rural parts of India people face scarcity of potable water or the water used for drinking purpose is not properly filtered. It has prompted to undertake this project. Physico-chemical properties of the water supply scheme Reservoir sample carried out from July 2013 to February 2014 shown that, the parameters are within range prescribed by BIS, WHO and ISI standards for drinking purpose.

Key words: Physico-chemical parameters, Water quality, Reservoir.

INTRODUCTION :

The Water plays a vital role for life, used by man, plants and animals are universal. It is essential for health and sanitation. 71% of the Earth's surface is covered by Water. Only 2.5% of the Earth's water is fresh water, and 98.8% of that water is in ice and groundwater. Natural water, whether in the atmosphere, on the ground surface, or under the ground, always contains dissolved minerals and gases as a result of its interaction with the atmosphere, minerals in rocks, organic matter, and living organisms. Reservoirs are one of the most important water resources used for water supply and irrigation. A low DO would indicate poor water quality and thus would have difficulty in sustaining many sensitive aquatic lives.

Considerable physico-chemical analysis studies have been carried out on manmade Impoundments in India. (Aher et.al. 2000; Dayal and Gopal 1992). Physico-chemical analysis studies of lakes and ponds of Maharashtra have been carried out by many workers like Dhembare and Pondhe 1998; Trivedy and Goel 1986; Sonawane and Saler 2008. In rural areas the ground water is depleted up to more than 400 ft. depth. The water obtained from bore wells is salty and not used for drinking purpose in study area. The total population of four villages i.e. Rameshwar, Wakhari, Subhash nagar and Gunjal nagar depends upon the Kishor Sagar reservoir for water supply.

MATERIALS AND METHODS :

Water Supply Scheme Reservoir Sample, Kishor Sagar is located 3.5 km away from Deola Tahsil. The Water Samples were collected randomly from reservoir in Polythene bottles from July 2013 to February 2014. The Water samples were brought in to Laboratory for the estimation of various physico-chemical parameters like pH, DO, TDS, Total Hardness, Calcium, Magnesium, Sodium, Chlorides,

Alkalinity and Nitrate. For the analysis of water, procedure given in standard methods i.e. APHA (1989) and Trivedy & Goel (1986) were followed. The parameters for water quality are determined by the intended use. Work in the area of water quality tends to be focused on water that is treated for human consumption, or in the environment. Water samples collected from reservoir preserved, transported, and analyzed in Laboratory.

Table- Physico-chemical parameters of water samples collected from reservoir from July 2013 to February 2014.

RESULTS AND DISCUSSIONS:

pH - The pH is a measure of the intensity of acidity or alkalinity and measures the concentration of hydrogen ions in water. It has no direct adverse effect on health, however, a low value below 4.0 will produce sour taste and higher above 8.5 shows alkaline taste. A pH range of 6.5-8.5 is normally accepted as per guidelines suggested by ISI. In the present study, the fluctuation of pH in the samples was from 7.90 to 8.20. The maximum pH (8.20) was observed in July 2013 to September 2013 and in December 2013. While minimum pH was observed in October 2013 and November 2013. Similar observation was made by Manoranjini and Johnson (1998). The variation in pH may be due to the condition of earth and minerals present.

Turbidity - The measurement of Turbidity reflects the transparency in water. It is caused by the substances present in water in suspension. In natural water it is caused by clay, silt, organic matter, phytoplankton and other microscopic organisms. In the present study the Turbidity ranges from 0.74 to 2.20 NTU. In the reservoir Turbidity was found within the prescribed limits (BIS 5 NTU and ISI 10 NTU).

Total Dissolved solids (TDS) - Total Dissolved solids (TDS) are a measure of the solid materials dissolved in the reservoir

water. This includes salts, organic materials, and wide range of nutrients to toxic materials. The maximum TDS (450 mg/L) was observed in December 2013. While minimum TDS (254 mg/L) was observed in August 2013. Todd (1980) found total dissolved solids of fresh water was lesser than 1000ppm, which can be used safely for drinking purpose.

Total Alkalinity (TA) - the alkalinity in natural water is caused by Bicarbonates, Carbonates and Hydroxides and can be ranked in order of their association with high pH values. In present study alkalinity was ranged from 110 mg/L in December 2013 to 144 mg/L in September 2013.

Total Hardness (TH) - the standard value of Total Hardness specified is 300 mg/L by BIS, WHO and ISI is potable, beyond this limit it causes problems to the human health. In the present study the Total Hardness varied between 148 mg/L in February 2014 and 192 mg/L in October 2013.

Calcium (Ca) - Maximum value of Calcium (72.0 mg/L) was noted in October 2013, while minimum (60.0 mg/L) in July 2013. The standard unit of Calcium specified is 75.0 mg/L. The results indicate that the water of reservoir is suitable for domestic purpose.

Magnesium (Mg) - Maximum value of Magnesium (28.0 mg/L) was noted in July 2013 and October 2013, while minimum (24.0 mg/L) in August 2013 and in December 2013. The specified unit of Magnesium in 30.0 mg/L. So the reservoir water is suitable for drinking purpose.

Nitrate (NO₃) - A limit of 45 mg/L has been prescribed by BIS (1993) and ISI for drinking water supplies. Its concentration above 45 mg/L may be harmful to human health. The value of Nitrate in the reservoir is ranged from 22.6 mg/L to 38.6 mg/L, which is within the limit.

Chloride (Cl) - In the study area there is no significant change in chloride concentration and is ranged from 55.0 mg/L to 58.6 mg/L, found below the permissible value i.e. 250 mg/L. it is because of no waste material added in the river as well as reservoir.

Sodium (Na) - Maximum value of Sodium (7.0 mg/L) was noted in December 2013, while minimum (70.0 mg/L) in July 2013. This is suitable for domestic purpose.

Dissolved O₂ (DO) - The dissolved oxygen (DO) concentration present in water reflects atmospheric dissolution, as well as autotrophic and heterotrophic processes that respectively, produce and consume oxygen. The oxygen deficiency was never noticed in the reservoir during the study period. DO ranges from 1.40 mg/L to 3.10 mg/L, whereas the prescribed limit for DO by WHO is 5.0 mg/L.

On the basis of above Physico-chemical parameters it is concluded that, the water of the reservoir of the study area is within the range prescribed by WHO, BIS and ISI standards for drinking water.

Parameters	Standards for Domestic water			Results of water sample reservoir												Unit
	BIS	WHO	ISI	July 13	Aug. 13	Sep. 13	Oct. 13	Nov. 13	Dec. 13	Jan. 14	Feb. 14	AVG	MA X.	MIN		
pH	6.5-8.5	6.5-9.2	6.5-8.5	8.20	8.20	8.20	7.90	7.90	8.20	8.00	8.00	8.07	8.20	7.90	--	
Turbidity	5	-	10	2.20	1.40	1.26	1.46	1.46	1.66	0.74	0.74	1.36	2.20	0.74	NTU *	
Total Dissolved solids (TDS)	500	500	1500	264	254	278	268	350	450	320	320	313	450	254	Mg/L	
Total Alkalinity (TA)	200	-	600	136	122	144	122	120	110	124	122	125	144	110	Mg/L	
Total Hardness (TH)	300	300	300	158	175	180	192	180	180	154	148	170.8	192	148	Mg/L	
Calcium (Ca)	75	100	75	60	64	62	72	68	62	64	68	65	72	60	Mg/L	
Magnesium (Mg)	30	150	30	28	24	26	28	26	24	26	26	26	28	24	Mg/L	
Nitrate (NO ₃)	45	-	45	22.6	36.8	38.6	38.0	31.2	32.4	35.4	34.8	33.7	38.6	22.6	Mg/L	
Chloride (Cl)	250	500	600	56.6	55.0	58.4	58.6	56.4	55.8	55.4	55.0	56.4	58.6	55.0	Mg/L	
Sodium (Na)	200	150	150	70	72	75	72	72	78	76	76	73.8	78	70	Mg/L	
Dissolved O ₂ (DO)	5	-	3.0	1.98	1.94	1.40	2.80	2.64	2.80	3.10	3.00	2.20	3.10	1.40	Mg/L	

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Effective Communication modes Increases yield of Groundnut in Rural Agriculture of Kalwan Tahsil of Nashik District, Maharashtra, India

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Abstract

Groundnut (*Arachis hypogaea* L.) is the major edible oilseed crop of India. It accounts for 45% of the area and 55% of the production of total oilseeds in the country. It also accounts for 43% of total oil production in the country. Within the country, Andhra Pradesh ranks second in both area and production. The crop is grown in rainy (85% area), post-rainy (10% area) and summer (5% area) seasons. The rainy season groundnut is generally Rainfed, while post-rainy and summer groundnuts are irrigated. Productivity of the crop is however low, primarily because of its cultivation in marginal and sub-marginal soils under Rainfed conditions subjected to frequent droughts, poor agronomic practices and low levels of input, use of traditional low yielding varieties, incidence of insect pests and diseases. The average yield of Kharif groundnut in India is extremely low, 750 kg/ha, compared to yields at over 3000kg / ha in the developed countries. In this research paper Forty eight farmers were selected from rural Tahsil i.e. Kalwan of Nashik District. All farmers are grouped into four classes A, B, C and D. Group 'A' and 'B' farmers were supplied *Rhizobium* biofertilizer packets for seed dressing. Farmers were communicated by seed dressing at homes, at fields, supplied pamphlets, arranging poster show in respective villages. To determine per hectare yield, pods were harvested and weighed separately. The pod yield of treated plots was compared with untreated plots. The pod yield data was recorded, tabulated and statistically analyzed. The pod yield increases by 18 to 21 %, which is stimulatory for Groundnut in Kharif season.

Keywords: Bio-fertilizer, Communication Modes, Groundnut, *Rhizobium*.

Introduction

In India 1985 –86 some 7.4 million hectare land was brought under cultivation and 4.7 million tones of dried pods were harvested and 1986 – 87, some 7.15 million hectare land was under cultivation of groundnut and 6.06 million tones of dried pods were harvested. This indicates that in India oil seeds accounts for one ninth of the total agricultural production and ranks next to food grains in importance. The crop productivity is directly related with use of manures and fertilizers. Fertilizer consumption in India is very low. Small and marginal farmers are unable to purchase and use chemical fertilizers. The availability of bio-compost from domestic cattle's is reduced due to a pressure on forest for fodder source and decreased number of domestic animals. The small landholders of the study area are not applying chemical fertilizers or FYM to groundnut fields presently. This had seriously affected the soil fertility and total soil hygiene. Our soils are mostly nitrogenous deficient. There is scope for production and use of nitrogenous fertilizers. The chemical fertilizer causes impact on soil micro flora and fauna. In such situation it is need of the day to develop new easy low cost eco-friendly technology, which reach to small farmers. The use of *Rhizobium* bio-fertilizer for groundnut is best answer to all above.

Material and Methods

The present study was carried out in the twelve villages KalwanTahsil during the crop season of 2006 and 2007. Eight farmers from each village likewise from twelve (total-96) were selected and grouped into four classes, in which forty eight were experimental and forty eight in control group.

The experimental farmers were again sub grouped in to two categories having twenty four farmers in each. The farmers of Ist group of twenty four farmers were provided 250 gms. of *Rhizobium* bio-fertilizer. The IInd group of twenty four farmers was advised to use *Rhizobium* bio-fertilizer along with chemical fertilizer. The IIIrd group of sample farmers of control group i.e. twenty four farmers were allowed to use only chemical fertilizer and IVth group of twenty four farmers was allowed to followed traditional method of Groundnut cultivation¹.

Investigators made field demonstrations of seed dressing of *Rhizobium* bio-fertilizer to Groundnut at the farmer's field. The communication to the farmers made by printed matter, pamphlets of use of *Rhizobium* bio-fertilizer technology, Message oriented booklets etc⁴.

Results and Discussion

The role of effective communication modes in dissemination of information, use of effective communication modes changes the attitude of farmers and their Adoption behavior were studied^{2,3}. The field demonstrations of improved agro-technology were directly affects the adoption behavior of farmers^{4,5}. Table-1, table-2, figure-1, table-3, table-4.

Table-1
Attitudinal behavior analysis on dissemination of technology towards society

Category of farmers	Number of sample farmers	%
Positive with Active participation	51	53.12
Followers	21	21.87
Traditional	24	25.00
Total	96	100

Table-2
Attitudinal analysis of sample farmers on adoption of technology

Sr. No.	Innovation adoption category of Farmers	No. of farmers	%
1	Innovator Farmers	11	11.45
2	Early adopter Farmers	13	13.54
3	Early majority Farmers	27	28.12
4	Late majority Farmers	21	21.87
5	Traditional minded Farmers	24	25.00
	Total	96	100

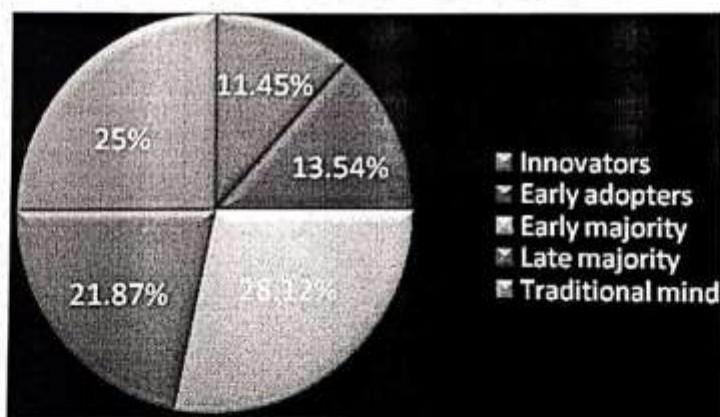


Figure-1
Graph showing attitudinal analysis of sample farmers on adoption of technology

Table-3
The grouping of sample farmers

Sr.No.	Groups of Sample farmers	Class	Demonstration purpose
1	I st and II nd	I	Use of <i>Rhizobium</i> bio-fertilizer
2	III rd and IV th	II	Use of <i>Rhizobium</i> bio-fertilizer and chemical fertilizer
3	V th and VI th	III	Use of chemical fertilizer only
4	VII th and VIII th	IV	Traditional method of Groundnut cultivation

Table-4
Groundnut production data of sample farmers of two crops seasons 2006 and 2007

Sample group	No. of sample farmers	Average yield of Groundnut/year quin./acre			Yield increases or decreases quin./acre		% of yield quin./acre	
		2005*	2006**	2007**	2006**	2007**	2006**	2007**
A	24	2.27	2.64	2.70	0.37	0.43	16.11	20.06
B	24	2.34	2.73	2.82	0.39	0.48	16.52	20.04
C	24	2.20	2.31	2.42	0.11	0.22	5.73	4.11
D	24	2.19	2.20	2.21	0.01	0.02	0.5	1.06

* -Before communication ** -After communication

Conclusion

Table 1 shows that 51 farmers (53.12%) showed positive attitude and active participation to adopt and spread the technology to other farmers in future. 21 farmers (21.87%) assured to adopt the technology if found economical to them. 24 farmers (25%) did not express positive or negative approach on dissemination of *Rhizobium* bio-fertilizer technology to the society.

Table 2 reveals that out of ninety six farmers 51 farmers (53.12%) showed positive attitude of adoption and were eager to know detail information about *Rhizobium* bio-fertilizer technology, those were categorized in three groups i.e. 11 farmers (11.45%) innovators, 13 farmers (13.54%) were adopters and 27 farmers (28.12%) were early majority. The 21 farmers (21.87%) showed positive attitude, but did assured to adopt the technology in the first year. They decided to observe the field trials, results of neighbors and then undertook field trials in their fields in the next year. The 24 farmers (25%) were traditional minded and did not expressed either positive or negative attitude⁶.

Table 4 reveals results related to the yield of Groundnut recorded by investigators before communication (in year 2005) and after communication (in year 2006 and 2007). The experimental groups A and B of sample farmers who used *Rhizobium* bio-fertilizer showed increase in yield 16.11% and 20.06% in 2006 and 16.52% and 20.04% in 2007. The control group of sample farmers C and D has very less increase in yield⁷.

From above data it can be concluded that the groundnut yield increased significantly due to the application of *Rhizobium* bio-fertilizer and effective communication of improved

technology to the farmers increases awareness among Groundnut cultivars⁸.

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PHYSICO-CHEMICAL ANALYSIS OF WATER IN TUBE WELLS OF KALWAN TAHSIL, MAHARASHTRA

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ABSTRACT: Wells are important water resources used for water supply and irrigation to the field in Nashik district. In the study area, because of low rainfall during rainy season and no reservoirs, the water level goes much deep in soil. The farmers dig out the tube wells for domestic as well as irrigation. A change in pH of tube well water is an indicator of increasing pollution. As per ISI, pH of drinking water should be in the range of 6.5 to 8.5. In natural water, salts and chemical compounds comprised of anions such as Carbonates, Chlorides, Sulphates, Nitrates and cations such as Potassium (K), Magnesium (Mg), Calcium (Ca), Sodium (Na). In rural parts of Nashik district people face scarcity of potable water or the water used for drinking purpose is not properly filtered. The present work deals with the study of physico-chemical analysis of water sample collected from tube wells of selected villages in Kalwan Tahsil of Nashik District (Trivedy and Goel 1986). Normally the tube wells go as deep as 400 feet or more. The results obtained from the study revealed that the drinking water quality or status of the tube wells remained safe during the study period (WHO 1984). Physico-chemical properties of the tube well water carried out from March 2013 to Feb. 2014 shown that, the parameters are within the range prescribed by BIS, WHO and ISI standards for drinking and irrigation purpose.

Key words: Water reservoir, Water quality, Drinking water, Irrigation, Tube well etc.

INTRODUCTION:

Water covers 71% of the Earth's surface, and is vital for all known forms of life. Only 2.5% of the Earth's water is fresh water, and 98.8% of that water is in ice and groundwater. Natural water, whether in the atmosphere, on the ground surface, or under the ground, always contains dissolved minerals and gases as a result of its interaction with the atmosphere, minerals in rocks, organic matter, and living organisms.

Surface wells are one of the most important water resources used for water supply and irrigation, but because of heavy depletion of water for irrigation the water level goes into much depth in the study area. So the farmers dig out the tube wells for supply of water for domestic and irrigation purpose. The colour of water is depends on the ingredients mixed in the water. Turbidity may be due to organic and inorganic constituents. Organic particulates may harbor microorganisms. Thus, turbid conditions may increase the possibility for waterborne disease. A changing pH in a stream can be an indicator of increasing pollution. As per ISI pH of drinking water should be in the range of 6.5 to 8.5. In natural waters, salts are chemical compounds comprised of anions such as Carbonates, Chlorides, Sulphates and Nitrates (primarily in ground water) and cations such as Potassium (K), Magnesium (Mg), Calcium (Ca) and Sodium (Na) (APHA 1985). If there are additional inputs of dissolved solids to the system, the balance is altered and detrimental effects may be seen. A low DO would indicate poor water quality and thus would have difficulty in sustaining many sensitive aquatic lives.

Water is mankind's most precious resource, and one of the most important necessities for existence of Human Life. Unfortunately it is often contaminated with impurities such as organic, inorganic contaminants and microorganisms. Over 80% of all Infectious Diseases are caused by Water Borne Contaminants. Without good water supplies people can cause

to all types of illnesses, the majority of which can take lives. The contaminated water also causes different diseases in cultivated crops. All this has prompted to undertake this research.

MATERIALS AND METHODS:

Kalwan is a Taluka place located at distance of 75 Km from Nashik district. It lies between 19°35' and 20°52' north latitude and 73°16' and 74°56' east longitude. All selected villages are having water supply facility, but majority of the people live in farm and uses water from wells & tube wells for drinking and irrigation. Contaminants that may be in untreated water include microorganisms such as viruses and bacteria; inorganic contaminants such as salts and metals, organic chemical contaminants from pesticides and herbicides. Water quality depends on the local geology and ecosystem, as well as human uses such as sewage dispersion. The complexity of water quality as a subject is reflected in the many types of measurements of water quality indicators.

The Water Samples were collected randomly from five different stations in Polythene bottles in March 2013 to February 2014.

The Water samples were brought in to Laboratory for the estimation of various physico-chemical parameters like pH, Turbidity, Total Dissolved solids (TDS), Total Alkalinity (TA), Total Hardness (TH), Calcium (Ca), Magnesium (Mg), Nitrate (NO₃), Chloride (Cl), Sodium (Na), Dissolved O₂ (DO) were estimated in the laboratory by using standard methods (Trivedy and Goel 1986). The parameters for water quality are determined by the intended use. Work in the area of water quality tends to be focused on water that is treated for human consumption, or in the environment. Water samples collected from five different stations, preserved, transported, and analyzed in Laboratory.

RESULTS AND DISCUSSION :

The pH is a measure of the intensity of acidity or alkalinity and measures the concentration of hydrogen ion in water. It has no direct adverse affect on health, however, a low value, below 4.0 will produce sour taste and higher value 8.5 shows alkaline taste. A pH range of 6.5-8.5 is normally acceptable as per guidelines suggested by ISI. In the present study, the fluctuation of pH in the samples was from 7.90 to 8.20. The average pH is 8.08 (APHA 1985).

The solids found in water consist of both inorganic and organic materials, such as soil particles and small pieces of vegetation respectively. They are an important water quality concern because the cause Turbidity. In the studied water samples the average Turbidity was found 1.55 NTU. This is much below the standards given in BIS (1993) and ISI.

The total dissolved solids (TDS) in water consist of inorganic salts and dissolved materials. The highest Dissolved solids value is found in a water sample collected from Wadi (Bk.) which is 350 mg/l, while the water samples collected from Dahyane, Eklahare and Niwane are lower in order i.e. 278 mg/l, 268 mg/l, 264 mg/l respectively. The lowest TDS value found in sample collected from Navi Bej showed 254 mg/l. (Manoranjini *et al.* 1998)

The highest total hardness as CaCO_3 is found in a water sample collected from Eklahare which is 192 mg/l. The water samples collected from Dahyane, Wadi (Bk.) and Navi Bej are in lower order 180 mg/l, 180 mg/l, 175 mg/l respectively. The lowest CaCO_3 value found in sample collected from Niwane showed 158 mg/l.

The highest Calcium value is found in a water sample collected from Eklahare village which is 72 mg/l, but the water samples collected from Wadi (Bk.), Navi Bej and Dahyane are lower in order shows 68 mg/l, 64 mg/l, 62 mg/l respectively. The lowest CaCO_3 value found in sample collected from Niwane is 60 mg/l.

The highest Magnesium value is found in a water sample collected from Niwane and Eklahare which is 28 mg/l, but the water samples collected from Dahyane and Wadi (Bk.) are 26 mg/l. The lowest Mg value found in sample collected from Navi Bej is 24 mg/l.

Chloride occurs naturally in all types of water with a very low concentration. Chlorides are important in detecting the contamination of water. The highest Chloride value is found in a water sample collected from Eklahare village which is 58.6 mg/l, but the water samples collected from Dahyane, Niwane and Wadi (Bk.) are lower in order shows that 58.4 mg/l, 56.6 mg/l and 56.4 mg/l respectively. The lowest Chloride value found in sample collected from Navi Bej is 55.0 mg/l. In the studied samples of tube well water, the average concentration of Chlorides was 57 mg/l and it is very less as prescribed by BIS (1993) and ISI.

Sodium (Na) in excess amount increases individual risk of hypertension, heart disease, and stroke. The highest sodium content is found in a water sample collected from Dahyane village which is 75 mg/l, but the water samples collected from Navi Bej, Wadi (Bk.) and Eklahare was 72 mg/l. The lowest Sodium value found in sample collected from Niwane which is 70 mg/l. (Sonawane 2009)

Dissolved O_2 test measures the amount of life

sustaining oxygen dissolved in water. It is essential for aquatic life. A low DO (less than 2 mg/l) would indicate poor water quality and thus would have difficulty in sustaining many sensitive aquatic lives. The highest amount of dissolved O_2 is found in a water sample collected from Eklahare which is 2.80 mg/l. The water samples collected from Wadi (Bk.), Niwane and Navi Bej are lower in order shows that 2.64 mg/l, 1.98 mg/l and 1.94 mg/l respectively. Lowest amount found in sample water of Dahyane is 1.40 mg/l. (Dayal and Gopal 1992)

CONCLUSION :

The results indicate that most of the water quality parameters were in the permissible limits in the study area of five different collection stations. So the water from the collection centers is fit for drinking and irrigation purpose. (Dhembare and Pondhe 1998, Aher *et al.* 2000)

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Table- Physico-chemical parameters of water samples collected from five different stations from March. 2013 to February 2014.

Parameters	Standards for Domestic water			Collection stations					AVG.	MAX.	MIN.	Unit
	BIS	WHO	ISI	Niwane	Navi Bej	Dahyane	Eklahare	Wadi (Bk.)				
pH	6.5-8.5	6.5-9.2	6.5-8.5	8.20	8.20	8.20	7.90	7.90	8.08	8.20	7.90	--
Turbidity	5	-	10	2.20	1.40	1.26	1.46	1.46	1.55	2.20	1.26	NTU*
Total Dissolved solids (TDS)	500	500	1500	264	254	278	268	350	282.8	350	254	Mg/L
Total Alkalinity (TA)	200	-	600	136	122	144	122	120	128.8	144	120	Mg/L
Total Hardness (TH)	300	300	300	158	175	180	192	180	177	192	158	Mg/L
Calcium (Ca)	75	100	75	60	64	62	72	68	65.2	72	60	Mg/L
Magnesium (Mg)	30	150	30	28	24	26	28	26	26.4	28	24	Mg/L
Nitrate (NO ₃)	45	-	45	22.6	36.8	38.6	38.0	31.2	33.44	38.6	22.6	Mg/L
Chloride (Cl)	250	500	600	56.6	55.0	58.4	58.6	56.4	57	58.6	55.0	Mg/L
Sodium (Na)	200	150	150	70	72	75	72	72	72.2	75	70	Mg/L
Dissolved O ₂ (DO)	5	-	3.0	1.98	1.94	1.40	2.80	2.64	2.15	2.80	1.40	Mg/L

* NTU- Nephelometric Turbidity Unit

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CONSTRAINTS FACED BY TARGET FARMERS IN ADOPTION OF *RHIZOBIUM* BIOFERTILIZER TECHNOLOGY IN DEOLA TEHSIL OF NASHIK DISTRICT, MAHARASHTRA

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Deola, Maharashtra, India.

ABSTRACT

The broad objective of this study was to communicate and transfer the adoption of *Rhizobium* biofertilizer technology by various methods of communication for groundnut growers. It is also attempted to understand various constraints faced by groundnut growers of study area. In this research paper 96 farmers were selected from rural Tahsil i.e. Deola of Nashik District. The behavior of farmers is influenced by the socio-psychological and socio-personal situations in which they have dwellings. Accordingly the personal characters were studied in relation to adoption of *Rhizobium* biofertilizer technology with the help of different methods. Constraints faced by target farmers in adoption of *Rhizobium* biofertilizer technology are unreliable rain fall patterns, pest and diseases, socio-economic status of farmers, failure of communication media to reach in the area, lack of awareness and traditional mind psychology of farmers about improved agro-practices, high cost of chemical fertilizers, as well as the high percentage of illiteracy among the farmers acts as main constraints for non-adoption of improved practices.

Keywords: Constrains, Biofertilizer, *Rhizobium*, Communication Modes, Groundnut etc.

INTRODUCTION:

In India 1985 –86 some 7.4 million hectare land was brought under cultivation and 4.7 million tones of dried pods were harvested and 1986 – 87, some 7.15 million hectare land was under cultivation of groundnut and 6.06 million tones of dried pods were harvested. This indicates that in India oil seeds accounts for one ninth of the total agricultural production and ranks next to food grains in importance. The crop productivity is directly related with use of manures and fertilizers. Constraints faced by target farmers in adoption of *Rhizobium* biofertilizer technology are unreliable rain fall patterns, pest and diseases, socio-economic status of farmers, failure of communication media to reach in the area, lack of awareness and traditional mind psychology of farmers about improved agro-practices, high cost of chemical fertilizers, as well as the high percentage of illiteracy among the farmers acts as main constraints for non-adoption of improved practices. Adoption of any new improved technology by farmers is the most complex process. It may take few months to few years to develop awareness for final adoption by individual farmer. Non adoption of improved agricultural practices in general and modern methods of farming under study in particular as commonly known as attributed to non adoption of information by target farmers. As to understand the constraints for non adoption of new improved technology it was witnessed that, farmers had a lot of difficulties with them in the process of adoption or getting information. In the present study, an attempt was made to know the main constraints.

Material and Methods:

The present study was carried out in the six villages of Deola Tehsil during the year 2013 - 2014. Eight farmers from each village likewise from six (total-48) were selected.

The interview schedule was prepared, by keeping in view the objectives of the study. All the efforts were made to formulate the clear and easily understandable questions. The schedule was made in Marathi language because the farmers living in sample villages are illiterate or educated up to primary level except few up to graduation. In the present study a pre-structured interview schedule was used to collect primary data, cultural practices, improved methods and role of *Rhizobium* biofertilizer technology etc. All questions are arranged in a logical sequence. The researcher personally contacted to target farmers at their home or their respective fields. The answers were collected and recorded.

Results And Discussion:

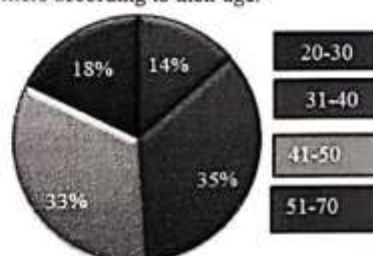
1- Age:-

The age of groundnut growers considered as controlling factor of their behavior in respect of their cultural activities in the field. The target farmers are classified on the basis of age as shown in table 1.1.

Table-1.1- Distribution of target farmers according to their age:-

Group	Age Category (yrs.)	No. of Respondents	percentage	mean	Range
I st	20-30	13	13.54	24.99	21-70
II nd	31-40	34	35.41		
III rd	41-50	32	33.33		
IV th	51-70	17	17.70		
Total		96	100		

Pie Chart- Distribution of target farmers according to their age:-



The data of the target farmers (Table-1.1) revealed that the majority of the target farmers belonging the age group between 31-40 years. The oldest target farmer was 70 years old and the youngest target farmer was 22 years old. The average age of the groundnut growers were 25 years. The age old target farmers were seventeen and below thirty of target farmers were thirteen.

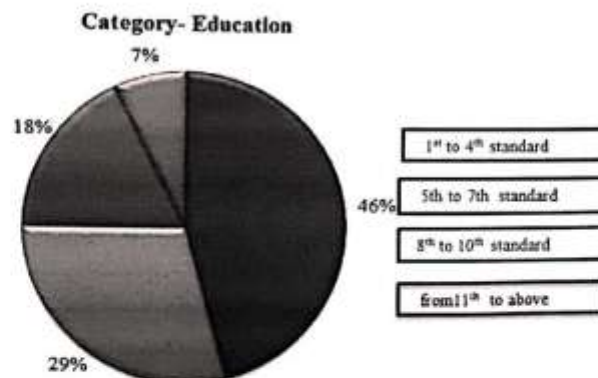
2- Education:-

Education is very important process for mental progress of individuals. The peoples can learn as well as know the world better as it gives shape and direction to their thinking process. Therefore the educated individuals become more prone to change. The education level of the target farmers of this study are shown in the table 2.1

Table- 2.1 - Distribution of target farmers according to their education

Group	Education category	No. of respondents	Percentage	Range
I st	Education between 1 st to 4 th standard	44	45.83	1-13
II nd	Education between 5 th to 7 th standard	28	29.17	
III rd	Education between 8 th to 10 th standard	17	17.71	
IV th	Education from 11 th to above	7	7.29	
Total		96	100	

Pie Chart- Distribution of target farmers according to their education:-



The study of educational status of groundnut growers shows that, the highest percentage of target farmers educated up to primary level is 45.83%. The percentage of target farmers educated up to seventh standard is 29.17%. Higher education level of target farmers is very low i.e. 7.29%. The farmers of study area have very low level of education. Similar distribution were noted by Kebede, Gunjal and Coffin (1994), Klotz, Saha and Butler (1995).

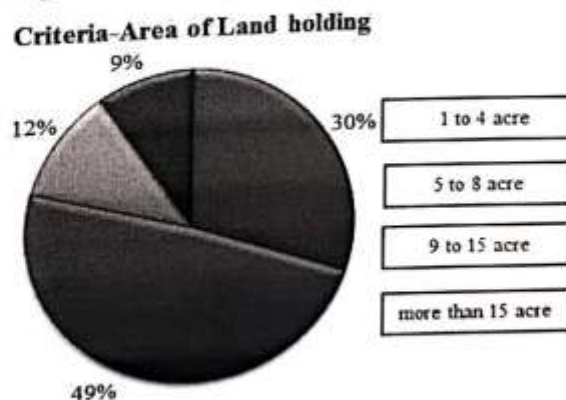
Area of Land holding:

The agricultural land is the main source of the farmers. The area of land holding of farmers decides the level of their income and social status also. The study is related to the distribution of target farmers according to the area of land holding shown in table 3.1.

Table – 3.1 - Distribution of target farmers according to the area of land holding.

Group	Category	No. of respondents	Percentage
I st	Marginal land between 1 to 4 acre	29	30.21
II nd	Small land between 5 to 8 acre	47	48.96
III rd	Big land between 9 to 15 acre	11	11.46
IV th	Other i.e. more than 15 acre	09	9.37
Total		96	100

Pie Chart- Distribution of target farmers according to the area of land holding:



The study on the area of land holding revealed that 29 target farmers (i.e. 30%) were marginal having land one to four acre. The maximum number of target farmers belonging to the group of small landholder, having land in between five to eight acre. Forty seven farmers (i.e. 49%) belonging to this group. The IIIrd and IVth group of target farmers have comparatively small land. Thus in the study area majority of target farmers are marginal and small landholders.

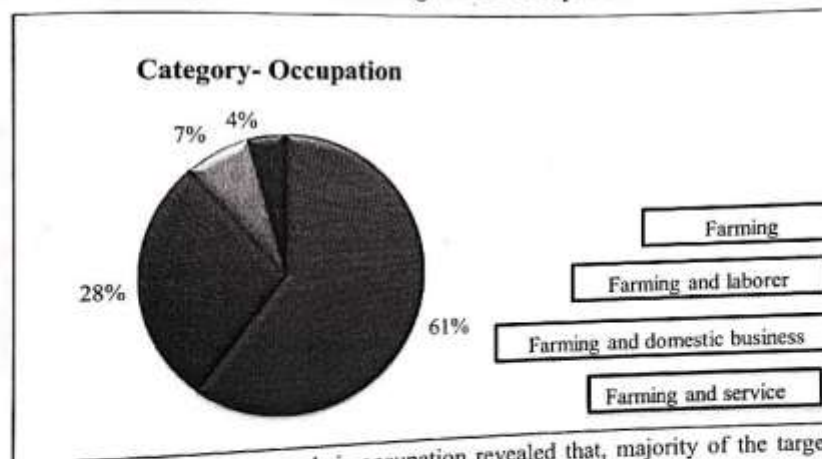
Occupation:

Farming is the main occupation of the study area. Some of the target farmers had some side business like service, fishing etc. The classification of the target farmers on the basis of occupation is shown in table 4.1.

Table- 4.1- Distribution of target farmers according to their occupation

Group	Category	No. of respondents	Percentage
I st	Farming as main business	58	60.41
II nd	Farming and laborer	27	28.12
III rd	Farming and domestic business	07	7.29
IV th	Farming and service	04	4.17
Total		96	100

Pie Chart- Distribution of target farmers according to their occupation:



The data of target farmers in relation to their occupation revealed that, majority of the target farmers i.e. 58 (60.41%) were had the main occupation is farming. The occupation of 27 target farmers were had farming and agricultural laborer. The IIIrd and IVth group of target farmers (i.e. 7.29% and 4.17%) are less in number and has occupation as farming and domestic business and farming and service respectively.

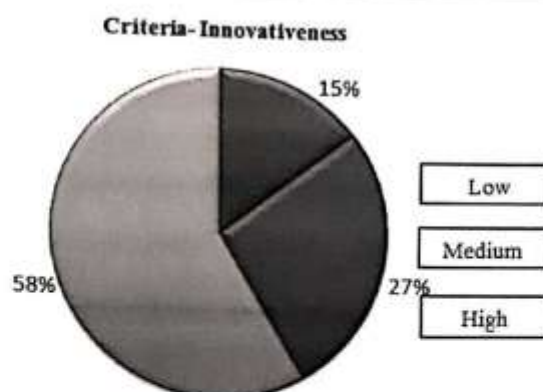
S- Innovativeness:-

Innovativeness is the tendency of an individual's for earlier in the adoption of new improved technology, as compared to other members in the society. Innovativeness for the present study refers to relative earliness of an individual in using *Rhizobium* biofertilizer technology studied during three experimental years. The table 5.1 shows the distribution of target farmers.

Table- 5.1: Distribution of target farmers according to their innovativeness

Sr. No.	Category	No. of respondents	Percentage
1	Low	14	14.58
2	Medium	26	27.08
3	High	56	58.33
Total		96	100

Pie Chart- Distribution of target farmers according to their innovativeness:



In the present study the data indicates that 58.33% target farmers were high innovativeness followed by medium i.e. 27.08% and low innovativeness i.e. 14.58% for all activities of *Rhizobium* biofertilizer technology. Same findings were reported by Wibunphong (1994) and Nagaraj, Lalitha and Lalitha (2000).

6- Information seeking behavior:-

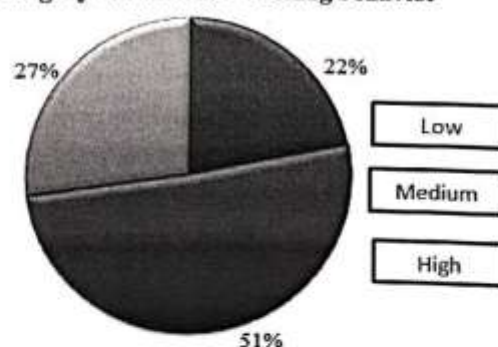
Information seeking behavior is psychological character of human being, in which he seeks to collect information from various sources to fulfill his need of knowledge. The table 6.1 shows the classification of target farmers according to their information seeking behavior.

Table- 6.1- Distribution of target farmers according to their information seeking behavior

Sr. No.	Category	No. of respondents	Percentage
1	Low	21	21.88
2	Medium	49	51.04
3	High	26	27.08
Total		96	100

Pie Chart- Distribution of target farmers according to their information seeking behavior:

Category-Information seeking behavior



In the present study it is found that 21.88% of target farmers had low information seeking behavior, while 51.04% and 27.08% of target farmers had medium and high information seeking behavior respectively. The earlier workers like Baldeo sikh (1990), Khatik (1997) and Shinde and Bhoite (2003) reported that, relationship between information seeking behavior.

7- Constraints faced by farmers in adoption of improved agricultural practices:-

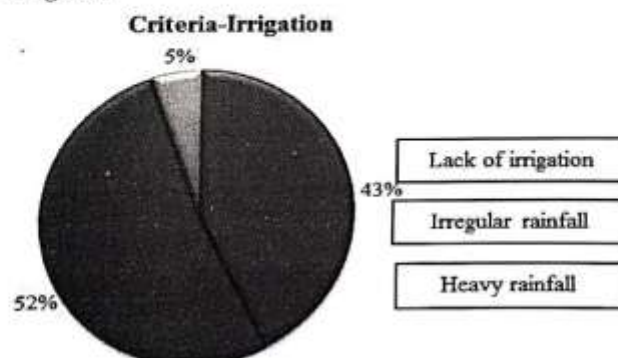
The information collected from target farmers in relation to less yield and the problems which are responsible for the losses in groundnut cultivation. It was found that unreliable rain fall patterns, pest and diseases, socio-economic status of farmers, failure of communication media to reach in the area, lack of awareness and traditional mind psychology of farmers about improved agro-practices, high cost of chemical fertilizers, as well as the high percentage of illiteracy among the farmers acts as main constraints for non-adoption of improved practices. Adoption of any new improved technology by farmers is the most complex process. It may take few

months to few years to develop awareness for final adoption by individual farmer. Non adoption of improved agricultural practices in general and modern methods of farming under study in particular as commonly known as attributed to non adoption of information by target farmers. As to understand the constraints for non adoption of new improved technology it was witnessed that, farmers had a lot of difficulties with them in the process of adoption or getting information. In the present study, an attempt was made to know the main constraints.

Table- 7.1- Constraints faced by the target farmers in adoption of improved agricultural practices

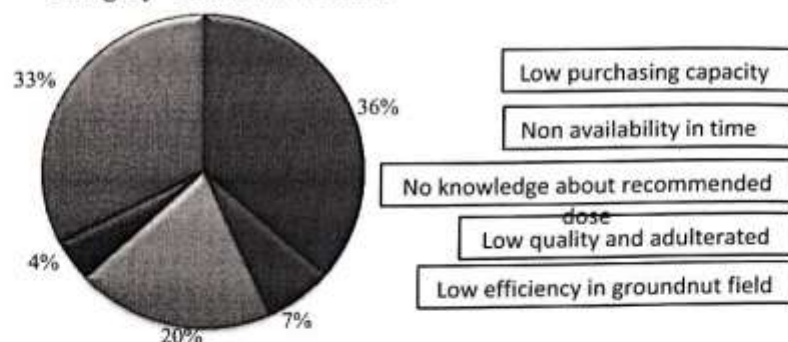
Nature of Constraints		No. of respondents	Percentage
a)	Irrigation		
I)	Lack of irrigation	41	42.70
II)	Irregular rainfall	50	52.08
III)	Heavy rainfall	05	05.21
b)	Chemical fertilizers		
I)	Low purchasing capacity	57	59.38
II)	Non availability in time	11	11.46
III)	No knowledge about recommended dose	31	32.29
IV)	Low quality and adulterated	07	7.29
V)	Low efficiency in groundnut field	51	53.13
c)	Miscellaneous problems		
I)	No knowledge about improved practices	49	51.04
II)	Non availability of improved implements	24	25.00

Pie Charts- Criteria - Irrigation



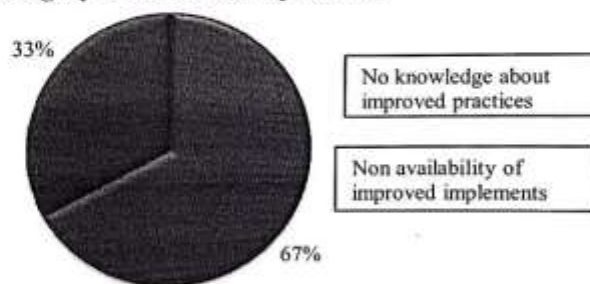
Pie Charts- Criteria - Chemical fertilizers:

Category- Chemical fertilizer



Pie Charts- Criteria - Miscellaneous problems:

Category- Miscellaneous problems



From the above table 7.1 it is found that, 50 target farmers (i.e. 52.08%) were suffered due to irregular rainfall for groundnut cultivation. The 41 target farmers (i.e. 42.70%) target farmers could not using modern agro practices due to lack of irrigation facility and 5 target farmers (i.e. 5.21%) were suffered from heavy rainfall. At present there some high yielding varieties of groundnut, but because of various constraints the target farmers only cultivates the two varieties of groundnut i.e. SB-11 and JL-24 in the sample villages. The earlier workers reported the same constraints. Pawar and Patil (1983), Shrivastva and Singh (1990), Kharat and Kulkarni (1996) reported that, the lack of awareness, knowledge of fertilizers, rainfall are the main constraints in agriculture of tribal farmers. Jagtap and Kadam (1984), Ingale et.al. (1988), Trivedi and Patel (1996) also reported the same. Chote and Borkar (2000), Shinde, Bhoite and Sawant (2003) stated that, lack of knowledge about various recommended cultivation practices, non-availability of inputs in time and at reasonable prices, non-availability of improved implements, inadequacy of laborers, and high rates of wages, lack of knowledge about biofertilizers, low income, unavailability of literature, not showing of method and result demonstrations by extension agents to farmers were important constraints in adoption of technology. In the present study it was observed that, irregular rainfall patter, lack of knowledge about *Rhizobium* biofertilizer, irrigation facility, shortage of labors, high prices of chemical fertilizers etc. were the major constraints of target farmers for groundnut cultivation. Thus the findings of researcher are agreed with studies of earlier workers.

From table 7.1 it is clear that, the target farmer's shows unwillingness about the chemical fertilizers because the farmer's from the study area are economically poor and many are marginal landholders. Thus they couldn't purchase high priced chemical fertilizers. About 57 target farmers' i.e.59.38% had low purchasing capacity. 51

target farmer's i.e. 53.13% said low efficiency of chemical fertilizers while seven target farmer's i.e. 7.29% said about low quality and adulteration of chemical fertilizers. While 11 target farmer's i.e. 11.46% complained about non availability of chemical fertilizers in time.

The application of chemical fertilizers for crops affects the yield. In present study the selected sample farmers are small and marginal landholders, so the high price and low purchasing power of target farmers restrict the use of chemical fertilizers. The work of Nagaraj and Katteppa (1999) reported that, high price of chemical fertilizers, low purchasing capacity of farmers was constrains in using chemical fertilizers. In present investigation it was noted that, 57 target farmers (59.38%) had low purchasing power, 31 target farmers (32.29%) had no knowledge about the recommended doses to the crop and 07 target farmers (07.29%) had complained about the low quality and adulteration of chemical fertilizers.

The table 7.1 revealed that, about 49 target farmers (51.04%) had no knowledge about improved practices for groundnut cultivation and 24 target farmers (25.00%) said about non availability of improved implements for modern practices.

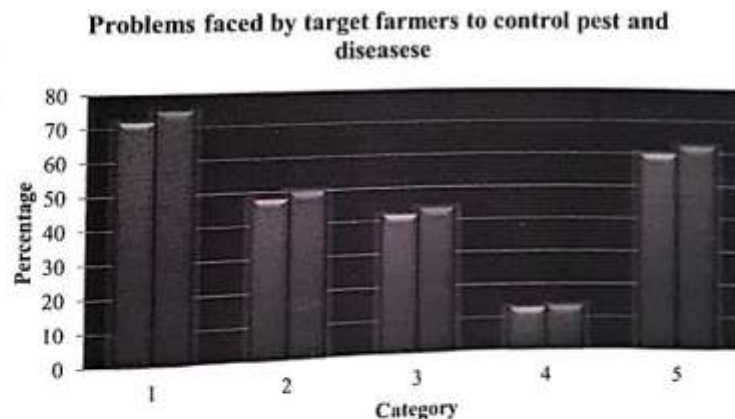
8- Problems of target farmers to control pest and diseases:-

The pest and diseases in the study area is the important problem. The common diseases and pest for groundnut in the study area are Tikka disease, Fusarium wilt, root rot, leaf hoppers etc. the use of pesticides is of prime importance for optimum crop yield. The use of costly pesticides to control the diseases in the study area acts as constraint by the small and poor farmers.

Table 8.1- shows the different problems faced by target farmers to control pest and diseases:-

Sr. No.	Category	No. of respondents	Percentage
1	High price of pesticides	72	75.00
2	Plant protection not possible due to continuous rainfall	48	50.00
3	Lack of knowledge about pesticides	42	43.75
4	Non availability of pesticides	13	13.54
5	Neighbours not used pesticides	60	62.50

Column chart- Problems faced by target farmers to control pest and diseases:-



- 1- High price of pesticides
- 2- Plant protection not possible due to continuous rainfall
- 3- Lack of knowledge about pesticides
- 4- Non availability of pesticides
- 5- Neighbours not used pesticides

In the present study it was found that, 72 target farmer's i.e. 75.00% couldn't using pesticides because of high price, 42 target farmer's i.e. 43.75% had lack of knowledge about pesticides and 60 target farmer's i.e. 62.5% told that, their neighbours are not using pesticides to control diseases of groundnut in Kharip season. Kharat and Kulkarni (1996) also pointed out that, the high price of pesticides and insecticides, low purchasing

capacity were acts as constraints for control the pest and diseases. It is observed that, high price of pesticides acts as the main constraint for the control of diseases and pest in the study area.

Acknowledgement:

The researcher are thankful to YCM Open University Nashik for allowing the research in Subject Communication.

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PHYSICO-CHEMICAL ANALYSIS OF WATER IN WELLS AND TUBE WELLS FROM DEOLA TAHSIL.

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ABSTRACT

The present work deals with the study of physico-chemical analysis⁴ of water sample collected from wells and tube wells of selected villages in Deola tahsil of Nasik District. Normally the tube wells go as deep as 400 feet or more. The results obtained from the study revealed that the drinking water quality or status of the wells and tube wells remained unsafe during the study period. The present study demonstrates application of water quality index in estimating the quality of the wells and tube wells water, which appears to be promising in the field of water quality management.²

Figure: 00

References: 04

Table : 01

KEY WORDS: Water quality, Physico-chemical parameters.

Introduction

Water covers 71% of the Earth's surface, and is vital for all known forms of life. Only 2.5% of the Earth's water is fresh water, and 98.8% of that water is in ice and groundwater. Natural water, whether in the atmosphere, on the ground surface, or under the ground, always contains dissolved minerals and gases as a result of its interaction with the atmosphere, minerals in rocks, organic matter, and living organisms. Reservoirs are one of the most important water resources used for water supply and irrigation. The colour of water was depends on the ingredients mixed in the water. Turbidity may be due to organic and/or inorganic constituents. Organic particulates may harbor microorganisms. Thus, turbid conditions may increase the possibility for waterborne disease. A changing pH in a stream can be an indicator of increasing pollution. As per IS pH of drinking water should be in the range of 6.5 to 8.5. In natural waters, salts are chemical compounds comprised of anions such as carbonates, chlorides, sulphates and nitrates (primarily in ground water) and cations such as potassium (K), magnesium (Mg), calcium (Ca) and sodium (Na)¹. If there are additional inputs of dissolved solids to the system, the balance is altered and detrimental effects may be seen. A low DO would indicate poor water quality and thus would have difficulty in sustaining many sensitive aquatic lives. Water is mankind's most precious resource, and one of the most important necessities for existence of Human Life. Unfortunately it is often contaminated with impurities such as organic, inorganic contaminants and microorganisms. Over 80% of all Infectious Diseases are caused by Water

Borne Contaminants. Without good water supplies people can cause to all types of illnesses, the majority of which can take lives. All this has prompted to undertake this research.

Materials and Methods

Deola is a tahsil place located at distance of 75 Km from Nasik district. All selected villages are having water supply facility, but majority of the people live in farm and uses water from wells and tube-wells for drinking and irrigation. Contaminants that may be in untreated water include microorganisms such as viruses and bacteria; inorganic contaminants such as salts and metals; organic chemical contaminants from pesticides and herbicides. Water quality depends on the local geology and ecosystem, as well as human uses such as sewage dispersion. The complexity of water quality as a subject is reflected in the many types of measurements of water quality indicators. The Water Samples were collected randomly from five different stations in Polythene bottles in November 2010 to October 2011. The Water samples were brought into laboratory for the estimation of various physicochemical parameters like pH, DO, TDS, Total Hardness, Calcium, Magnesium, Sodium, Chlorides, Alkalinity and Nitrate were estimated in the laboratory by using standard methods^{1, 2, 3 and 4}. The parameters for water quality are determined by the intended use. Work in the area of water quality tends to be focused on water that is treated for human consumption, or in the environment. Water samples collected from five different stations, preserved, transported and analyzed in laboratory¹⁻⁴.

Results and Discussion

As per IS pH of drinking water should be in between 6.5 to 8.5. If the pH of water goes below 6.5 above 8.5 leads to harmful effects. In present study it is observed that, the pH of water remained alkaline throughout. Maximum pH (7.73) found in water sample collected from Umrane and in lower order in Bhaur (7.54), Pimpalgaon (7.45) and Khuntewadi (7.15) while minimum (7.11) in Meshi. The total dissolved solids (TDS) in water consist of inorganic salts and dissolved

water samples collected from Pimpalgaon, Meshi and Khuntewadi were lower in order shows 122mg/l, 106mg/l, 100 mg/l respectively. The lowest CaCO_3 value found in sample collected from Bhaur is 18.7 mg/l. The highest magnesium value was found in a water sample collected from Umrane which was 38.2 mg/l, but the water samples collected from Meshi, Khuntewadi and Bhaur are lower in order showed that 18.6mg/l, 13.6mg/l, 5.2 mg/l respectively. The lowest Mg value found

Table 1. Physico-chemical parameters of water samples from study area.

Parameters	Collection stations					Mean	Standards for Domestic water		
	Umrane	Meshi	Bhaur	Khuntewadi	Pimpalgaon		BIS	WHO	ISI
pH	7.73	7.11	7.54	7.15	7.45	7.39	6.5-8.5	6.5-9.2	6.0-9
Dissolved solids (DS) ppm	2385	615	390	795	409	918.8	500	500	500
Total Alkalinity (TA)	Traces	Traces	Traces	Traces	Traces	-	-	-	-
Total Hardness (TH) mg/lit	716	184	117	238	25	256	300	500	-
Calcium (Ca)	143	100	187	106	122	131.6	75	100	250
Magnesium (Mg)	38.2	18.6	5.2	13.6	4.3	15.98	30	150	100
Chloride (Cl) mg/lit	1370	85.2	56.8	347.9	113.9	394.76	250	500	600
Sodium (Na) mg/lit	210	75	65	90	85	121	200	150	150
Dissolved O ₂ (DO) mg/lit	3.9	6.5	10.4	6.1	7.0	6.78	-	-	3.0

materials. The highest Dissolved solids value is found in a water sample collected from Umrane which is 2387mg/l, while the water samples collected from Khuntewadi, Meshi are lower in order i.e 795, 615, 409 mg/l respectively. The lowest TDS value found in sample collected from Bhaur showed 390 mg/l. The highest phosphates alkalinity of CaHCO_3 found in Umrane sample water (14.4mg/l), lowest in Khuntewadi water sample (6.8mg/l) and other decline in order. The highest total hardness as CaCO_3 is found in a water sample collected from Umrane which is 716 mg/L. The water samples collected from Khuntewadi, Meshi and Bhaur are in lower order 238mg/l, 184mg/l, 117 mg/l respectively. The lowest CaCO_3 value found in sample collected from Pimpalgaon showed 25 mg/l. The highest Calcium value was found in a water sample collected from Umrane village which was 143 mg/l, but the

in sample collected from Pimpalgaon is 4.3 mg/l. Chloride in water may be considerably increased by treatment processes in which chlorine or chloride is used. The highest Chloride value was found in a water sample collected from Umrane village which was 1370 mg/l, but the water samples collected from Khuntewadi, Pimpalgaon and Meshi are lower in order shows that 347.9, 113.6 and 85.2 mg/l respectively. The lowest Chloride value found in sample collected from Bhaur is 56.8 mg/l. Sodium (Na) is an essential element required for normal body function including nerve impulse transmission, fluid regulation muscle contraction and relaxation. However in excess amounts, sodium increase individual risk of hypertension, heart disease and stroke. The highest sodium content was found in a water sample collected from Umrane village which is 210 mg/l but the water samples collected from Khuntewadi

Pimpalgaon and Meshi are lower in order and shows 90, 85 and 75 mg/l respectively. The lowest Na value found in sample collected from Bhaur which was 65 mg/l. Dissolved O₂ is essential for aquatic life. A low DO (less than 2mg/l) would indicate poor water quality and thus would have difficulty in sustaining many sensitive aquatic lives. The highest amount of dissolved O₂ was found in a water

sample collected from Bhaur which was 10.4 mg/l and the water samples collected from Pimpalgaon, Meshi and Khuntewadi were lower in order shows that 7.0, 6.5 and 6.1 mg/l respectively. Lowest amount found in sample water of Umbrae is 3.9 mg/l. So the water from the collection centers is fit for drinking purpose.

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Percentage prevalence and morphological details of *Stylonychia pustulata* (Ehrenberg, 1830) in the fresh waters of Nashik district

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ABSTRACT

The ciliates are one of the most important groups of Protozoa, common everywhere in waters of lake, pond, oceans and soils with many ecto and endosymbiotic members, as well as some obligate opportunistic parasites. Free living ciliates are found in fresh, marine, estuarine waters and in the soil. The present species described as *Stylonychia pustulata* Ehrenberg (1830), (O. F. Muller, 1786) Ehrenberg, 1835 (O. F. Muller, 1786) Ehrenberg, 1838, *S. pustulata* (Deshmukh, 2010) has found in fresh water ponds, ditches and streams, especially more abundantly in rain water bodies of Nashik district.

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Introduction

The ciliates are one of the most important groups of Protozoa, common almost everywhere there is water (lake, pond, and oceans) and soils with many ecto and endosymbiotic members, as well as some obligate opportunistic parasites. Free living ciliates are found in fresh, marine, estuarine waters and in the soil.

An excellent source is a shallow semi permanent pond in a farm yard. Any stream large or small, or any freshwater hole, temporary or permanent, water at the base of aquatic plants is likely to be a valuable source of material. Such places as moist crotches or bark (crevices) in trees or any other moist or water containing silt, floating algal mats provide food. Cilia covering the body of the organism or a part of it, a major defining characteristic of this group and hence the phylum name "Ciliophora".

The ciliates possess a marked variety of motile systems based on ciliary motion. Thus, the organisms are able to move through the environment in search of prey often with remarkable agility and swiftness, or when sedentary, to create a flow of water carrying food to the organism. The arrangement of hair like organelles on the cell surface and the degree of coordinated action made possible by close proximity of the cilia varies considerably among the groups.

A cirrus is a composite group of cilia (a few to hundreds of cilia) often tapering toward the distal end and acting in unison. Typically they are found in localized regions on the cell surface. When the cirri are largely localized on the ventral and anterior surfaces, the ciliates are characterized as hypotrichs, signifying that the cirri are positioned beneath the cell. In other species, cilia are arranged in spirals (e.g. Spirotricha) or in ribbon like assemblages near the anterior (sometimes broader end) of the cell. Although many ciliates exhibit rapid and impressive locomotion, others such as suctorians are sedentary and lack cilia during most of their life cycle. These feeding (trophont) stages are anchored to the substratum by a stalk or other form of holdfast.

Ciliates in general have great power of regeneration, and the process like reproduction is more complex, a missing part can be replaced by simple growth. Unlike eukaryotes, ciliates have two different nuclei; large polyploid macronucleus and smaller diploid micronucleus. The former is important for protein synthesis, and latter for reproduction. The macro nuclei must be regenerated from the micronuclei. In most, this occurs during sexual reproduction which is not usually through syngamy but through conjugation. Joblet (1645-1723), has done pioneer work on ciliature, nuclei and contractile vacuoles in ciliates. In the eighteenth century Muller (1773, 1776 and 1786) gave the first extensive taxonomic account of all protozoa.

Extensive studies have been made during the last 80 years, with numerous outstanding and noteworthy contributions in the field of Protozoology, covering cytology, cytochemistry, structure, life cycle transmission, evolution, and ultrastructure, and inter relationship a verity of protozoa.

Although all ciliates conform, more or less, to the principle of nuclear dimorphism, they vary greatly in shape, size and number of nuclei. The macronucleus may be single compact, rounded or kidney shaped.

In reproduction by binary fission, the macro and micronuclei, either or both, divide; so that the parental nuclei are equally represented in both daughters. During sexual process of conjugation, two individual (the conjugant) unite temporarily. Micronucleus, or micronuclei, of both divide twice. All but one of the resulting micronuclei in each conjugant degenerate and disappear while the remaining one divides unequally forming two pronuclei. The smaller one is active, migratory, male pronucleus and the bigger one stationary, female, pronucleus. The male pronucleus migrates into the other conjugant and fuses with its stationary pronucleus forming a zygote nucleus or syncaryon. The two conjugants then, separate and are known as the exconjugant. These differ from ordinary individuals in having only a single nucleus, for the old macronucleus by now is in the process of losing its identity and being absorbed into the cytoplasm. The way in which the macronucleus disappears, varies considerably in different ciliates. During subsequent

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divisions the syncaryon gives rise to both macro and micronuclei.

Endoplasm is the seat of the main metabolic processes. The endoplasm is completely enclosed by cortex except at two places where it is brought into contact, temporarily or permanently, with the outside world. These are the cell mouth (cytostome) and cell anus (cytoproct). Food is taken in by the cytostome and surrounded by a vacuole into which digestive enzymes are secreted. The vacuole circulates slowly in the interior of animal during which time its contents are digested and absorbed through its wall and finally brought to the site of cytoproct which opens to discharge the undigested matter. In some ciliates the part of the endoplasm immediately adjoining the mouth forms a fairly well defined oesophagus like tube and among some groups of holotrichs this is surrounded by a series of parallel rods (trichites) of unknown origin, sometimes elaborate enough to form a basket like structure.

One or more contractile vacuoles are present typically in freshwater ciliates to regulate ion balance of the cytoplasm and expel excess water. Various extrusomes (ejecatile organelles) occur beneath the surface of the cell including mucocysts that secrete surface substances either to coat the cell to improve its immediate environment, provide material for cyst walls or aid in the capture of prey.

Most ciliates feed on smaller organisms, such as bacteria, algae and detritus swept into the mouth by modified oral cilia. Feeding consist of two processes each of which may limit the actual rate of feeding. The first one is the process of phagocytosis, i.e. the enclosure of a food particle in a membrane covered vacuole in which digestion takes place. In ciliates this occurs at a special site on the cell surface called cytostome or cell mouth. Cytostome is simply a two dimensional aperture and most commonly permanently open. It is covered by a single unit membrane from which food vacuoles are formed. Food materials first pass into the endoplasm of the organism via a more or less distinct cytopharynx. It may open directly to the exterior or be sunken into a depression or cavity of some kind, such as atrium, vestibulum or buccal or peristomial cavity.

The cytostome is often associated with various organelles in the surrounding cytoplasm in particular bundles of microtubules. Later play a role in the transport of captured particles on the surface surrounding the cytostome. A variety of ciliary's and other organelles serve to concentrate or retain food particles.

Material and Methods-

For the study, the water samples were collected from different parts of Nashik dist (Deola, Kalwan Nandgaon, Surgana, Satana) of Maharashtra state. Water samples were collected in wide mouth, sterilized glass bottles. Due care was taken and the samples were collected from where the submerged plants and decaying leaves were present. Mostly the samples were collected during morning and evening. The temperature of the sample bottles were maintained with the help of ice bags.

Rapid movements of ciliates make it difficult to identify ciliate species. To immobilize their movements methyl cellulose solution was used.

Culture methods -

For cultivation various media are used such as

- Hay infusion
- Wheat infusion
- Rice infusion

Hay infusion was good for *Stylonychia* and many other ciliates species. Rice grain infusion is also best for the *Vorticella*, *Stylonychia* and *Coleps* species.

Water sample is obtained from different water bodies contains a mixer of organism, by adding any type of culture media (Wheat or rice infusion) can generally rise the number of certain ciliate species (by rising the bacterial population present) in the water sample, but often lower the number of species. However the rough sample containing several ciliates and unknown bacterial and algal floras can be obtained for several weeks. Selection of a particular ciliate species and culturing it in the isolation of organisms other than its prey may obtain a greater degree of control over a culture.

The choice of culture medium depends largely upon what the ciliate feeds. Many feed upon bacteria and that is why many of the media commonly used are designed to encourage the growth of bacterial populations. Different culture media and methods published by Mackinnon and Hawes (1961), Kirby (1950) and committee on cultures, Society of Protozoologist (1958).

Culture were examined under low power and then in to high power microscope taking care to focus at all levels in the culture watching for movements of any kind. Movements of ciliates were also trapped in video camera for the proper understanding. Dry silver impregnation was used to study infraciliature of the ciliates. For the permanent slides the ciliates were fixed in terms of number of individuals and species composition. Methyl cellulose has been found too many advantages, as it arrest the movement, ciliates can be identified by their appearance. The species identification has been made mainly on the basis of arrangement of cilia, size and shape of body and structure of macro and micronucleus.

Discussion and Results-

Percentage of prevalence of *Stylonychia pustulata* in fresh water during the period of January 2007 to December 2008, for the two years

Table 1. Showing month wise prevalence of *Stylonychia* Sp. in freshwaters of Nashik District during the year 2007

Sr No	Month	Total No. of samples Examined	No. of +ve samples	% of Total Prevalence
1	Jan-07	45	6	13.33
2	Feb-07	55	7	12.73
3	Mar-07	47	6	12.77
4	Apr-07	60	6	10.00
5	May-07	61	5	8.20
6	Jun-07	67	15	22.39
7	Jul-07	54	21	38.89
8	Aug-07	57	20	35.09
9	Sep-07	58	12	20.69
10	Oct-07	60	11	18.33
11	Nov-07	64	10	15.63
12	Dec-07	49	7	14.29
	Total	677	126	18.61

Figure 2. Showing month wise % of total prevalence of *Stylonychia* in freshwaters of Nashik District during the year Jan. to Dec. 2007

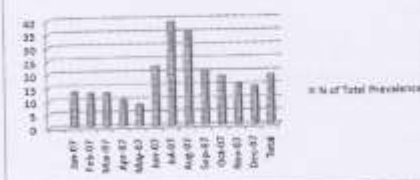
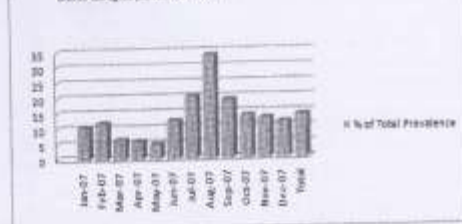


Table 2. Showing month wise prevalence of *Stylonychia* in freshwaters of Nashik District During the year 2008

Sr No	Month	Total No. of samples Examined	No. of +ve Hosts	% of Total Prevalence
1	Jan-08	68	7	10.29
2	Feb-08	84	10	11.90
3	Mar-08	79	5	6.33
4	Apr-08	69	4	5.80
5	May-08	62	3	4.84
6	Jun-08	89	11	12.36
7	Jul-08	94	19	20.21
8	Aug-08	80	27	33.75
9	Sep-08	89	17	19.10
10	Oct-08	87	12	13.79
11	Nov-08	69	9	13.04
12	Dec-08	77	9	11.69
	Total	947	133	14.04

Graph 2. Showing month wise % of total prevalence of *Stylonychia* in freshwaters of Nashik District During the year Jan. to Dec. 2008



During the period of two years (Jan.2007 to Dec. 2008) a total number of water samples 1624 were examined, 259 of these were positive with free living ciliate *Stylonychia pustulata*.

In the first year (Jan.2007 to Dec.2007) 677 fresh water samples were examined, 126 of these were positive with free living ciliates. The percentage of prevalence of free living ciliates was about 18.61%.

In the second year (Jan.2008 to Dec.2008) 947 fresh water samples were examined, 133 of these were positive. The percentage of prevalence of free living ciliate *Stylonychia* was about 14.04%.

A month wise analysis in first year (Jan.2007 to Dec.2007) shows the maximum percentage of prevalence during August (33.75%) and minimum in May which was only 4.84% and minimum to moderate in remaining months.

During the period of Jan. 2008 to Dec.2008) maximum percentage of prevalence of this ciliate was showed again during July (33.75%) and lowest in May (4.84%) and minimum to moderate in remaining months.

The pattern in both the years suggests that the peak is soon after the monsoon rain. The percentage then gradually reduces at the end of the winter months and reaches a low with the onset of summer. The details of the number of water samples examined and the month wise prevalence is shown in Table No1 and 2.

Description of the species

Synonym of *Stylonychia* was described by O. F. Muller (1786) later Kerona, the Andre, (1916) had given the name *Protopsema*. Ehrenberg, (1838) included this genus in Family Oxytrichidae. The species which are included in genus *Stylonychia* are inflexible, elongate, oval, dorso-ventrally flattened body with a large and powerful AZM supported anteriorly by a collar. 2 rows of marginal cirri not continuous posteriorly, but 3 long, strong and prominent caudal cirri present.

The genus has the typical fronto-ventral and transverse arrangement of cirri with 3 strong anterior frontal cirri. The dorsal surface has several longitudinal rows of short cilia. Macronucleus in two parts each with an adjacent micronucleus. Several species have been recorded.

Undulating membrane is present in *Stylonychia* pattern. One right and one left row of marginal cirri, distinctly separate posteriorly. Presence of six dorsal kineties, caudal cirri present and often distinctly elongated, which have, however, a more slender and flexible body and intersecting undulating membranes. There are two (two distinct segments of one macronucleus) macronuclei present which are oval in shape with single spherical to ovoid micronucleus each.

The genus *Stylonychia* has following species

S. pustulata Ehrenberg, 1838

S. mytilus Ehrenberg, 1838

S. putrina Stokes, 1885

S. notomorphia Stokes, 1885

Description of the *Stylonychia pustulata*

The present species described as *Stylonychia pustulata* Ehrenberg (1830), (O. F. Muller, 1786) Ehrenberg, 1835 (O. F. Muller, 1786) Ehrenberg, 1838, *S. pustulata* (Deshmukh, 2010). Present author has found this species in fresh water ponds, ditches and streams, especially more abundantly in rain water bodies of Nashik district.

Body is inflexible and elliptical. It measures about 44 to 125µm in length and 22µm to 81µm in width. Both anterior and posterior ends are rounded and more or less parallel. Macronuclear segments two which are ovoid in shape. Each macronucleus measures about 14 to 16µm in length and 6 to 8µm in width, lying left of the median. Micronuclei are two in number, they are small spherical, each in close contact with one of the macronuclear segments.

Contractile vacuole is single. It measures about 9µm to 11µm in length, present at the middle of the body. Endoplasm was seen bright yellow in colour in living condition. Food vacuoles are few to moderate in number. The large size food vacuole measures about 27 to 32µm in length.

Movement moderately slow, gliding, and often standing still for sometimes, rotation, around the longer axis on disturbance. The presences of various cirri are the organs of swimming and gliding locomotion. Marginal cirri are measures about 12 to 16µm long. Right marginal row is composed of many more cirri than the left one. Three anterior frontal cirri enlarged, which measures 19-23 µm in length. Four posterior cirri, arranged in an oblique hook-shaped row, and one enlarged buccal cirrus. Two postoral and three ventral cirri are present. Transverse cirri are five in number they measures about 20-24 µm in length. The Caudal cirri are three in number; they are 16-25 µm in length, very stiff and projecting laterally.

Comments

Body of present species is ovoid to reniform, inflexible and elliptical, with short dorsal bristles. Three long stiff caudal cirri are present and hence it belongs to genus *Stylonychia*. This genus is first reported by Ehrenberg, 1830. Later many workers reported different species of this genus. Kudo (1966), Bick (1972), Berger & Foissner (1997), Lynn & Small (2000), reported the different species of the same genus. *Stylonychia pustulata* was identified by the shape of the body, the arrangement and the number of cortical elements, the mode of locomotion and morphological similarities in number and the positions of cirri. Movement moderately slow, gliding, and often standing still for sometimes, rotation, around the longer axis on disturbance.

Table 3: Comparison of different species of genus *Stylonychia* with present species, *S. pustulata*

Sr. No.	Particulars	1 <i>S. pustulata</i> Ehrenberg, (1838)	2 <i>S. mytilus</i> Ehrenberg, (1838)	3 <i>S. putrina</i> Stokes, (1885)	4 <i>S. notomorphia</i> Stokes, (1885)	5 <i>S. pustulata</i> Deshmukh, (2010)	6 <i>S. pustulata</i> Present authors
1	Body shape	Ovoid	Elongate	Elongate	Elongate	Ovoid	Ovoid
2	Body dimensions	L- 150 um	L- 100 to 300um	L- 125 to 150um	L- 125um	L- 55 to 65um W- 30 to 38um	L-44 to 125um W- 22 to 81um
3	Macronuclei	2, ovoid	2	2, ovoid	2, ovoid	2, ovoid	2, ovoid
4	AZM	1/3 body length	1/3-1/2 body length	1/3-1/2 body length	1/3-1/2 body length	1/3 body length	1/3 of body length
5	Habitat	Fresh water	Fresh water	Fresh water	Fresh water	Muddy soil	Fresh water

AZM - Adoral zone of membranelle

Body of present species is ovoid and hence similar to previously described species *S. pustulata* but differs from *S. mytilus* (Ehrenberg, 1838) which is elongate and has anterior end wider than the posterior. *S. putrina* (Stokes, 1885; Deshmukh, 2010) is elongate and anterior end is not wider than posterior but anterior end is somewhat conical and rounded posterior end while in present species anterior end is rounded and posterior is broadly pointed and hence present species is also separates from *S. putrina*. It also distinguishes from *S. notomorphia* (Stokes, 1885) which has somewhat conically rounded anterior end and body laterally narrowed in some cases.

In body dimensions when compared with other species of *Stylonychia*, present species found to be small among all the previous ones (Table.....). Present species has 3 to 8 frontal, 2 post. oral, 3 to 5 ventral, 5 transverse and 3 caudal cirri and hence similar to all the species of genus *Stylonychia* which also has 3 frontal, 3 ventral, 5 transverse and 3 caudal cirri.

AZM in present species also covers the one-third part the body length and hence this species is resembles that of *S. pustulata* but differs from *S. putrina* (Stokes, 1885), *S. mytilus* (Ehrenberg, 1838) in which AZM extends one-third to one-half the body length. It also separates from *S. notomorphia* (Stokes, 1885) in which AZM extends up to one-half the body length.

Present species has two ovoid macronuclei and hence similar to all the species of genus *Stylonychia*.

Present author compared present species with all the species of genus *Stylonychia* and found morphologically close similar to *S. pustulata* (Ehrenberg, 1838) in body outline, length of AZM and hence redescribed as a *Stylonychia pustulata*.

Figure - *Stylonychia pustulata*

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EFFECT OF MEDIA COMPONENTS AND PHYSICAL PARAMETERS ON CITRIC ACID FERMENTATION

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ABSTRACT:

Worldwide demand of Citric acid is about 6.0×10^5 tons per year (Karaff and Kubicek, 2003). Approximately 75% commercial use of citric acid is for food and 12% for pharmaceutical industries (Haq et al, 2001). Many microorganisms have been evaluated for citric acid production including bacteria such as *Bacillus licheniformis*, *B. subtilis*, *Corynebacterium sp* (Kapoor et al, 1983), Fungi such as *Aspergillus niger*, *A. awamori*, *A. foetidus*, *Penicillium restrictum* etc. (Mattey and Allen, 1990), Yeast such as *Candida lipolytica*, *C. intermedia* and *Saccharomyces cerevisiae* (Crolla and Kennedy, 2001).

In the present study different factors affecting microbial production of citric acid like methanol, strain of microorganism, carbon source, PH etc. were considered. Isolation of *Aspergillus niger* from soil sample collected from different localities, 2% methanol added into culture medium gives higher yield, 13% sucrose was better carbon source than the glucose, 4.5 PH was suitable for production of citric acid in vitro and in 28-30° temperature healthy growth was found.

Key Words: Fermentation broth, citric acid, PH, methanol, Carbon source, *Aspergillus niger* etc.

INTRODUCTION:

Citric acid is mainly produced by submerged fermentation of *Aspergillus niger*. The yield depends upon composition of medium and on the micro organism strain (Aftab Nadeem, Quratulain Sayed, Shahjahan Baig, Muhammed Irfan and Muhammed Nadeem, 2010). Citric acid production using *A. niger* is influenced by the process variables such as initial sucrose concentration, pH, nutrient concentration, additive, incubation period, temperature etc. However demand for Citric acid production is increasing faster than the its production and hence requires more economical process. The fitness of solution would be measured by determining the total weight of the proposed solution. The higher the weight, greater the fitness provided that solution (K. Anand Kishor, M. Praveen Kumar, V. Ravi Krishna and G. Venkat Reddy, 2008).

Citric acid, a tricarboxylic acid widely used as an acidifying agent and antioxidant in a food, beverages and pharmaceutical industries (Kapoor et. al, 1982; Wang and Liu, 1996).

In the present study locally isolated *Aspergillus niger* employed for the production of Citric acid.

MATERIALS AND METHODS:

Aspergillus niger is a fungus recommended for the production of various metabolites. Citric acid is one of the important organic acids synthesized and released on synthetic medium by this fungus. Natural source of *Aspergillus niger* is a soil, hence soil from different localities from Nashik District was collected and tested for higher yielding strain of *Aspergillus niger* for the production of citric acid and use further.

1. Screening of *Aspergillus niger* for citric acid production: Selection and isolation of micro-organism which produces high amount of citric acid. Primary screening determines which microorganism is able to produce a citric acid followed by secondary screening to determine capacity of that organism producing citric acid quantitatively.

2. Isolation of Microorganism: The natural source of *Aspergillus niger* is the soil. Collection of soil samples from different locations with respect to pH of the soil. In this way ten soil samples were collected and diluted 1/100, 1/1000 and 1/10000 of each sample. The diluted samples were observed and they were purified by sub culturing on Czapeck's Dox agar slants. Culture Plates were incubated at 28 °C and isolated cultures were observed and they were purified by sub culturing on Czapeck's Dox agar slants.

3. Screening for organic acid production: Spore from slant cultures were inoculated on sterile Czapeck's Dox agar medium plates incorporated with Bromo-cresol green dye. Plates were incubated at 28°C for 24 to 28 hrs. and checked colour change blue to yellow indicates organic acid production.

To study the effect of media component on citric acid fermentation, all the components except one to be studied are kept constant with respect to the control medium and one component concentration is changed in particular range. Broths were tested for citric acid production by selected strains of *Aspergillus niger*.

Table No.1: Isolation of soil from different area and test for citric acid production

Sr.No.	Area	Culture	Soil pH	Yield mg/ml
1.	Nashik Caves area	NS1	4.4	3.8
		NS2	5.2	3.6
		NS3	4.8	4.1
		NS4	5.6	2.9
2.	Shaptshrungi Garh	SG1	5.3	2.8
		SG2	5.5	3.1
		SG3	4.8	3.9
		SG4	5.7	2.8
3.	Deola forest	DF1	5.6	2.6
		DF2	6.2	2.4
		DF3	5.4	2.9
		DF4	5.1	2.8
4.	Deola college Garden	DCG1	6.5	2.2
		DCG2	6.3	2.4
		DCG3	7.6	1.8
		DCG4	7.8	1.6

Table No.2: Effect of Sucrose % on Yield of citric acid.

Sucrose %	Yield(mg/ml)		
	NS1	NS3	SG3
12	2.2	1.5	1.2
13	3.5	3.2	3.4
14	2.9	2.5	2.7
15	2.4	2.6	2.2
16	2.3	2.7	2.7
17	2.1	2.8	2.5
18	1.6	1.4	0.8

Table No.3: Effect of different NaNO₃ concentration on Yield of citric acid.

Sr.No.	NaNO ₃ mg/l	NS1	NS3	SG3
1.	200	2.2	2.0	1.7
2.	250	2.4	2.1	1.5
3.	300	2.6	2.2	1.8
4.	350	3.1	2.8	1.3
5.	400	3.7	3.9	2.9
6.	450	2.8	2.6	2.0
7.	500	2.1	2.6	1.7
8.	550	1.8	2.1	1.6
9.	600	1.6	1.9	1.4

Table No.4: Effect of different KH_2PO_4 concentration on Yield of citric acid.

Sr.No.	KH_2PO_4 mg/l	NS1	NS3	SG3
1.	25	2.9	2.8	2.2
2.	50	2.8	3.2	2.4
3.	75	3.7	3.8	2.6
4.	100	4.7	4.5	3.5
5.	125	3.6	4.2	3.1
6.	150	3.1	3.2	2.2

Table No.5: Effect of different MgSO_4 concentration on Yield of citric acid

Sr.No.	MgSO_4 mg/l	NS1	NS3	SG3
1.	10	0.7	0.9	1.1
2.	15	1.9	2.2	1.3
3.	20	3.8	3.6	3.5
4.	25	3.1	2.9	3.4
5.	30	1.8	2.1	2.3

Table No. 6: Effect of different pH on citric acid production.

Sr.No.	pH	NS1	NS3	SG3
1.	2.5	2.6	2.8	2.9
2.	3.0	2.8	2.8	3.0
3.	3.5	3.0	3.1	3.3
4.	4.0	2.9	3.5	3.9
5.	4.5	3.9	3.7	3.8
6.	5.0	1.8	2.1	1.9
7.	5.5	1.3	1.2	1.5

Table No.7: Paper chromatography of organic acid

Sr. No.	Sugar	Distance travelled by solvent	Distance travelled by solute	Rf	% Rf
1.	Citric acid	10.0	4.0	0.4	40
2.	Oxalic acid	10.0	5.0	0.5	50
3.	Succinic acid	10.0	6.0	0.6	60
4.	Test	10.0	4.0	0.4	40

RESULT AND DISCUSSION:

Table No.1 Soil from various areas was collected and different cultures isolated from it. These were checked for citric acid production. The highest yield was reported from NS1, NS3 and SG3. It was found that the highest yield was found when the pH of soil was 4.5, above this pH the yield was less.

Table No.2, When all the three cultures were tested for variation in sugar concentration (Sucrose), it was reported that the at sugar concentration 13% all the three cultures gave the higher yield. It was also found that sugar concentration (15% to 18%) the yield reported was less as compared to 13%. Kovats (1960) reported that higher sugar concentration (15 to 18%) greater amount of residual sugars remains in the medium and process become uneconomical.

Table No.3 A wide range (200 to 600 mg) of NaNO_3 for all the three cultures was tested and found that at the concentration of 400 mg the yield of citric acid was higher, this result matched with Dhankar's (1974) finding. It was showed that at lower and higher concentration of NaNO_3 the yield reported was poor and higher yield of citric acid at 400 mg of NaNO_3 was found to be optimum.

Table No. 4 A wide range of KH_2PO_4 was checked for citric acid production, it was found that 100 mg of KH_2PO_4 was suitable for citric acid production for all the three cultures. The higher concentration of KH_2PO_4 leads to less yield and promotes growth. This result confirms findings of Khan's and Szuc's that higher KH_2PO_4 decreases production of citric acid.

Table No. 5 Variation of MgSO_4 ranging from 10 to 30 mg, it was found that higher yield was given by a concentration of 20 mg of MgSO_4 which helped for both growth and citric acid production. These results compared with findings of Prescott and Dunn as Mg is essential for a variety of enzyme reactions in the cell.

Table No. 6 A pH of 4.5 was found to be suitable for all the three cultures for the yield of citric acid. The culture SG3 showed higher yield at pH 4.0. This showed the contrasts with the finding of Prescott and Dunn which claims that the initial pH for sucrose.

Table No. 7 Ascending chromatography was done by using the solvent system n-Butanol, formic acid and water in the proportion of 10:2:5 respectively. It was prepared by separating funnel and out of the two layers upper organic layer was used. The fermented broth concentrated by evaporating it in a petri dish. Chromatogram removed, dried and sprayed with 0.4% Bromo-Cresol Green prepared in ethanol (pH is equal to 6.7) and Rf values were calculated. Rf value of samples compared with the organic acid and from this it was confirmed that fermentation broth contains citric acid

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14. Effect of selected medicinal plants on the growth of seed borne Fungi

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Abstract

Agriculture is a back bone of our country, whole economy of India is related with agriculture. India is having the second largest population after the China. Plants are utilized as a food, clothes, shelter, medicinal, fertilizer, antimicrobial agent and many other purposes. Green manuring has been an agricultural practice among European farmers for more than two thousand years but not until the nineteenth century did students of agriculture become interested in the process by which plant material turned under became available for subsequent crops. Indian plants wealth is about 45000 plant species, every year huge waste biomass of plants going waste, Indian plant diversity represents 7% of world flora (Chakraborty, 2004). It may be utilized for agriculture purposes because most of plant having antimicrobial activity.

In the present study, the effect of ten wild medicinal plants biomass in the form of root extract on spore germination, growth and sporulation of seed borne fungi of Bhendi were carried out in-vitro. It was found that all the plants biomass found more or less effective against seed borne fungi, and enhances seedling emergence of Bhendi.

Keywords

Seed mycoflora, Sporulation, Growth of Seed Borne Fungi, Bhendi.

Introduction

India is one of the mega biodiversity centre of the world. Indian plant wealth is near about 45,000 sp. of plants. We are unaware of biomass produced by wild plants which going waste every year. If it may be utilized for various purposes in agriculture, it improves crop yield eco-friendly. Every year huge biomass of plant is going waste. It may be utilized for agricultural purpose because most of plants having anti-microbial activity. By using chemical fertilizer, pesticides causes imbalance in biodiversity. If we used plant based product as fertilizer, pesticide and seed dressing material which do not causes any hazardous effect on plants and soil micro flora. By considering above importance this study was undertaken, Bhendi is one of important and the nutritious vegetable cultivated in our region. The medicinal plant however is usually applied to those plants which show the presence of phytochemicals which form main source of potential drug and medicine. The waste biomass of plant may be utilized as a source of insecticides, fungicides, bactericides and herbicides. Therefore attempts were made to utilize waste biomass of the medicinal plants in the welfare of vegetable crops specially Bhendi. Similarly Dhawale and Kodnewar (1978) carried out similar study and isolated *Aspergillus niger* and species of *Fusarium* from the seeds of chilli, Vidyasekaran and Thiagrajan (1981) also carried out similar study.

In the present study the effect of root biomass of ten test medicinal plants against seed mycoflora, sporulation and dry mycelial weight of *Alternaria tenuis* and *Fusarium oxysporum* was studied.

Materials and Methods

1. Collection of Seed Samples

A seed sample of test vegetables of Bhendi was collected from field, store houses and market places. A composite seed sample of individual test vegetable was prepared by mixing the individual samples together and preserved in gunny bags at room temperature during the studies.

Collection of plant materials

Ten very common and easily available wild plants were selected, the root of selected plants were surface sterilized, dried in oven and ground into fine powder with the help of blender. 5% aq. root extract was found more effective for control of seed mycoflora of Bhendi.

2. Testing of root extracts & Effect of root extract on percent incidence of seed mycoflora

Aqueous extract of different percentage of the selected biomass was prepared by dissolving 1, 2, 3,..... gm of biomass powder in 100ml sterile distilled water. The aqueous extract of biomass was tested against seed mycoflora. The biomass extract of effective percentage was determined. The biomass extract of five percent was found to be effective. Therefore five percent extract of medicinal plant biomass was used for further studied.

3) Detection of seed mycoflora

a) Moist blotter plate method

The isolation of seed borne fungi was carried out by blotter test method, described by ISTA (1966), Agarwal and Sorbhoy (1978). A pair of white blotter paper of 8.5 cm diameter was jointly soaked in sterile distilled water and placed in pre-sterilized Petri-plates of 10 cm diameter. 10 Seeds of Spinach were placed equal distance on moist blotter paper. More than 400 seeds were tested for each treatment. Plates were incubated at room temperature for seven days. Identification and confirmation of different fungi on seed was made by preparing slides (Mukadam, D.S., 1997). Many fungi were isolated, out of these two were very common fungi brought in to the pure culture and further used.

b) Identification of seed borne fungi

The seed borne fungi were preliminary identified on the basis of sporulation characters like asexual or sexual spores or fruiting structures. Detailed examination of fungal characters was done under compound microscope and their identification was confirmed with the help of latest manuals (Subramanian, 1971; Jha, 1993 and Mukadam, 1997). Pure culture of the identified fungi were prepared and maintained on PDA (Potato Dextrose Agar) slants.

c) Preparation of spore suspension

For this 10 ml of sterile distilled water was poured in to the Sporulation pure cultures of seed born fungi which maintained on PDA slants for seven days at room temperature. The slants were shaken and the content was filtered through muslin cloth. The filtrate was used as spore suspension.

d) Study of spore germination

During the present study, 25 ml of GN medium supplemented with 2 ml of 5% plant extract was poured in 100 ml of borosil conical flasks. The flasks were autoclaved separately with 2 ml of spore suspension of the test seed borne fungi which were maintained on PDA slants for seven days. The flasks were incubated at room temperature for seven days. The flasks were incubated at room temperature for twenty four hours. After incubation the spore germination was studied by preparing slides of the incubated solution and observing under compound microscope.

The flask poured with 25 ml of GN medium without the supplement of 2 ml of 5% plant extract inoculated separately with spore suspension of test fungi were served as a control.

4. Effect of root extract on growth on seed borne fungi

During the present studies some common and dominant seed borne fungi of Bhendi like *Alternariatenuis*, and *Fusariumoxysporum* were grown in GN medium supplemented separately with 2ml of five percent plant extracts of medicinal plant biomass for seven days at room temperature. After incubation contents of the flasks were filtered through pre-weighed Whatman filter paper No. 1. The filter papers with mycelial mat were oven dried for twenty four hours at sixty degree centigrade and reweighed. Growth of the seed borne fungi in terms of dry mycelial weight was measured by subtracting the initial weight of the filter paper from the final weight of filter paper with mycelial mat. The seed borne fungi grown in GN medium without supplementation of medicinal plant biomass extract were served as control. The sporulation was studied by preparing slides of the seed borne fungi before filtration.

Table 1.
Effect of root biomass of selected medicinal plants on seed mycoflora, seed germination of Bhendi.

Sr. No.	Root extract	Incident of Seed mycoflora %	Seed germination		
			%	RL	SL
1.	Abrus precatorius L.	40	40	50	35
2.	Aegle marmelos L.	42	85	46	31
3.	Balanites aegyptiaca Delile.	45	60	51	34
4.	Datura metel L.	35	45	32	18
5.	Dioscorea bulbifera L.	50	41	35	16
6.	Helicteres isora L.	55	40	32	15
7.	Sapindus laurifolius Vahl.	70	65	38	15
8.	Semecarpus anacardium L.	65	53	36	16
9.	Solanum xanthocarpum Schrad	30	80	40	33
10.	Vitex negundo L.	80	45	10	09
	Control	100	40	30	18

Table 2.
Effect of root biomass of selected medicinal plants on spore germination, growth and sporulation of Alternaria tenuis and Fusarium oxysporum.

Sr. No	Root extract	Alternaria tenuis			Fusarium oxysporum		
		Spore germination (%)	Dry mycelial weight (mg)	Sporulation	Spore germination (%)	Dry mycelial weight (mg)	Sporulation
1.	Abrus precatorius L.	55	40	+	40	25	++
2.	Aegle marmelos L.	65	32	++	35	30	++
3.	Balanites aegyptiaca Delile.	75	50	+++	70	45	++
4.	Datura metel L.	47	35	++	20	30	+
5.	Dioscorea bulbifera L.	40	25	++	42	15	++
6.	Helicteres isora L.	60	29	++	69	16	++
7.	Sapindus laurifolius Vahl.	50	25	++	31	25	++
8.	Semecarpus anacardium L.	35	20	++	34	20	++
9.	Solanum xanthocarpum Schrad	32	19	+	31	13	+
10.	Vitex negundo L.	70	40	+++	65	35	+++
	Control	80	52	+++	80	50	+++

+Low, ++Medium, +++ high

Result and Discussion

It is evident from the result presented in Table No.1 that seeds of Bhendi soaked in 5% aqueous leaf extract of selected medicinal plant found to be inhibitory for seed mycoflora and stimulatory for seed germination of Bhendi. The seed soaked in root extract of *Datura metel* (35%) and *Solanum xanthocarpum* (30%) showed reduced incidence of seed mycoflora. Seed germination found to be maximum in the leaf extract of *Aegle marmelos* (85%), *Abrus precatorius* (80%) and *Solanum xanthocarpum* (80%) and leaf extract of *Dioscorea bulbifera* (41%) and *Vitex negundo* (45%) as compared to the other test medicinal plants leaf biomass. Similar study carried out by Waghmare (1996), Mishra and Rath (1986), Dwivedi and Pathak (1981).

The biomass produced by the medicinal plants contains many chemicals which have insecticidal, fungicidal and bactericidal properties. It is evident from the result presented in Table 2 that the root biomass of all the medicinal plants was found to be inhibitory for spore germination, growth and Sporulation of *Alternaria tenuis* and *Fusarium oxysporum*. Spore germination found greater (75%) in *Balanites aegyptiaca*, followed by *Datura metel* (72%) and *Vitex negundo* (70%) of *Alternaria tenuis*. Spore germination of *Alternaria tenuis* inhibited by *Solanum xanthocarpum* (32%) and *Semecarpus anacardium* (35%). *Fusarium oxysporum* spore germination was reported stimulates in *Balanites aegyptiaca* (70%), followed by *Helicteres isora* (69%) and in *Vitex negundo* (65%). Spore germination of *Fusarium oxysporum* inhibited by *Datura metel* (20%), *Solanum xanthocarpum* (31%) and *Sapindus laurifolius* (31%). It is also evident from the results that root biomass of *Solanum xanthocarpum* was found to be more inhibitory and root biomass of *Balanites aegyptiaca* was found to be stimulatory for spore germination, growth and Sporulation of *Alternaria tenuis* and *Fusarium oxysporum* as compared to the root biomass of other test medicinal plants. Similar results were obtained by Liang (1993) and Bhowmik and Choudhary (1982).

It is clear from the results presented in the table 1 that the root biomass of all test medicinal plants was found more or less inhibitory of growth of seed borne fungi of *Alternaria tenuis* and *Fusarium oxysporum*. Dry mycelial weight of *Alternaria tenuis* found in root extract *Balanites aegyptiaca* (50 mg), *Vitex negundo* (40mg) and *Abrus precatorius* (40mg). Dry mycelial weight of *Alternaria tenuis* is reduced or inhibited in root extract of *Solanum xanthocarpum* (19mg) and *Semecarpus anacardium* (20mg). Dry mycelial weight of *Fusarium oxysporum* found greater in root extract of *Balanites aegyptiaca* (45 mg) and *Vitex negundo* (35 mg) and inhibited growth in root extract of *Solanum xanthocarpum* (13mg) and *Dioscorea bulbifera* (15 mg). It is also evident from the result that the root biomass of *Solanum xanthocarpum*, *semecarpus anacardium*, *Datura metel*, *Dioscorea bulbifera* were found to be more inhibitory and root biomass of *Balanites aegyptiaca* and *Vitex negundo* were found to be stimulatory for spore germination, growth and Sporulation of *Alternaria tenuis* and *Fusarium oxysporum* as compared to rest of the selected medicinal plants. Similar study was carried out by Vidhysekaran et al (1980).

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Studies on production and total phenol content (TPC) of leaf biomass of the selected medicinal plants

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Abstract - Wild medicinal plants waste biomass going waste every year, it may be utilize for the welfare of agricultural purpose. Such studies are meager in India. By using chemical fertilizer, weedicides and pesticides causes pollution which decreases soil fertility, kills ecofriendly soil micro flora and many other hazardous effects. We are unaware of biomass produced by wild medicinal plants going waste every year. If it is utilized for various purposes in agriculture, it improves crop yield ecofriendly. Because of most of the plants consist of antimicrobial activity in them. It may be utilized as a source of insecticide, fungicide, bactericides and herbicides.

In the present study plant leaf biomass in the form of dry weight, total phenol content was carried out of selected ten wild medicinal plants. Plant waste biomass in the form of leaf extract was used against seed mycoflora, seedling emergence, spore germination, sporulation and dry mycelial weight were carried out for *Aspergillus niger*. It was also found that all the test medicinal plants leaf extract was found more or less inhibitory effect on all above mentioned factors.

KEY WORDS: TPC; seed mycoflor; growth of seed borne fungi; spore germination; leaf biomass; Cauliflower

I. INTRODUCTION

Indian plant wealth is about 45,000 species of plants. Every year huge medicinal plants biomass were going waste. It may be utilized for agricultural purpose because all most all plants having antimicrobial activity. If we utilize plant based product which does not causes any harmful effect on biodiversity. There is a great boom to use herbal medicine to treat almost all afflictions of human beings. Herbal plants play an important role in the health care of the country. Due to its effectiveness and no side effect, people prefer herbal medicines now days. But herbal medicinal plants may be used for welfare of agriculture, such studies are meager in our country.

In the present studies *Sapindus laurifolius* produced more leaf biomass (39 gm) and *Helicteres isora* produced very less leaf biomass (25 gm) as compared to the other test medicinal plants. Leaf biomass of *Semecarpus anacardium* showed more TPC (2.1 mg) and leaf biomass of *Dioscorea bulbifera* showed very less TPC (0.8 mg) as compared to the other test medicinal plants. Seeds of cauliflower were soaked in the

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5% aqueous leaf extract of selected medicinal plants found to be inhibitory for the incident of seed mycoflora and stimulatory for seed germination of cauliflower. Leaf extract of *Vitex negundo* showed 72% of seed mycoflora and *Semecarpus anacardium* showed less seed mycoflora (40%) of cauliflower seeds. Seeds of cauliflower observed 85% of germination with greater elongation of root and shoot in the leaf extract of *Semecarpus anacardium*. Spore germination and dry mycelial weight of *Aspergillus niger* found stimulatory in the leaf extract of *Balanites aegyptiaca* (65%) and leaf biomass *Solanum xanthocarpum* showed inhibitory effect on spore germination (25%) and dry mycelial weight (18 mg)

II. MATERIALS AND METHODS

1. Studies on biomass production of the medicinal plants:

During the present studies ten very common and easily available ten medicinal plants were selected. The fresh leaves of the selected medicinal plants were collected. The collected plant material was washed and cleaned separately. 100gm of fresh plant material was weighed (Arnoud, 1988). The weighed plant material was dried in the hot air oven. The dried plant material was reweighed. The dry biomass of the medicinal plants was determined by subtracting the dry weight from the fresh weight. The resulted weight in gm/100gm was treated as the biomass produced by the selected medicinal plants (Guy, 1981)

2. Studies on total phenol content (TPC) of the biomass of the medicinal plants:

Total phenol content (TPC) of the biomass of the test medicinal plants was estimated by using Folin-Ciocalteu method as described by Mahadeven and Sridhar in 1996. For this 1ml of the alcoholic extract of biomass of the test medicinal plants was taken in a graduated test tube. 1ml of Folin-Ciocalteu reagent and 2ml of sodium carbonate (Na_2CO_3) solution was added to the test tube. The test tube was well shaken and heated in a boiling water bath for exactly one minute. The test tube was cooled under running tap water. The blue colored solution in the test tube was diluted to 25ml with distilled water and the absorbance was measured at 650nm in a colorimeter. The unknown were read from a standard curve made from different concentrations of catechol. A blank containing all the reagents minus alcoholic extract of biomass of the test medicinal plants was used to adjust the absorbance to zero. Yubedee (1998) studied phenolic content of different species of *Dioscorea* and similar study in sunflower carried out by Pathak and Srivastva (2000). Pandey et al (2004) studied changes in TPC of leafy vegetables.

3. Preparation of aqueous extract of Biomass of medicinal plants:

During the present study leaf extract of ten test medicinal plants was prepared separately. Leaves of selected plants were dried and grind into fine power. 5 gm leaf powder of each medicinal plant dissolved separately into 100 ml of sterile water. This used in further experiment as 5% leaf extract tested for the study of seed mycoflora, root and shoot length and growth of seed borne fungi of cauliflower. Seeds of cauliflower were soaked in 5% leaf extract of each plant throughout the night. Such treated seeds used further. These treated seeds studied by the method suggested by Neergaard (1973).

4. Detection of seed mycoflora:

a. Collection of Seed Samples:

Seed samples of the test vegetables were collected from field, store houses and market places common test vegetable selected for further study. A composite seed sample of individual test

vegetable was prepared by mixing the individual samples together, preserved in gunny bags at room temperature during the studies.

b. Moist blotter plate method:

The isolation is made by blotter test method as described by International Seed Testing Association (ISTA, 1966), De Tempe (1970), Neergaard (1973) and Agarwal and Sarbhoy (1978).

Ten treated seeds of cauliflower were placed at equal distance on the moist blotting paper in the petridishes. Four hundred seeds were tested for each treatment. The plates were incubated at room temperature for seven days. On the seventh day the seeds were examined under compound microscope for the determination fungal species. Identification and further confirmation of twelve different species of fungi occurred on the seeds was made by preparing slides of the fungal growth and observing under compound microscope. Out of these *Aspergillus niger* was very common and maintained on PDA slants in the form of pure culture for further studies.

c. Identification of seed borne fungi:

The seed borne fungi were identified on the basis of sporulating characters like asexual spores or fruiting structures. Detailed examination of fungal characters was done under compound microscope and their identification was confirmed with the help of latest manuals (Subramanian, 1971; Jha, 1993 and Mukadam, 1997). Pure culture of the identified fungi were prepared and maintained on PDA (Potato Dextrose Agar) slants.

d. Preparation of spore suspension:

For this 10ml sterile distilled water was poured in to the sporulating pure cultures of the seed borne fungi maintained on PDA slants for seven days at room temperature. The slants were shaken and the content was filtered through muslin cloth. The filtrate was used as spore suspension.

e. Study of spore germination:

During the present studies, 25ml of GN medium supplemented separately with 2ml of 5% plant extract was poured in 100ml borosil conical flasks. The flasks were autoclaved and inoculated separately with 2ml spore suspension of the test seed borne fungi which were maintained on PDA slants for seven days. The flasks were incubated at room temperature for twenty four hours. After incubation the spore germination was studied by preparing slides of the incubated solution and observing under the compound microscope. The germ tube lengths of the germinating spores were measured in microns (μ) with the help of calibrated microscope. The flasks poured with 25ml of GN medium without the supplementation of 2ml of 5% plant extract inoculated separately with spore suspensions of test fungi were served as control.

5. Study of growth and sporulation of seed borne fungi:

During the present studies dominant seed borne fungus of cauliflower vegetable like *Aspergillus niger* was grown in GN medium supplemented separately with 2ml of five percent plant extracts of medicinal plant biomass for seven days at room temperature. After incubation contents of the flasks were filtered through pre-weighed Whatman filter paper No. 1. The filter papers with mycelial mat were oven dried for twenty four hours at sixty degree centigrade and reweighed. Growth of the seed borne fungus in terms of dry mycelial weight was measured by subtracting the initial weight of the filter paper from the final

weight of filter paper with mycelial mat. The seed borne fungus grown in GN medium without supplementation of medicinal plant biomass extract were served as control. The sporulation was studied by preparing slides of the seed borne fungus before filtration.

Table- 1: Studies on production and total phenol content (TPC) of leaf biomass of the medicinal plants.

Sr. No.	Botanical Name	Leaf biomass (gm/100gm)	TPC (mg/gm)
01.	<i>Abrus precatorius</i> L.	26	2.0
02.	<i>Aegle marmelos</i> (L.) Corr.	38	1.9
03.	<i>Balanites aegyptiaca</i> Delile.	29	1.9
04.	<i>Datura metel</i> L.	31	2.0
05.	<i>Dioscorea bulbifera</i> L.	30	0.8
06.	<i>Helicteres isora</i> L.	25	1.9
07.	<i>Sapindus laurifolius</i> Vahl.	39	1.6
08.	<i>Semecarpus anacardium</i> L.	32	2.1
09.	<i>Solanum xanthocarpum</i> Schra.	27	2.0
10.	<i>Vitex negundo</i> L.	29	0.2

Table- 2: Effect of leaf biomass of medicinal plants on seed mycoflora and seed germination of cauliflower.

Sr. No.	Extract of leaf biomass (5%)	Incidence of seed mycoflora (%)	Seed germination		
			%	RL (mm)	SL (mm)
01.	<i>Abrus precatorius</i> L.	55	85	42	39
02.	<i>Aegle marmelos</i> (L.) Corr.	55	80	43	31
03.	<i>Balanites aegyptiaca</i> Delile.	50	82	30	26

04.	<i>Datura metel</i> L.	85	70	39	30
05.	<i>Dioscorea bulbifera</i> L.	75	65	40	42
06.	<i>Helicteres isora</i> L.	80	62	33	45
07.	<i>Sapindus laurifolius</i> Vahl.	45	80	40	35
08.	<i>Semecarpus anacardium</i> L.	40	86	43	34
09.	<i>Solanum xanthocarpum</i> Schra.	70	80	39	35
10.	<i>Vitex negundo</i> L.	72	50	32	30
	Control	90	62	43	39

RL-Root length SL- Stem length

Table No.3: Effect of leaf biomass of selected medicinal plants on spore germination, growth and sporulation of *Aspergillus niger*

Sr. No.	Extract of leaf biomass	<i>Aspergillus niger</i>		
		Spore germination (%)	Dry mycelium Wt. (mg)	Sporulation
01	<i>Abrus precatorius</i> L.	30	25	++
02	<i>Aegle marmelos</i> (L.) Corr.	58	38	+++
03	<i>Balanites aegyptiaca</i> Delile.	65	45	+++
04	<i>Datura metel</i> L.	35	30	++
05	<i>Dioscorea bulbifera</i> L.	35	30	+++
06	<i>Helicteres isora</i> L.	40	28	++
07	<i>Sapindus laurifolius</i> Vahl.	34	31	+++

08	<i>Semecarpus anacardium</i> L.	32	29	++
09	<i>Solanum xanthocarpum</i> Schra.	25	18	++
10	<i>Vitex negundo</i> L.	45	40	+++
	Control	80	50	+++

III. RESULT AND DISCUSSION

It is evident from the results presented in table-1 that the *Semecarpus anacardium* (39 gm/ 100gm) and *Aegle marmelos* (38gm/ 100gm) were found to produce more leaf biomass and *Helicteres isora* produce very less leaf biomass (25gm/100gm) as compared to the other test medicinal plants. It is clear from the results that the leaf biomass of *Semecarpus anacardium* (2.1mg/ gm) and *Solanum xanthocarpum* (2mg/gm) showed more TPC while the leaf biomass of *Vitex negundo* showed very less TPC (0.2mg/gm) as compared to the leaf biomass of the other test medicinal plants. Similar study carried out by Bhadra et al (2000) in bael fruit TPC and found that decreased TPC with growth of bael fruit. Srivastava (2000) studied that TPC in sunflower and observed that it maximum after treatment with benomyl powder. Similarly Lavanya (2007) carried out in sunflower necrosis.

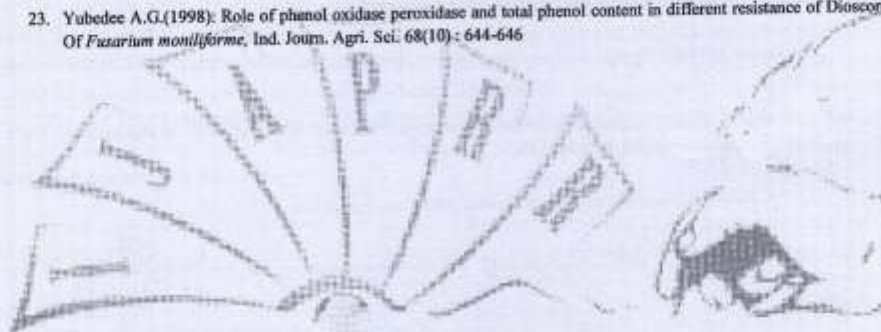
It is clear from the results presented in table-2 that leaf extracts of all the test medicinal plants were found to be inhibitory for the incidence of seed mycoflora. The leaf extract of *Semecarpus anacardium* was found to be inhibitor and leaf extract of *Datura metel* was found to be very less inhibitory for the incidence seed mycoflora of Bhendi as compared to the leaf extracts of the other test medicinal plants. In all leaf extracts of the test medicinal plants found to be inhibitory for seed germination. Same results were observed in shoot length and root length in Bhendi stimulatory for elongation of root and elongation of shoot of Bhendi. Except in *Dioscorea bulbifera* and *Helicteres isora* it was stimulatory for elongation of root and shoot of Bhendi. Chouksey and Srivastava (2001) studied root extract of *Terminalia arjuna*, found antimicrobial effect against *Aspergillus niger*, *Candida* and *Bacillus oryzae*. Similarly Raja et al found that leaf extract was inhibitory for incidence of seed mycoflora and similar study carried out by Bodke et al (2005), Dhekle (2007), Mashooda Begum and Lokesh (2008) and Musiyimi (2008).

It is clear from the results presented in table-3 that, the leaf biomass of all test medicinal plants were found to be found inhibitory for spore germination, growth and sporulation of *Aspergillus niger*. It is also evident from the results that the leaf biomass powder of *Solanum xanthocarpum* was found to be more inhibitory and leaf biomass powder of *Balanites aegyptica* was found to be more stimulatory for the spore germination, growth and sporulation of *Aspergillus niger* as compared to leaf biomass of other test medicinal plants. Danai (1994) carried out comparative study on the species of *Aspergillus* occurring different plant seeds. Similar result observed by Sharma and Suchdev (1984).

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UTILIZATION OF MEDICINAL PLANT BIOMASS AGAINST SEED MYCOFLORA, SEEDLING EMERGENCE, VIABILITY AND GROWTH OF SEED BORNE FUNGI OF CAULIFLOWER

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ABSTRACT

Agriculture is a back bone of our country, whole economy of India is related with agriculture. India is having the second largest population after the China. Wild plants huge waste biomass may be utilized for the welfare of agricultural purpose. Such studies are meager in India. By using chemical fertilizer, pesticide, weedicide & insecticide causes imbalance in environment like pollution, decreases soil fertility and many other hazardous effects. We are unaware of biomass produced by wild plants which going waste every year. If it is utilized for various purposes in agriculture, it improves crop yield eco-friendly. In present study, effect of ten wild medicinal plants biomass in the form of Stem extract on seed mycoflora, seedling emergence and growth of seed borne fungi of Cauliflower was determined in vitro. It was found that all the plant extract were effective against seed mycoflora, seedling emergence and growth of seed borne fungi of Cauliflower.

Keywords: Plant Biomass, Seed Mycoflora, Seedling Emergence, Cauliflower

INTRODUCTION:

Agriculture is a back bone of our country, whole economy of India is related with agriculture. India is having the second largest population after the China. Plants are utilized as a food, clothes, shelter, medicinal, fertilizer, antimicrobial agent and many other purposes. Green manuring has been on agricultural practice among European farmers for more than two thousand years but not until the nineteenth century did students of agriculture became interested in the process by which plant material turned under became available for subsequent crops. Indian plants wealth is about 45000 plant species, every year huge waste biomass of plants going waste. It may be utilized for agriculture purposes because most of plant having antimicrobial activity.

Medicinal plants also utilized for the welfare of agriculture. In the present study the effect of Stem extract of selected medicinal plants on the incident of seed mycoflora, seed germination and growth of seed borne fungi and seedling emergence of Cauliflower was determined in vitro. During the present studies twelve different fungi were isolated, out of these very common four fungi brought into pure culture and effect of ten medicinal plants biomass extract tested on seed mycoflora, seedling emergence and growth of seed borne fungi was determined.

MATERIALS AND METHODS:

Collection of seed samples:

The method described by Neergaard (1973) has been adopted for collection of seed sample of Cauliflower. Seeds were collected from field, store house, market places and mixed them and used for further experiments.

2) Detection of seed mycoflora:**a) Moist blotter plate method:**

The isolation of seed borne fungi was carried out by blotter test method, described by ISTA (1966), Agarwal and Sorbhoy (1978). A pair of white blotter paper of 8.5 cm diameter was jointly soaked in sterile distilled water and placed in presterilized petriplates of 10 cm diameter. 10 Seeds of Cauliflower were placed on equal distance on moist blotter paper. More than 400 seeds were tested for each treatment. Plates were incubated at room temp. for seven days. Identification and confirmation of different fungi on seed was made by preparing slides (Mukadam, D.S., 1997). Twelve fungi were isolated, out of these four very common fungi brought in to the pure culture and further used.

3). Collection of plant material and preparation of plant Stem extract:

Ten very common and easily available plants were selected, the Stem of selected plants were surface sterilized, dried in oven and ground into fine powder with the help of blender. 5% aq. Stem extract was found more effective for control of seed mycoflora of Cauliflower.

4) Effect of Stem extract on growth of seed borne fungi:

The dominant seed borne fungi of Cauliflower were grown in liquid GN medium supplement with 1 ml of Stem extract of selected plants separately. It incubates for seven days at room temp. After incubation the content were filtered through pre-weighed Whatman filter paper no.1. The filter paper with mycelial mat was oven dried and reweighed.

5) Effect of Stem extract on seed germination, root and shoot elongation:

Cauliflower seeds were soaked separately in aq. Stem extract of selected plants for 24 hrs. Soaked seeds were placed on moist blotter in presterilized petriplates. These were incubated for ten days at room temp., after incubation percent of seed germination, root and shoot length were recorded.

6) Effect of Stem extract on seedling emergence:

Cauliflower seeds were soaked separately in the aq. Stem extract of test plants for 24 hrs. Soaked seeds were sown at the depth of 2 cm equidistantly in a pot containing sterilized black soil and sand. It kept for observation for ten days and result was noted down.

**TABLE NO.1: EFFECT STEM BIOMASS OF TEST MEDICINAL PLANTS
ON INCIDENCE OF SEED MYCOFLORA, SEED GERMINATION
AND SEEDLING EMERGENCE OF CAULIFLOWER**

Sr. No	Stem biomass	Incidence of seed mycoflora	Seed germination			Seedling emergence	Seed viability %
			%	RL (mm)	SL (mm)		
1	<i>Abrus precatorius</i> L.	18	86	35	42	81	80
2	<i>Aegle marmelos</i> L.	22	79	35	40	84	78
3	<i>Balanites aegyptiaca</i> Delile	59	68	26	31	65	62
4	<i>Datura metel</i> L.	30	81	31	38	78	65
5	<i>Dioscorea bulbifera</i> L.	60	72	24	32	67	52
6	<i>Helicteres isora</i> L.	65	67	23	28	59	68
7	<i>Sapindus laurifolius</i> Vahl.	45	81	36	43	61	63
8	<i>Semecarpus anacardium</i> L.	15	82	39	48	92	76
9	<i>Solanum xanthocarpum</i> Schrad.	22	74	34	39	79	72
10	<i>Vitex negundo</i> L.	78	56	21	27	48	55
	Control	92	62	23	32	56	50

% Percent, RL: Root Length, SL: Shoot Length

TABLE NO.2: EFFECT OF STEM EXTRACT OF TEST MEDICINAL PLANTS ON THE GROWTH OF SEED BORNE FUNGI OF CAULIFLOWER

Sr. No.	Stem biomass %	Growth in terms of dry mycelial weight (mg.)			
		ALT	CUL	DRL	FUM
1	<i>Abrus precatorius</i> L.	25	13	16	21
2	<i>Aegle marmelos</i> L.	23	17	13	23
3	<i>Balanites aegyptiaca</i> Deile	58	49	51	66
4	<i>Datura metel</i> L.	42	41	48	38
5	<i>Diocoreo bulbifera</i> L.	59	54	46	49
6	<i>Helicteres isora</i> L.	61	68	59	67
7	<i>Sapindus laurifolius</i> Vahl	21	25	36	28
8	<i>Semecarpus anacardium</i> L.	18	11	12	19
9	<i>Solanum xanthocarpum</i> Schrad	22	16	19	15
10	<i>Vitex negundo</i> L.	68	76	64	72
	Control	81	78	86	89

ALT-*Alternaria tenuis*, CUL-*Curvularia lunata*, DRL-*Drechslera longirostrata*, FUM-*Fusarium moniliforme*

RESULTS AND DISCUSSION:

It is evident from the results presented in the table 1 that Stem extracts of all test medicinal plants were found to be inhibitory in more or less degree for the incident of seed mycoflora. The Stem extracts of *Semecarpus anacardium*, *Abrus precatorius*, *Aegle marmelos* and *Solanum xanthocarpum* were found to be more inhibitory for the incident of seed mycoflora. Similar study carried out by Saha et.al (2005) and Mundhada and Lokesh (2008).

All the test medicinal plant enhance the seed germination of these *Abrus precatorius*, *Sapindus laurifolius*, *Semecarpus anacardium* were found more effective than the other. Root and shoot length also increases by all the test medicinal plant out of which *Semecarpus anacardium*, *Sapindus laurifolius*, *Aegle marmelos* were more beneficial for root and shoot length. Seedling emergence and seed viability were enhancing by *Semecarpus anacardium*, *Abrus precatorius* and *Aegle marmelos* than the other test medicinal plants.

It is clear from the results presented in table 2 that, the Stem extract of all test medicinal plants were found to be inhibitory for the growth of all dominant seed borne fungi of Cauliflower. The Stem extract *Semecarpus anacardium*, *Abrus precatorius*, *Aegle marmelos* and *Solanum xanthocarpum* were found to be inhibitory for the growth of all dominant seed borne fungi, same results was obtained by Prabha and Jaisri (1997).

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STUDIES ON PROTEIN CONTENT AND CULTIVATION OF *PLEUROTUS SAJOR CAJU* (FR.) SINGER ON DIFFERENT AGRICULTURAL WASTE AS A SUBSTRATE

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ABSTRACT

Pleurotus mushroom having a superior quality of food, non-conventional type. It has a high protein even more than pulses, minerals, low carbohydrates, fibers, amino acids and vitamins. In India commonly paddy and wheat straw used for commercial cultivation of oyster mushroom (Jain & Vyas, 2002). *Pleurotus* was cultivated on the different agriculture waste which remains after harvesting of crops in the field. Those substrates were utilized for cultivation of mushroom. It also consists of large amount of vitamins, minerals, fibers, amino acid and low in sugar content, hence it is excellent dietary food source. It provides alternative income source for the farmers. Mushroom production does not demand land, but helps in the bioconversion of potential pollutants like agro-wastes to useful and nutritive food for human consumption. In the present investigation *Pleurotus* mushroom was cultivated on different substrates like green gram, black gram, soybean, pigeon pea, wheat and paddy straws. Number of fruiting bodies and their weights measured and protein constituent was detected. It was found that suitable substrate for cultivation of *Pleurotus sajor caju* was wheat and paddy straws. Along with these Pigeon pea and Soybean also good substrate for cultivation of *Pleurotus* mushroom. Highest protein percent was determined in soybean (28.45%), Wheat (27.94%), Paddy (27.44%) than the other substrate. Yield in the form of fresh weight was found in paddy (960 gm/bed), Wheat (938 gm/bed) and Soybean (930 gm/bed) higher than the other substrate. Similar study carried out by Singh et al (2003).

Keywords: *Pleurotus*, Yield, Agricultural wastes, Protein etc.

INTRODUCTION:

A wide range of different cellulose substrates are used for cultivation of *Pleurotus* mushroom (Khanna & Garcha, 1982, Jain & Vyas, 2002), Paddy and wheat straw were best substrates for cultivation of *Pleurotus* (Bonatti et al, 2004). Besides this many substrate used for cultivation of *Pleurotus* on *Sorghum* by Patil et al (2006), Pearl millet, Banana waste (Bonatti et al, 2004) and many other types of substrates were also used. *Pleurotus* is a richer source of fibers, minerals, protein, amino acids, low sugar and low fat. In our country large population found protein deficient in their diet. Mushroom recovers protein deficiency. It can be cultivated by farmers and landless worker. Agricultural waste easily available everywhere in rural area. Mushroom production in India was about 50,000 tons during 2004-05 year (Suman and Sharma, 2005). *Pleurotus* products have great demand in metropolitan cities and abroad. Along with wheat and paddy straws, *Sorghum* straw used effective cultivation of oyster mushroom (bahukhandi & Munjal, 1989). Similarly Bhandari et al (1991) cultivate *Pleurotus* on *Echinochloa frumentacea* (Poaceae) & *Eleusine coracana* (Poaceae) and grass. Chemical analysis was carried out by Patrabansh and Madan (1997).

In the present investigation four pulses and two cereals straw were used as a substrate for cultivation of *Pleurotus* mushroom. In them paddy and wheat substrates were found most suitable substrates than the other substrate used i.e. soybean, pigeon pea, green gram and black gram straw respectively for cultivation of *Pleurotus* mushroom. Highest protein content was observed in *Pleurotus* cultivation on the soybean (28.45%), wheat straw (27.94%), paddy straw (27.44%), pigeon pea (26.94%), green gram

(25.56%) and black gram (25.46%) respectively. Highest yield in the form of fresh weight of fruiting bodies was found in the paddy straw substrate (960gm/bed) and lowest in black gram (692 gm/bed).

MATERIALS AND METHODS:

01. Source of Spawn :

The culture of *Pleurotus sajor caju* was obtained from the National Chemical Laboratory (NCL), Pune.

02. Collection of different types of agricultural substrates:

After the harvesting of crop, the plants debris is commonly burnt in the field causes pollution. These agricultural wastes were utilized as a substrate for the cultivation of *Pleurotus* mushroom. Wheat, soybean, pigeon pea & green gram plant debris were collected from the different fields and brought into laboratory in gunny bags.

03. Cutting & Sterilization of substrates:

These agricultural wastes (substrates) material chopped and cut into small pieces (1 or 2 cm) separately and wetted into water throughout the night. These stalk material pasteurized with water steam at 100 °C for 2 hours.

04. Preparation of bed and spawning :

The 1 kg of substrate samples were used for preparation of bed of green gram black gram, soybean, pigeon pea, wheat and paddy straw separately. These substrates were transferred into pre-sterilized transparent plastic bags and inoculated with 2% spawn of Oyster mushroom. These bags were 200 u in thickness, tied at the top and provide perforation. Five layers of 2% spawn were added into the separate substrates.

05. Incubation :

These bags were transferred into mushroom culture laboratory where temperature and humidity conditions were maintained at 20-25°C & 80-90% respectively.

06. Harvesting:

After incubation of 20 to 24 days, initiation of fruiting body takes place. Later on number of fruiting bodies were counted according to their size and also fresh weight measured. The protein content was determined the procedure recommended by AOAC (1975) and Raghuramulu et al (1980).

Table No.1: Utilization of different types of agricultural substrates for cultivation of Oyster Mushroom showing number, size, fresh weight and protein content of Oyster mushroom

Substrate used	Mycelial growth in days	Initiation of fruiting bodies	Number of fruiting bodies & size (cm)				Fresh weight (gms)	Protein content %
			1-10	11-15	16-above	Total No.		
Green gram	19	24	35	23	12	70	814	25.56
Black gram	17	23	22	16	10	48	692	25.46
Soybean	16	23	28	25	14	67	930	28.45
Pigeon pea	18	24	34	24	12	70	918	26.94
Wheat	14	21	36	22	16	74	938	27.84
Paddy	15	20	34	26	15	75	960	27.44

RESULT OF DISCUSSION:

Pleurotus species having the ability to degrade lignin, hemicelluloses and cellulose materials from this production of fruiting bodies contain valuable nutrients. Variation in stipe length and pileus size was found on different substrates. Mycelial growth completed in 15 to 19 days and initiation of fruiting bodies was found 20 to 24 days on different substrates after bed preparation. Bigger size and greater number of fruiting was found on Wheat and paddy substrate. The Production of oyster mushroom on different agricultural substrates enhances the constituents of it. Because of its low calorific value and very high

content of proteins, vitamins and minerals, mushrooms may contribute significantly in overcoming protein deficiency problems.

The data presented in table 1 clearly indicates that mycelial growth completed in 15-19 days after the spawning. Fruiting body initiation takes place in 20 to 24 days after incubation of oyster mushroom on different substrates.

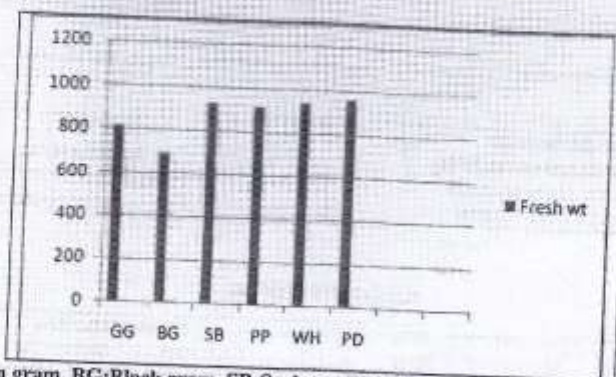
The highest fresh weight of fruiting bodies (960gm/bed) was recorded on the rice substrate and lowest in black gram (692gm/bed). Similar result was recorded by Shymal Rajak et al (2011).

The highest protein content was observed on the substrate soybean (28.45%) followed by wheat (27.84%), paddy (27.44%), Pigeon pea (26.94%), green gram (25.56%) and black gram (25.46) substrates respectively. The results were confirmed with the finding of Singh et al (2003). Similar study and finding confirmed with Patil S.S. and et al, (2006) Patrabansh and Madan (1997).

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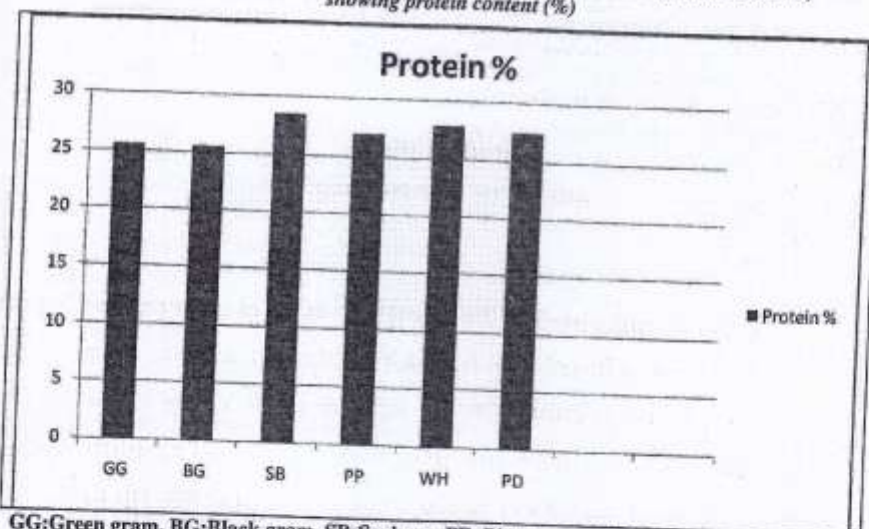
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Graph-I: Fresh weight (gm/bed) of fruiting bodies of Pleurotus sajor caju cultivated on different substrate



GG: Green gram, BG: Black gram, SB: Soybean, PP: Pigeon pea, WH: Wheat, PD: Paddy

Graph II: Fruiting bodies of Pleurotus sajor caju cultivated on different substrate, showing protein content (%)



GG: Green gram, BG: Black gram, SB: Soybean, PP: Pigeon pea, WH: Wheat, PD: Paddy

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MAAZ PUBLICATIONS

"Honey Bee as a Good Pollinator for Pomegranate Crop"

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ABSTRACT:

Ecofriendly enhancing crop yield of pomegranate crop by the use of honey bee culture have been carried out in the present study. Agriculture is a backbone of India, whole economy of India is related with agriculture. Use of honey bees for the increase in the production of pomegranate crop ecofriendly and given the economic support to the farmers leads to decrease the percentage of suicides of farmers. Pomegranate is a perennial plant harvesting twice in a year. It is cross pollinated plant. Flowers are large, bell shaped, and dark red in colour and consist of few hundred in number. It also has unique medicinal value along with nutritive values. This fruits are available in market more or less throughout the year. Honey bees boxes cultures are placing in the study region of selected farmers, causes significantly increased the yield in the form of fruits (30-60%). Due to honey bees increases yield ecofriendly. Naturally pollinating insects are found very rare because of hunting of honey colonies, decrease in the forest area, cutting of wild plants, industrialization and spraying of pesticides.

In the present study the role of honey bees in the production of pomegranate has been considered. Most of the farmers in this region are cultivating pomegranate crop as per availability of irrigation. This crop is harvest twice in a year. Honey bees suck juice from the flowers and carried out pollination in this crop. Pollination rate increased and setting of fruit enhances ecofriendly, hence yield increased significantly. Hence they are visited to many flowers and carries pollen grains from one to another flower with their mouth and body parts. Pollination rate enhances by the honey bees eco-friendly and increasing yield up to 30-60%. Similar result study have been obtained by Morse and Calderone (2000), pollen substitute (Chhumeja, 1990). Due to use of pesticide and deforestation population of honey bee decreases (Sandilyan, 2014; Potts et al, 2010). Honey bees are very useful insects for cross pollination crops like sunflower, pomegranate, onion, wheat, bajra etc. These bees living in the colony in which three types of honey bees are living in each colony. Workers are playing vital role in the pollination and increases production in cross pollinated crops. Use of honey bee is an eco-friendly and cheaper method of increase the crop yield. Many institutes sell the culture in the form of bee boxes.

Keywords: Honey bee, Pomegranate, Ecofriendly, Fruit setting, etc.

Introduction:

Pomegranate has originated from Iran. It is cultivated in various countries like China, Japan, Russia, Pakistan, Afghanistan, Egypt, Spain, America and India. In India Maharashtra is a leading producer of pomegranate. In India land under pomegranate cultivation is more than 107 thousand hectares and 743 thousand tons production. Maharashtra is leading producer of pomegranate followed by Karnataka, A. P., Gujarat, and Tamil Nadu. In Maharashtra cultivation in the district of Solapur, Nashik, Ahmednagar, Pune, Sangli, Dhule, Latur, Osmanabad, Jalna, Parbhani, Aurangabad and Satara. In India Land under cultivation decreases during 2010-11 i.e. 107 thousand hectares and production 743 tons and in 2008-09 which was 109 thousand hectares and production 807 tons (National Horticulture Board, 2011).

Deola is one of the small revenue place of Nashik District. It occupies an area 10,523 sq. km. In this region onion, bajra, maize, pomegranate, vegetables, ground nut, sugar cane etc. crops are commonly

cultivated. Deola is one of the large market place for onion and pomegranate. Pomegranate is one of the important major cash crops cultivated on large area due to availability of water facilities.

Major varieties cultivated in Maharashtra are Mridula, Phule Arakta, Ganesh and Bhagwa. Pomegranate fruits are available throughout the year. Flowering found in the period-

Mrig Bahar- June to August and harvesting November to March,

Hasta Bahar- October to November and harvesting February to May

Ambe Bahar - January to February and harvesting June to August

India produce a finest varieties of pomegranate which having soft seeds, very attractive color of fruits and grains. The climate of Nashik region is characterized by dryness except in monsoon season. Western ghat (Igatpuri, Surgana and Peth) rainfall is heavier than the rest part of district. The temperature is going down to 50 c in winter and rising up to 430c in summer.

In the present study, it was found that due to deforestation and spraying of pesticide in our area pollinating insect specially honey bees are become very rare. Cross pollination rate decrease significantly leads to the yield loss, though provide all the favourable condition to crop. So purchased artificially colonies of honey bees applied to pomegranate crop. It was found that yield increases significantly and less use of spraying material. Eight farmers have been selected from study area and bee keeping training has been given to them. Honey bee boxes were given to them and put into pomegranate field which was in flowering condition.

Table No.1: List of Selected Farmers for Bee Keeping From Deola Taluka, Dist. Nashik (Maharashtra)

Sr No	Name of the farmer	Address of the Farmer	Variety cultivated	Bee Box given	Land under cultivation (acres)	
					Total Land	Pomegranate
1.	Aher Ashok Gangadhar	Matane Tal. Deola Dist. Nashik	Shendri	01	05	01
2.	Jadhav Chandrakant Namdeo	Wakhari Tal. Deola Dist. Nashik	Mridula	01	3.5	02
3.	Jadhav Nandkishor Pandharinath	Wakhari Tal. Deola Dist. Nashik	Shendri & Arakta	01	15	04
4.	Nawale Ramdas Namdeo	Vithewadi Road Deola, Tal. Deola, Dist. Nashik	Shendri & Arakta	01	6.5	6.5
5.	Nawale Santosh Gobaji	Vithewadi Road Deola, Tal. Deola, Dist. Nashik	Shendri & Arakta	02	09	09
6.	Pawar Amol	Bhaur Tal. Deola Dist. Nashik	Shendri	01	10	04
7.	Pawar Hemant	Bhaur Tal. Deola Dist. Nashik	Shendri & Arakta	02	12	04
8.	Pawar Sachin	Bhaur Tal. Deola Dist. Nashik	Shendri	01	32	04
Total				10		

METHODOLOGY:

1. **Survey of pomegranate crop in the study region:** Deola is a one of small revenue place of the Nashik district. In this area pomegranate, onion, bajra, maize, sugarcane and vegetable crops are commonly grown every year. We visited most of the farmer who cultivated pomegranate as a cash crop. We discussed with the farmer and telling them importance of honey bees. We gave detail information and role played by honey bees in the pollination and increase in the yield of pomegranate ecofriendly. Few of farmers uprooting the pomegranate plants from their field because of one severe disease occurred on the pomegranate plants. This disease is very common in Deola

region since 2008. Tellya is a bacterial disease which causes oily spots on leaves and fruits. Affected fruits cracked open and become uneconomical.

2. **Selection of farmers for putting honey culture box:** After survey of pomegranate field ten farmers were selected whose field having in the flowering stage. These selected ten farmers trained by Dr. T.B. Nikam, Director of Suprakruti Madhushala, Gangapur, Nashik. He gave practical training to the selected farmers with the help of honey bee cultures, laptop and working of various instruments in his Madhushala. We have taken two days training in the January, 2013. Immediately after this, *Apis mellifera* L. culture in wooden box placed in the pomegranate field at the night time. Bee box are placed above the ground on the table and protected from their natural enemies like red ants, wasps etc. After placing the bee box in the field regular visiting and observations is note down. Farmers make aware about pesticide spraying (Moritz et al, 2007).
3. **Discussion with the farmers:** First time in Deola region this experiment of putting honey cultures into the pomegranate field carried out by Deola College under the guidance of UGC. We deserve or telling the importance of honey bees and cross pollinated crops. In the hive worker bees are hardworking and pollinating agent. Drones and queen are also found in the hive. Farmer getting double advantages, like increase the crop yield and honey can sold into the market. Farmer gets extra income and income which timely help to the farmers and their suicide decreases. Farmer makes aware about the honey bees and advantages of them. Along with this increase the yield of farmer by selling the honey, royal jelly, wax and other byproducts.
4. **To Create Awareness In The Farmers To Use Of Honey Bee Culture:** Due to depletion of forest wild or natural honey bees and pollination insect are not found commonly (UNEP, 2010). Hence with the help of honey bees cultures increase the crop yield and restore the biodiversity. Honey bees are visiting 2-3 km away from bee box and provide free pollination service to mankind. Honey bees are called as "Krusha Laxmi" of farmers. In another country like USA, Canada, Israel etc. bee keeping is an agro based commercial business. Special industries provide service for pollination. Honey bee culture is available on hiring services.
5. **Placing of Bee Hives in The Field:** It depends upon several factors like density of plants in the field, number of flower per plant, duration of flowering, strength of bees and number of flowers per unit area. Generally two colonies of *Apis mellifera* required per hectare.
6. **Time of Placing Colonies:** For better pollination bee colonies should place in the field at night time when the 20% of crop in bloom. Their number depends upon the number of flower per plant and number of plants in the field.

Table No.2: Yield Increased of pomegranate after placing the honey culture in the Farmer's field

Sr No	Name of Farmer	Cultivate d year	Total No. of Plants	Yield in tons			Yield Increased %
				Without bee box	With bee box	Increased Yield	
1.	Aher Ashok Gangadhar	2002	400	05	08	03	60
2.	Jadhav Chandrakant Namdeo	2005	600	06	09	03	50
3.	Jadhav Nandkishor Pandharinath	2006	1200	11	16	05	45
4.	Nawale Ramdas Namdeo	2009	2400	27	40	13	48
5.	Nawale Santosh Gobaji	2005 & 2011	2600	50	65	15	30
6.	Pawar Amol	2012	1600	06	09	03	50
7.	Pawar Hemant	2013	1200	-----	09	-----	-----
8.	Pawar Sachin	2012	3000	06	10	04	40

RESULT AND CONCLUSION:

It has reported that the population of bees depleted due to spraying of pesticide and deforestation. We have purchased honey bee boxes as source of eco-friendly pollination. The main objective of this study was to measure honey bees (*Apis mellifera* L.) impact on the fruit set and yield of pomegranate. Similar studies have been carried out by Sharma and Gupta (2001). Effect of pollination on the yield of examined canola crop, it was confirmed that increased seed yield in plants available to pollinating insect compared to those 16% in Australian studies (Manning and Boland, 2000), by 20-24% (Jablonski et al, 1985) and by over 50% in Czech Republic experiment (Kamler, 1983) similarly USDA (2011).

Similarly in this study yield of pomegranate was significantly increased after placing of bee culture box in the pomegranate field. Pomegranate is cultivated commonly in this area. But last seven years in this area one severe disease occurs on the pomegranate plant called as "Tellya disease." Many farmers uprooted their pomegranate plants. In such condition we placed apiculture in the eight farmer's field. Before that to the farmers training is given at 'Suprakruti Madhushala, Gangapur Road, Nashik (Mah) on 19 and 20th Jan, 2013. After that ten honey boxes given to selected farmers in their field.

Crop yield of pomegranate crop is significantly increased up to 60% in the study area. Ten apiculture boxes were given to the farmers. These boxes were placed into their pomegranate field and it was found that increase in the yield from 30 to 60% of pomegranate crop.

It was also reported that fruit setting was 100% successful and fall down rate of flowers was zero approximately. Fruit enhanced in all the respect i.e. size, shape, colour and weight.

Observations:

1. Yield increased up to 30 to 60% of pomegranate crop.
2. No flowers fall down below the plant (Drop out rate).
3. Fruit setting 100% successful.
4. Fruit size and colour become brighter.
5. Fruits more economical and nutritive.
6. Farmers getting honey and its products.
7. Fruits healthier and disease free.

Applications:

1. Pomegranate yield increases significantly by this method cheaply.
2. Naturally wild insects like honey bees, wasp etc. are uncommon due to deforestation, restores it and don't hunting of bee hives.
3. In Israel revolution in yield of agriculture crop only due to the use of apiculture.
4. Hunger of increased population may be fulfilled by placing of apiculture in the field.
5. This method is ecofriendly, cheaper, easy & increases employment.
6. Bees provide free pollination service.

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SCREENING OF HIGHER YIELDING STRAIN OF *ASPERGILLUS NIGER* FOR CA PRODUCTION FROM SOIL OF NASHIK DISTRICT

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Abstract

Natural source of citric acid is citrus fruits which contain 7-9% of citric acid. It was obtained by the processing of citrus fruits and precipitation of calcium salt. Now a day citrus fruits could not sufficient for fulfill the required demand of citric acid. Hence alternative source of citric acid is a microbial origin. Many microorganisms are involved in the production of citric acid (Wang- Jiaglong, 1998).

In the present study isolation of higher yielding strains of *Aspergillus niger* from the different locality of soils of Nashik district. Culturing and screening of *Aspergillus niger* strains were tested for citric acid production in vitro. It was also found that many nutrient factors were affecting for fungal origin production of CA. Some of these factors were considered here. It was clear from resulted presents in the tabular form indicated that Sucrose (13%) was a suitable carbohydrate source for normal growth and healthy production of CA (Currie 1917). Micronutrients in the culture medium were considered and tested for NaNO_3 (400 mg/L), KH_2PO_4 (100 mg/L) and MgSO_4 (mg/L) in the culture medium all the selected strain were giving higher yield of CA. P^{II} also plays important role in the healthy growth and development of organic acids at the temperature 30°C . Similar study and observations carried out by Aftab Nadeem et al (2010) and Rosaria Ciriminna et al (2017).

Key Words: Nashik soil samples, Citric acid, pH, KH_2PO_4 , NaNO_3 , *Aspergillus niger*.

Introduction:

Citric acid is mainly produced by submerged fermentation of *Aspergillus niger*. The yield depends upon composition of medium and on the microorganism strain (Aftab Nadeem et al 2010). Citric acid production using *A. niger* is influenced by the process variables such as initial sucrose concentration, pH, nutrient concentration, additive, incubation period, temperature etc. However demand for Citric acid production is increasing faster than the its production and hence requires more economical process. The fitness of solution would be measured by determining the total weight of the proposed solution. The higher the weight, greater the fitness provided that solution (K. Anand Kishor and et al, 2008).

In the present study different factors affecting microbial production of citric acid like methanol, strain of microorganism, carbon source, PH etc. were considered. Isolation of *Aspergillus niger* from soil sample collected from different localities, 2% methanol added into

culture medium gives higher yield, 13% sucrose was better carbon source than the glucose, 4.5 P^H was suitable for production of citric acid in vitro and in 28-30⁰ temperature healthy growth was found. Citric acid, a tricarboxylic acid widely used as an acidifying agent and antioxidant in a food, beverages and pharmaceutical industries (Kapoor et. al, 1982).

In the present study locally isolated *Aspergillus niger* employed for the production of Citric acid.

Materials and methods:

Aspergillus niger is suggested for production of CA and other organic acids. All these were produced in fermented broth method by *Aspergillus niger* fungus. These organic acids specially CA were isolated by crystallization method.

1. Isolation of higher yielding strain for CA production:

Naturally *Aspergillus niger* grows in the soil. For isolation of *Aspergillus niger* from soil which was collected from different areas of Nashik District. These soil samples were separately cultured and tested for CA production. Higher yielding strains were selected for further use which were TRA1, SPG3, DLF3 and CCS2 (Kovats, 1960; Prescott and Dunn, 1987)

2. Primary testing for CA yield:

Four different localities soil samples were tested for the production of CA in vitro. Each soil sample strains were prepared separately and screened for CA production. Similarly four higher yielding strains were selected and primary yield trial was carried out. These selected four strains were maintained and utilized for further experiments (Prescott and Dunn, 1987)

3. Determination of pH of soil samples:

Collected soil samples pH was measured with the help of pH meter. There were sixteen soil samples pH was recorded in the table.

4. Preparation and conservation of pure cultures of higher yielding strains:

Four strains of four localities were selected and further sub culturing on Czapeck Dox agar medium. These cultures were incubated at 30⁰ C separately.

5. Selected strains testing for CA production:

Aspergillus niger spores taken from each pure culture slants and poured into sterilized culture plates and in this addition of Bromo-cresol green dye previously. These culture plates were observed for changing the color of culture plates blue to yellow. Change in the color of cultures confirmed that the production of organic acid (Sing S.P et al, 1998)

6. Chromatographic test for CA Confirmation:

In the fermented broth production of organic acid specially CA by *Aspergillus niger* which confirmed by ascending chromatography method. On chromatogram loading of fermented broth, standard CA, oxalic acid and Succinic acid and their Rf values were calculated. Solvent system prepared by the use of n-Butanol, Formic acid and water in the proportion of 10:2:5 respectively.

Table No.1: Screening of Soil samples for pH and citric acid production.

Sr. No.	Area	Culture	Soil pH	Yield mg/ml
1.	TRYAMBAK AREA	TRA1	4.5	4.0
		TRA2	5.3	3.7
		TRA3	4.7	3.3
		TRA4	5.9	2.8
2.	SAPTSHRUNGI GARH	SPG1	5.6	2.5
		SPG2	5.7	3.2
		SPG3	5.2	4.6
		SG4	5.7	2.9
3.	DEOLA FOREST	DLF1	5.3	3.1
		DLF2	6.3	2.8
		DLF3	5.7	2.7
		DLF4	5.9	2.9
4.	COLLEGE CAMPUS	CCS1	6.1	2.6
		CCS2	6.8	2.7
		CCS3	7.3	1.6
		CCS4	7.5	1.8

Table No.2: Effect of sucrose percentage on yield of Citric acid

Sucrose %	Yield(mg/ml)			
	TRA1	SPG3	DLF1	CCS2
12	2.2	1.5	1.2	2.5
13	3.6	3.8	3.9	3.7
14	2.9	3.2	2.7	2.5
15	2.6	2.7	2.4	2.7
16	2.1	2.4	3.1	2.6
17	2.5	2.7	2.1	2.4
18	1.3	1.1	0.8	1.4

Table No.3: Effect of NaNO₃ on yield of citric acid production

Sr. No.	NaNO ₃ (mg)	TRA1	SPG3	DLF1	CCS2
1.	200	2.2	2.0	1.7	1.9
2.	250	2.4	2.1	1.5	2.3
3.	300	2.6	2.2	1.8	1.9
4.	350	3.1	2.8	1.3	2.1
5.	400	3.7	3.8	2.8	3.9
6.	450	2.8	2.6	2.0	2.5
7.	500	2.1	2.6	1.7	2.2
8.	550	1.8	2.1	1.6	1.9
9.	600	1.6	1.9	1.4	1.8

Table No.4: Effect of KH₂PO₄ on yield of Citric acid

Sr. No.	KH ₂ PO ₄ (mg)	TRA1	SPG3	DLF1	CCS2
1.	25	2.9	2.8	2.2	2.1
2.	50	2.8	3.2	2.4	2.0
3.	75	3.7	3.8	2.6	2.1
4.	100	4.7	4.5	3.5	2.9
5.	125	3.6	4.2	3.1	2.7
6.	150	3.1	3.2	2.2	2.4

Table No.5: Effect of MgSO₄ on production of Citric acid

Sr. No.	MgSO ₄ (mg)	TRA1	SPG3	DLF1	CCS2
1.	10	0.7	0.9	1.1	1.6
2.	15	1.9	2.2	1.3	1.8
3.	20	3.8	3.6	3.5	2.9
4.	25	3.1	2.9	3.4	2.5
5.	30	1.8	2.1	2.3	1.6

Table No. 6: Effect of pH on Citric acid production.

Sr. No.	pH	TRA1	SPG3	DLF1	CCS2
1.	2.5	2.6	2.8	2.9	1.9
2.	3.0	2.8	2.8	3.0	2.5
3.	3.5	3.0	3.1	3.3	2.3
4.	4.0	2.9	3.5	3.9	2.6
5.	4.5	3.9	3.7	3.8	3.1
6.	5.0	1.8	2.1	1.9	2.5
7.	5.5	1.3	1.2	1.5	2.1

Table No.7: Chromatography confirmation of Citric acid:

Sr. No.	Sugar	Distance travelled by solvent	Distance travelled by solute	Rf	% Rf
1.	Citric acid	10.0	4.0	0.4	40
2.	Oxalic acid	10.0	5.0	0.5	50
3.	Succinic acid	10.0	6.0	0.6	60
4.	Test	10.0	4.0	0.4	40

Result and discussion:

It was clear from the result presented in the Table No.1 that sixteen soil samples of four places were selected and tested for CA production. Out of these soil samples four higher yielding samples/ cultures were selected. These were used for further experiment. Primary screening of CA production and determination of high yielding strain of *Aspergillus niger* as compared to other strains. The highest yielding strains were TRA1 (3.9 mg/ml), SPG3 (3.8 mg/ml), DLF1

(3.1 mg/ml) and CCS2 (2.7 mg/ml). The soil samples pH was determined separately. Most of soil samples have acidic soil and two samples with basic pH.

It was found that from Table No.2 that sucrose was a suitable carbohydrate source for normal and healthy growth of *Aspergillus niger* selected strains. It was also found that 13% of sucrose in the culture medium gives higher yield than the rest of percentage of sucrose. At high percentage of sucrose in the culture medium observed residual sugar (Chaturvedi Madhusudan et al, 2010; Gupta et al, 1976)

It was clear from result presented in the Table No.3 that the amount of NaNO_3 in the culture medium affects the production of CA in fermented broth. It was clear from the result that 400 mg NaNO_3 was more suitable for all the four selected strains of *Aspergillus niger* for the higher yield of CA (Dhankar et al, 1974).

It was found from the result presented in table No.4 that along with NaNO_3 the KH_2PO_4 micronutrient added in the culture medium enhanced the yield of Ca. It was found that 100 mg/l KH_2PO_4 was more suitable for healthy production of CA (V.K. Jain, 2008). All other percentages of KH_2PO_4 in culture were showed less yield as compare to 100 mg KH_2PO_4 culture.

It was clear from the observations presented in the Table No. 5 that MgSO_4 micronutrient affect CA production. The higher yield observed at 20 mg/l of MgSO_4 as compared to other percentages of MgSO_4 for all the selected strains.

It was found that from observations enlisted in Table No.6 that the pH is one of the important factors for the yield of CA. It was found that 4.5 pH of culture medium gives higher yield of CA by all the selected strains as compared to other pH of culture (Gupta et al, 1976).

The result presented in the table No. 7 that for the confirmation of test solutions for production of Ca with other organic acid (Standard Citric acid, Oxalic acid, Succinic acid). It was found that fermented broth chromatogram Rf value (0.4) and compared with other organic acid including Citric acid. Fermented broth Rf value matched with standard CA value. This was concluded from that fermented broth produced CA.

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HERBAL MANAGEMENT OF SEED BORNE PATHOGEN OF METHI

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ABSTRACT

Fungi are most destructive pathogen for the crop plants. After harvesting crop, many microorganisms may be growing on the stored seeds. These fungal pathogen spores adhere to seeds or internally growing. Such affected seeds are not used for sowing or food purposes.

In the present study seeds of common vegetables have been selected for this study. Isolation of many fungi have been carried out by the method described by ISTA, 1966. Many fungi isolated from vegetables seeds, out of which four very common fungi have been selected and brought into pure culture. Out of these fungi *Aspergillus niger* and *Fusarium oxysporum* were very common than the *Curvularia lunata* and *Drechslera longirostrata*. Effect of very common ten medicinal plants extract have been tested against spore germination, dry mycelial weight and sporulation of these selected four fungi have been carried out. It is clear from the study that *Solanum xanthocarpum*, *Semecarpus anacardium*, *Dioscorea bulbifera* and *Aegle marmelos* leaf extract were found more inhibitory for spore germination, growth and sporulation of seed borne fungi. Similar studies have been carried out in Okra by Mashooda Begam and Lokesh (2008). Similar results have been reported by Prabha et al (2003), Ashish et al (2008), Muzumdar et al (2004). Similar study in egg plant was carried out by Amer Habib et al 2007.

Key Words: Medicinal plants, Spore germination, Dry mycelial weight, Vegetables seeds etc.

INTRODUCTION:

Agriculture is a back bone of our country, whole economy of India is related with agriculture. India is having the second largest population after the China. Plants are utilized as a food, clothes, shelter, medicinal, fertilizer, antimicrobial agent and many other purposes. Green manuring has been on agricultural practice among European farmers. Indian plants wealth is about 45000 plant species, every year huge waste biomass of selected wild medicinal plants going to be waste. It may be utilized for agriculture purposes because most of plant having antimicrobial activity. (Mughal, 2000, Maith Sameer Khadhim, 2018)

India is one of the mega biodiversity centre of the world. We are unaware of biomass produced by wild plants which going waste every year. If it is utilized for various purposes in agriculture, it improves crop yield eco-friendly. Every year huge biomass of plant is going waste. It may be utilized for agricultural purpose because most of plants having anti-microbial activity. By using chemical fertilizer, pesticides causes imbalance in biodiversity. If we used plant based product as fertilizer, pesticide and seed dressing material which do not causes any hazardous effect on plants and soil micro flora. By considering above importance this study is undertaken. Methi is important and the nutritious vegetable which cultivated in our region.

In the present study seeds of Methi have been selected for this study. Isolation of many fungi have been carried out by the method described by ISTA, 1966. Many fungi isolated from vegetable seeds, out of which four very common fungi have been selected and brought into pure culture. Out of these fungi *Aspergillus niger* and *Fusarium oxysporum* were very common than the *Curvularia lunata* and *Drechslera longirostrata*. Effect of very common ten medicinal plants leaf extract have been tested against spore germination, dry mycelia weight and sporulation of these selected four fungi have been carried out. It is clear from the study that *Solanum xanthocarpum*, *Semecarpus anacardium*, *Dioscorea bulbifera* and *Aegle marmelos* were found more inhibitory for spore germination, growth and sporulation of seed borne fungi of methi. Similar study has been carried out in Okra by Mashooda Begam and Lokesh (2008). Similar results have been reported by Prabha et al (2003), Ashish et al (2008), Muzumdar et al (2004).

MATERIALS AND METHOD:

1. Collection of plant materials:

Ten very common and easily available wild medicinal plants were selected, the leaf of selected plants were surface sterilized, dried in oven and ground into fine powder with the help of blender. 5% aqueous leaf extract was found more effective for control of seed mycoflora of vegetable seeds specially methi.

2. Testing of stem extracts & Effect of leaf extract on percent incidence of seed mycoflora:

Aqueous extract of different percentage of the selected biomass was prepared by dissolving 1, 2, 3..... gm of biomass leaf powder in 100ml sterile distilled water. The aqueous extract of biomass was tested against seed mycoflora. The biomass extract of effective percentage was determined. The biomass extract of five percent was found to be effective. Therefore five percent extract of medicinal plant biomass was used for further studied.

3) Detection of seed mycoflora:

a) Moist blotter plate method:

The isolation of seed borne fungi was carried out by blotter test method, described by ISTA (1966), Agarwal and Sorbhoy (1978). A pair of white blotter paper of 8.5 cm diameter was jointly soaked in sterile distilled water and placed in pre-sterilized Petri-plates of 10 cm diameter. 10 Seeds of Methi were placed equal distance on moist blotter paper. More than 400 seeds were tested for each treatment. Plates were incubated at room temp. for seven days. Identification and confirmation of different fungi

on seed was made by preparing slides (Mukadam, D.S., 1997). Many fungi were isolated, out of these four were very common fungi brought in to the pure culture and further used.

2. Identification of seed borne fungi:

The seed borne fungi were preliminary identified on the basis of sporulation characters like asexual or sexual spores or fruiting structures. Detailed examination of fungal characters was done under compound microscope and their identification was confirmed with the help of latest manuals (Subramanian, 1971; Jha, 1993 and Mukadam, 1997). Pure culture of the identified fungi were prepared and maintained on PDA (Potato Dextrose Agar) slants.

3. Preparation of spore suspension:

For this 10ml sterile distilled water was poured in to the sporulating pure cultures of the seed borne fungi maintained on PDA slants for seven days at room temperature. The slants were shaken and the content was filtered through muslin cloth. The filtrate was used as spore suspension.

4. Study of spore germination:

During the present studies, 25ml of GN medium supplemented separately with 2ml of 5% plant extract was poured in 100ml borosil conical flasks. The flasks were autoclaved and inoculated separately with 2ml spore suspension of the test seed borne fungi which were maintained on PDA slants for seven days. The flasks were incubated at room temperature for twenty four hours. After incubation the spore germination was studied by preparing slides of the incubated solution and observing under the compound microscope.

The germ tube lengths of the germinating spores were measured in microns (μ) with the help of calibrated microscope. The flasks poured with 25ml of GN medium without the supplementation of 2ml of 5% plant extract inoculated separately with spore suspensions of test fungi were served as control.

5. Study of growth and sporulation of seed borne fungi:

During the present studies some common and dominant seed borne fungi of vegetable Methi like *Aspergillus niger*, *Curvularia lunata*, *Drechslera longirostrata* and *Fusarium oxysporum* were grown in GN medium supplemented separately with 2ml of five percent plant extracts of medicinal plant biomass for seven days at room temperature. After incubation contents of the flasks were filtered through pre-weighed What man filter paper No. 1. The filter papers with mycelial mat were oven dried for twenty four hours at sixty degree centigrade and reweighed. Growth of the seed borne fungi in terms of dry mycelial weight was measured by subtracting the initial weight of the filter paper from the final weight of filter paper with mycelial mat. The seed borne fungi grown in GN medium without supplementation of medicinal plant biomass extract were served as control. The sporulation was studied by preparing slides of the seed borne fungi before filtration.

Table-1: Effect of leaf biomass of selected medicinal plants on spore germination, growth and sporulation of

Aspergillus niger; *Curvularia lunata*; *Drechslera longirostrata* and *Fusarium oxysporum*.

Sr. No	Medicinal plants (5% Leaf extract)	<i>Aspergillus niger</i>			<i>Curvularia lunata</i>			<i>Drechslera longirostrata</i>			<i>Fusarium oxysporum</i>		
		SG %	DMW (mgs)	SPN	SG %	DMW (mgs)	SPN	SG %	DMW (mgs)	SPN	SG %	DMW (mgs)	SPN
1	<i>Abrus precatorius</i> L.	44	40	++	38	30	++	40	36	++	40	25	++
2	<i>Aegle marmelos</i> (L.) Corr.	12	18	++	18	16	+	16	15	+	14	20	++
3	<i>Balanites aegyptica</i> Delile.	48	40	+++	42	52	+++	48	38	+++	48	45	+++
4	<i>Datura metel</i> L.	36	38	++	36	44	++	38	32	++	40	32	++
5	<i>Dioscorea bulbifera</i> L.	14	16	++	18	15	++	20	18	++	18	20	++
6	<i>Helicteres isora</i> L.	28	29	+++	50	27	+++	50	26	+++	42	28	++
7	<i>Sapindus laurifolius</i> Vahl.	32	36	+++	30	42	+++	36	34	++	48	38	+++
8	<i>Semecarpus anacardium</i> L.	10	12	+	14	15	+	14	12	+	14	12	+
9	<i>Solanum xanthocarpum</i> Schra.	11	10	+	26	14	+	14	12	+	10	14	+
10	<i>Vitex negundo</i> L.	60	44	+++	48	50	+++	52	35	+++	52	40	+++
	Control	78	58	+++	84	60	+++	70	48	+++	68	50	+++

SG: spore germination %; DMW: dry mycelial weight (mgs); SPN: sporulation

Low= +, Medium= ++, High= +++

RESULT AND DISCUSSION:

It is clear from the result presented in Table 1 that the leaf biomass in the form of extract (5%) of all the test medicinal plants were found more or less inhibitory to spore germination, growth in the form of dry mycelial weight and sporulation of all selected seed borne fungi. (Perumal et al, 2005)

It is evident from the result that leaf extract of *Aegle marmelos*, *Dioscorea bulbifera*, *Semecarpus anacardium* and *Solanum xanthocarpum* were found more inhibitory for spore germination, growth in the form of dry mycelial weight and sporulation of all selected seed borne fungi of methi than the other test medicinal plants. Effect of leaf extract of *Aegle marmelos* was found more inhibitory for spore germination of *Aspergillus niger* (22%), similarly growth in the form of dry mycelial weight in the leaf extract of *Solanum xanthocarpum* was 19 mg and sporulation of the fungus more inhibited by the leaf extract of *Semecarpus anacardium* as compared with the other test medicinal plants. Similar study carried out by Cherkupally et al, 2017.

Effect of leaf extract of test medicinal plants on the spore germination of *Curvularia lunata* found more inhibitory in the leaf extract of *Semecarpus anacardium* (22%), growth more inhibited in the leaf extract of *Solanum xanthocarpum* (22 mg) and sporulation also very low in the same plant extract than the other test medicinal plants.

Effect of leaf extract of test medicinal plants on the spore germination of *Drechslera longirostrata* was found more inhibitory in the leaf extract of *Dioscorea bulbifera* (20%), growth and sporulation was found more inhibitory in the *Aegle marmelos* (12 mg.).

Effect of leaf extract of selected medicinal plants on the spore germination, growth in the form of dry mycelial weight and sporulation of *Fusarium oxysporum* was found more inhibitory in the leaf extract of *Solanum xanthocarpum* (18%) and (13 mg) respectively than the other test medicinal plants. Similar study was in sunflower wilt by Kerrio, 2017.

It is clear from result presented in the Table no.1 that the leaf extract in the form of 5% aq. Extract of all herbal test plants were found more or less inhibitory to spore germination, growth in the form of dry mycelial weight and sporulation of selected seed borne fungi of methi. Similar investigation carried out by Pandey K.N. (1982), Vyas (1988) and Musiyami et al, (2008).

It is evident from result that leaf extracts of *Solanum xanthocarpum* (11%) *Aspergillus niger*, (12%) *Curvularia lunata*, 12% *Drechslera longirostrata* and 14% *Fusarium oxysporum* was found that more inhibitory for spore germination, followed by *Semecarpus anacardium*, *Aegle marmelos* and *Dioscorea bulbifera* than the other test medicinal plants.

It is also evident from result presented in the table no.1 that, leaf extract test herbal plants were found more or less inhibitory to growth in the form of dry mycelial weight of selected seed borne fungi of methi. *Solanum xanthocarpum* leaf extract was most inhibitory to growth in the form of mycelial dry weight *Aspergillus niger* (10 mg), *Curvularia lunata* (14 mg), *Drechslera longirostrata* (12 mg), and *Fusarium oxysporum* (12 mg) than the followed by *Semecarpus anacardium*, *Dioscorea bulbifera* and other test plants.

It is clear from result presented in the Table no.1 that leaf extract of test medicinal plants were found more or less inhibitory to sporulation. *Solanum xanthocarpum* and *Semecarpus anacardium* (+) were more inhibitory for selected fungal sporulation than the other test plants.

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Screening and Isolation of Higher Yielding Strain for Citric Acid Production

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Abstract

Microbial production of citric acid carried out by various microorganism especially commercial productions carried out by the *Aspergillus niger* since twentieth century. Citric acid used as flavouring agent in food, beverages, Pharmaceutical and confectionary industries. Traditional source of citric acid is a citrus fruits. World demand and use of Citric acid in the different industries (food, beverages and pharmaceutical industries) and kitchens is increasing day by day, more than 80 lack tons/year (Pohnerkar and Desai, 2014). Natural source of citric acid was citrus fruits which contain 7-9% of citric acid which is extracted by traditional method. It was obtained by the processing of citrus fruits and precipitation with calcium salt. Now a day citrus fruits could not sufficient for fulfill the required growing demand of citric acid. Hence alternative source of citric acid production is a microbial origin.

In the present study *Aspergillus niger* considered as more suitable than the other microorganisms for production of citric acid by fermented broth method. Many factors were affecting invitro production of citric acid. It was found that sucrose is suitable carbon source (13-15%). Similar study was carried out by Currie (1917), Wang-Jianglong (1998). Different factors affecting microbial production of citric acid like methanol, strain of microorganism, temperature, carbon source, p^H etc. were play important role in the production of citric acid. Isolation of *Aspergillus niger* strain from soil and lemon fruits sample collected from different localities, 2% methanol added into culture medium gives higher yield (Dhankar et al, 1974), 13% sucrose was better carbon source than the glucose and other, 4.5 p^H was suitable for higher production of citric acid in vitro and in 28-30° temperature healthy growth was found (Aftab Nadeem et al, 2010).

Keywords: Citric acid, Fermentation broth, *Aspergillus niger*, lemon fruit, ascending chromatography

I. INTRODUCTION

Citric acid, a tricarboxylic acid soluble in water and widely used an acidifying agent and antioxidant in a food, beverages and pharmaceutical industries (Kapoor et. al, 1982). Citric acid is mainly produced by submerged fermentation of *Aspergillus niger*. The yield depends upon composition of medium (Sing S.P. et al, 1998) and on the microbial strain (Aftab Nadeem et al, 2010). Citric acid production using *Aspergillus niger* is influenced by the process variables such as initial sucrose concentration, pH, nutrient concentration, additive, incubation period, temperature etc. However demand of Citric acid production is increasing faster than the its production and hence requires more economical process. The fitness of solution would be measured by determining the total weight of the proposed solution. The higher the weight, greater the fitness provided that solution (K. Anand Kishor et al, 2008). Similar Study carried with cane bagasse by Abdullah Al Mahin et al, 2008 and Chaturvedi Madhusudan et al, 2010.

In the present study locally isolated *Aspergillus niger* employed for the production of Citric acid. In the present study different factors affecting microbial production of citric acid like strain of microorganism, carbon source, p^H and ascending chromatography were considered. Isolation of *Aspergillus niger* from soil sample collected from different localities, 2% methanol added into culture medium gives higher yield, 13% sucrose (LF1 4.2 mg/ml, FS3 3.9mg/ml and CCG5 3.7mg/ml) was better carbon source than the glucose, Galactose and fructose, 4.5 p^H was suitable for healthy production of citric acid in vitro and in 28-30° temperature healthy growth was found.

II. MATERIALS AND METHODS

Aspergillus niger is a fungus recommended for the production of various organic acids. Citric acid is one of the important organic acid synthesized and released on synthetic medium by this fungus. Natural source of *Aspergillus niger* is a soil, hence soil from

different localities from Nashik District was collected and tested for higher yielding strain of *Aspergillus niger* for the production of citric acid and it also isolated from lemon fruits.

A. Isolation of Microorganism

The natural source of *Aspergillus niger* is the soil. Collection of soil samples from different locations with respect to pH of the soil. In this way ten soil samples were collected and diluted 1/100, 1/1000 and 1/10000 of each sample. The diluted samples were observed and they were purified by sub culturing on Czapek's Dox agar slants. Culture Plates were incubated at 28 °C and isolated cultures were observed and they were purified by sub culturing on Czapek's Dox agar slants. Isolation from affected fruits of lemon and pure culture was prepared and maintained. Similar to soil screening lemon strain tested for citric acid production. Similarly fresh and healthy lemon fruits were soaked in the water placed in closed container for a 5- 7 days. After incubation pure cultures of *Aspergillus niger* maintained on culture medium.

B. *Aspergillus Niger*

Aspergillus niger high yielding strains were LF1, FS3 and CCS5 purified and cultured by streak plate method, loopful of culture at 25 °C for a week. It was used for further fermentation experiment.

C. Screening for Organic Acid Production

Spore from slant cultures were inoculated on sterile Czapek's Dox agar medium plates incorporated with Bromo-cresol green dye. Plates were incubated at 28°C for 24 to 28 hrs. And checked colour change blue to yellow indicates organic acid production. To study the effect of media component on citric acid fermentation, all the components except one to be studied are kept constant with respect to the control medium and one component concentration is changed in particular range. Broths were tested for citric acid production by selected strains of *Aspergillus niger*.

D. Screening of *Aspergillus niger* for citric acid production

Selection and isolation of micro-organism which produces high amount of citric acid. Primary screening determines which microorganism is able to produce a citric acid followed by secondary screening to determine capacity of that organism producing quantitatively.

Table No.1: Isolation and Selection of Higher Yielding Strain from Soil and Lemon Fruits

Sr. No.	Area	PH	Culture	Yield mg/ml
1.	Lemon fruits		LF1	4.0
			LF2	3.7
			LF3	4.3
			LF4	2.8
			LF5	3.9
2.	Forest soil	6.2	FS1	2.5
		6.1	FS2	3.2
		5.9	FS3	3.9
		5.4	FS4	2.9
		6.1	FS5	3.5
3.	College Campus Soil	4.8	CCS1	2.6
		5.2	CCS2	2.7
		4.9	CCS3	1.6
		5.1	CCS4	1.8
		4.8	CCS5	3.7

Table No.2: Effect of Different Carbon Source % on the Production of CA by *Aspergillus niger*

Carb on source	Yield mg/ml Sucrose			Yield mg/ml Glucose			Yield mg/ml Galactose			Yield mg/ml Fructose		
	L	F	C	L	F	C	L	F	C	L	FS	C
%	1	3	5	1	3	5	1	3	5	1	3	5
10	1.6	2.1	1.9	1.4	1.1	1.3	1.1	0.8	0.8	1.2	1.6	1.7
11	1.9	1.8	1.9	1.4	1.6	1.3	0.5	0.8	0.9	1.1	1.5	1.3
12	2.5	2.6	2.8	1.8	1.6	1.9	0.9	0.7	1.0	1.2	1.5	1.4
13	4.2	3.9	3.7	2.9	2.4	1.8	0.6	0.9	1.6	1.6	1.8	1.2
14	3.1	2.9	2.6	2.4	2.1	2.3	1.1	1.5	1.7	1.9	2.0	1.6
15	2.9	2.4	2.1	1.9	1.8	1.8	0.9	0.8	0.7	1.7	1.9	1.4
16	1.8	1.4	1.3	1.0	1.2	1.3	0.5	0.7	0.6	0.9	0.9	0.8

Table No. 3: Effect of pH on the production of CA by *Aspergillus niger*

Sr. No.	pH	LF1	FS3	CCS5
1.	2.5	2.6	2.8	2.9
2.	3.0	2.8	2.8	3.0
3.	3.5	3.0	3.1	3.3
4.	4.0	2.9	3.5	3.9
5.	4.5	3.9	3.7	3.8
6.	5.0	1.8	2.1	1.9
7.	5.5	1.3	1.2	1.5

Graph Fig. Showing Effect of pH on Production of Citric Acid

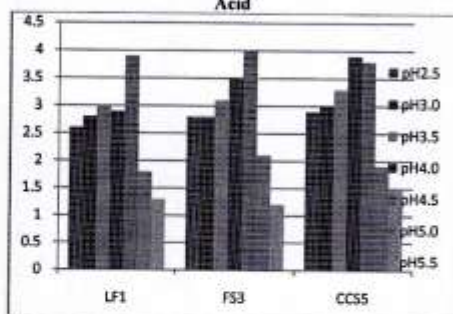
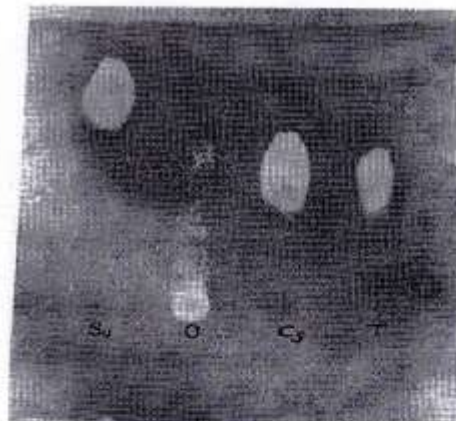


Table No.4: Ascending Chromatography of Organic Acid and Test Solution

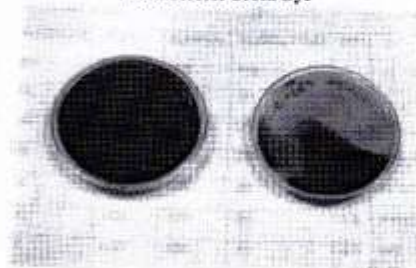
Sr. No.	Sugar	Distance travelled by solvent	Distance travelled by solute	Rf	% Rf
1.	Citric acid	10.0	4.0	0.4	40
2.	Oxalic acid	10.0	5.0	0.5	50
3.	Succinic acid	10.0	6.0	0.6	60
4.	Test	10.0	4.0	0.4	40

Photograph No.1: Chromatogram Showing Position of Standard Citric Acid and Fermented Broth



Su-Succinic acid, O-Oxalic acid, Cs-Standard citric acid, T-Fermented broth

Photograph No. 2: Primary Screening of Organic Acid Production on Culture Medium by using Bromocresol Green Dye



III. RESULT AND DISCUSSION

It was clear from Table No.1 Soil from different localities was collected and different concentration cultures prepared and from which *Aspergillus niger* strains were isolated from it. These were checked for citric acid production. The highest yield was reported from *Aspergillus niger* strain LF1 (4.0 mg/ml), FS3 (3.9 mg/ml) and CCS5 (3.7 mg/ml). It was found that the highest yield was found when the pH of medium was 4.5, above and below this pH the yield was decrease.

Table no. 2, When all the three cultures were tested for different carbon sources and their concentration (Sucrose, Glucose, Galactose and Fructose), it was found that the at sugar concentration

(Sucrose) 13% all the three cultures LF1 (4.2 mg/ml), FS3 (3.9 mg/ml) and CCS5 (3.7 mg/ml) gave the higher yield. It was also found that sugar concentration (15% to above) the yield found decreased as compared to 13% and residual sugar observed higher concentration of sugar in the culture medium. Kovats (1960) reported that higher sugar concentration (15 to 18%) greater amount of residual sugars remains in the medium and process become uneconomical. Similar study carried out by Gupta et al, 1976.

pH play an important role in the production of citric acid by *Aspergillus niger*. It was clear from Table no. 3 that pH of 4.5 was found to be suitable for all the three cultures for the yield of citric acid. The culture SG3 showed higher yield at pH 4.0. This showed the contrasts with the finding of Prescott and Dunn (1987) which claims that the initial pH for sucrose.

It was confirmed from the Table no. 4 that ascending chromatography was done by using the solvent system n-Butanol, formic acid and water in the proportion of 10:2:5 respectively. It was prepared by separating funnel and out of the two layers upper organic layer was used. The fermented broth concentrated by evaporating it in a Petri dish. Standard Succinic acid, oxalic acid and citric acid with test fermented sample were loaded. Chromatogram removed, dried and sprayed with 0.4% Bromo-Cresol Green prepared in ethanol (pH is equal to 6.7) and Rf values were calculated. Test sample and standard citric acid Rf value are matched. Rf value of samples compared with the organic acid and from this it was confirmed that fermentation broth contains citric acid

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Original article

Novel one-pot synthesis of 4H-chromene derivatives using amino functionalized silica gel catalyst

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ABSTRACT

A simple, efficient, and environmentally benign method for the synthesis of 4H-chromene derivatives was developed using well ordered and recoverable amino functionalized silica gel as a base catalyst. The 4H-chromene derivatives were obtained in short time and excellent yield (87%–96%) by three component reaction of aldehydes, malononitrile and cyclic 1,3-diketones in water at 70 °C.
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1. Introduction

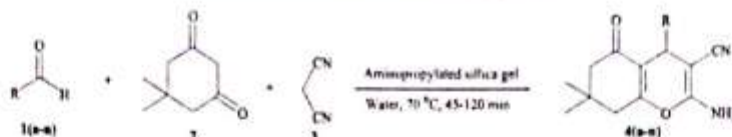
Base-catalyzed condensation and addition reactions such as the Aldol, Knoevenagel and Michael reactions are well reported in the literature for the production of drugs, fragrances, and chemical intermediates [1–4]. The use of novel environmentally friendly solid catalysts for the synthesis of biologically potent heterocyclic compounds has become one of the most active areas of research. Heterogeneous catalysts, particularly the solid-base catalysts synthesized by the functionalization of several solid-state materials are capable of catalyzing various C–C coupling reactions [5,6]. Recently, mesoporous silica (OMS) and related materials have become popular as catalysts and adsorbents and have found extensive applications as containers for cluster/nanowire growth, etc. [7]. These materials have several advantages such as tunable pore diameter and high surface area, for which they have emerged as effective heterogeneous catalysts in organic synthesis [8]. Aminopropyl functionalized mesoporous silica materials are reported to be effective base catalysts for Knoevenagel condensation [9], Aldol condensation [10], Michael addition [9], epoxidation reactions [11], and Claisen–Schmidt condensations [12]. Furthermore, the development of biomimetic catalysts is also well reported in the literature [13]. The use of such heterogeneous catalysts offers several advantages in process development, particularly the separation of products from catalyst, and recycling of catalyst in reactor. Solid acidic and basic catalysts are alternatives for clean technologies and sustainable chemistry for different processes.

Tetrahydrochromene moiety is an important class of benzopyran derivatives found in many natural products [14]. More specifically, 2-amino-4H-chromene-3-carbonitrile derivatives possess many biological activities such as anticancer, anticoagulant, antibacterial, and fungicidal properties [15]. These compounds find extensive applications in different fields, such as cosmetics, pigments, and agrochemicals [16]. Polyfunctionalized 4H-pyrans constitute the essential part of several natural products [17] and are also known as potential calcium channel antagonists [18]. As a result of widespread applications, the synthesis of these compounds has attracted a lot of interest. From the literature survey, numerous methods have been reported for the synthesis of tetrahydrochromene derivatives by one pot three component condensation of aldehyde, malononitrile and 1,3-dicarbonyl compounds using acidic or basic catalysts. Mola et al. documented borax catalyzed three component coupling of tetrahydrochromene in refluxing ethanol [19]. Silica-bonded N-propylpiperazine sodium n-propionate was employed as a recyclable catalyst for the synthesis of tetrahydrochromene derivatives [20]. Nano-ZnO catalyzed synthesis of dihydropyrano[2,3-c]chromenes can be accomplished in aqueous medium [21]. The other methods used for the synthesis of these compounds

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Scheme 1. Synthesis of 2-amino-5-oxo-4-phenyl-5,6-dihydro-4H-benzo[h]chromene-3-carbonitrile derivatives.

involve basic catalysts such as piperidine [22], morpholine, pyridine [23], triethylamine [24] and sodium bromide [25]. The reported methods still have drawbacks such as long reaction time, high reaction temperature and use of toxic organic solvents. Therefore, development of a simpler synthesis method for chromene derivatives becomes essential. In the present study we report the synthesis of 2-amino-5-oxo-4-phenyl-5,6-dihydro-4H-benzo[h]chromene-3-carbonitrile derivatives by the reaction of aldehyde (1a) with 5,5-dimethylcyclohexane-1,3-dione (2) and malononitrile (3) at 70 °C using aminopropylated SiO₂ (AP-SiO₂) as a polyamine heterogeneous base catalyst (Scheme 1).

2. Experimental

All solvents were used as commercial grade without further purification. Silica gel coated aluminium sheets (Merck made) were used for thin layer chromatography to monitor progress of reactions. The column chromatography was done over silica gel (80–120 mesh). Melting points were determined in an open capillary tube and are uncorrected. ¹H NMR and ¹³C NMR spectra were recorded on a Bruker 300 MHz spectrometer in CDCl₃ solvent. Mass spectra were taken on Polaris-Q Thermoscientific GC-MS. Silica gel supported polyamine catalyst was prepared by a known literature process [27].

2.1. General procedure for the synthesis of 4H-chromene derivatives

The mixture of aromatic aldehyde (1 mmol), 5,5-dimethylcyclohexane-1,3-dione 2 (1 mmol), and malononitrile 3 (1 mmol) was taken in water. To this mixture 10 mol% of solid aminopropylated SiO₂ catalyst was added. The reaction mixture was stirred at 70 °C for the appropriate time (as shown in Table 1) and the progress of reaction was monitored by thin layer chromatography. After completion of reaction as indicated by TLC, the reaction mixture was cooled at room temperature. The solvent was removed under vacuum to obtain the crude product. To the crude

product, ethyl acetate was added and the solid catalyst was filtered off. The organic layer was evaporated to obtain the solid product. The obtained product was purified by recrystallization using ethyl acetate to get the desired compound 4a–n. All compounds were characterized by comparing their spectral data with those reported in literature [15,26–27]. Spectral data for representative and newly synthesized compounds is listed below.

2-Amino-7,7-dimethyl-5-oxo-4-phenyl-5,6,7,8-tetrahydro-4H-chromene-3-carbonitrile (4a): White solid, mp 235–237 °C, ¹H NMR (300 MHz, CDCl₃): δ 7.79–7.89 (m, 2H), 7.41–7.50 (m, 1H), 6.88–7.04 (m, 2H), 6.57 (brs, 2H, NH), 4.29 (s, 1H), 2.58 (s, 2H), 2.26 (m, 1H), 2.01 (m, 1H), 1.23 (s, 3H), 0.84 (s, 3H); ¹³C NMR (75 MHz, CDCl₃): δ 201.2, 162.3, 155.8, 145.6, 128.7, 127.5, 119.2, 112.1, 57.6, 49.9, 40.3, 39.9, 36.1, 27.4; GC-MS: m/z 294 (M⁺); Elem. Anal. Calcd. for C₁₈H₁₈N₂O₂: C, 73.45; H, 6.16; N, 9.52; O, 10.87; found: C, 73.43; H, 6.18; N, 9.54; O, 10.90.

2-Amino-7,7-dimethyl-5-oxo-4-(3,4,5-trimethoxyphenyl)-5,6,7,8-tetrahydro-4H-chromene-3-carbonitrile (4f): Yellow solid, mp 247–249 °C, ¹H NMR (300 MHz, CDCl₃): δ 7.29–7.41 (m, 2H), 6.71 (brs, 2H, NH), 4.22 (s, 1H), 3.73 (s, 9H), 2.51 (s, 2H), 2.23 (m, 1H), 2.17 (m, 1H), 1.10 (s, 3H), 0.92 (s, 3H); ¹³C NMR (75 MHz, CDCl₃): δ 201.1, 160.0, 157.8, 132.0, 129.6, 129.0, 119.1, 107.2, 106.4, 60.3, 59.3, 57.1, 50.0, 38.0, 32.3, 28.9; GC-MS m/z 384 (M⁺); Elem. Anal. Calcd. for C₂₁H₂₄N₂O₅: C, 65.61; H, 6.29; N, 7.29; O, 20.81; found: C, 65.63; H, 6.26; N, 7.31; O, 20.83.

2-Amino-7,7-dimethyl-5-oxo-4-(2,3-dichlorophenyl)-5,6,7,8-tetrahydro-4H-chromene-3-carbonitrile (4i): White solid, mp 225–227 °C, ¹H NMR (300 MHz, CDCl₃): δ 7.17–7.21 (m, 1H), 7.40–7.47 (m, 1H), 7.82–7.90 (m, 1H), 6.72 (brs, 2H, NH), 4.24 (s, 1H), 2.61 (s, 2H), 2.28 (m, 1H), 2.06 (m, 1H), 0.94 (s, 3H), 0.74 (s, 3H); ¹³C NMR (75 MHz, CDCl₃): δ 200.7, 159.8, 154.0, 140.1, 131.3, 130.2, 130.0, 119.2, 113.2, 67.6, 60.0, 44.3, 41.2, 32.1, 28.6; GC-MS: m/z 363 (M⁺); Elem. Anal. Calcd. for C₁₈H₁₆Cl₂N₂O₂: C, 59.52; H, 4.44; Cl, 19.52; N, 7.71; O, 8.81; found: C, 59.53; H, 4.43; Cl, 19.55; N, 7.69; O, 8.83.

Table 1
Synthesis of 4H-benzo[h]pyran derivatives using aminopropylated silica gel catalyst.

Entry	R	Product	Time (min)	Yield (%) ^a	Mp (°C)	
					Obs	Lit
1	Ph	4a	90	93	235–237	234–236 [20]
2	4-Me-C ₆ H ₄	4b	60	94	208–210	209–210 [15]
3	4-OH-C ₆ H ₄	4c	120	96	223–225	224–226 [21]
4	4-Br-C ₆ H ₄	4d	90	89	199–200	197–199 [25]
5	4-OMe-C ₆ H ₄	4e	120	95	200–202	201–203 [26]
6	3,4,5-OMe-C ₆ H ₂	4f	150	96	247–249	–
7	4-Cl-C ₆ H ₄	4g	90	92	213–214	215–216 [25]
8	2-Cl-C ₆ H ₄	4h	90	89	201–203	200–202 [25]
9	2,3-Cl ₂ -C ₆ H ₃	4i	90	88	225–227	–
10	4-NO ₂ -C ₆ H ₄	4j	45	90	152–154	–
11	3-NO ₂ -C ₆ H ₄	4k	60	92	209–211	210–212 [20]
12	4-F-C ₆ H ₄	4l	60	89	210–212	208–210 [25]
13	3-Pyridine carboxaldehyde	4m	90	87	187–189	–
14	Furfuraldehyde	4n	90	90	201–203	198–200 [26]

2-Amino-7,7-dimethyl-5-oxo-4-(pyridin-3-yl)-5,6,7,8-tetrahydro-4H-chromene-3-carbonitrile (**4m**) Brownish solid; mp 187–189 °C; ^1H NMR (300 MHz, CDCl_3): δ 7.17–7.21 (m, 1H), 7.40–7.47 (m, 1H), 7.82–7.90 (m, 1H), 6.72 (brs, 2H, NH), 4.24 (s, 1H), 2.61 (s, 2H), 2.28 (m, 1H), 2.06 (m, 1H), 0.94 (s, 3H), 0.74 (s, 3H); ^{13}C NMR (75 MHz, CDCl_3): δ 200.0, 161.3, 154.0, 153.6, 142.8, 135.1, 129.9, 122.8, 119.1, 114.1, 59.9, 53.5, 38.1, 37.5, 31.3, 30.7; GC-MS: m/z 295 (M^+); Elem. Anal. Calcd. for $\text{C}_{17}\text{H}_{15}\text{N}_3\text{O}_2$: C, 69.14; H, 5.80; N, 14.23; O, 10.83; found: C, 69.15; H, 5.77; N, 14.25; O, 10.81.

2.2. Synthesis of solid aminopropylated SiO_2

Silica gel was synthesized under acidic conditions. A known weight of sodium silicate solution (23.31 $\text{SiO}_2\%$; 7.48 $\text{Na}_2\text{O}\%$) was diluted with deionized water. 12% (w/v) SiO_2 was added to 5.1 mol/L H_2SO_4 solution under stirring with a peristaltic pump over 12.5 min at room temperature to adjust the SiO_2 concentration to 8% (w/v), aged for 2 h, and then kept at 100 °C for 12 h in a closed Simax glass bottle. The gel obtained was washed until it was sulfate free (BaCl_2 test), dried at 100 °C in an oven, and further calcined at 600 °C for 6 h. Samples were cooled under vacuum and stored in a capped bottle over P_2O_5 in a desiccator. Surface functionalization of the silica gel was carried out by suspending the gel in a solution of 3-aminopropyltrimethoxysilane in dry toluene (solid, liquid, 10:100, w/v) and refluxed at boiling temperature for 24 h. Samples were filtered, washed with isopropanol thoroughly, and dried at 100 °C for overnight. Two different functionalized silica samples were prepared with APTMS using different APTMS: silica ratios (w/w), viz. 0.1 (0.56 mmol/g), which were designated as GN1. The synthesized material was characterized by powder X-ray diffraction and ^{29}Si solid state NMR analysis.

Powder X-ray diffraction: Powder X-ray diffraction (PXRD) patterns of functionalized silica showed the hexagonal structure of GN1; a typical mesoporous structure with three sharp peaks corresponding to the (1 0 0), (1 1 0), and (2 0 0) planes (Fig. 1). It has been seen that the value of d_{100} and a_0 remained almost constant with the standard deviation of 0.35, indicating that the surface modification did not result in structural properties of GN1.

^{29}Si NMR spectra: The ^{29}Si NMR spectra of silica gel samples treated at different temperatures and functionalized silica gels are shown in Fig. 2. The three peaks at δ -112, -102 and -92 can be

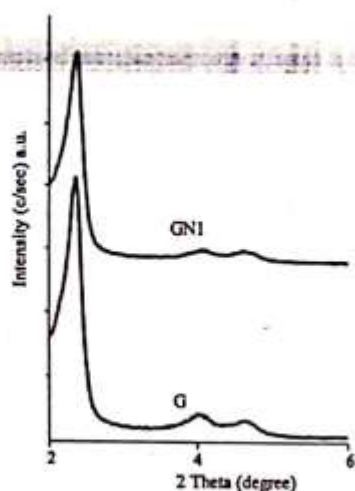


Fig. 1. PXRD patterns of silica gel G and aminopropylated silica gel.

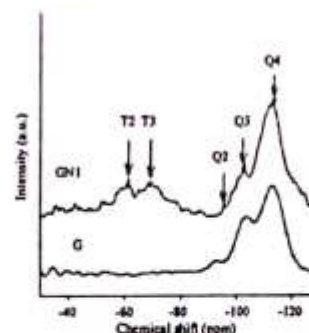


Fig. 2. ^{29}Si MAS NMR spectra of silica gel and aminopropyl functionalized silica gels.

attributed to silicon in the siloxane binding environment without hydroxyl groups $\text{Q}^4[(\text{SiO})_4\text{Si}]$, isolated silanol groups $\text{Q}^3[(\text{SiO})_3\text{Si-OH}]$, and geminal silanol groups $\text{Q}^2[(\text{SiO})_2\text{Si-(OH)}_2]$ of the silica gel.

3. Results and discussion

The presence of several free NH_2 groups in the catalyst (such as GN3) [28] may lead to the formation of excess hydrogen bonding with acidic hydrogens of substrates such as phenols and hence may require prolonged time for completion of reaction. In the case of the GN1 catalyst the probability of such interactions is less due to the presence of a single NH_2 group. Hence, it catalyzes the reaction more efficiently in a short time to afford the corresponding products in high yields.

Preliminary efforts were mainly focused on the evaluation of different molar ratios of the catalyst AP- SiO_2 . Initially, the reaction was carried out using 5 mol% of the catalyst in ethanol; the product **4a** was obtained in lower than 52% yield within 12 h. When the reaction was carried out using 10 mol% of catalyst, the reaction was completed in 5.5 h and the yield obtained of product **4a** was 64%. Further increase in catalyst concentration did not show any significant effect on reaction time and yield of **4a**. The reaction proceeds well in the presence of 10 mol% of the catalyst in ethanol at room temperature but require longer time for completion. As the temperature of reaction was raised slowly (Table 2); it was found that the reaction proceeds giving excellent yield at 70 °C temperature within 1.5 h. Further increase in reaction temperature to 80 °C showed similar results without change in yield or reaction time, and thus the optimized reaction conditions involve the use of 10 mol% of the catalyst at 70 °C with a 1.5 h reaction time.

Under the optimized reaction conditions, the ability of catalyst was explored in multicomponent reaction. Both electron-rich and electron deficient aryl aldehydes afforded 4H-chromene derivatives in 73%–98% yield in relatively short reaction times. Comparatively, the rate of reaction of electron-deficient aryl aldehyde was faster than the electron-rich aryl aldehyde. 4H-Chromene derivatives formed were obtained in pure form by

Table 2
Effect of temperature on synthesis of **4a**.

Entry	Temperature (°C)	Time (h)	Yield (%) ^a
1	r.t.	4.5	69
2	50	3.0	78
3	60	2.0	86
4	70	1.5	93
5	80	1.5	92

^a Isolated yield.

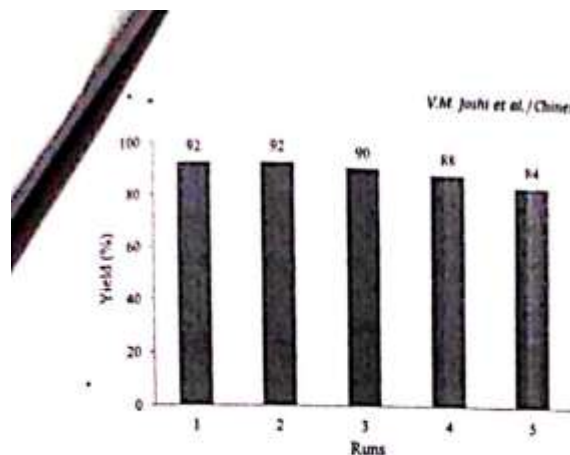


Fig. 3. Reusability of solid aminopropylated SiO_2 as a catalyst for the synthesis of **4a**.

recrystallization process. In order to extend the scope of amino propylated silica gel catalyzed multicomponent reactions, it was also successfully applied to aromatic heterocyclic aldehydes (Table 1).

After performing the condensation of C-H activated ketones with aromatic aldehydes and alkylmalonates for the synthesis of 2-amino-7,7-dimethyl-5-oxo-4-phenyl-5,6,7,8-tetrahydro-4H-chromene-3-carbonitrile derivatives under present conditions, ethyl acetate was added to the reaction mixture. The catalyst was separated by a simple filtration from the resulting heterogeneous mixture, washed with water 3–4 times, dried, and reused for consecutive runs under the same reaction conditions. The average isolated yield of **4a** for five consecutive runs was 89%, which clearly demonstrates the practical reusability of this catalyst (Fig. 3). Structure of the recovered catalyst was also studied with XRD analysis. The powder XRD pattern of the recovered catalyst was similar to that of the fresh catalyst indicating that the recovered catalyst remains unaffected in its structure.

4. Conclusion

In summary, we synthesized silica gel supported amino functionalized heterogeneous solid aminopropylated SiO_2 as a base catalyst. After structural characterization, its capability in organic transformations was investigated to synthesize 2-amino-7,7-dimethyl-5-oxo-4-phenyl-5,6,7,8-tetrahydro-4H-chromene-3-carbonitrile **4a**. The catalyst was found to catalyze the reaction under mild reaction conditions. The solid catalyst aminopropylated SiO_2 was efficient for the synthesis of **4a** and showed excellent stability and activity. The scope of the catalyst was further explored to catalyze the synthesis of 4H-chromene derivatives using different aromatic and heterocyclic aldehydes. The reactions proceeded well on all kind of aldehydes giving excellent yield of products in shorter reaction time. Finally, silica supported amine catalyst can be recovered by simple filtration procedure and reused without much loss in its activity.

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$\text{Fe}_{0.2}\text{Al}_{1.8}\text{Zn}_1\text{O}_4$ Composite: An Efficient Catalyst for the Synthesis of 1, 4-Dihydropyridine Derivatives

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Authors' contributions

This work was carried out in collaboration between all authors. Author VMJ performed the said work. Author RPP designed the study and wrote the protocol. Authors SUT and SSK managed the analyses of the study and wrote the draft of manuscript. Authors SKV and AMZ managed the statistical analysis and provide the catalyst. Authors SBS and KLA managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

A simple and rapid protocol has been developed for the synthesis of 1, 4-dihydropyridine derivatives in short reaction time to afford the products in excellent yield. Operational simplicity, clean reaction, high yield, simple work up are the significant advantages of the present protocol.

Keywords: $\text{Fe}_{0.2}\text{Al}_{1.8}\text{Zn}_1\text{O}_4$, Aldehyde; 1, 4-Dihydropyridines; EAA.

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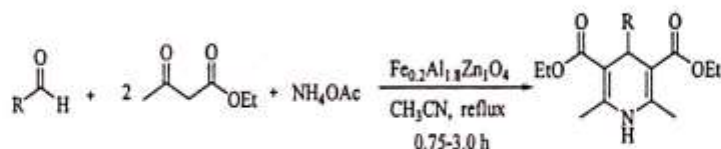
1. INTRODUCTION

1, 4-Dihydropyridine derivatives are the biologically active potent heterocyclic compounds possessing pharmacological and medicinal properties. Dihydropyridine (DHP) skeleton is an integral part of many commercial drugs used in the treatment of hypertension such as amlodipine, nifedipine, nifedipine etc. [1]. 1, 4-Dihydropyridine derivatives are documented in literature for anti-inflammatory [2], antiulcer [3], anticonvulsant [4], antitubercular [5], antimicrobial etc. activities [6]. These also act as potential antagonists [7] as well as antidyslipidemic and antioxidant agents [8]. 1, 4-Dihydropyridine and their derivatives are therapeutically significant compounds due to their ability to bind to calcium channels and thus decreasing the flow of transmembrane calcium current [9]. Thus vast biological activities of these compounds have attracted the attention of synthetic organic chemists to synthesize such molecules.

The first classical method for the synthesis of 1,4-DHPs carried out by Hantzsch and Liebig involves the one pot condensation of aldehydes with 1,3-dicarbonyl compounds and ammonia either in acetic acid or in an refluxing alcohol for a prolonged time. Due to certain disadvantages associated with this method, different protocols were developed in due course by the scientific community from academia as well as industry for the synthesis of these heterocyclic compounds which comprise the use of heterogeneous catalysts such as silica sulfonic acid [10], alumina [11], alumina sulfuric acid [12], HY-Zeolite [13] etc. Other Lewis acid catalysts including $Mg(ClO_4)_2$ [14], phenylboronic acid [15], molecular iodine [16] are also reported for their catalytic efficiencies in the synthesis of these heterocyclic compounds. Furthermore the use of ionic liquid [17], ultrasound [18] or microwave [19] irradiation is also reported. However, research is mainly focused on the modification by optimization of the Hantzsch reaction to minimize reaction time, maximize reaction conversion and offer high purity 1, 4-DHPs.

Heterogeneous catalysts are always superior to homogeneous ones in many aspects. Currently the study of multicomponent reactions by heterogeneous catalysts has become an active part of ongoing research due to several advantages associated with the heterogeneous catalysts over homogeneous counterparts such as easy separation, recycling ability, minimization of metal traces in products after isolation etc.

As a part of our research in the development of new methods for the synthesis of heterocyclic compounds [20]; in present work we wish to report the synthesis of 1, 4-dihydropyridine derivatives by the condensation reaction between aldehyde, ethylacetoacetate and ammonium acetate using the composite $Fe_{0.2}Al_{1.8}Zn_1O_4$ as an efficient catalyst in acetonitrile under reflux condition (Scheme 1).



Scheme 1 Synthesis of 1,4-dihydropyridines catalyzed by $Fe_{0.2}Al_{1.8}Zn_1O_4$ nanocomposite catalyst

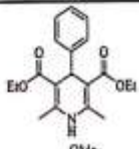
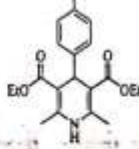
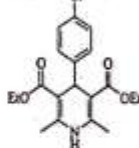
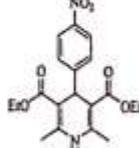
2. EXPERIMENTAL DETAILS

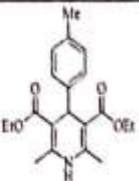
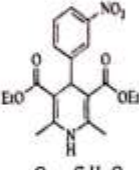
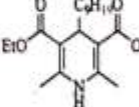
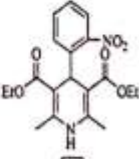
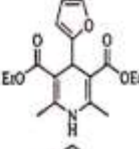
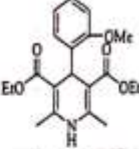
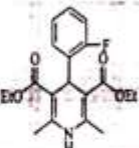
The chemicals used were SD fine made and were used without further purification. Melting points of the synthesized compounds were recorded in capillaries open at one end and were uncorrected. ^1H NMR (400 MHz) and ^{13}C NMR (100 MHz) spectra were recorded on Varian spectrophotometer using CDCl_3 solvent and TMS as the reference. IR spectra of the samples were recorded on Perkin FTIR spectrometer using KBr discs. The catalyst was synthesized by reported literature sol-gel method [21-23].

2.1 General Procedure for Synthesis of 1, 4-dihydropyridine Derivatives

A mixture of aldehyde (1 mmol), ethylacetoacetate (2 mmol), ammonium acetate (1.5 mmol) and the composite $\text{Fe}_{0.2}\text{Al}_{1.8}\text{Zn}_1\text{O}_4$ catalyst (10 mol %) in acetonitrile (2 mL) was refluxed for appropriate reaction time as specified in Table 1. The progress of reaction was monitored by Thin Layer Chromatography (25% EA: Hexane). After completion of reaction as indicated by TLC, the reaction mass was diluted with acetonitrile and filtered off to separate the catalyst. The residue being recovered catalyst; on subsequent washings with acetonitrile twice followed by drying it at 100°C can be recovered and reused. The filtrate was concentrated on rotary evaporator and purified by crystallization from ethanol to obtain the pure product.

Table 1. Synthesis of 1, 4-dihydropyridines using composite- $\text{Fe}_{0.2}\text{Al}_{1.8}\text{Zn}_1\text{O}_4$ catalyst

Entry	R	Product	Time (hr)	Yield (%) ^a	Melting point ($^\circ\text{C}$)
1	Ph		0.75	98	156
2	4-MeOC ₆ H ₄		1.5	95	159
3	4-ClC ₆ H ₄		1.0	91	141-143
4	4-NO ₂ C ₆ H ₄		1.5	89	127

5	4-MeC ₆ H ₄		0.75	89	160-61
6	3-NO ₂ C ₆ H ₄		1.75	80	163
7	n-C ₉ H ₁₉		4.25	78	—
8	2-NO ₂ C ₆ H ₄		3.5	77	119
9	2-Furyl		2.0	89	163-65
10	2-MeOC ₆ H ₄		2.5	87	148-149
11	2-FC ₆ H ₄		3.0	92	151

^bReactions were carried on aldehyde (1mmol), EAA (2 mmol) and NH₄OAc (1.5 mmol) using Fe₂O₃Al₂O₃ZnO₄ (10 mol %) in 2 drops HCl and CH₃CN

All aldehydes reacted smoothly to afford the corresponding 1, 4-dihydropyridines in excellent yield (Table 1). The spectral data of representative compounds is mentioned below:

Diethyl 1, 4-dihydro-2, 6-dimethyl-4-phenylpyridine-3, 5-dicarboxylate (Entry 1, Table 1): Yield: 98%; Colorless solid; m.p.156 °C ; IR (KBr) : 500, 620, 1050, 1100, 1180, 1200, 1500, 1667, 1690, 2350, 2867, 3440 cm⁻¹; ¹H NMR (CDCl₃): δ 1.23 (t, J =7.2Hz, 6H), 2.35 (s, 6H), 4.09 (q, 4H), 4.97 (s, 1H), 5.7(brs, 1H), 7.08 - 7.26 (m, 5H); ¹³C NMR (CDCl₃): δ 14.28, 19.23, 39.59, 59.56, 103.92, 126.06, 127.89, 144.10, 147.61, 167.54.

Diethyl 1, 4-dihydro-2, 6-dimethyl-4-(4-methoxy-phenyl) pyridine-3, 5-dicarboxylate (Entry 2, Table 1): Yield: 92%; Colorless solid, m.p.194 °C; IR(KBr) : 500, 700, 1000, 1050, 1200, 1250, 1300, 1500, 1700, 2400, 3300 cm^{-1} ; ^1H NMR (CDCl_3): δ 1.25 (t, J = 7.1Hz, 6H), 2.38 (s, 6H), 3.94 (s, 3H), 4.05 (q, J = 7.1Hz, 4H), 4.87 (s, 1H), 5.92 (s, 1H), 6.88 (d, J = 8.7Hz, 2H), 7.11 (d, J = 8.6 Hz, 2H); ^{13}C NMR (CDCl_3): δ 14.68, 19.55, 39.13, 55.30, 59.85, 104.53, 113.62, 129.19, 140.79, 144.17, 158.30, 167.98.

Diethyl 1, 4-dihydro-2, 6-dimethyl-4-(2-nitro-phenyl) pyridine-3, 5-dicarboxylate (Entry 8, Table 1): Yield: 75%; colorless solid; m.p.172-173 °C; IR (KBr): 757, 858, 1020, 1103, 1190, 1217, 1284, 1309, 1352, 1434, 1492, 1529, 1618, 1649, 1689, 3020, 3442 cm^{-1} ; ^1H NMR (CDCl_3): δ 2.34 (s, 6H), 3.79 (s, 6H), 5.73 (s, 1H), 5.87 (s, 1H), 7.21 - 7.30 (m, 1H), 7.41 - 7.54 (m, 2H), 7.66 - 7.70 (m, 1H); ^{13}C NMR (CDCl_3): δ 19.0, 34.29, 52.84, 103.0, 125.65, 126.88, 130.88, 132.70, 142.10, 145.42, 147.54, 167.62.

3. RESULTS AND DISCUSSION

Different aldehydes were used with ethyl acetoacetate, ammonium acetate and $\text{Fe}_{0.2}\text{Al}_{1.8}\text{Zn}_1\text{O}_4$ in acetonitrile to illustrate generality of the condensation reaction. The results are summarized in Table 1. The present protocol affords products in good yields. Products were obtained in short reaction time. This method tolerates a variety of functional groups such as methyl, methoxy, hydroxyl, halides etc under the reaction conditions. Importantly, aromatic aldehydes carrying either electron-donating or electron-withdrawing substituents all reacted very well, giving moderate to excellent yields of desired products. The substituent on the aromatic ring of aldehyde did not show much difference in the yield of products.

After completion of reaction, the catalyst was recovered by diluting the reaction mass with hot ethanol followed by filtration and the recovered catalyst was reused for few more cycles (Table 2). During washing with the solvent, it is clearly evident that there was no leaching of catalyst and was confirmed by performing the reaction with the residue as the recovered catalyst. The catalyst reusability study was carried out using the model reaction of benzaldehyde (1 mmol), EAA (2 mmol) and NH_4OAc (1.5 mmol) using $\text{Fe}_{0.2}\text{Al}_{1.8}\text{Zn}_1\text{O}_4$ (10 mol %) in 2 drops HCl for the synthesis of diethyl 1, 4-dihydro-2, 6-dimethyl-4-phenylpyridine-3, 5-dicarboxylate (Entry 1, Table 1) whose results are summarized in Table 2. Reusability of the catalyst was studied for three successive recycles which afforded good yield of products indicating that the catalyst can be reused without appreciable loss of catalytic activity.

Table 2. Recycle study of the $\text{Fe}_{0.2}\text{Al}_{1.8}\text{Zn}_1\text{O}_4$ composite catalyst

Run	Fresh	I	II	III
Yield (%)	98	96	95	94

From our investigations, we observed that the catalyst shows excellent to good reactivity with promising yields even for the next three cycles in the same reaction. Since, there was no observable loss in the percentage yield; there is no leaching of the catalyst. Table 3 shows the comparative study of the effect of $\text{Fe}_{0.2}\text{Al}_{1.8}\text{Zn}_1\text{O}_4$ composite with some literature protocols on the synthesis of 1,4-dihydropyridines. From literature the use of alcoholic solvent or solvent free conditions was useful for the synthesis of Hantzsch's dihydropyridines. But with our catalyst, acetonitrile suited well.

Table 3. Comparative study of effect of $\text{Fe}_{0.2}\text{Al}_{1.8}\text{Zn}_1\text{O}_4$ composite on the synthesis of 1, 4-dihydropyridines

Entry	Catalyst	Conditions	Yield (%)	Reference
1	Sulfonic acid on silica gel (0.2 g/mmol)	hexane or neat, 60°C, 4.5-7 h	85-95	[10]
2	Alumina- H_2SO_4 (0.2 g/3mmol)	MeOH, 70°C, 2-5 h	82-95	[12]
3	HY-zeolite (10 mg/mmol)	EtOH, reflux, 2.5-3.5 h	70-90	[13]
4	I_2 (30 mol %),	EtOH, r.t., 2.5-5 h	80-95	[16]
5	$\text{Fe}_{0.2}\text{Al}_{1.8}\text{Zn}_1\text{O}_4$ (10 mol %)	ACN, 2-drops HCl, reflux, 0.75-4.25 h	77-98	[Present method]

4. CONCLUSION

In conclusion, we have developed a simple and efficient method for the synthesis of 1, 4-dihydropyridines by using the composite $\text{Fe}_{0.2}\text{Al}_{1.8}\text{Zn}_1\text{O}_4$ as a solid catalyst, which has many advantages such as ease of preparation, easy handling, reusability and insolubility in most organic solvents. The present protocol affords the 1, 4-dihydropyridines in moderate to excellent yield within short reaction time. We believe this catalyst as a valuable addition to the synthesis of heterocyclic compounds such as 1, 4-dihydropyridine derivatives.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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IN VITRO BIOLOGICAL SCREENING AND NOVEL SYNTHESIS OF CHALCONES USING REUSABLE POLYAMINE CATALYST

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Keywords: chalcone synthesis, antibacterial activity, flavones, polyamine catalyst

A simple and efficient method for the synthesis of chalcone derivatives using polyamine catalyst has been described. The antibacterial activity of chalcones are also evaluated by using gram positive (*S. aureus*, *B. subtilis*) and gram negative bacteria (*Klebsiella pneumonia*, *P. aeruginosa*) microorganisms.

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INTRODUCTION

Flavonoids are the largest group of naturally occurring phenolic compounds, abundantly occurs in different plant both in free state and as glycosides. The presence of these pigments is responsible for the various colors and combination of such colors exhibited by bark, leaves, flowers, fruits and seeds of plants.¹ Flavonoids are present in vegetables, fruits, berries and beverages such as tea, red wine and fruit juices, having similar effects as antioxidants. Acyclic flavonoids include chalcones & aurones which also contain C6-C3-C6 backbone.²

They were formerly considered to be minor flavonoids. Chalcones are open chain flavonoids in which two aromatic rings are joined by three carbons α , β -unsaturated carbonyl system. They are the important intermediates of flavonoids synthesis.

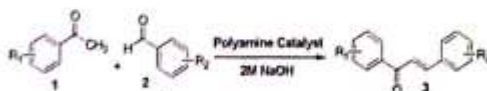
Aurones, (Z)-2-benzylidenbenzofuran-3-(2H)-ones are responsible for the bright yellow colour of some ornamental flowers. They are biosynthesized from chalcones by the key enzyme aureusidin synthase.³ They contribute to the yellow flower color in several ornamental plants.

Chalcones are readily accessible via two well-established routes comprising a base catalyzed aldol condensation or acid mediated aldolisation of 2-hydroxyacetophenone and benzaldehyde. The base catalyzed aldol condensation is usually preferred route toward the chalcone formation.

Several methods have been reported for the synthesis of chalcones.⁴ Under acidic conditions cyclization of chalcones leads to the formation of corresponding hydroxyl dihydrochalcone, 2-hydroxy heterochalcones. Chalcone derivatives are known as versatile physiologically active compounds.⁵⁻⁸

Chalcones have been reported to possess many useful properties, including anti-inflammatory,⁹ anti-microbial,⁸ antifungal,⁹ antioxidant,¹⁰ antitumor,¹¹ antimalarial,¹² antiprotozoal,¹³ antibacterial properties,¹⁴ antifilarial activity,¹⁵ mosquito larvicidal activity,¹⁶ anticonvulsant activity,¹⁷ mammalian α -amylase inhibitory activity,¹⁸ cyclooxygenase inhibitory activity,¹⁹ monoamine oxidases inhibitory activity.²⁰

In reported work, we developed a new methodology for the synthesis of biologically important chalcones using the mixture of aldehydes and acetophenones in presence of polyamine catalyst. The recovered polyamine catalyst was recycled and reused several times to carry out the same reaction, without any loss in its efficiency (Scheme 1).



Scheme 1. Synthesis of chalcones by using polyamine catalysts

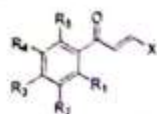
RESULTS AND DISCUSSION

Chalcones are synthesized using various catalysts like ionic liquid resins, clays, non-aqueous cation-exchange resin etc. Herein, we are reporting a simple and easy method for chalcone synthesis by using novel silica gel supported poly amine catalyst. The catalyst was prepared from solution of 3-aminopropyl-trimethoxy silane in dry toluene. The chalcone obtained using this catalyst is having more yields and it can be reusable. The activity of chalcones was found to be better. Structures of different chalcones synthesized are shown in Table 1.

Determination of minimum inhibitory concentration (MIC)

MIC of synthesized chalcone was determined using tube dilution technique against gram positive (*S. aureus*, *B. subtilis*) and gram negative bacteria (*Klebsiella pneumonia*, *P. aeruginosa*). The turbidity was measured by colorimeter at 620 nm. Colorimetrically, the MIC was found to be 125 $\mu\text{g mL}^{-1}$.

Table 1. Synthesis of chalcones using N,N-dibasic polyamine catalyst



Comp. Codes	Substituent groups						M. p. (°C)	Yields (%)
	X	R1	R2	R3	R4	R5		
C1		OH	H	OH	H	H	187	93.32
C2		OH	H	OH	H	H	138	95.67
C3		OH	H	OH	H	H	124	87.45
C4		OH	H	OH	H		174	88.67
C5		OH	H	OH	H	H	96	76.45
C6		OH	H	OH	H	H	110	78.56
C7		OH	H	OH	H	H	5	73.45
C8		H	H	H	H	H	122	67.34
C9		H	H	H	H	H	94	87.78
C10		H	H	NO2	H	H	118	68.78

Table 2. MIC Results of C9 compound against gram positive and gram negative bacteria

Sr. No.	Concentration, $\mu\text{g mL}^{-1}$	Transmittance, %			
		<i>S. aureus</i>	<i>K. pneumonia</i>	<i>B. subtilis</i>	<i>P. aeruginosa</i>
C9a	1000	99	100	97	99
C9b	500	96	99	98	97
C9c	250	95	93	94	95
C9d	125	84	83	91	91
C9e	62.5	27	31	47	51

Table 3. MIC Results of C10 compound against gram positive and gram negative bacteria

Sr. No.	Concentration	Transmittance			
		<i>S. aureus</i>	<i>K. pneumonia</i>	<i>B. subtilis</i>	<i>P. aeruginosa</i>
C10a	1000	99	100	98	99
C10b	500	97	99	97	97
C10c	250	95	97	96	93
C10d	125	96	94	93	92
C10e	62.5	28	52	52	54

This concentration was used to study zone of inhibition of synthesized compounds. MIC results of chalcone C9 are shown in Table 2, Figure 1 and MIC results of chalcone C10 are shown in Table 3, Figure 2.

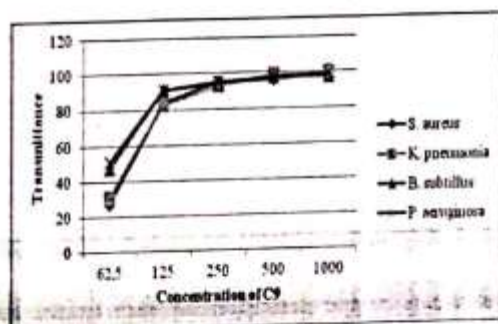


Figure 1. Graph indicating MIC of C9 against gram positive and gram negative bacteria

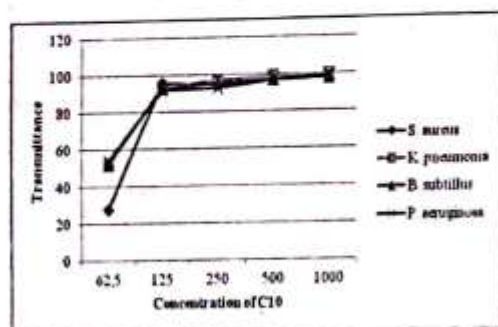


Figure 2. Graph indicating MIC of C10 against gram positive and gram negative bacteria

The results of MIC confirmed that the chalcone derivatives C9 and C10 showed inhibition growth of gram positive (*S. aureus*, *B. subtilis*) and gram negative bacteria (*K. pneumonia*, *P. aeruginosa*). MIC of 125 $\mu\text{g/mL}$ of testing compound is the concentration used to determine zone of inhibition against various microorganisms.²¹

Antibacterial activity of novel chalcone compounds

The chalcone are found to be antibacterial in nature. Various food borne pathogens are common agents responsible for various diseases. Several gram negative bacteria are harmful for human beings. The chalcone were used for bacterial growth inhibition. Compounds C9 and C10 are found to be antibacterial and showed a broad range of antibacterial activity.²²

Zone of Inhibition

As per MIC results, it was founds that 125 $\mu\text{g/mL}$ concentration is the minimum inhibitory concentration to inhibit further microbial growth. This concentration of compounds were used for the study of zone of inhibition on various microorganism. 100 μg of Ciprofloxacin was taken as standard and DMF were used as control.

Table 4. Zone of inhibition of compounds

Compound code	Zone of inhibition (mm)			
	<i>S. aureus</i>	<i>K. pneumonia</i>	<i>B. subtilis</i>	<i>P. aeruginosa</i>
C4	20	22	19	21
C5	22	23	21	20
C9	22	24	22	19
C10	19	24	19	13
Ciprofloxacin	31	30	32	32

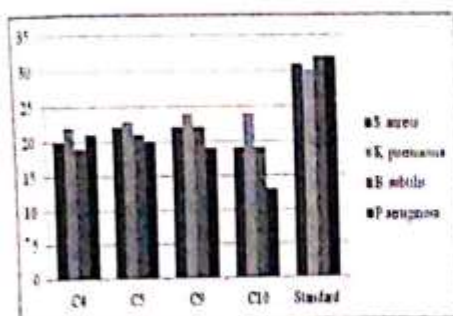


Figure 3. Zone of inhibition of compounds

EXPERIMENTAL SECTION

Melting point of the synthesized compounds were determined in melting point apparatus made by viggo. The IR was monitored in the range of 400–4000 cm^{-1} IR spectra of final derivatives were recorded using a Shimadzu FT-IR spectrometer, MASS analyses of synthesized compounds were done on Micromass TOF mass spectrometer, and NMR analysis by VARIAN USA Mercury plus 300 MHz NMR spectrometer.

Preparation of silica gel supported polyamine catalyst

Silica gel supported polyamine catalyst was prepared by known literature processes. Silica gel was synthesized under acidic conditions. To control the population density of hydroxyl groups in the silica gel, it was calcinated at 600°C for 6 hours. Surface fictionalization of the silica gel was carried out by suspending the gel in solution of 3-aminopropyl-trimethoxy silane in dry toluene and refluxed at boiling temperature for 24 hours.²³

General procedure for synthesis of chalcones derivatives

The substituted chalcone derivatives were prepared by stirring a mixture of substituted acetophenone (0.01 mol) and aromatic benzaldehyde (0.01 mol) in catalytic amount of polyamine catalyst in adequate amount of ethanol for 3–4 hrs in presence of 2M NaOH. The reaction mixture was poured on crushed ice and neutralized with dilute HCl. The precipitated product was filtered and purified by recrystallisation in ethanol.

Spectral data of selected compounds from Table 1.

(2E)-1-(2,4-dihydroxyphenyl)-3-[4-(dimethylamino)phenyl]prop-2-en-1-one (C1): M.F. $\text{C}_{17}\text{H}_{17}\text{NO}_2$, FT-IR (KBr): $\nu=1629.85, 1693.50, 852.54, 852, 1300.02, 1261.45, 3552.88 \text{ cm}^{-1}$. ^1H NMR (300 MHz, CDCl_3 , δ ppm): 3.04(6H, s, $-\text{N}(\text{CH}_3)_2$), 6.85(1H, d, α -H), 7.90 (1H, d, β -H), 7.05–7.80(7H, m, Ar-H), 9.25(1H, s, Ar-OH), 9.20(1H, s, Ar-OH), MS (EI, 70 eV): (M⁺) 283.32, M+1= 284.10

(2E)-3-[4-(dimethylamino)phenyl]-1-phenylprop-2-en-1-one (C9): M.F. $\text{C}_{17}\text{H}_{19}\text{NO}$, FT-IR (KBr): $\nu=1602.85, 1641.42, 819.75, 850.61, 1230.58, 1307.74 \text{ cm}^{-1}$. ^1H NMR (300 MHz, CDCl_3 , δ ppm): 7.90 (1H, d, β -H), 6.85(1H, d, α -H), 3.05(6H, s, $-\text{N}(\text{CH}_3)_2$), 7.05–7.80(8H, m, Ar-H). MS (EI, 70 eV): (M⁺) 251.32, M+1= 252.50

CONCLUSIONS

A new methodology for the synthesis of biologically important chalcones using the mixture of aldehydes and acetophenones and novel catalyst silica gel supported polyamine has been developed. The advantages of this catalyst is environmental friendly approach, recycled and reused several times, mild condition, etc. In biological screening C9 and C10 compounds were found to be potential antibacterial against gram positive and gram negative bacteria.

Compounds C9 and C10 were showed better zones of inhibition which confirms their effectiveness against the test microorganisms. These zone of inhibitions were measured in mm scale as shown in Table 4 and the respective graphs were plotted (Figure 3).

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2-MORPHOLINOETHANESULFONIC ACID CATALYZED ONE POT SYNTHESIS OF ISOINDOLO [2,1-a]QUINAZOLINE AT ROOM TEMPERATURE UNDER ULTRASONICATION

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R. N. Udavant^[c] and R. P. Pawar^{[a]*}

Keywords: 2-morpholinoethanesulfonic acid, ultrasound, multi-component reactions, 2-carboxybenzaldehyde, isatoic anhydride, aromatic amines, benzylamine

An efficient and greener one pot method has been developed for the synthesis of isoindolo[2,1-a]quinazolines using 2-morpholinoethane sulfonic acid as a water soluble green catalyst at ambient temperature and excellent yield of product. The synergistic effect of 2-morpholinoethane sulfonic acid and ultrasound irradiation process has been also discussed.

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Introduction

Construction of complex molecules through multicomponent reactions (MCRs) under ultrasonication constitutes a very attractive strategy in organic synthesis. Sonochemistry is widely used in organic chemistry, offering a versatile and facile pathway for a large variety of syntheses. Ultrasound is the part of the sonic spectrum, which ranges about 20 to 100 MHz and can be roughly subdivided in three main regions: low frequency high power ultrasound (20–100 kHz), high frequency medium power ultrasound (100 kHz–1 MHz), and high frequency low power ultrasound (1–10 MHz). Sonochemistry involves the use of ultrasound technique to promote the chemical reactions.¹ Ultrasonic irradiation has been introduced as an eco-environmental technology in green chemistry.² Ultrasonic energy provides an unusual mechanism to generate high-energy chemistry owing to the extraordinary temperature and pressure generated by the cavitations bubble collapse.³

Some compounds synthesized by using ultrasonication are pyrimidine,⁴ 5-(pyrazol-4-yl)-4,5-dihydropyrazoles,⁵ benzimidazoles, benzoxazoles and benzothiazoles,⁶ amine-N-Oxides, polyhydroquinolines⁷ and Schiff's bases.⁸ In MCRs three or more reactants are involved in a cascade of bond-forming individual steps to provide a complex molecule without isolation of intermediates or modification of the reaction conditions. Attractive features of MCRs are simplicity of operation, reduction in isolation and purification steps, and minimization of costs, time, energy, solvents, and waste production. 2-Morpholinoethanesulfonic acid (2-MESA) mediated reactions at room temperature in ultrasonication have been explored as a green approach for this purpose.

The quinazolinone moiety is a building block for approximately 150-200 natural important sub-structure of various biologically active natural products such as bhimamycin C, and bhimamycin D,⁹ potent inhibitors of TNF- α ,¹¹ antifungal,¹² anti-tumour activity,^{13,14} antibacterial,¹⁵ anti-inflammatory,^{16,17} anticonvulsant,¹⁸ analgesic¹⁹ and antitubercular.²⁰ Drugs containing quinazolinone moiety showed significant therapeutic efficiency against solid tumors,²¹ antimalarial,²² antiviral,²³ antimicrobial activities,^{24,25} ovarian cancer cell lines and are also EP4 receptor agonists in the treatment of pain,²⁶ anticancer,²⁷ cytotoxicity and anti-HIV.²⁸

The title synthesis has been carried out under different reactions conditions viz., without catalyst and solvent²⁹ and catalyzed by Pt-multi-walled carbon nanotubes (Pt-MWCNTs),³⁰ *Saccharomyces cerevisiae*,³¹ montmorillonite K10 and (+)-camphor-10-sulfonic acid (CSA)¹¹ and DEAD³², etc. A comparison of the yields is given in Table 1.

Experimental

General procedure for synthesis of 6-phenyl-6,6a-dihydroisoindolo[2,1-a]quinazoline-5,11-dione (1)

To a mixture of isatoic anhydride (1 mmol), 2-formylbenzoic acid (1.1 mmol) and aniline (1.2 mmol) in ethanol (2.0 mL), 2-MESA (15 mol %) was added. The reaction vessel was irradiated in sonication bath for a period ranging from 1.8 to 2.8 h. The progress of reaction was monitored by TLC. After completion of reaction, the mixture was cooled to room temperature the reaction mixture was poured onto ice cold water and the crude product was recrystallized from ethanol. Some derivatives were purified by column chromatography technique. The general reaction is depicted in Scheme 1.

Structures of the synthesized products were confirmed by comparison of their melting points with authentic values reported in literature and spectral data like ¹H NMR, IR, and LRMS.

Table 1. Comparison of catalyst and solvent on yields under different reaction conditions.

S. No.	Catalysts	Time	Yield (%)	Temp. (°C)	Solvent	Ref.
1	Pt-MWCNTs	15	95	600	EtOH	16
2	<i>S. cerevisiae</i>	2 h	84	RT	THF	31
3	CSA	6 min	72	80-850	EtOH	11
4	DEAD	10-12 h	40	RT	EtOH	32
5	No catalyst	3 h	80	1500	-	29
6	2-MESA	2h	90-98	RT	EtOH	Present work

Spectral data of representative compounds

6,6a-Dihydro-6-m-tolylisoindolo[2,1-a]quinazoline-5,11-dione

This compound is a white solid, yield 95 %. M.p. 162-163 °C. IR (KBr) 3028, 2926, 1662, 1584, 1489, 1332, 1138 cm^{-1} . ^1H NMR 1.63 (s, 3H), 7.37-7.41 (t, 1H), 7.48-7.52 (t, 3H), 7.65-7.67 (d, 3H), 7.75-7.88 (m, 4H), 8.30 (s, 1H), 8.51-8.53 (d, 1H). LRMS m/z 333 (M) $^+$.

6-(2,4-Dichlorophenyl)-6,6a-dihydroisoindolo[2,1-a]quinazoline-5,11-dione

This compound is a white solid, yield 75 %. M.p. 223-225 °C. IR (KBr) 3052, 1661, 1585, 1489, 1327, 1135, 734 cm^{-1} . ^1H NMR 7.38-7.52 (m, 4H), 7.65-7.88 (m, 6H), 8.30 (s, 1H), 8.51-8.53 (d, 1H). LRMS m/z 413, 416(M) $^+$.

6,6a-Dihydro-6-phenylisoindolo[2,1-a]quinazoline-5,11-dione

This compound is a white solid, yield 78 %. M.p. 184-185 °C. IR (KBr) 3038, 2926, 1660, 1592, 1489, 1332, 1137 cm^{-1} . ^1H NMR 7.38-7.41 (t, 1H), 7.49-7.52 (m, 3H), 7.66-7.67 (m, 3H), 7.75-7.86 (m, 5H), 8.30 (s, 1H), 8.51-8.52 (d, 1H). LRMS m/z 351(M) $^+$.

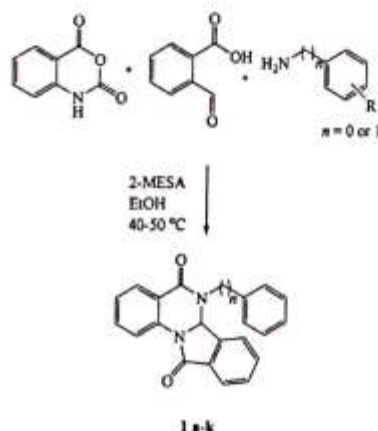
6-(4-chlorophenyl)-6,6a-dihydroisoindolo[2,1-a]quinazoline-5,11-dione

This compound is a white solid, yield 85 %. M.p. 207-209 °C. IR (KBr) 3063, 2924, 1662, 1584, 1489, 1332, 1138, 767 cm^{-1} . ^1H NMR 7.24-7.44 (m, 1H), 7.51-7.55 (m, 3H), 7.67-7.70 (m, 3H), 7.82-7.84 (m, 1H), 7.87-7.90 (m, 3H), 8.33 (s, 1H), 8.53-8.55 (d, 1H). LRMS m/z 385, 386 (M+Na) $^+$.

Result and Discussion

In search of the best experimental reaction conditions, the reaction of isatoic anhydride, 2-formylbenzoic acid and aromatic amines or benzylamine in the presence of 2-MESA as a catalyst in ethanol was considered as a standard model reaction (Scheme 1). To evaluate the exact concentration of 2-MESA required for the reaction, we investigated the model reaction of aniline using different concentrations. The result revealed (Table 2) that when the reaction was carried out in the absence of catalyst, the product formed in a very trace amount (entry 1).

When the reaction was carried out in presence of 2, 5 and 8 mol % of catalyst, yields were lower even after prolonged duration. The reaction in the presence of 10, 12 and 15 mol % of catalyst gave excellent yields in shorter time. The optimal results were obtained with 15 mol % of catalyst and this concentration was ideal to carry out reaction smoothly (entry 7).



Scheme 1. Synthesis of title compounds.

Table 2. Effect of concentration of catalyst.

S. No.	2-MESA, mol %	Time, h	Yield, %
1	0	2	10
2	2	8	40
3	5	6	50
4	8	2	60
5	10	2	80
6	12	1.5	85
7	15	1	90
8	20	1	90

In order to evaluate the effect of solvent, reactions were carried out in various solvents. Dichloromethane, acetonitrile, THF and DMSO afforded moderate yield 50, 65, 55 and 40 %, respectively. Methanol and DMF resulted in good yields of 80 and 70 %, respectively. However, ethanol furnished the product in 90 % yield making it the most suitable solvent. To investigate the role of substituents on

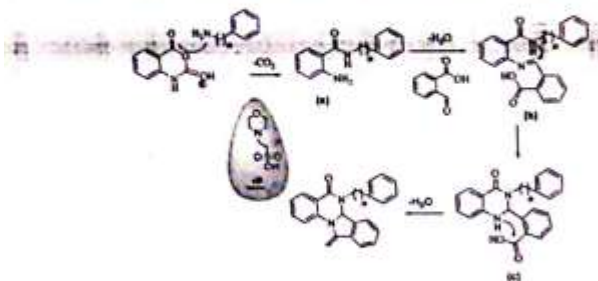
aniline on the reaction ($n=0$, Scheme 1) differently substituted anilines were treated with 2-formylbenzoic acid, isatoic anhydride in presence of 2-MESA using ethanol as a solvent to get desired product. The results found for benzylamine (entry h, $n=1$) is also mentioned in the Table 3. It was noticed that all the substrates are well tolerated under optimized conditions furnishing the product in good to excellent yields. The results are summarized in Table 3. Formation of the desired product was confirmed by comparing their physical constant, IR, ^1H NMR and mass spectroscopic data with reported compounds.

Table 3. Synthesis of isoindolo[2,1-a]quinazoline derivatives

Entry	Amino group	Time, h	Yield, %	Mp, °C
a	3-Methylaniline	2	95	162-163
b	2,4-Dichloroaniline	2.2	75	223-225
c	Aniline	2.8	78	184-185
d	4-Chloroaniline	2.4	85	207-209
e	4-Bromoaniline	2.2	82	111-112
f	4-Acetylaniline	2.6	77	158-161
g	3-Nitroaniline	2.8	83	235-237
h	Benzylamine	2	88	149-150
i	4-Methylaniline	2	82	195-196
j	4-Cyanoaniline	1.8	90	202-203
k	4-Hydroxyaniline	1.9	88	215-217

Reaction Mechanism

The nucleophilic attack of the aromatic amine on isatoic anhydride gives an intermediate (a), the amino group of intermediate (a) attack on 2-formylbenzoic acid gives another intermediate (b), which on cyclization is converted to another intermediate (c). Finally intermediate (c) on dehydration gives isoindolo [2,1-a]quinazoline (Scheme 2).



Scheme 2. A probable mechanism of the synthesis.

Conclusion

Here we have demonstrated the use of 2-MESA as greener catalyst to accelerate the synthesis of isoindolo [2,1-a]quinazoline derivatives in ethanol. The role of ultrasonication in the use of greener organic acid catalyzed

reaction has been highlighted. The methodology may prove useful for this transformation is high yield at room temperature under mild reaction conditions with fast, and easy isolation of the product under ultrasonic irradiation.

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Mahatma Gandhi's Philosophy of Life Regarding Violence and Non-violence

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"Non-violence and cowardice are contradictory terms. Non-violence is the greatest virtue, cowardice the greatest vice. Non-violence springs from love, cowardice from hate. Non-violence always suffers, cowardice would always inflict suffering."

—Mahatma Gandhi

Introduction:

British rule was well established in India when Mahatma Gandhi was born on October 2, 1869. Mahatma means Great Soul. He was indeed a great soul. He was the architect of the *Satyagraha* movement, the firm resistance against tyranny through mass civil disobedience truly founded on *Ahimsa* (total non violence). *Satya* (truth) implies love, and *Agraha* (firmness) implies force. When put together, this describes a force that is born of truth with love or nonviolence. His nonviolence movement, the only revolution of its kind, ultimately succeeded in getting independence for India in 1947 from the British.

Mahatma Gandhi, a man with many facets, could be the most needed inspiration to humankind. He was a consummate artist and an accomplished craftsman, a resolute scientist and astute thinker. *Satyagraha*, for example, is an art as well as a science. Mahatma Gandhi is the most significant and relevant proponent of nonviolence and peace for the modern world marked by so much violence and war. According to Gandhi, most of us who claim to be for nonviolence and peace are in fact very violent and contribute to and are complicit with our world of violence and war. Gandhi's philosophical approach to nonviolence is integrally related to his approach to truth. According to Gandhi, modern human beings live violent, immoral, and unspiritual lives of untruth. Gandhi challenges us to rethink and transform our basic assumptions, values, and ways of living toward greater *Satya* and *Ahimsa*.

Gandhism:

Gandhism consists of the ideas, which Mahatma Gandhi put forth before human world. Along with that, to the maximum possible extent, Mahatma Gandhi treated his individual life in accordance with these ideas. Clearly, Gandhism is a mixture of Gandhi's concepts and practices. The basic groundship of Gandhism happens to be non-violence. The non-violence is the most ancient eternal value. This non-violence is the ground of

ancient-most civilization and culture of India. Mahatma Gandhi said on this very account while making his concepts and practices based on non-violence. "I have nothing new to teach you... Truth and non-violence are as old as hill." As we know, non-violence and truth are two sides of the same coin. After knowing Gandhism, it is imperative for us to know clearly the concept of non-violence also as it accords the ground for Gandhism.

Origin of Violence:

There is a killer instinct in every human being. Violent behaviors in humans have biological, evolutionary underpinnings that found throughout the animal kingdom and commonly occur both within species and between species. For example, antagonistic interactions within species such as social competition for status, food and sex tend to occur within social groups. They also tend to be ritualized, both in humans and other animals, for example escalating from arousal, display, menace, and ritualized attack to violence but rarely killing, as there are various means for breaking off the engagement such as submission, fleeing, or, within human groups, restraint by others. By contrast, predator-prey interactions, typically involving arousal, stalk, attack, and kill sequences tend to occur between different species, although they can also occur within species.

Violence is a complex and multidimensional concept with implications for a variety of disciplines; it comes in different forms and varying degrees of intensity. The agents and victims of violence belong to different categories. Some violence is defensive, but much of it is aggressive. Its effects are varied as are its causes. Some forms of violence are clearly pathological. Certain acts of violence are self-directed while others are directed at others. Some practices of violence are legally licensed while some others are expressly prohibited. Therefore, it is not easy to have an agreed on definition of violence. Violence appears to be a heterogeneous concept difficult to clearly define and delineate.

The Concept of Non-Violence:

The question that comes into our mind is what is non-violence? Ordinarily, we attribute non-violence as a dictum that prescribes non-snatching of anyone's life. Really, this is not complete derivation pertaining to the concept of non-violence. Non-violence is quite opposite to violence. As such, it would be better to know the position relating to violence in order to know non-violence and to be in knowledge of its meaning. According to a Jain scholar, "Whenever, we hurt some other living being through our thought, utterance or action under non-cordial stipulation and non-apt learning, such an impure spirit or act of destroying life of some other one, including the impure tendency, utterance or presuming, is taken to be full of vice of violence. In such a situation, even if there is no part of violence externally, it intrinsically ipso facto remains a tendency of violence."

As a situation opposite to violence is non-violence, we can firmly state, "Total non-violence consists in not hurting some other one's intellect, speech or action per own thought, utterance or deeds and not to deprive some one of his life." We can clearly say this in a few words as follows: Abstinence in toto from violence is non-violence. Gandhi said, "Non-violence is not a concrete thing as it has generally been enunciated. Undoubtedly, it is a part of non-violence to abstain from hurting some living being, but it is only an iota pertaining to its identity. Non-violence is an active force for the highest order".

The *Satyagrahi* was enjoined to see that he was in no way a party to exploitation and injustice. It is a technique of conversion, not of coercion. In fact, violence in any shape or form, against anyone or the Government was considered 'suicidal'. A non violent person would lay down his life to prevent, violence. There should be no reliance on the sword, as according to him, violence always springs out of vengeance which comes out of fear of harm. Above all, there is no word like enemy in the vocabulary of a follower of *Ahimsa*. *Ahimsa* cannot be a weak weapon. Non-violence is a dynamic concept always hopeful, confident and optimistic about its potentialities. It is through this technique that Gandhi could reach the mass mind so easily and quickly and with much unprecedented effect.

Gandhiji was a staunch champion of non violence. His views on non-violence are extensively discussed, but what he said about violence received only scant attention. However, a more wholesome understanding of Gandhi is possible only when we study them together. The reason for this becomes obvious once we recognize that non-violence, according to Gandhi is not identical with absence or avoidance of violence. We are repeatedly reminded by Gandhi that non-violence is a positive force. A good description of non-violence is "live with goodwill". We can define non-violence as "Non-violence means an ocean of compassion, it means shedding from us every trace of ill-will for others". It is a spiritual force that controls violence and has the potential for "magical transformation" of the adversary. Gandhi pointed out that violence is the law of the beast in us. Abstaining from violence is controlling the beast in us. Practicing nonviolence is awakening the spiritual being within.

Path of Non-Violence

Gandhiji stated the path of glory through the non violence. In context of non-violence being perpetual, Mahatma Gandhi states, "...When we peruse the era from beginning unto now relating to the period for which we gain historical evidence, we find that man has been ultimately treading path of non-violence". It is, as such, that non-

violence came into existence along with man. "In case it has not been with man from the very beginning, there might have been self-doom by man". However, it has not been that and not only human race is alive in such a huge number but there has been gradual enhancement in development and nearness in spite of presence of various obstacles and nuisances. This could never have been, but because non-violence is perpetual, it happened.

Truth and Non-Violence:

Non-violence is governing because it is perpetual and permanent. It is on this accord that Mahatma Gandhi says, as I have already enunciated that 'Truth and Non-violence' are two sides of the same coin. Both have same value. Difference consists in approach only. On one side there is non-violence, on other side is truth". The derivation is that Truth stays with permanence or that Truth is permanent. Non-violence on account of being permanently present stays to be true. Mahatma Gandhi integrally combines non-violence with God. According to him, "It is impossible to tread path of 'Truth and Non-violence' unless one has vital faith in God. God is that alive force which incorporates all remaining forces of the world. This force does not depend upon anyone and it exists even when all other forces in the world come to an end. In case I do not believe unto this all glittering light, that incorporates everything, I fail to understand as to how be I alive!"

Non-Violence and Cowardice:

Mahatma Gandhi always believed in active non-violence. He always desisted from inaction like a brave man. It is a truth relating to non-violence that it is not a weapon of a weak person. It has no place for cowardice. In own words of Mahatma Gandhi, "...Non-violence should not be mistaken to be a true battle against every sort of evil". He further states, "In contrast, non-violence of my conception is true battle against evil; it is active confrontation and not a device of tit for tat." He clarified to those who were keen to take non-violence to be a weapon of the weak or those who terming it as concrete and was upbrining non-action, "...Non-violence and cowardice are not at all inter-related. I can think of a person to be coward at heart even if he is totally armed. In case it is not taken as cowardice to be equipped with arms, it is certainly symbolical of fearfulness. Pure non-violence is impossible without pure bravery". He clearly said at innumerable occasions in time of national struggle for freedom that was being bravely carried out with fearlessness under his very leadership. "Non-violence is an active force. There is no possibility of cowardice or weakness in it". Further he adds, "There can be hope of a violent person being non-violent one day but there cannot be such a hope in relation to a coward".

Non-Violence and Democracy:

In fact, Mahatma Gandhi takes real democracy to be that admits governmental interference at the minimum, which has peace at the maximum and all progress on the basis of equality. It is possible only when non-violence is imparted the supreme status in practice as well as in principle and at social as well as individual plane. Only such a democracy can be successful in its real goal. Presently, the democratic system in operation in worldly nations is not according to Gandhian principle. We are not getting what Mahatma Gandhi ultimately cherished from democracy. If it was so, these nations could be devoid of atmosphere of violence and presence of fear. There could not have been corruption and divided human society. It is already emphasized that there could not have been problems pertaining to terrorism, communalism, regionalism and problems relating to languages. More than this all, there could not have been observance of ethical and moral degradation in public life. Such degradation is being observed constantly. The main cause after all these things remain that all activities of these nations are not non-violent. There cannot be any possibility of violence while there is Gandhism in democracy. Violence is not sacred, pure or welfaristic from any point of view. Whatever is gained on the basis of it is impure and temporary. It is on this accord that it cannot pace with democracy even for a moment. Mahatma Gandhi says, "Democracy and violence can never be mutual".

Basis of democracy is non-violence in toto. And, there cannot be any diminution in it. Non-violence should be real; not merely titular. Democracy shall be pro-people only while so. Mahatma Gandhi said in this context, "If they are to be truly made democratic, they must be valiantly non-violent". In case of absence of this attribute, democracy shall be there for namesake only and it would be better for it to...clearly be supporter of dictatorship.

As we have analyzed, Mahatma Gandhi is in favor of spontaneous development of non-violence. To make democracy ultimately in accordance with non-violence remains to be his goal. This is possible. He rightly said in this regard, "... Non-violence is not merely an individual concept. It is social concept also. It must be developed in this form".

Conclusion:

Non-violence as an intrinsic as well as an instrumental value bears the same relationship as the one between *purusha* and the mind in *Yoga*. In phenomenal states of consciousness, violence and non-violence become contextual and they take on instrumental character. From a spiritual perspective they present themselves in abstract and absolute forms. Non-violence becomes an intrinsic value. It is this value that is reflected in our value judgements, though blemished to a degree by the contextual

constraints. Gandhi's philosophy of life may be described in one word *sarvodaya* (literally rise of all). *Sarvodaya* is Gandhi's slogan for cultivating altruism. Altruism consists in finding one's happiness in the happiness of others. Gandhiji believed that humans are intrinsically altruistic. Non-violence is the attitude that one needs to cultivate and practice for realization of altruism in one's being. Nonviolence is the countervailing condition that enables the person to transcend the existential roadblocks, achieve self-realization and become altruistic.

In the words of Mahatma Gandhi- *"An opponent is entitled to the same regard for his principles as we would expect others to have for ours. Non-violence demands that we should see every opportunity to win over opponents"*.

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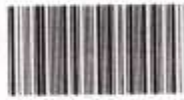
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ACROSS THE BLACK WATERS : A SOCIOLINGUISTIC INTERPRETATION

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Research Paper - English

Abstract

*Sociolinguistic approach is a vital tool to study the effects of all the aspects of society, including cultural norms, expectations, and context, in the way language is used, and the effects of language use on society. It investigates the interrelationship between language use and society. It is a relatively new discipline as it developed in the last quarter of the 20th century after the relationship between language and society had been 'ignored' by linguistic studies for the sake of theoretical advances (Trudgill, 1995). It is not only useful for interpreting the day-to-day exchanges of various speech communities but it is also an important device to understand fictional discourse. Indian writers of the first generations of the writers writing in English made linguistic experiments to portray Indian characters with the help of typical use of language. Mulk Raj Anand, R. K. Narayan and Raja Rao molded the English to suit their characters. The purpose of the present article is a sociolinguistic interpretation of the novel **Across the Black Waters** by Mulk Raj Anand.*

Introduction

The sociolinguistic approach is one of the vital tools to study the masterpieces in



English literature in general and Indian fiction in particular. According to sociolinguists, the way people use language may reveal information about their social background. Trudgill (1995) speaks about two aspects of language behaviour that have a social dimension: the first is the role of language in establishing relationship between people and the second is the role of language in conveying information about people's background. Trudgill (1974) says:

"Because language as a social phenomenon is closely tied up with the social structure and value system of society, different dialects and accents are evaluated in different ways. Standard English, for example, has much more status and prestige than any other English dialect. It is a dialect that is highly valued by many people, and certain economic, social and political benefits tend to accrue to those who speak and write it. The RP accent also has very high prestige, as do certain American accents." (p.19)

In case of fictional discourse, it is important to know how the writer makes an experiment with language. He/she manipulates the language to suit his/her characters. The characters are given certain specific roles in the society. Therefore, their language has to be governed by the set of social norms. Indian writers of the first generation such as R. K. Narayan, Raja Rao and Mulk Raj Anand have skillfully used Indian English to describe and portray the characters using Indian English.

Sociolinguistic Interpretation of the Novel -

Since sociolinguistics is the study of language in relation to its society, the novel *Across the Black Waters* is examined and interpreted against the backdrop of the Indian socio-political context. Mulk Raj Anand's novel reveals the Indian soldiers' plight in the war situation very effectively. Therefore, sociolinguistic approach would prove a vital tool to explore the various aspects of the language used by the writer while depicting not only the deplorable condition of the Indian soldiers fighting in France through the linguistic behavior of the characters. The characters portrayed by the writer come alive as they make use of local words, phrases and idiomatic expressions to convey their emotions and attitude to life. Mulk Raj Anand also uses the techniques of code mixing and code switching to highlight the sociolinguistic realities in India.



In the novel *Across the Black Waters* Mulk Raj Anand deals with a very different theme. It is regarded as exceptional among the earlier novels of Mulk Raj Anand due to a different setting. The theme of the novel is war and its aftermath. It has been translated in eleven European languages, with the British Council adapting this war-time novel overlooking the claims of classics like *All Quiet on the Western Front*, into a play to mark the 80th anniversary of the end of World War I. It recounts the experiences of an Indian regiment brought hastily to France in 1914, and the impact of the War on men from half the world away.

The professional soldiers from India, mostly second third or fourth sons have left their villages with the intention of sending back enough money to help pay off the family mortgage. A few might actually managed to win a medal, which would earn them a pension and make their old age comfortable.

When Lalu, the main character, makes friends with a French girl, he is acutely embarrassed by the attention aroused when she takes his arm in public. Anand was a nationalist but he does not overplay the theme of racial prejudice. There is no resentment among the sepoys about their treatment by the British. The French are a lot easier in their relations with other races. When disaster happens, they are more likely to blame fate than the army officers are. The British officers are by and large drawn sympathetically, especially Owen Sahib, who takes pains to behave decently to the men under his command.

These men are soldiers, but they begin with little conception of the war they are joining. They have been told that Germans are wicked monsters who kill women and children, but have little interest in the matter; they are mercenaries, and their job is to fight. They find themselves in sodden trenches (too shallow for the tall sepoys) and subject to intense artillery barrage and rifle fire 'like a rapid dysentery of lead'. They are foot soldiers in a gunner's war, and soon well aware that the British have a shortage of shells, which makes the battles very one-sided.

The men are involved in a couple of abortive attacks and a disastrous raid, but the most disturbing incidents are the summary execution of one terrified soldier by his N.C.O., and the suicide of a veteran, for reasons never fully explained.

Anand as a boy must have been close to the life of soldiers during the War. He



must have done a lot of listening to ex-soldiers, though, because (to me, at least) the details ring true in a way that is rare in novels by writers with no personal experience of the War. In the 1920s, he came to England, knew E. M. Forster and wrote for the Criterion. His first novel was *Untouchable*, a novel about the iniquities of the caste system (a subject touched on ironically in *Across the Black Waters*). He volunteered for the Spanish Civil War, and spent the Second World War working for the B.B.C.

In this novel, Anand uses the vocabulary suitable to the war situation. The characters chosen for this novel are drawn from the mixed background. Therefore, it is interesting as well as fascinating to study the language use, especially sociolinguistic aspects. The following examples in the novel are worth studying:

1. *The phrunt!* (p.10)
2. *'Wah Guruji ka Khalsa! Wah Gurujiki Fateh!* (p.14)
3. *Wake up, lazybones, wake up, it is time for you to say prayers.* (p.15)
4. *'Ohe, ja, ja, don't try to impress me', said Lalu* (p.20)
5. *'Oh, come, raper of your sister, we shall celebrate.;* (p.20)
6. *He means Vilayat.* (p.22)
7. *There is Holdar Lachman Singh.* (p.24)
8. *It is now known that the Angrezi sarkar was completely unprepared for the war.* (p.25)
9. *Yus, yus,* (p.25)
10. *'We shall wait for orders, then Huzoor', said Jemadar Subah Singh.* (p.29)
11. *'Oh come Chacha, come' he begged.* (p.30)
12. *'Salaam Huzoor', said the sepoys.* (p.31)
13. *I can't understand this Sansar!* (p.565)
14. *Ache hai?* (p.91)
15. *'Oh pity!' 'Wah Guru!'* (118)
16. *'Bale! Oh, 'Bale! Bale!'* (p.20)
17. *'Ah Lal Singh, ache hai?'* (p.133)
18. *Aloo right.* (p.135)
19. *Bol Kali mai ki jay!' shouted the sepoys.* (p.138)



20. 'Ohe Ooloo!' exclaimed Uncle Kirpu. (p.142)
21. 'Ah, Jemadar Sahib, come on my head.' (p.157)
22. 'My head is kneeling at your feet, at the feet of my aunt Uttam Kaur and sister-in-law Kesari.' (p.187)
23. Toba! (196)
24. 'Boys', he said, 'that great Jernel, Lat Robert Sahib. (p.197)
25. 'Rape mothers, they are all alike, these afsars,' said Rikhi Ram. (p.205)
26. Tea Sarkar, chota hazri. (p.213)
27. I am frightened of Holdar Lok Nath who ordered me to serve cha-biscoots at six o' clock. (p.214)
28. 'ohe, yar, you are marvelous!' (p.233)
29. 'Come, sons, come, this rape-daughter cold gets me.' (242)
30. 'Your kismet' (p.245)
31. 'It had been the dream of life to see Vilayat. (p.247)
32. 'Hai Mother' (p.264)

It is noticed that most of the expressions are related to the Punjabi language. For instance, in the last example, when a bullet, which went through the calf of his left leg, and when he fell on the face, hurt Lalu, cried in the name of his mother. It is observed that when a person is in pain, he/she remembers the mother. Therefore, the expression in 32 is typical of not only the Punjabi speakers but it is applicable to the people who are Indians and speak one of the Indian languages. The expression, 'My head is kneeling at your feet, at the feet of my aunt Uttam Kaur and sister-in-law Kesari.' speaks volumes of the emotional world of Lal Singh in his letter to his mother using so many Punjabi idiomatic expressions. This letter is a fine example for the strategy of code mixing and code switching. The entire letter evokes the feeling of Indianness in the true sense of the term. Lalu is writing the letter from the battlefield in France. The emotional world of Lalu had to be revealed through the mother tongue. Mother tongue plays an important role in disclosing the inner world of the characters. Mulk Raj Anand knows the spirit of using the language, which suit the temperament of his characters. His characters are inclined to use some of the peculiar words that are borrowed from the vernacular language.



This strategy of using the vernacular expressions pays him dividends largely.

The novelist makes use of Hind or Punjabi words in English sentences to show the sociolinguistic reality. When the soldiers shout in the name of Kali Mata they use the expression, 'Bol Kali mai ki jay! As stated in the example 19. The expression, 'Salaam Huzoor' (12) is used to show respect to the senior soldiers. The expression, 'Your kismet' (30) contains two words; one from English and the other from Hindi or Punjabi. The expression, "It is now known that the Angrezi sarkar was completely unprepared for the war", contains the words "Angrezi sarkar" that show the nativization or Indianization. The words from Punjabi or Hindi language are deliberately used by Anand to show that how Indian soldiers are prone to use English mixing the Indian words

Conclusion

Thus, the sociolinguistic interpretation of the novel serve the purpose of establishing the genuineness of the incidents and the characters depicted in the novel. Without the study of sociolinguistic aspects, the interpretation of the novel *Across the Black Waters* may be inadequate and wayward.

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SOCIOLINGUISTIC READING OF MULK RAJ ANAND'S COOLIE

Annasaheb B. Pawar*

Sociolinguistic analysis is one of the effective tools to analyze and interpret literature especially fictional works for there is an inherent relationship between language and society. It is true that understanding language in society means to understand the social networks in which the language is embedded. Sociolinguistics is the study of the effects of all aspects of society, including cultural norms, expectations and contacts in the way language is used. This article endeavors to thoroughly study, examine, and explore the various socio-cultural factors which might have gone a long way in creating, supporting and sustaining the caste and the class based on the hierarchical social structure as reflected in Mulk Raj Anand's sociological novels. His other novels can be best understood against the existing socio-cultural backgrounds. In Coolie the variety of language used by the characters is unique and culture bound and culture – specific. Therefore, an attempt is made to scrupulously discover the socio-cultural reality in pre-independence and post-independence India taking into account the vital aspects of sociolinguistics. Sociolinguistic approach can be applied in reading 'Coolie' which will be very interesting.

Introduction

Sociolinguistic approach is one of the effective tools to analyze and interpret literature especially fictional works for there is an inherent relationship between language and society. Understanding language in society means to understand the social networks in which the language is embedded. Sociolinguistics is the study of the effect of all aspects of society, including cultural norms, expectations and contacts in the way

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language is used. This paper endeavors to thoroughly study, examine, and explore the various socio-cultural factors which might have gone a long way in creating, supporting and sustaining the caste and the class based on the hierarchical social structure as reflected in Mulk Raj Anand's sociological novels. His other novels can be best understood against the existing socio-cultural backgrounds. In *Coolie* the variety of language used by the characters is unique and culture bound. Therefore, an attempt is made to scrupulously discover the socio-cultural reality in pre-independence and post-independence India taking into account the vital aspects of sociolinguistics.

Language, society, culture and literature cannot be separated from one another. They are complementary to each other. However, every culture has different patterns of socio-cultural values existing in the society. These values are reflected in literature through language. In fact, language use is influenced by the social norms. The Indian writers in English of the first generation used Indian English in a way that suited to the depiction of the characters. Mulk Raj Anand is such a writer who made a sociolinguistic experiment in his novels. In the novel *Coolie*, he makes sociolinguistic experiments to portray his characters. His characters come from the underprivileged class of Indian society where discrimination is rampant. The present article is about the sociolinguistic reading of the said novel.

Polite language

Indian social system is bound to be reflected in its literature. Indian social system is hierarchal in nature. Some people are at the higher level of the social ranking whereas others are given the low social status. The people who are at the lower level have to please everybody and act upon everybody's order. They have to use politeness strategy while interacting with their superiors. The present article unveils various sociolinguistic dimensions of the language used by the characters in the novel *Coolie*.

There are a number of factors, which influence the way characters use language in linguistic exchanges. The use of language depends on age, social position, social context, gender, class, caste, ethnicity, etc. The

person at the lower rung of the social system is likely to use polite language whereas the person from the higher social rank, status or age is likely to use less polite forms of expression.

It is observed that people are acutely aware of the sociolinguistic behavior. They often adjust their language style according to the situation. For instance, Daya Ram, a fourth class servant of the bank says to Babu Nathu Ram:

'Maharaj, I have brought my little nephew for your service' (p.20).

The nature of interpersonal relationship between the speaker and the listener is that of servant-master. The speaker of the above utterance is the 'chaparasi,' the fourth class employee and the listener is the sub-accountant in the Imperial Bank of India. Daya Ram, the speaker of the above utterance wants his nephew to get a job as a servant in the house of Babu Nathu Ram. He is full of servility, becomes humble and begs for his benevolence. It becomes quite clear from the way he uses the honorific term 'maharaj' to get a favour from his master.

The expressions of Prabha Dayal such as 'I join hands my to you' and 'I will fall at your feet' are the typical Indian ways of displaying humility and humbleness. He further says that the woman, Lady Todar Mal is like a mother to them all and they are her children. This can happen in India alone where a woman is considered as the mother to all people. Moreover, the words 'please, forgive, make it amply clear that Seth Prabha Dayal is humble and has an unassuming nature. He is also seen begging for pity and mercy at the feet of Rai Bahadur:

'Forgive us, Rai Sahib, forgive us this once. It will never happen again. You are our father and mother' (p 119).

The above linguistic expression of Prabha Dayal makes it clear that he is modest in his behavior. Rai Sahib is angry for two reasons: one reason is that the smoke emitted from the pickle factory has spoiled his whole estate; the second reason is that the servants of the factory are resentful in giving a jar of rose-leaf jam as a mark of gratefulness. Rai Sahib is not angry with Prabha but he is angry with Ganapat, his partner in the factory. Therefore, being humble and self-effacing he

used the face saving strategy to please Rai Sahib. The above mentioned expression 'You are our father and mother' is typical as far as Indian English is concerned. Here, the expression means that Rai Sahib is their protector and life giver for father gives physical support and mother gives emotional support. When Ganapat leaves Prabha Dayal making him bankrupt, he goes to the police station because his creditors have lodged a complaint against him. Prabha says:

'Forgive me, oh, forgive me. I am only a humble workman, a coolie. I didn't know that Ganpat would go away and leave me like this' (p.129).

The above utterance implies that Prabha is very docile and submissive. He wants Lallaji and the 'Thanedar' to forgive him for he was let down by his partner. He is humble because he is powerless. He did not know then that his friend would go away from him leaving him in huge debts. The circumstances have forced him to become humble. He considers himself a coolie because when he came from the hills, he started working as a coolie in the town of Daulatpur. The addresser is the borrower and the addressee is the lender. Therefore, the relationship between the speaker and the listener of the utterance is the result of social stratification. Here, the relationship between the haves and have-nots is shown by the linguistic experiment made by Mulk Raj Anand. There is a good combination of humbleness and arrogance in the novel under consideration. Let us examine and analyze the speech acts related to arrogance.

Arrogance

Arrogance is influenced by social stratification. In other words, it is the impolite form of linguistic behaviour. It also indicates hierarchical order in the society. The lower the person in social position, the more polite form of expressions he/she uses while interacting with the people in higher social and economic class. The higher the rank and social position the person enjoys, the less polite he/she becomes towards the people from the lower class. Since the novel *Coolie* is based on class distinction, it is imperative that there are bound to be speech acts, which involve arrogance. It is noticed that power and arrogance may

go hand in hand. The more powerful people may become arrogant to less powerful people due to their egoistic nature. The powerless people cannot necessarily become arrogant because they are at the mercy of their superiors. In the novel *Coolie*, we come across certain characters that use the speech acts threatening the face of the listener.

Small children also use arrogant expressions to show that they are superior to those who come from the poor families. Shaila and Kausalya are small children who use arrogant language for showing their contempt for Munoo. Shaila and Kausalya say:

'You are a servant; you must not play with us' (p.46).

Shaila is the daughter of Babu Nathu Ram. Kausalya is their neighbour's daughter. They belong to the middle class family. The girls are class conscious. Provoked by the feeling of superiority, they do not allow Munoo to play with them. The utterance is a face-threatening act aimed at Munoo who is a mere servant in the house and he has no voice of his own. He is made servile and nincompoop by the forces of circumstances. He belongs to the poorest of the poor class. Therefore, he is denied even the right to childhood. He should have been in school but the unfortunate circumstances compel him to toil for toil for getting his daily bread. Apart from arrogance, we discover the curses and blessings in the novel.

● Abuses

The importance of social relationships in determining address forms is, in fact the subject of Sociolinguistics. It is the social fact that abuses are used intentionally. The use of abuses is common to all cultures. For example, Munoo is ill-treated by his uncle. He considers the boy a burden in the family. Therefore, he expects the boy to do some work to support himself. He takes the boy to his master and asks him to pay respect by joining hands. His uncle says:

'Join your hands, pig, and say, "I fall at your feet" (p.23).

Munoo's uncle flings an abuse in the name of pig. The boy is ordered to join hands as the mark of respect. In India, people give respect to the superiors or elderly people by joining their hands. Munoo is asked to

do so by his uncle to get favour of Bibiji, the wife of Babu Nathu Ram. Since Munoo is an adolescent, he submissively obeys his uncle and joins his hands. Let us observe the further example of code switching:

"Spoiler of our salt !' 'You have brought bad luck to our house! Beast! And I have tried hard to correct you' (p.59).

The phrase '*Spoiler of our salt!*' is an example of code switching. The Hindi phrases of abuse '*namak haram*' has been borrowed using English rephrasing. The Hindi abusive term is often used in India to indicate the person who is poor and who works at his master's place betraying his master. Munoo is called a beast because he is poor and miserable. He is harassed due to his low class.

Mulk Raj Anand deliberately makes his characters use abusive language and thus makes a new experiment in the use of language. He uses Typical expressions to show class distinction in Indian society. The abusive expressions in the novel are not only related to class but they are also used in relation to dirty animal's abnormal sexual activities.

Curses and Blessings

Blessings and curses have an important role in linguistic exchanges. In every culture, we come across curses and blessings. The nature of curses and blessings depends on interpersonal relationship and social customs. In India the so-called upper caste people consider that it is their right to curse the lower class/caste people. A Brahmin (a high caste Hindu) curses Munoo, the protagonist of the novel, at one point in the novel. The Brahmin at the shrine of Har Das says to Munoo:

'May the misers fade away' (p154).

Munoo, being thirsty, drinks water without throwing a copper coin at the feet of the holy man. Therefore, the Brahmin gets angry and starts cursing the boy. The Brahmin's utterance has the strong implication. His intention is to show that the Brahmins should be given money. Another intention of the speaker is that the miserly people like Munoo have no right to exist.

The people from the higher economic class curse the people whose

economic status is lower. In the novel *Coolie*, we notice that Lady Todar Mal curses Prabha Dayal in the following way:

'Come vay, open the door! Where have you absconded now? Where are you? May the vessel of your life never float in the sea of existence!' (p.128).

Lady Todar Mal is the wife of Sir Todar Mal who was a public prosecutor in the Angrezi Sarkar. She belongs to the higher economic class.

Code Mixing and Code Switching

Code mixing can occur at three levels- noun, verb, and a clause or the sentence. For example, in the novel *Coolie* Ratan says:

'I will show you a tamasha today' (p.240).

Here, the word '*tamasha*' is a vernacular word and is used as a noun in the English construction. Ratan and Munoo are friends who go together on the outings on Saturdays in Bombay. One Saturday they decide go to the lanes of Bhendi Bazaar where the prostitutes are engaged in the flesh trade. On the way, they happen to sit in a shop where Ratan spoke to Munoo using the word '*tamasha*'. Here, the word '*tamasha*' stands for the gaudily dressed prostitutes who were sitting on the low stools in the windows of the balconies, smiling strange smiles and winking at the male crowd below the street. In fact, the word '*tamasha*' stands for the spectacular sight of the prostitutes.

In one incident, Prabha uses the word '*sarkar*' indicating the exalted status of the person addressed. Prabha says:

'It is the truth Sarkar. It is the truth' (p.132).

The word '*sarkar*' is used for showing the respect to the police. Actually, the meaning of the word '*sarkar*' is government if translated into English but here it indicates exalted social status of the police. It is also an honorific term in the sense that the addressee is a police officer on duty.

Code-switching occurs when there is a switching of the code from one language variety to another language variety. For example, at some

point in the novel, a Sikh peasant says to a Muhammadan peasant on the train:

'Wah Guru! Wah Guru! Strange are the ways of Wah Guru!' (p.78.)

The Sikh peasant did not like the linguistic behavior of the Muhammadan peasant who saw Munoo at Prabha Dayal's feet on the train. He was in consternation because he saw that the condition of the boy was miserable, as he was unable to speak a single word. The Sikh peasant switches the Hindi code to English and again goes back to Hindi. His code switching is the result of his surprise. There is a tone of sarcasm in his expression. He sarcastically uttered the above expression to show indirectly that the Muhammadan peasant was unkind to the boy who was on the verge of dying.

Conclusion

The foregoing discussion reveals that sociolinguistic approach is a vital tool to study the linguistic behavior of the characters. The application of this device helps the reader to interpret the novel in proper perspective. Mulk Raj Anand's sociological novels offer a tremendous scope for discovering the hidden agenda if certain principles of sociolinguistics are taken into account. The analysis of polite use of language, arrogance, abuses, curses and blessings, diminutives and code mixing and code switching firmly establishes the authenticity of interpretation. The novel reading can be interesting if the sociolinguistic approach is applied.

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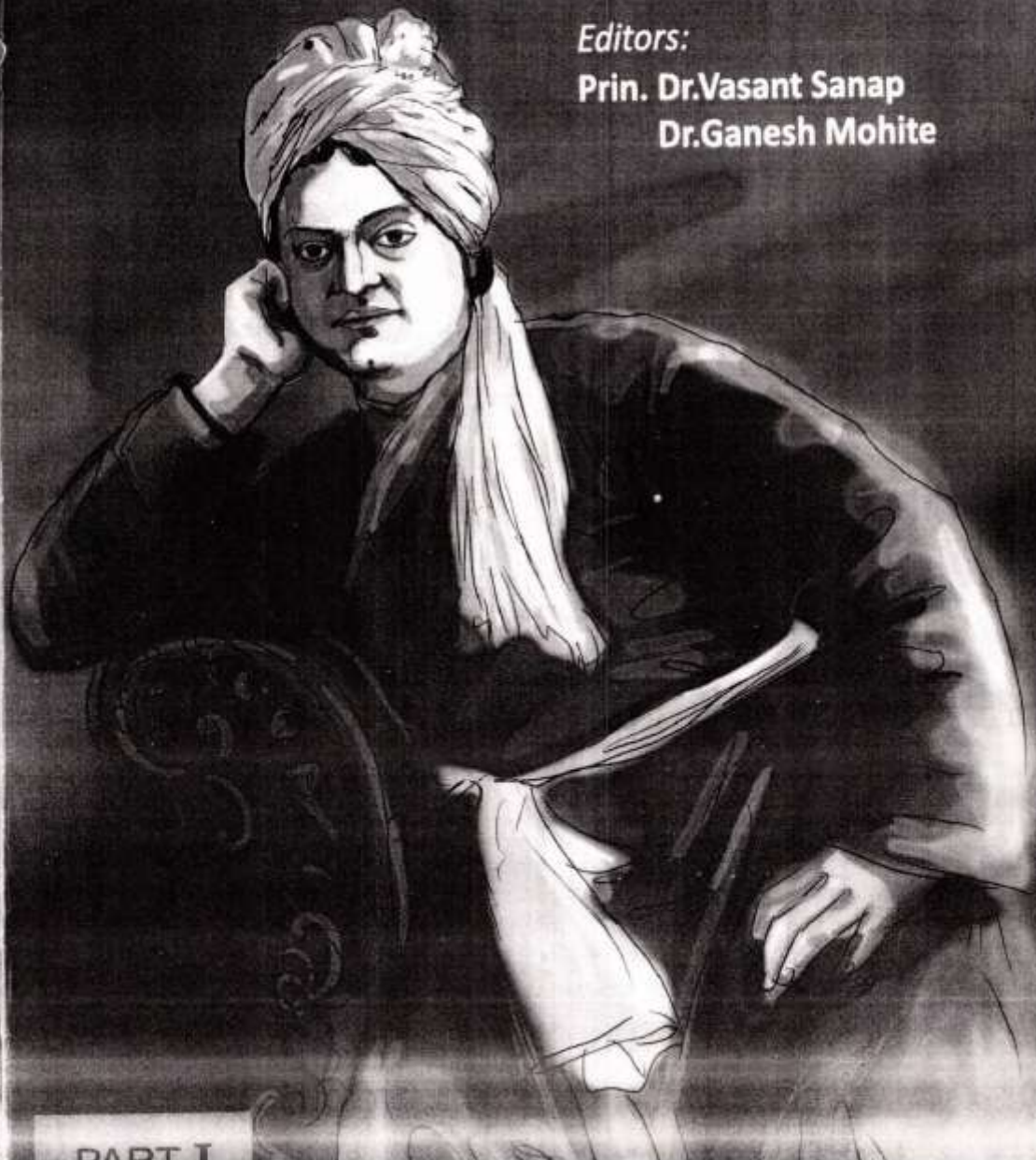
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Thoughts in 21st Century

Editors:

Prin. Dr.Vasant Sanap

Dr.Ganesh Mohite



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Swami Vivekananda's Views on Religion

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"If you want to know India, study Vivekananda, in him everything is positive and nothing negative". -- Rabindranath Tagore.

Introduction: Swami Vivekananda (1863-1902), was a religious leader, great thinker and social reformer of India. He was a religious leader and philosopher. He realized that mankind is passing through a crisis. The moral and religious values were being undermined. He was also a priest-poet and a patriot saint of India. This paper, which purports to expound and analyze Vivekananda's views on religion, is an endeavor and an attempt has been made to focus on his thoughts of religion.

Swami Vivekananda is the very spirit of youth and dream. His exemplary and distinguished life impacted considerably on the entire flow and direction of our cultural formation during a crucial time of our national awakening. Born and raised in an upper class *kayastha* family in Calcutta, Narendranath Dutta as he was then known was a brilliant student. After his *Guru* Sri Ramakrishana's death, Swami Vivekananda founded Ramakrishna Mission to cement the goal of mass awakening.

According to Swamiji, Religion is not attained through the ears, nor through the eyes, nor yet through the brain. No scriptures can make us religious. We may study all the books that are in the world, yet we may not understand a word of religion or of God. We may talk all our lives and yet may not be the better for it; we may be the most intellectual people the world ever saw, and yet we may not come to God at all. Swamiji's view on religion is still applicable in this modern world. These are unique and universal for the human beings.

Is Vedanta The Future Religion? Serve of the philosopher expressed their views on Vedanta. About Vedanta Swami Vivekananda Says, "*Vedanta* is everywhere, only you must become conscious of it. These masses of foolish beliefs and superstitions hinder us in our progress. If we can, let us throw them off and understand that God is spirit to be worshipped in Spirit and in Truth. All the different ideas of God, which are more or less materialistic, must go. As man becomes more and more spiritual he has to throw off all these ideas and leave them

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behind. If *Vedanta*- this conscious knowledge that all is one Spirit-spreads, the whole humanity will become spiritual. But is it possible? I do not know..." These views can bring out the spiritual unity in the universe.

Swamiji strongly attacked Charlton's, cheats and fakes in the religion. In one place he says, "...Gradual or not gradual, easy or not easy for the weak, is not the dualistic method based on falsehood? Are not all the prevalent religious practices often weakening and therefore wrong? They are based on a wrong idea, a wrong view of man. Would two wrongs make one right? Would the lie become truth? World darkness becomes light?"... Harmony of religions, universal solidarity, and human being as the highest manifestation of Spiritual Consciousness are the basic fundamentals which one should not lose sight of in reading or understanding Swami Vivekananda. The practical aspects of these teachings reflect in renunciation and service. This forms the twin ideal where Vivekananda's emphasis for the modern man and woman to strive for. Along with excellence and perfection in every field of human endeavor one should keep these ideals before eyes, lest the person should miss the aim.

Religion brings Harmony in the real world: According to Swami Vivekananda, religion brings harmony in the real world. Religion must be studied on a broader basis than formerly. All narrow, limited, fighting ideas of religion have to go. All sect ideas and tribal or national ideas of religion must be given up. That each tribe or nation should have its own particular God, and think that every other is wrong, is a superstition that should belong the past. All such ideas must be abandoned. As so many rivers, having their source in different mountains, roll down, crooked or straight, and at last come into the ocean. So, all these various creeds and religions, taking their state from different standpoints and running through crooked or straight courses, at last come unto Thee. He says, there never was my religion or yours, my national religion or your national religion; there never existed many religions, there is only the one. One infinite Religion existed all through eternity and will ever exist, and this Religion is expressing itself in various countries, in various ways. By studying the lives of all these great messengers, we find that each, as it were, was destined to play a part, and a part only; that the harmony consists in the sum total, and not in one note. The whole world of religions is only a travelling, a coming up, of different men and women, through various conditions and circumstances, to the same goal. Every religion is only evolving a God out of the material man the same God is the inspirer of all of them. The Christian is not to become a Hindu or a Buddhist, nor a Hindu or a

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Buddhist to become a Christian. But each must assimilate the spirit of the others and yet preserve the individuality and grow according to his own law of growth.

Swami Vivekananda's address at the World's Parliament of Religions: In the World Parliament of Religion, Swami Vivekananda says, "Sisters and Brothers of America, it fills my heart with joy unspeakable to rise in response to the warm and cordial welcome which you have given us. I thank you in the name of the most ancient order of monks in the world. I thank you in the name of the mother of religions, and I thank you in the name of millions and millions of Hindu people of all classes and sects". In World's parliament of religions at Chicago in 1883 brings him international fame. Swamiji quotes from The Gita: "Whosoever comes to me, through whatsoever form, I reach him; all men are struggling through paths which in the end lead to me".

Swamiji very plainly expressed his view of fanaticism. Swami Vivekananda also speaks in very clear terms that sectarianism, bigotry and its horrible descendant fanaticism have long possessed this beautiful earth. They have filled the earth with violence drenched it often and often with human blood, destroyer civilization, and sent whole nations to despair. Had it not been for these horrible demons, human society would be far more advanced than it is now. He hopes that a universal tolerance will come in rescue and universal brotherhood would prevail in earth. In totality, Swami Vivekananda in every of his works speaks of the spiritual uniqueness of India, and the greatness of Hinduism, but he speaks even more forcefully about the current degradation of India, its causes and cure.

Swamiji was a great blessing from God to India. Of the Swamiji's address before the Parliament of Religions, it may be said that when he began to speak it was of "the religious ideas of the Hindus", but when he ended, Hinduism had been created. The moment was ripe with this potentiality. The vast audience that faced him represented exclusively the occidental mind, but included some development of all that in this was most distinctive. Every nation in Europe has poured in its human contribution upon America, and notably upon Chicago, where the Parliament was held. Much of the best, as well as some of the worst, of modern effort and struggle, is at all times to be met with, within the frontiers of that Western Civic Queen, whose feet are upon the shores of Lake Michigan, as she sits and broods, with the light of the North in her eyes. There is very little in the modern consciousness, very little inherited from the past of Europe that does not hold some outpost in the city of Chicago. And while the teeming life and eager interests of that centre may seem to some of us for the present largely - ah, yet they

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are undoubtedly making for the revealing of some noble and slow-wrought ideal of human unity, when the days of their ripening shall be fully accomplished.

Swamiji stated various usefulness and harmfulness of religions in the world parliament of religions held at Chicago. Address at the Final session of the World's Parliament of Religions has become an accomplished fact, and the merciful Father has helped those who labored to bring it into existence, and crowned with success their most unselfish labor. He says, "Much has been said of the common ground of religious unity, anyone hopes that this unity will come by the triumph of any one of the religions and the destruction of the other, to them I say, "Friends, yours is an impossible hope". Do I wish that the Christian would become Hindu? God forbid". Do I wish that the Hindu or Buddhist would become Christian? God forbid. The seed is put in the ground, and earth and air and water are placed around it. Does the seed become the earth, or the air, or the water? No. It becomes a plant, it develops after the law of its own growth assimilates the air, the earth, and the water, converts them into plant substance, and grows into a plant. Similar is the case with religion. The Christian is not to become a Hindu or a Buddhist, nor a Hindu or a Buddhist to become a Christian. But each must assimilate the spirit of the others and yet preserve their individuality and grow according to their own law of growth.

The Ideal of a Universal Religion: Swamiji also expressed his opinion about the idea of a Universal Religion. We see that in every religion there are three parts. In every great and recognized religion, first, there is the philosophy which presents the whole scope of that religion, setting forth its basic principles, the goal and the means of reaching it. The second part is mythology, which is philosophy made concrete. It consists of legends relating to the lives of men, or of supernatural beings, and so forth. It is the abstractions of philosophy concretized in the more or less imaginary lives of men and supernatural beings. The third part is the ritual. Through high philosophy or low, through the most exalted mythology or the grossest, through the most refined ritualism or arrant fetishism, every sect, every soul, every nation, every religion, consciously or unconsciously, is struggling upward, towards God; every vision of truth that man has, is a vision of him and of none else, Suppose we all go with vessels in our hands to fetch water from a lake. One has a cup, another jar, another a bucket, and so forth, and we all fill our vessels. The water in each case naturally takes the form of the vessel carried by each of us. He who brought the cup has the water in the form of a cup; he who brought the jar- his water is in the shape of a jar, and so forth, but in every case, water, and nothing but water, is in

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the vessel. So it is in the case of religion; our minds are like these vessels, and each one of us is trying to arrive at the realization of God. God is like that water filling these different vessels, and in each vessel the vision of God comes in the form of the vessel, Yet He is one. He is God in every case. This is the only recognition of universality that we can get.

According to Swamiji 'a religion, to satisfy the largest proportion of mankind, must be able to supply food for all these various types of minds; and where this capability is wanting, the existing sects all become one sided, suppose you go to a sect who preaches love and emotion. They sing and weep, and preach love. For religion must be able to show how to realize the philosophy that teaches us that this world is one, that there is but one Existence in the universe'.

Of Religion, Vivekananda said: 'To be good and to do well unto others- that is the essence of Religion'. According to Swami Vivekananda, religion is the idea which raises the brute to man, and man unto God. He preached that Truth is the basis of all religions and hence we must always practice tolerance towards other religions- be it Hinduism, Buddhism Christianity, Islam or other Religion.

Conclusion: Thus, harmony of religions, universal solidarity, and human being as the highest manifestation of Spiritual Consciousness are the basic fundamentals which one should not lose sight of in reading or understanding Swami Vivekananda. No longer will religion remain a bundle of ideas or theories, nor an intellectual assent; it will enter into our very self. By means of intellectual assent we may today subscribe to many foolish things, and change our minds altogether tomorrow. But true religion never changes; Religion is realization; not talk nor doctrine, nor theories, however beautiful they may be. It is being and becoming, not hearing or acknowledging; it is the whole soul becoming changed in to what it believes. That is religion.

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Dr. Vasant Sanap
Mr. Shailesh Akulwar

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14.

Relevance of Gandhian Thoughts on Women in Modern Perspectives

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"To call woman the weaker sex is a libel; it is man's injustice to woman. If by strength is meant moral power, then woman is immeasurably man's superior".--M.K.Gandhi.

M. K. Gandhi popularly revered as Mahatma Gandhi was not only one of the greatest leaders of Indian Nationalism but a major social and political reformer, who played a significant role in purging the Indian society of its inherent evils. In this regard, he assumed a pioneering role in attempting to eradicate the social wrongs committed against the women of the country through ages. Gandhi's political ideologies, strongly anchored in humanitarian values, were a reflection of his spiritual self. As a great humanist, Gandhi put forth before the world from-to-time his views on almost all subjects related to life. He discussed at length all walks of life –importance, impact and related problems thereof in particular. How was it then possible that he could remain indifferent to the role, significance and contribution of women to the society, nation and humanity as a whole? Rather, he had sanguine thoughts about them. His views pertaining to women were unique. They are still matchless and worth considering in current perspective. How? Before taking this in course of discussion and analysis, it is necessary be familiarity with extracts of some of the statements and articles Mahatma Gandhi penned on women.

Status of Women in Pre Independence India: To understand in depth the role that Gandhiji played in improving the position of women in society, it is essential to look at women's status, prevalent at that time. When Gandhiji emerged on to the political scenario, social evils like child marriage and dowry system were rampant. Indian women had an average life span of only twenty seven years. Death of women in labor was a common phenomenon. The percentage of women with basic education was as low as two percent. The patriarchal nature of the society confined women to the status of an inferior sex subordinate to their male counterparts.

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The Concept of Equality of sex: To Gandhi, social emancipation was as critical as political emancipation. Gandhi throughout his life waged a crusade for the upliftment of the socially downtrodden, making significant contributions for the enhancement of the status of women in India. Women under his aegis took a milestone step towards reestablishing their identity in the society. Gandhi's inspiring ideologies boosted their morale and helped them to rediscover their self esteem. Not only there was a general awakening among the women, but under Gandhi's leadership, they entered into the national mainstream, taking parts in the National Movements.

Gandhi's reformist spirit seasoned the role that he played in uplifting the status of women in India. Women must not suffer any legal disability which is not suffered by men. Both are perfectly equal. Sexual equality does not translate into occupational equality in spite of the absence of a legal bar. Women instinctively recoil from a function that belongs to men. Nature has created sexes as complements of each other. Their functions are defined as are their forms. What belongs to men and what belongs to women is deeply embedded in the psyche of men and women. The question is therefore who should complement whom. It should be matter of choice both for the man and the woman as husband and wife as to what vocation they should take up. It is unjust to expect the women to complement as a matter of an unwritten rule. To say that their functions are defined as are their forms is to emphasize on the sexual division of labor. The theory of sexual division of labor has been set aside by the developments since the departure of the Mahatma.

Today men and women, compete and co-operate, complement and even supplant each other. However, the Mahatma's view on women being a complement of man should be looked at from the point of view of his intention. Today few women take part in politics and most of these do not do independent thinking. They are content to carry out their parents' or their husbands' behests. Realizing their dependence, they cry out for women's rights. Instead of doing this, however, women worker should enroll women as voters, impart or have import or have imparted to them practical education, teach them to think independently, release them from the chains of caste that bind them, so as to bring about a change in them which will compel men to realize woman's strength and capacity for sacrifice and give her places of honour. Likewise, declaring a woman the shaper and the modular of society and the nation in the same measure as the man. Gandhiji wrote, "Man and woman are of equal rank...they are a peerless pair being supplementary to one-another: each helps the other, so that

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without one the existence of the other cannot be conceived, and therefore it follows as a necessary corollary from these facts that anything that will impair the status of either of them will involve the equal ruin of them both." That is why; while discussing the issues pertaining to rights of women, he firmly stated, "I am uncompromising in the matter of women's rights....treat the daughters and sons on a footing of perfect equality

Gandhiji's views on Women Education: Education enables women to uphold their natural rights. Men and women are complementary to each other. Man is supreme in the outward activities and therefore he should have a greater knowledge thereof. Home life is entirely the sphere of woman and therefore in domestic affairs, in the upbringing and education of children women ought to have more knowledge. Unless courses of instruction are based on a discriminating appreciation of these basic principles, the fullest life of man and woman cannot be developed. The Mahatma's views on women's education are based on family ideals because he assumes that man is supreme in the extra-mural activities and that woman is supreme in intra-mural activities. Hence, education imparted to both men and women should be according to their pre-ordained stations in life. The Mahatma's views on women's education are based on his belief in woman being a complement of man and are therefore out of sync in the modern context.

Gandhiji's Opinions about Marriage, Remarriage and Divorce: Marriage is a sacrament, and a natural thing in life. Thinking of the state of affairs in our country, very few Indians need marry at the present time. The purpose of marriage is to get progeny but all progeny that is born now is the issue of passion, mean and faithless. Gandhi advised young men not to marry till 25 or 30. He preferred arranged marriages but the young man needs to be consulted by the parents if he is more than 25. Marriage has become a contract between consenting individuals. It is an artificial fact of life. His views on the age at marriage for young men are however relevant to this day. His view that marriages should be arranged by parents and that a young man of more than 25 should be consulted by the parents reflects upon the fact that the Mahatma had a traditional view of life and that he wanted reforms within the tradition. Widowhood imposed by religion or custom is an unbearable yoke and defiles the home by secret vice and degrades religion. In order to save Hinduism, enforced widowhood must be ridden. Child widows must be duly and well married and not remarried. They were never really married. One cannot have a better view on Widow Remarriage than what the Mahatma has presented. He was

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clearly against Child Marriages and wanted child widows to be well married because they were not really married. Marriage confers no right upon one partner to demand obedience of the other. The Mahatma believed that marriage was not serfdom for men and women and that men and women had equal status. The loss of discipline is a moral breach and divorce is not a solution. Moral breach can be corrected by moral restraint and repentance. More importantly, he says that Hinduism offers the freedom of self-realization for both men and women. The Mahatma is clearly against any kind of male chauvinism.

Gandhi's Voice against the Social Evils: According to the Mahatma, social reforms were essential for the restructuring of the societal values that had so far dominated the perception of Indian women. Although, he had great reverence for the traditions of the country, he also realized that certain customs and traditions of the Indian society were antithetical to the spirit of development of the women of the nation. To quote Gandhi, "It is good to swim in the waters of tradition, but to sink in them is suicide". The custom of child marriage became a target of his criticisms. In his opinion, child marriage is a source of physical degeneration as much as a moral evil. The system of dowry could not pass unnoticed from his critical eyes. He defined dowry marriages as 'heartless'. He opined that girls should never marry men who demand dowry, at the cost of their self respect and dignity. As Gandhi believed that the basis of marriage is mutual love and respect, he urged people to solemnize inter communal marriages between the Harijans and caste Hindus.

Gandhi was extremely perturbed by the plight of the widows, particularly child widows. He put forth an earnest appeal to the young generation of the country to marry the widows. He was also quite hopeful about the immense potentials of the widows in furthering national issues. The system of *purdah* also came under Gandhi's attacks and he questioned the very foundation of this practice. For him, the *purdah* system was no less than a "vicious, brutal and barbarous" practice. The predicaments of the *devadasis*, a part of the lower, untouchable segment of the society, had an indelible effect on the sensitive mind of the Mahatma.

Gandhi's Perception of Women: There was a marked departure of Gandhi's perception of women from that of other reformers. The stance taken by other social reformers and leaders, prior to Gandhi created a helpless image of the Indian women. With the emergence of Gandhi, a new conception of women gradually gained currency. For Gandhi, women were not mere toys in the hands of men, neither their competitors. Men and women are essentially endowed with the same

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spirit and therefore have similar problems. Women are at par with men, one complementing the other. According to Gandhi, education for women was the need of the time that would ensure their moral development and make them capable of occupying the same platform as that of men. In Gandhi's views, women can never be considered to be the weaker sex. In fact, women for Gandhi were embodiments of virtues like knowledge, humility, tolerance, sacrifice and faith. These qualities were essential prerequisites for imbibing the virtue of *satyagraha*. The capability of enduring endless suffering can be witnessed only in the women, according to the Mahatma. The doctrine of *ahimsa* as preached by Gandhi incorporates the virtue of suffering as is evident in the women. Therefore, Gandhi envisaged a critical role for women in establishing non-violence. Gandhi invoked the instances of ancient role models who were epitomes of Indian womanhood, like Draupadi, Savitri, Sita and Damayanti, to show that Indian women could never be feeble. Women have equal mental abilities as that of men and an equal right to freedom. To sum up in Gandhi's words; "The wife is not the husband's slave but his companion and his help-mate and an equal partner in all his joys and sorrows - as free as the husband to choose her own path."

Role of Women as Envisaged by Gandhi : According to Gandhi, the role of women in the political, economic and social emancipation of the country was of overriding importance. Gandhi had immense faith in the capability of women to carry on a non violent crusade. Under his guidance and leadership, women shouldered critical responsibilities in India's struggle for freedom. It can be said without an iota of doubt that Mahatma Gandhi was indeed one of the greatest advocates of women's liberty and all throughout his life toiled relentlessly to improve the status of women in his country. His faith in their immense capabilities found expression in his decisions to bestow leadership to them in various nationalistic endeavors.

Conclusion: On a scale of one to ten, the Mahatma comes out with flying colors for his views on the various aspects concerning women in our society. Considering the fact that he wrote his ideas about 70 to 80 years ago, we can set aside some of his views such as the women being a complement of men in matters of occupation and education and female chastity in the context of women's honor. The Mahatma, by far, can be considered the best friend of women in India and the world. The Mahatma's purity of thought and honest intentions are beyond question. No other man in the entire history of India or in the world had such godly ideas about women.

Relevance of Gandhian Thoughts

In the context of women –their condition, particularly arising from centuries of inequality and injustice, lack of responsibility of men towards daughters, mothers and sisters is to blame. Man has exploited woman in numerous ways, and he is still doing it as Mahatma Gandhi himself admits, “Women has been suppressed under custom and law for which man was responsible and in the shaping of which she had no hand.” The Mahatma went on to add that, “They can never be imposed from outside. Men have not realized this truth in its fullness in their behaviour towards women. They have considered themselves to be lords and masters of women instead of considering them as their friends and co-workers. Hence, the clarity we find in the Gandhian view pertaining to youth and women seems unique and such a thing is not often found in ideas, addresses and writings of thinkers. Mahatma Gandhi himself was matchless in this regards. For his clarity of reality-based thoughts he still rules the roost. Apart from this, the manner in which he prepared ground for active participation of youth and women in national liberation movement of India and simultaneously engaged them in constructive work for enhancement of their own self-sufficiency, was astonishing, and remains unparalleled till today.

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3. Study of Photovoltaic Characteristics of Indium Sulfide Thin Films Useful for Solar Cell Applications

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Abstract

Deposition of In_2S_3 was carried out in acidic bath. With the same depositing parameter In_2S_3 film is used for fabrication of solar cell. The compact layer of Titania (TiO_2) nanostructured films was made available for the fabrication of SSSC. TiO_2 deposited by doctor blade method on FTO substrate which is acts as photo anode. The surface area of TiO_2 was kept 0.25 cm^2 . In_2S_3 was deposited on FTO / TiO_2 by chemical bath deposition method at room temperature in acidic bath. Without any further treatment prepared films were further used for the synthesis of photo electrode of SSSCs. efficiency of fabricated solar cell in acidic bath is 0.034% .

Keywords: Indium sulfide, Thin film, CBD, Photovoltaic characteristics,

1. Introduction

Photovoltaic cell is most useful approach to generate an electrical power from solar radiation. Third generation solar cell specially designed to provide low cost, simple fabrication technology and to overcome the SQ limit photo conversion efficiency [1]. In organic heterojunction solar cell charge separation occurs at the junction and maximum efficiency is around 7% but it has vast potential [2-4]. However because of being eco-friendly and effective technology for solar energy conversion DSSC received great attention [5-8]. The use of semiconductor materials in solar cells as sensitizers was started from 1990's [9-12]. Because of high cost and low stability of DSSC, narrow band gap semiconductor sensitized solar cells are the best alternatives to enhance the conversion efficiency [13]. SSSC achieve higher conversion efficiency due to multiple electron-hole pair generation [14]. Hence sensitized semiconductor has been regard as superb alternative to replace DSCs.

It is reported that $\text{TiO}_2/\text{In}_2\text{S}_3$ fabricated solar cell shows quite low energy conversion efficiency which less than 1%. [15]. In_2S_3 sensitized solar cell were prepared by chemical bath deposition method achieved efficiency as shown in table [16].

Table .1: Photovoltaic performance parameter of In_2S_3 sensitized TiO_2 solar cell .

Photoanode	V_{oc} (mV)	J_{sc} (mA/cm^2)	FF %	Efficiency (%)
$\text{TiO}_2/\text{In}_2\text{S}_3$	504	0.42	11	0.02
$\text{TiO}_2/\text{In}_2\text{S}_3$ (annealed)	362	0.52	39	0.07
$\text{TiO}_2/\text{In}_2\text{S}_3/\text{Y}_2\text{O}_3$	524	0.92	65	0.32
$\text{TiO}_2/\text{In}_2\text{S}_3$ (annealed)/ Y_2O_3	557	0.75	66	0.27

2. Experimental Work

2.1 Material and Method

All chemicals used in this work were commercially available, and used without further purification. These chemicals are indium sulphate, 80 % hydrazine hydrate, thioacetamide, and triethanolamine. Films deposited on glass substrate and ITO coated glass substrates which are available in the market . This work, focus on the chemically synthesis of indium sulfide thin films deposit by chemical bath deposition (CBD) techniques.

2.2. Procedure

2.2.1 Synthesis of In_2S_3 Film

Deposition of InS was carried out in acidic bath. The solution was prepared in 25 ml beaker by sequential addition of 5 ml of 0.1 M indium sulphate and 0.1 ml of 0.15 M triethanolamine. The solution was stirred well. Then under the continuous stirring 0.2 ml of 80% hydrazine hydrate was added and 5 ml of 0.1 M thioacetamide solution was mixed to the bath. Acetic acid was added drop wise to the bath so that the initial pH of the solution was about 4. Clean glass substrates and ITO coated glass substrates were placed vertically in reactive solution separately. Without any further treatment prepared films were further used for the synthesis of photoelectrode of SSSCs

2.1.2 Synthesis of $\text{TiO}_2/\text{In}_2\text{S}_3$ Semiconductor Sensitized Solar Cell

The compact layer of Titania (TiO_2) nanostructured films was made available for the fabrication of SSSC. TiO_2 deposited by doctor blade (DB) method on FTO substrate which is acts as photoanode [17]. The surface area of TiO_2 was kept 0.25 cm^2 . In_2S_3 was deposited on FTO / TiO_2 by chemical bath deposition method at room temperature in acidic bath

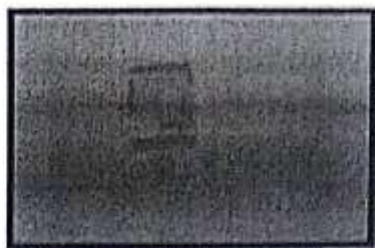


Fig. 1: Actual photographs of In_2S_3 films deposited on TiO_2 by CBD method in acidic bath on FTO-coated glass substrates.

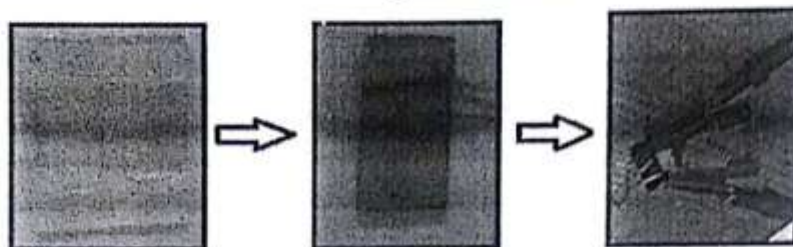


Fig.2: Actual photographs of depositing In_2S_3 on TiO_2 in acidic bath on FTO-coated glass substrates and fabricating it for SSSC.

3. Results and Discussion

Figure 3 shows the EDX spectrum of In_2S_3 films synthesized on to glass substrate by CBD in alkaline bath. The average elemental atomic percentage ratio of In: S was about 36:63 which shows good agreements for chemical stoichiometric of the In_2S_3 thin film, which conforms the deposition of indium sulphide.

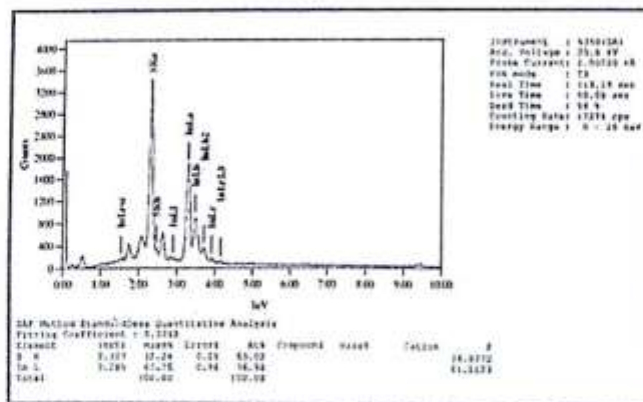


Fig 3. Typical EDS spectra of In_2S_3 film deposited on glass substrate

Photo-Current Density- Photo Voltage (J-V) Characteristic

The active surface area of each device was maintained about 0.25cm². Cell voltage corresponds to the difference between redox potential of the electrolyte and conduction band energy level of the semiconductor [18]. Voltage and current measurements were done by using Keithly-2602 source meter.

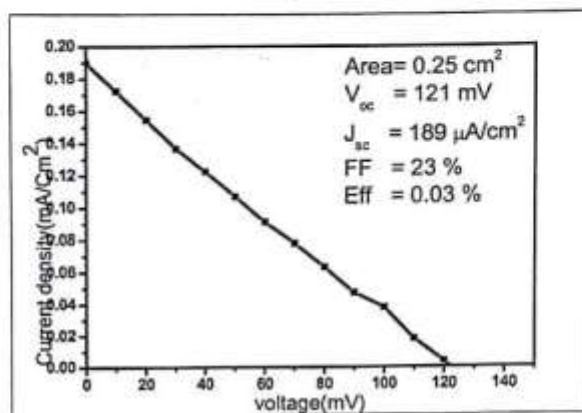


Fig.4.: Photo-current density- photo voltage (J-V) characteristics of SSSC based on FTO TiO₂ / In₂S₃/ Pt.

Fig.4 shows the J-V curves measured for In₂S₃ sensitized TiO₂ photoelectrode. All the output parameters namely, open-circuit voltage (V_{oc}) short circuit current densities (J_{sc}), fill factor (FF) and photovoltaic efficiency (η) are given in the table 5.2. It is observed that the J_{sc} and conversion efficiency is 0.034% for In₂S₃ sensitized TiO₂ photoelectrode.

Table 2: Photovoltaic parameters of TiO₂/ In₂S₃ based SSSC for the films deposited on FTO coated glass substrates.

Sample	Area (cm ²)	V _{oc} (mV)	J _{sc} (mA/cm ²)	FF (%)	Efficiency (%)
TiO ₂ /In ₂ S ₃ /Acidic	0.25	121	0.189	23	0.034

Among this the best performance with J_{sc} = 0.189 mA and V_{oc} = 0.121 is observed for the film deposited in acidic bath with In₂S₃ sensitization. It is reported that the change in V_{oc} may be the influenced by the negative band edge movement of the FTO layer and electron recombination Occurred by the passivation of sub-band-edge surface states [19,20].

Conclusions

The In_2S_3 sensitized thin films were successfully synthesized deposited by chemical method in acidic and alkaline bath In_2S_3 deposited by CBD for SSSC over TiO_2 surface. The SSSC fabricated with the In_2S_3 films deposited on TiO_2 by CBD method at room temperature in acidic bath on FTO-coated glass substrates. Because of efficient charge transport and reduced the recombination losses SSSCs shows good performance with efficiency 0.034 % which is close to the best reported.

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2-MORPHOLINOETHANESULFONIC ACID CATALYZED ONE POT SYNTHESIS OF ISOINDOLO [2,1-a]QUINAZOLINE AT ROOM TEMPERATURE UNDER ULTRASONICATION

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Keywords: 2-morpholinoethanesulfonic acid, ultrasound, multi-component reactions, 2-carboxybenzaldehyde, isatoic anhydride, aromatic amines, benzylamine.

An efficient and greener one pot method has been developed for the synthesis of isoindolo[2,1-a]quinazolines using 2-morpholinoethane sulfonic acid as a water soluble green catalyst at ambient temperature and excellent yield of product. The synergetic effect of 2-morpholinoethane sulfonic acid and ultrasound irradiation process has been also discussed.

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Introduction

Construction of complex molecules through multicomponent reactions (MCRs) under ultrasonication constitutes a very attractive strategy in organic synthesis. Sonochemistry is widely used in organic chemistry, offering a versatile and facile pathway for a large variety of syntheses. Ultrasound is the part of the sonic spectrum, which ranges about 20 to 100 MHz and can be roughly subdivided in three main regions: low frequency high power ultrasound (20–100 kHz), high frequency medium power ultrasound (100 kHz–1 MHz), and high frequency low power ultrasound (1–10 MHz). Sonochemistry involves the use of ultrasound technique to promote the chemical reactions.¹ Ultrasonic irradiation has been introduced as an eco-environmental technology in green chemistry.² Ultrasonic energy provides an unusual mechanism to generate high-energy chemistry owing to the extraordinary temperature and pressure generated by the cavitations bubble collapse.³

Some compounds synthesized by using ultrasonication are pyrimidine,⁴ 5-(pyrazol-4-yl)-4,5-dihydropyrazoles,⁵ benzimidazoles, benzoxazoles and benzothiazoles,⁶ amine-*N*-Oxides,⁷ polyhydroquinolines⁸ and Schiff's bases.⁹ In MCRs three or more reactants are involved in a cascade of bond-forming individual steps to provide a complex molecule without isolation of intermediates or modification of the reaction conditions. Attractive features of MCRs are simplicity of operation, reduction in isolation and purification steps, and minimization of costs, time, energy, solvents, and waste production. 2-Morpholinoethanesulfonic acid (2-MESA) mediated reactions at room temperature in ultrasonication have been explored as a green approach for this purpose.

The quinazolinone moiety is a building block for approximately 150–200 natural important sub-structure of various biologically active natural products such as himamycin C, and himamycin D,¹⁰ potent inhibitors of TNF- α ,¹¹ antifungal,¹² anti-tumour activity,^{13,14} antibacterial,¹⁵ anti-inflammatory,^{16,17} anticonvulsant,¹⁸ analgesic¹⁹ and antitubercular.²⁰ Drugs containing quinazolinone moiety showed significant therapeutic efficiency against solid tumors,²¹ antimalarial,²² antiviral,²³ antimicrobial activities,^{24,25} ovarian cancer cell lines and are also EP4 receptor agonists in the treatment of pain,²⁶ anticancer,²⁷ cytotoxicity and anti-HIV.²⁸

The title synthesis has been carried out under different reactions conditions viz., without catalyst and solvent²⁹ and catalyzed by Pt-multi-walled carbon nanotubes (Pt-MWCNTs),³⁰ *Saccharomyces cerevisiae*,³¹ montmorillonite K10 and (+)-camphor-10-sulfonic acid (CSA)¹¹ and DEAD³², etc. A comparison of the yields is given in Table 1.

Experimental

General procedure for synthesis of 6-phenyl-6,6a-dihydroisoindolo[2,1-a]quinazoline-5,11-dione (1)

To a mixture of isatoic anhydride (1 mmol), 2-formylbenzoic acid (1.1 mmol) and aniline (1.2 mmol) in ethanol (2.0 mL), 2-MESA (15 mol %) was added. The reaction vessel was irradiated in sonication bath for a period ranging from 1.8 to 2.8 h. The progress of reaction was monitored by TLC. After completion of reaction, the mixture was cooled to room temperature the reaction mixture was poured onto ice cold water and the crude product was recrystallized from ethanol. Some derivatives were purified by column chromatography technique. The general reaction is depicted in Scheme 1.

Structures of the synthesized products were confirmed by comparison of their melting points with authentic values reported in literature and spectral data like ¹H NMR, IR, and LRMS.

Table 1. Comparison of catalyst and solvent on yields under different reaction conditions.

S. No.	Catalysts	Time	Yield (%)	Temp. (°C)	Solvent	Ref.
1	Pt-MWCNTs	15	95	600	EtOH	30
2	S. cerevisiae	2 h	84	RT	THF	31
3	CSA	6 min	72	80–850	EtOH	11
4	DEAD	10–12 h	40	RT	EtOH	32
5	No catalyst	3 h	80	1500	-	29
6	2-MESA	2h	90–98	RT	EtOH	Present work

Spectral data of representative compounds**6,6a-Dihydro-6-m-tolylisoindolo[2,1-a]quinazoline-5,11-dione**

This compound is a white solid, yield 95 %. M.p. 162–163 °C. IR (KBr) 3028, 2926, 1662, 1584, 1489, 1332, 1138 cm^{-1} . ^1H NMR 1.63 (s, 3H), 7.37–7.41 (t, 1H), 7.48–7.52 (t, 3H), 7.65–7.67 (d, 3H), 7.75–7.88 (m, 4H), 8.30 (s, 1H), 8.51–8.53 (d, 1H). LRMS m/z 333 (M) $^+$.

6-(2,4-Dichlorophenyl)-6,6a-dihydroisoindolo[2,1-a]quinazoline-5,11-dione

This compound is a white solid, yield 75 %. M.p. 223–225 °C. IR (KBr) 3052, 1661, 1585, 1489, 1327, 1135, 734 cm^{-1} . ^1H NMR 7.38–7.52 (m, 4H), 7.65–7.88 (m, 6H), 8.30 (s, 1H), 8.51–8.53 (d, 1H). LRMS m/z 413, 416(M) $^+$.

6,6a-Dihydro-6-phenylisoindolo[2,1-a]quinazoline-5,11-dione

This compound is a white solid, yield 78 %. M.p. 184–185 °C. IR (KBr) 3038, 2926, 1660, 1592, 1489, 1332, 1137 cm^{-1} . ^1H NMR 7.38–7.41 (t, 1H), 7.49–7.52 (m, 3H), 7.66–7.67 (m, 3H), 7.75–7.86 (m, 5H), 8.30 (s, 1H), 8.51–8.52 (d, 1H), . LRMS m/z 351(M) $^+$.

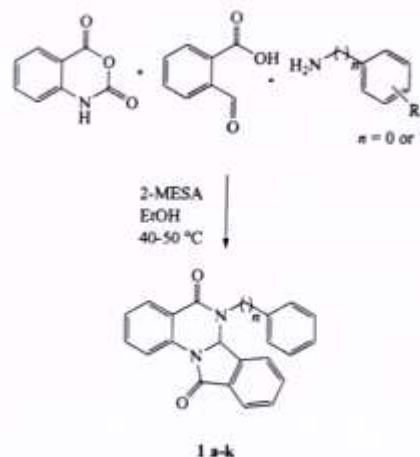
6-(4-chlorophenyl)-6,6a-dihydroisoindolo[2,1-a]quinazoline-5,11-dione

This compound is a white solid, yield 85 %. M.p. 207–209 °C. IR (KBr) 3063, 2924, 1662, 1584, 1489, 1332, 1138, 767 cm^{-1} . ^1H NMR 7.24–7.44 (m, 1H), 7.51–7.55 (m, 3H), 7.67–7.70 (m, 3H), 7.82–7.84 (m, 1H), 7.87–7.90 (m, 3H), 8.33 (s, 1H), 8.53–8.55 (d, 1H). LRMS m/z 385,386 (M+Na) $^+$.

Result and Discussion

In search of the best experimental reaction conditions, the reaction of isoic anhydride, 2-formylbenzoic acid and aromatic amines or benzylamine in the presence of 2-MESA as a catalyst in ethanol was considered as a standard model reaction (Scheme 1). To evaluate the exact concentration of 2-MESA required for the reaction, we investigated the model reaction of aniline using different concentrations. The result revealed (Table 2) that when the reaction was carried out in the absence of catalyst, the product formed in a very trace amount (entry 1).

When the reaction was carried out in presence of 2, 5 and 8 mol % of catalyst, yields were lower even after prolonged duration. The reaction in the presence of 10, 12 and 15 mol % of catalyst gave excellent yields in shorter time. The optimal results were obtained with 15 mol % of catalyst and this concentration was ideal of carry out reaction smoothly (entry 7).

**Scheme 1.** Synthesis of title compounds.**Table 2.** Effect of concentration of catalyst.

S. No.	2-MESA, mol %	Time, h	Yield, %
1	0	8	10
2	2	8	40
3	5	6	50
4	8	2	60
5	10	2	80
6	12	1.5	85
7	15	1	90
8	20	1	90

In order to evaluate the effect of solvent, reactions were carried out in various solvents. Dichloromethane, acetonitrile, THF and DMSO afforded moderate yield 50, 65, 55 and 40 %, respectively. Methanol and DMF resulted in good yields of 80 and 70 %, respectively. However, ethanol furnished the product in 90 % yield making it the most suitable solvent. To investigate the role of substituents on

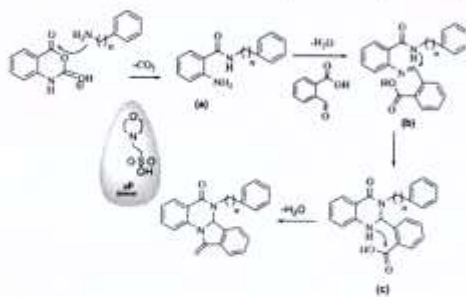
aniline on the reaction ($n=0$, Scheme 1) differently substituted anilines were treated with 2-formylbenzoic acid, isoatoic anhydride in presence of 2-MESA using ethanol as a solvent to get desired product. The results found for benzylamine (entry h, $n=1$) is also mentioned in the Table 3. It was noticed that all the substrates are well tolerated under optimized conditions furnishing the product in good to excellent yields. The results are summarized in Table 3. Formation of the desired product was confirmed by comparing their physical constant, IR, ^1H NMR and mass spectroscopic data with reported compounds.

Table 3. Synthesis of isoindolo[2,1-a]quinazolines derivatives

Entr y	Amine moiety	Time, h	Yield, %	M.p. °C
a	3-Methylaniline	2	95	162-163
b	2,4-Dichloro-aniline	2.2	75	223-225
c	Aniline	2.8	78	184-185
d	4-Chloroaniline	2.4	85	207-209
e	4-Bromoaniline	2.2	82	111-112
f	4-Acetylaniline	2.6	77	158-161
g	3-Nitroaniline	2.8	83	235-237
h	Benzylamine	2	88	149-150
i	4-Methylaniline	2	82	195-196
j	4-Cyanoaniline	1.8	90	202-203
k	4-Hydroxyaniline	1.9	88	215-217

Reaction Mechanism

The nucleophilic attack of the aromatic amine on isoatoic anhydride gives an intermediate (a), the amino group of intermediate (a) attack on 2-formylbenzoic acid gives another intermediate (b), which on cyclization is converted to another intermediate (c). Finally intermediate (c) on dehydration gives isoindolo [2,1-a]quinazoline (Scheme 2).



Scheme 2. A probable mechanism of the synthesis.

Conclusion

Here we have demonstrated the use of 2-MESA as greener catalyst to accelerate the synthesis of isoindolo [2,1-a] quinazoline derivatives in ethanol. The role of ultrasonication in the use of greener organic acid catalyzed

reaction has been highlighted. The methodology may prove useful for this transformation is high yield at room temperature under mild reaction conditions with fast, and easy isolation of the product under ultrasonic irradiation.

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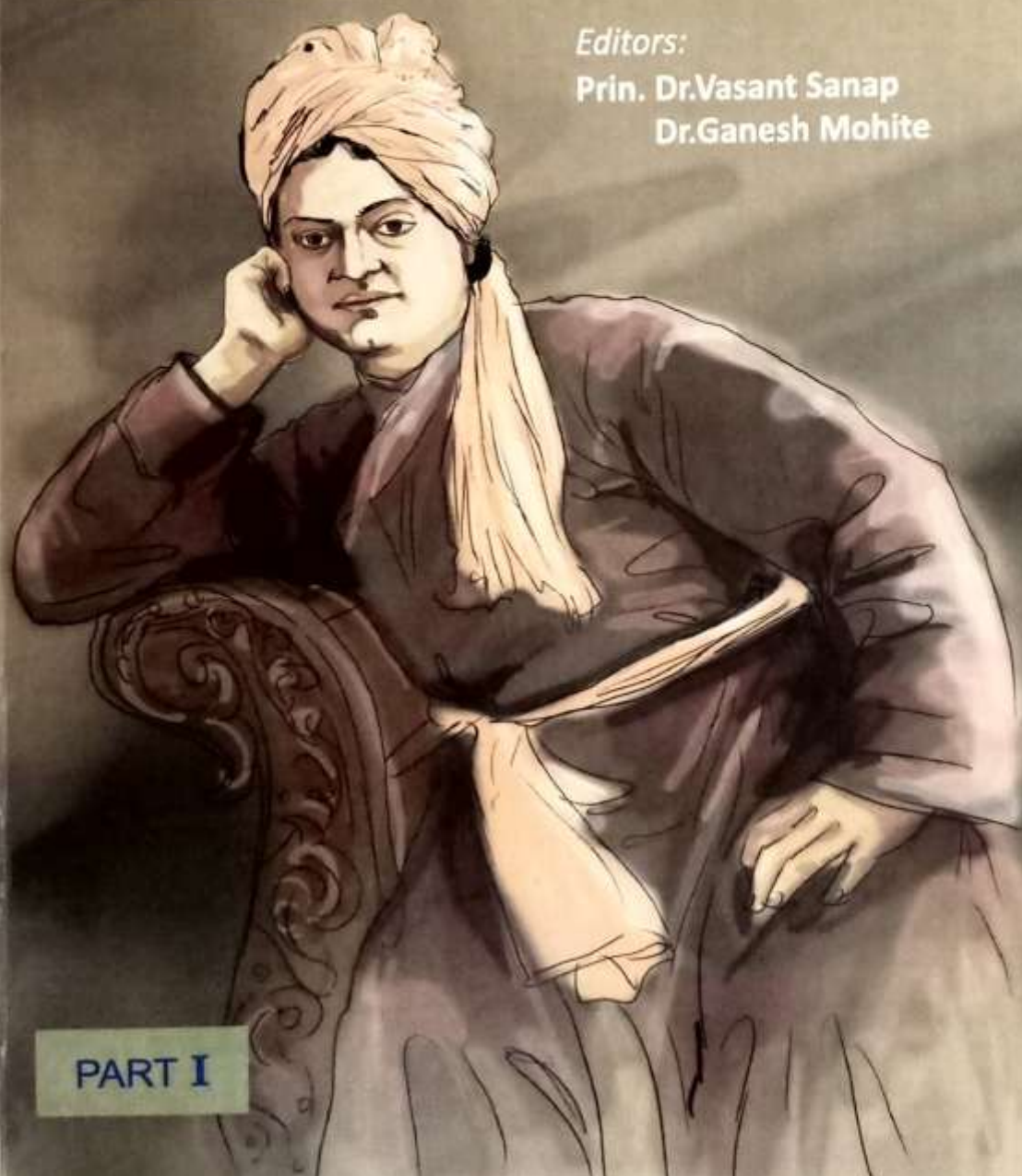
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Relevance of
Swami Vivekananda's
Thoughts in 21st Century

Editors:

Prin. Dr.Vasant Sanap

Dr.Ganesh Mohite



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Swami Vivekananda and Modern Science

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"Religion as a science, as a study, is the greatest and healthiest exercise that the human mind can have". --Swami Vivekananda

Introduction: Swami Vivekananda was a great scientific Visionary of all times. He strongly believed that the scientific attitude is a key to the pursuit of truth. He said, "Do not believe a thing because you read it in a book! Do not believe a thing because another has said it so! Find out the truth for yourself! That is realization!" He sowed the seeds of Vedanta in the West and scientific growth in India. He considered the synthesis of east and west as the best model for mankind and for excellence. He was one of the first among *Dharmic* teachers to understand the importance of Science and technology. In the first place, Swamiji saw that poor countries like India would be able to overcome poverty and backwardness only by mastering technology. Swami Vivekananda gave reorientation to the modern science the first spiritual scientist to elucidate the relevance of vedantic principles problems of science at fundamental level his prescience has been vindicated with the scientific developments taken place the last 125 years his concepts on consciousness and manifestation are at the converging point. Before we understand Swamiji's view on Physics, it is very important to understand the difference between classical science and intuitive science.

The Scientific Religion: In 1895, Swami Vivekananda entered London and said by the very nature of the discovery of modern science; science will come at the feet of Vedanta. What is Science? It is discovery of truths. It is also some universal truths, some truth which are universally applicable to all. He says, "I may like or may not like the law of Gravitation, yet it is correct. If I don't believe in law of gravitation nothing happens to Newton. I walk from the tenth floor or my house and I become evening news". Science discovers eternal truths. None violates the truth. Truth is eternal. You cannot change to law of Gravitation. You cannot change Newton's third law of motion. You cannot change relativity because it exists. Why do you go to sadhus? What is the need of monks? Science deals with matter isn't it

so? After the discovery of Darwin in last century where he showed men and women came not from Adam and Eve but from monkeys, the whole theological foundation of Christianity was eroded. Bible was supposed to be standing on some lies, wrong statement. The theological foundation, the spiritual foundation remains the same. Bible is pure Vedanta. The gospel according to St. John is the historical Christianity which got a jolt. People have changed and they declared themselves as materialists. In 1874, in Belfast, there was all world physicist congress. It was presided over by Tindal and Huxley and they said we are materialists, we don't believe in religion any more. If there is any religion at all it is the religion of scientific materialism. You have seen matter, believe in matter. You have not seen gods, so don't speak of gods. "For god's sake hold your tongue and don't become a *sadhu*". That is the idea.

Swamiji on Science and Vedic Spirituality: Swami Vivekananda had experienced the ancient truths through inward journey under the guidance of his Guru Sri Ramakrishna Paramhansa. Along with it he had the pulse of western scientific approach. Hence he felt the need for bridging the gaps between them. For this, he took a holistic approach and having envisioned the leads of the western science, he pronounced intuitively the truths related to the study of the external domains of physical, biological and chemical sciences. 'Certainly it is true that man cannot be simply an evolution. Every evolution presupposes an involution. This involution and evolution is on throughout the whole of nature', said Swami Vivekananda at the Parliament of Religions in London, in September of 1893. Swamiji believed that there is no one common ancestor we are all descended from, as Darwin said, because the people of this planet are too diverse for Darwin's theory to be completely correct. Swamiji taught about science, and about how similar the two actually are. Some of his teachings linked science with Vedic Spirituality, he believed that the goal of science is to find unity, and he also believed in the relativity of motion, teaching his disciples that it was evidence of the absoluteness of the universe. When Swamiji taught in the West, his teaching of the Samkhya theory struck his disciples as very similar to physics. His teachings are very significant, because with his teachings, he was able to closely link science to Vedic Spirituality. His teachings of Samkhya and physics impressed scientists like Nikola Tesla, and his teachings of biological science challenged theories such as Darwin's. He traveled and preached for nearly three and a half years after that speech, continuing his teachings on religion and science. Swamiji's teachings on science separated science into different categories- classical science and intuitive science.

As Swamiji said in his speech at the Parliament of Religions, "Science is nothing but the finding of perfect unity. As soon as science would reach perfect unity, it would stop from further progress, because it would reach the goal." He taught that the goal of science was achieving that unity; this would mean that the goals of science and Vedic spirituality are the same. It is said in Vedic Spirituality that God is everyone and everything. He is found everywhere, and so, He is the universe.

Classical Science and Intuitive Science: Science has improved the qualities of Modern human beings. It has provided them comforts as well as great intellect. Magnificent Classical science has tremendous impact on man by improving the quality of life, unravel the mysteries of the universe and remove barriers of subjectivity and objectivity. However, Swami Vivekananda cautions that, "Science stand on its own feet and in its own light and challenges comparison with any other sciences. There have been charlatans and magicians and cheats and more here than any other field. This is because that the more profitable the business, the greater the number of hypocrites and cheats. But that is no reason why the business is not good. Scientists make observations of natural phenomena and then through experiment try to create natural events under controlled conditions. Scientists will the gather the empirical evidence and will generate their hypothesis to explain the phenomenon.

Einstein was a great scientist who discovered the theory of relativity. He puts in one place, "The really valuable thing in creative science is Intuition." Intuition is distinctly different from instinct, logic, reason and intellect. It is the highest mental faculty hidden in man. It is above reason and is acquired by the life forms through repeated experiences and gained through transformation. It is voluntary and spontaneous and finds a solution for a given problem in a completely different place and situation. It is an inherent means of knowledge gathering and often leads to what science can achieve and sometimes even beyond that. Swamiji's views on instinct, reason and intuition is clear when he said, "Reason is the vehicle one rides to reach a certain point beyond which one cannot move. Intuition goes beyond reason but reason with unbiased mind is the only guide to reach there. Instinct is like ice, reason is like water and intuition is like vapor and each on follows the other.

Swami Vivekananda's views on Physics, Chemistry and Biological Sciences: It is science which means the finding of unity. When science would get perfection, it would stop from further progress, because it would reach the goal. Thus Chemistry could not progress farther when

it would discover one element out of which all other could be made. Physics would stop when it would be able to fulfill its services in discovering one energy of which all others are but manifestations. On theory of relativity, though the Theory of Gravitation had been established during the 19th century, it could not resolve the inter-relatedness and inter-dependence of four major parameters i.e. space, time, matter and energy. At this juncture Swami Vivekananda endowed with Vedantic knowledge proclaimed that it can be said that the four are not only inter-related but also that Energy and Matter are interchangeable in the Space and Time domains. However, there was no mathematical formulation available at that time. On theory of Unity-Swamiji said, "One atom of the universe cannot move without dragging the whole world with it" and "One man contains the whole universe. One particle of matter has all the energy of the universe at the back". He has also said that each mind is connected with every other mind and wherever it is located, it is in actual communication with the whole world! This is the miracle of great science.

Expressing his views on the evolution theory, Swami Vivekananda said, "Certainly it is true that man cannot be simply an evolution. Every evolution presupposes an involution. This involution and evolution is on throughout the whole of nature. This is in tune with new developments in the field of biology. Eminent Nobel Prize winning cell biologist Christian de Duve and Brain Goodwin's research shows that Darwin's theory works for small aspects of evolution and there is no significant support for gradual evolution of hereditary mutations adding up to large scale aspects of evolution. Swamiji's profound knowledge on science shows us that the basis for good scientific knowledge among the masses is proper education. Hence we shall see what Swami Vivekananda's ideas about education were.

Swami Vivekananda and Vedic Science: The Vedas are the treasure of India. The Vedas are a collection of writings consisting of hymns, prayers, myths, historical accounting, dissertation on science, and the nature of reality, which date back at least 5,000 years. The nature of matter, antimatter, and the makeup of atomic structure are described in the Vedas. The language of the Vedas is known as Sanskrit. The origin of Sanskrit is not fully understood. Western scholars suggest that it was brought into the Himalayas and thence south into India by the southward migrations of the Aryan culture. *Paramahansa Yogananda* and other historians however do not subscribe to the theory, pointing out that there is no evidence within India to substantiate such claims. There are words in Sanskrit that describe concepts totally foreign to the western mind. Single words may require a full paragraph for translation

into English. Having studied Sanskrit for a brief period during the late 70's, it finally occurred to this writer that Tesla's use of Vedic terminology could provide a key to understanding his view of electromagnetism and the nature of the universe. But where did Tesla learn Vedic concepts and Sanskrit terminology? A review of the well known biographies by Cheney, Hunt and Draper, and O'Neil, reveal no mention of Tesla's knowledge of Sanskrit.

Vivekananda's interaction with scientists and his appreciation of them: The eminent scientist Nikola Tesla was charmed by the resemblance of Samkhya theory of matter and energy and that of modern science. Actually, in 1895, Vivekananda shared with Tesla the idea of matter and energy to be one, and requested him to prove it through mathematics. However, Tesla failed to accomplish it. Vivekananda also interacted with the other two giants of Western science, namely William Thomson and von Helmholtz in New York. Eventually after 10 years, in 1905, Albert Einstein proved the oneness of matter and energy. Vivekananda's exploration of the cosmic universe was infinitely deeper than what science revealed after he was dead.

In 1929, Nobel laureate Werner Heisenberg visited India as the guest of *Gurudev Rabindranath Tagore*. They interacted extensively on science and Indian philosophy. Greatly impressed by Indian thought, Heisenberg realized that the fundamental aspects of physical reality lay in the recognition of relativity, interconnectedness, and impermanence. And this was the same as the foundation of the Indian spiritual traditions. These conversations with Tagore led Heisenberg to admit, 'Some of the ideas that had seemed so crazy suddenly made much more sense. That was a great help for me'. Unlike religion, science is not dogmatic and it is open to revision. 'But in the frontiers of science there is not much of a difference between science and religion', said Nobel laureate Dan Shechtman in an interview at Lindau on 4th July 2012 with a correspondent of *The Hindu*. It is remarkable to note that Albert Einstein has also summarized the relationship between religion and science in the same spirit as that of Vivekananda, 'Science without religion is lame, religion without science is blind'.

Swami Vivekananda met J.R.D. Tata on a ship in 1893, and discussed the latter's plan of bringing the steel industry to India. Tata wrote to Vivekananda five years later: 'I trust, you remember me as a fellow-traveler on your voyage from Japan to Chicago. I very much recall at this moment your views on the growth of the ascetic spirit in India. I recall these ideas in connection with my scheme of Research Institute of Science for India, of which you have doubtless heard or read'.

Impressed by Vivekananda's views on science and leadership abilities, Tata wanted him to guide his campaign. Vivekananda endorsed the project with enthusiasm. Today, the Indian Institute of Science, Bangalore has become a centre of excellence in the world, thanks to Vivekananda's holistic vision.

Conclusion: Swami Vivekananda returned to India in January 1897. He received an enthusiastic welcome everywhere. He awakened his countrymen/women by delivering a series of lectures in different parts of the country. He saw that science is not contradictory to the eternal spiritual principles, which is the foundation of Indian culture. Both Science and eternal principles of Dharma are concerned with truth. Science seeks truth in the physical world, whereas dharma seeks truth in the spiritual realm. He put his thoughts into action when he urged JRD Tata to setup IISC for the sake of furthering science education in India. Finally to end, let me quote Swami Vivekananda that will summarize all that he has said on science and education. He said, "If you have assimilated five ideas and made them your life and character, you have more education than any man who has got by heart a whole library".

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Dr. Babasaheb Ambedkar : Today & Tomorrow

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Dr. Babasaheb Ambedkar's Views on Agriculture and Small Land Holdings in India

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Introduction:

Bharat Ratna Dr. Babasaheb Ambedkar is not only the architect of Indian constitution but was a great economist, Indian jurist, political leader, philosopher, thinker, anthropologist, historian, orator, lawyer and social reformer. He was a born leader and has guided social reforms by his speeches and writings. His writing and speeches therefore continue to inspire thousands of people across the world in every era and in all walks of life. The history of agriculture in India today, India ranks second worldwide in farm output. The economic contribution of agriculture to India's GDP is steadily declining with the country's broad-based economic growth. At present the ideologies of Dr. Ambedkar's were very useful in collective farming and land revenue. He was critique of traditional definition of collective land holding and redefined that economic land holding is not depend up on the size of land holding but proportion of factor inputs. Small size of holdings is the cause of low production therefore consolidation of land reform must be undertaken.

Dr. Ambedkar criticized traditional definition of economic land holding and redefined that economic land holding is not depending upon the size of land holding but proportion of factor inputs to the production. According to him small size of holding is cause of low production therefore; consolidation of land holding must be undertaken. He advocated the collective and co-operative farming in the country. His thoughts are even relevant to today. In this paper attempts to discuss relevance of Dr. Babasaheb Ambedkar's Views on Indian Agriculture and Small Land Holdings. Dr. Ambedkar was the first Indian economist to examine the problem of subdivision and fragmentation of agricultural land holdings and formulate a very scientific definition of a holding.

Objectives:

- To study the importance of agriculture in Indian economy.
- To study Dr. Ambedkar views of Indian Agriculture and land reforms.
- To study the Views of Dr. Ambedkar on Small land Holding.

Methodology:

The present paper is based on the secondary data which has been collected for the various journals, books, articles, newspapers and websites.

Importance of Agriculture in Indian Economy.

Agriculture has got a prime role of in Indian economy. The share of agriculture in National Income has come down. Still it has a substantial share in GDP. The country's exports are likely to register a growth of about 15 per cent in the current fiscal, which will translate into about \$ 315 billion. While presenting the Union Budget for 2018-19, our exports are expected to grow at about 15 per cent in 2017-18. Exports of agriculture commodities, which have the potential of reaching \$ 100 billion. The country's agricultural exports are around \$ 30 billion at present. India's agriculture exports potential is as high as \$ 100 billion against a current export of \$ 30 billion. To realize this potential, export of agriculture commodities will be liberalized.

Agriculture does not only provide our nourishment for our daily intake but also and income source of every single nation that exists on this planet, where most manufacturing industries as well as businesses are dependent on it. 58 per cent of rural households in India are engaged in farming activity. The monthly income of an average farm household is Rs. 6,426/- This contributes not even 60 per cent to their average total monthly income. The large portion of Indian population is depended on agriculture. However is not a profitable business for many farmers? Small size of land holdings is one of the major reasons of low productivity and low income. While debating on 'small holder's 'relief bill' in 1927, Dr. Ambedkar suggested to introduce co operative agriculture



for standard areas and to compel owners of small holdings to join in cultivation without destroying private ownership.

According to him, agriculture shall be considered as a key industry and it shall be organized on collective basis. He pleaded for collectivized system of agricultural and collective farming. He also suggested that owners of the nationalized industries and land are to be compensated in the form of debentures the debenture holders are entitled to receive interest at such rates as defined by the law.

Problems of Indian Agriculture :

The major problems confronting Indian agriculture are those of population pressure, small holdings, depleted soils, lack of modern technology and poor facilities for storage. As per 2011 census the density of population is 382 at future it is increase. As per the Hindu News 26th Nov.2010, India losing 5,334 million tones of soil annually due to erosion. Because of indiscreet and excess use of fertilizers insecticides and pesticides over the years, parliament was told.

Dr. Ambedkar said, the government can make it compulsory to all marginal and small farmers to lease out their land to the government. The government itself can undertake production on this land. Thus with maintaining the ownership of land of the farmers, the government can make all marginal and small holdings as large holdings. The farmers can work on their land cultivated by the government and get a share in income or can undertake any other occupation.

Small holding and fragmented Holdings :

The total number of operational holding in the country has increased from 129.22 million in 2005-06 to 138.35 million, in 2010-11 showing an increase of 7.06 per cent. In today's context according to different agriculture census the average size of holdings decreases for all category of farmers from marginal to large whereas from 1970-71 to 2010-11.

Category wise average size of holding (In Ha)

Category of Farmers	1970-71	1976-77	1980-81	1985-86	1990-91	1995-96	2001-02	2005-06	2010-11
Marginal	0.41	0.39	0.39	0.39	0.4	0.4	0.4	0.38	0.38
Small	1.44	1.42	1.44	1.43	1.44	1.42	1.42	1.38	1.42
Semi Medium	2.81	2.78	2.78	2.77	2.76	2.73	2.72	2.68	2.71
Medium	6.08	6.05	6.01	5.95	5.9	5.84	5.81	5.74	5.76
Large	18.07	17.57	17.38	17.19	17.3	17.21	17.12	17.8	17.38
All group	2.28	2.00	1.84	1.69	1.57	1.41	1.33	1.23	1.16

Source: NABARD Rural Pulse Issue I Jan, Feb 2014

As per above Chart, the largest decreases in average size of holding shown by Marginal category of farmers. Next is by medium category of farmers. The average size of operational land holdings in the marginal and small categories have swelled by 56 million and 11 million respectively, during the same period.

Dr Ambedkar's Views on Small Land Holdings in India:

Dr. Ambedkar analyzed the disadvantages of small land holdings in India and wrote a paper, which was published in the 'Journal of the Indian Economic Society'.

In his customary way of presenting a subject he first executed a detailed study on how small land holdings crop up and why they are so prevalent in India. His conclusions on small holdings are -

"These small and scattered holdings have given a real cause for anxiety regarding our great national industry. Comparative Statistics go to swell this feeling by laying bare two very noteworthy but equally sad facts regarding economic life in India; (1) that it is largely an agricultural country; and (2) that its agricultural productivity is the lowest. Both these truths are painful enough to have startled many people into inquiring the causes of this low productivity. As a result, attention has now been concentrated on the excessive sub-division and fragmentation



of agricultural holdings. Enlarge and consolidate the holdings, it is confidently argued, and the increase in agricultural productivity will follow in its wake!"

He further analyzed the economics of too small or too large holdings – "... if agriculture is to be treated as an economic enterprise, then, by itself, there could be no such thing as a large or a small holding. To a farmer a holding is too small or too large for the other factors of production at his disposal necessary for carrying on the cultivation of his holding as an economic enterprise. Mere size of land is empty of all economic connotations. Consequently, it cannot possibly be the language of economic science to say that a large holding is economic while a small holding is uneconomic. It is the right or wrong proportion of other factors of production to a unit of land that renders the latter economic or uneconomic. Thus a small farm may be economic as well as a large farm; for, economic or uneconomic does not depend upon the size of land but upon the due proportion among all the factors including land.

An economic holding, therefore, if it is not to be a hollow concept, consists in a combination of land, capital and labour, etc., in a proportion such that the pro rata contribution of each in conjunction with the rest is the highest. In other words to create an economic holding it will not do for a farmer solely to manipulate his piece of land. He must also have the other instruments of production required for the efficient cultivation of his holding and must maintain a due proportion of all the factors for, without it, there can be no efficient production. If his equipment shrinks, his holding must also shrink. If his equipment augments, his holding must also augment. The point is that his equipment and his holding must not be out of proportion to each other. They must be in proportion and must vary, if need be, in proportion."

Dr. Ambedkar's views on the Small Farmer Agrarian Economy :

Dr. Ambedkar was one of the great personalities, who made dynamic changes in the society. He had fully devoted his life for improvement in the condition of downtrodden people in India. He was a great politician, constitutor and economist. His views deals with agriculture and are landmark in the field of economics. His views on land holding, collective farming and land revenue are most useful in the present time. He argued, land was only one of the many factors of production and the productivity of one factor of production is dependent upon the proportion in which the other factors of production are combined. In his words: 'the chief object of an efficient production consists in making every factor in the concern contribute its highest, and it can do that only when it can cooperate with its fellow in the required capacity.

Conclusion : Agriculture's contribution to the Indian economy plays a vital role in economic development and in keeping hunger of rural India at bay. Though secondary sector is dominant in contemporary economic development of the country, around 65 per cent of people's lives still depend on the primary sector. Dr. Ambedkar discussed consolidation and enlargement of land holding in India, and suggested that agricultural development is possible only through usage of more capital on land. He felt that agricultural development will lead to the development of primary industries. As far as agricultural production in India is concern, lack of irrigation facilities and small holding has been considered as a major constraints. He sees an extremely important role for the state in such transformation of agriculture and advocates the nationalization of land and the leasing out of land to groups of cultivators, who are to be encouraged to form cooperatives in order to promote agriculture.

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शेतकऱ्यांची कर्जमाफी: एक चिंतन

जयवंत भदाणे व कृषीसेवक मुरलीधर बच्छाव
कर्म.रामरावजी आहरे कला, विज्ञान व यागिज्य महाविद्यालय
देवळा, ता.देवळा, जि.नाशिक

प्रस्तावना:

भारतातीलच नाही तर जगातील अत्यंत पुरातन व्यवसाय म्हणून शेती व्यवसाय केला जातो. जगातील २/३ लोकांचा तर भारतातील ६८ टक्के लोकांचा शेती हाच मुख्य व्यवसाय आहे. शेतीचा शोध हा मुळातच शिकार आणि अन्न गोळा करण्यासाठी वणवण भटकण्यापेक्षा एका जागीच अन्न मिळविण्याची सोय म्हणून मानवाच्या इतिहासातील एक महत्वाचा टप्पा होता. शेतीचा शोध साधारणतः दहा हजार वर्षांपूर्वी मध्यपूर्वेकडील सुपीक भागात लागला. शेतीचा शोध स्त्रियांनी लावल्याचे मानले जाते. भारतीय शेतीलाही किमान साडेसहा हजार वर्षांचा इतिहास आहे. सुरुवातीच्या काळात नैसर्गिक संसाधने, माती, पाणी, झाडे, जंगले यांच्या जतन व संवर्धनाची जाणीव लोकांना होती. जंगलांचा शेती उत्पादनासाठी असलेला संबंध माहिती असल्यामुळे सामूहिक पद्धतीने पाणी व जंगलांच्या जपणूकीसाठी कामे केली जात होती. अनुभवजन्य उत्पादन पद्धती होती. सर्वत्र आर्थिक सुबत्ता होती. ब्रिटिशांची सत्ता येईपर्यंत शेतीत काय व कसे पिकवायचे आणि येणाऱ्या उत्पादनाचा विनियोग कसा करायचा याचे निर्णयस्वातंत्र्य शेतकऱ्यांना होते. जुनाट तंत्र असूनही समूहशेतीच्या माध्यमातून मोठ्या प्रमाणात उत्पादन घेतले जाई.

शेती हे प्राथमिक क्षेत्र असून यातूनच इतर क्षेत्रांचा विकास झाला आहे. स्वातंत्र्यप्राप्तीनंतर या क्षेत्रासमोर वाढलेल्या लोकसंख्येला पुरेशा अन्नपुरवठ्याची समस्या, दुष्काळ, अतिवृष्टी अशा समस्या निर्माण झाल्या. हरितक्रांतीने उत्पादन तंत्रात काही बदलही झाले. मात्र आवश्यक तो प्रगती न झाल्याने शेतीक्षेत्रात समस्या वाढतच गेल्या. शेतीसाठी विविध मार्गाने भांडवलपुरवठा करण्याचा प्रयत्नही झाला. रॉयल कॉमिशनने म्हटल्याप्रमाणे भारतीय शेतकरी कर्जात जन्म घेता, कर्जात वाढतो, कर्जात मरतो आणि वारसावर त्याचा भार ठेऊन जाताड आणि आजही तेच चित्र आहे. शेतकरी उत्पादन, उपभोग, शेतीविकास,

अनुत्पादक, आकस्मिक अशा वेगवेगळ्या कारणांसाठी कर्ज घेतो. अशा कर्जाचे काळानुसार, उद्देशानुसार, तारणानुसार आणि कर्जदात्यानुसार प्रकार आहेत. घेतलेल्या कर्जाची परतफेड करण्यास शेतकऱ्यांपुढे अनंत अडचणी आहेत. त्यात शेतीव्यवसायाची अनिश्चितता, सावकारांची शोषण नीती, सरकार व सहकाराचे पक्षपाती धोरण, रुढी-परंपरा, उत्पादनातील सातत्य, वंशपरंपरागत कर्ज, ग्रामीण उद्योगांचा ज्वस, विपणनातील दोष, पशुधनाची समस्या अशा विविध समस्यांमुळे शेतकऱ्यांची कर्जबाजारीपणाची समस्या अधिक गंभीर झाली आहे. सत्तेत नसलेले सर्वच राजकीय पुढारी, नेते शेतकऱ्यांना कर्जमाफी मिळाली पाहिजे, नव्हे त्यांचा सातवारा कोरा झाला पाहिजे. असे सतत म्हणत असतात. मात्र शेतकऱ्यांच्या या अवस्थेलाही हेच लोक आणि त्यांची धोरणे कारणीभूत आहेत. म्हणून शेतकरी वेळेवेळी रस्त्यावर उतरून कर्जमाफी, शेतमालाला भाव यासाठी आंदोलन करून आपल्या अस्तीत्वाची लढाई लढतो. महाराष्ट्रात अलिकडे कर्जमाफीबाबत मोठ्या प्रमाणावर आंदोलन झाले. ऐतिहासिक संपही झाला. सत्ताधाऱ्यांची धारणा होती की, पाऊस पडला की हे आंदोलन थांबेल. मात्र सरकारचा अपेक्षाभंग झाला आणि नाक मुठीत घेऊन कर्जमाफीची घोषणा करावी लागली.

महाराष्ट्रातल्या शेतकऱ्यांना ३४ हजार कोटींची कर्जमाफीची घोषणा झाली. राज्यातील ९० टक्के शेतकऱ्यांना या कर्जमाफीचा फायदा होईल आणि ज्या शेतकऱ्यावर दीड लाखपर्यंतचे कर्ज आहे त्याचे कर्ज सरसकट माफ करण्यात येईल. उर्वरीत शेतकऱ्यांच्या कर्जाकडेही दीड लाख रुपये राज्य सरकारचा वाटा असेल असे स्पष्ट करताना मुख्यमंत्र्यांनी या योजनेला छत्रपती शिवाजी महाराज कृषी सन्मान योजनाड असे नावही दिले. नियमित कर्ज भरणाऱ्या शेतकऱ्यांनाही २५ हजार रुपयांचे अनुदान मिळणार आहे. आजवरच्या काळातील महाराष्ट्रातील ही सर्वात मोठी कर्जमाफी म्हणून सरकारने आपली पाठशी धोपटून घेतली आहे. काही शेतकऱ्यांना कर्जमाफीचा लाभही झाला आहे. आता प्रश्न आहे तो यातील काही कायदेशीर बाबींचा व मुद्द्यांचा. सात-बारा म्हणजे काय?

७/१२ उतारा म्हणजे जमिनीचा एक प्रकारचा आरसाच. कारण हा उतारा वाचून प्रत्यक्ष जमिनीवर न जाता त्या जमिनीचा संपूर्ण अंदाज आपल्याला बसल्याजागी मिळू शकतो. महाराष्ट्र शासनाच्या महाराष्ट्र जमीन महसूल कायदा १९६६ अंतर्गत शेतजमिनीच्या हक्काबाबत विविध नोंदी ठेवल्या जातात. यासाठी वेगवेगळी नोंदणीपुस्तके असतात. या पुस्तकांमध्ये कुळांचे मालकी हक्क, शेतजमिनीचे हक्क, त्यातल्या पिकांचे हक्क, कर्जाबाबतचा व इतर अधिकाराबाबतचा तपशील असतो. गाव नमूना नं. ७ आणि नं.

१२ मिळून जो उतारा तयार होतो तोच ७/१२ उतारा असतो. जो प्रत्येकाला वाचताच आला पाहिजे आणि जाणीवपूर्वक समजूनही घेतला पाहिजे.

प्रत्येक खातेधारकास म्हणजे जमीनधारकास आपल्याकडे किती, कोणती व कुठे जमीन आहे हे या उताऱ्यावरून कळू शकते. गाव नमुना ७ हे इतर अधिकार पत्रक आहे. यावर वरच्या बाजूला गावाचे नांव, गट क्रमांक, उपविभाग क्रमांक, भू-धारणा पध्दती, कब्जेदाराचे नांव, खाते क्रमांक, शेतीचे स्थानिक नाव, लागवड योग्य क्षेत्र, पोट खराब क्षेत्र, आकारणी, कुळाचे हक्क, तसेच सरकार किंवा बँकेने दिलेल्या कर्जाचा बोजाही याच उताऱ्यावर इतर अधिकारात नोंदवलेला असतो. तर गाव नमुना १२ हे पीकपाहणी पत्रक असते. यात वर्ष, हंगाम, पीक, पिकाखालील क्षेत्र, जलसिंचनाचे साधन इत्यादी तपशील खालच्या बाजूला लिहिलेला असतो. जमिन व महसूलाच्या व्यवस्थापनासाठी प्रत्येक गावच्या तलाठी कार्यालयात हे नमुने असतात. साधारणपणे दर १० वर्षांनी ७/१२ पुस्तके नव्याने लिहिली जातात.

सातबारा कोरा म्हणजे काय?

७/१२ वर इतर हक्कात कोणत्या नोंदी आहेत हे काळजीपूर्वक पाहिले पाहिजे. कर्ज, तगाई रक्कम व कर्ज देणाऱ्या संस्थेचे नाव यावर असते. शेतकऱ्याला जर शहरीकरणांमुळे किंवा स्वतःच्या गरजेनुसार जमीन विकण्याची आवश्यकता असल्यास प्रांत अधिकारी यांची परवानगी घ्यावी लागते आणि त्यावरच्या इतर अधिकारातल्या कर्जांच्या नोंदी रद्द करून फेरफार नोंद घालावी लागते. म्हणजेच कर्जाची परतफेड झाल्याशिवाय संबंधित संस्था त्यासाठीचा ना-हरकत दाखला देत नाही. यासाठीच जर कर्ज पूर्णपणे माफ झाले म्हणजे सरकारने संबंधित संस्थेच्या कर्जांची परतफेड केली तरच सात-बाऱ्यावरच्या कर्जांच्या नोंदी रद्द होणार आहेत. म्हणजे सातबारा बोजारहित होईल याचाच अर्थ कोरा होईल असे मानले जाते. आणि यासाठीच शेतकरी आंदोलन करीत आहेत.

पीक कर्ज म्हणजे काय?

शेतीच्या अर्थकारणात जून हा सर्वात महत्वाचा महिना असतो. जून महिन्यात पावसाला सुरुवात होते असे मानले जाते. त्यापूर्वीच जमिनीची मशागत, धियाणे, खते, मजुरी यासाठी शेतकऱ्याला राष्ट्रीयकृत बँका आणि सहकारी संस्थांकडून पीक कर्ज दिले जाते. शेतकऱ्यांना दिले जाणारे पिककर्ज हे सर्वात कमी दिवसात म्हणजेच किमान १२ महिन्यांच्या आत परतफेड करावे लागते. ३ लाखापेक्षा कमी कर्ज घेणारे आणि मुदतीच्या आत कर्जांची परतफेड करणाऱ्या शेतकऱ्यांना व्याजात सवलत किंवा सूट दिली जाते. मुदतीनंतर या कर्जांला नियमित व्याजदर असतो. जमिनीचे क्षेत्र कितीही असले तरी ३ लाख पीक कर्जांलाच हा नियम लागू होतो. म्हणजेच जास्त जमीन

असलेले शेतकरी खूप कर्ज काढतात आणि कर्जमाफी मागतात असे जर कुणी म्हणत असेल तर ते चुकीचे आहे. कर्ज हे हेक्टरावर ठरते, त्याचप्रमाणे जमिनीवर काय पेरले आहे यावरही अवलंबून असते. म्हणजे कापसाला हेक्टरी ३० ते ३५ हजार फळबागांना ६० ते ८० हजार पीक कर्ज दिले जाते. त्यातही ते ३ लाखाचे वर गेले तर व्याजदरात सूट दिली जात नाही. ठिबक सिंचन, पाईपलाईन, विहिर खोदणे, फार्म हाऊस बांधणे अशा कामांसाठी घेतलेले दीर्घ मुदतीचे कृषीकर्ज हे पीक कर्ज म्हणून गणले जात नाही. यासाठीचा व्याजदर जास्त असतो. त्यात शेतकऱ्यांना सूट नसते. यात प्रसंगी थोडोफार तफावत असू शकते मात्र पीक कर्ज हे शेतकऱ्यांना यारमाप मिळत किंवा त्यासाठी कोणतेही नियम नाहीत असे मुळीच नाही.

कर्जमाफी म्हणजे काय?

सरकारने जाहीर केलेल्या ३४ हजार कोटींच्या कर्जमाफीमुळे ८९ टक्के शेतकऱ्यांपैकी ३६ ते ३८ लाख शेतकऱ्यांचा सातबारा कोरा होणार आहे. कर्जमाफीचे निकषही सूटसुटीत आहेत. यात आजो-माजी मंत्री, विधानसभा-विधानपरिषद सदस्य, पंचायत समिती सदस्य, नगरसेवक, जेसीबी बाळगणारे कंत्राटदार, केंद्र-राज्य सरकारी कर्मचारी आणि सरकारकडून अनुदान घेणाऱ्यांना या कर्जमाफीचा लाभ मिळणार नाही. त्याचप्रमाणे शेतीव्यतिरिक्त इतर करपात्र उत्पन्न असलेल्यांनाही या कर्जमाफीतून वगळले आहे. म्हणजेच प्रत्यक्ष गरजेत शेतकऱ्यालाच कर्जमाफी मिळणार आहे. महाराष्ट्रात शेतीचे धरटी कर्ज रुपये ५४,७०० म्हणजे इतर राज्यांच्या तुलनेत कमी आहे. कर्जमाफी देताना कोणताही घोटाळा होणार नाही याकडे सरकार काटेकोर लक्ष देणार आहे. बँकांनाही दक्ष रहावे लागणार आहे. या कर्जमाफीमुळे नियमित कर्ज भरत असलेल्या शेतकऱ्यांनाही कर्जांच्या रकमेवर २५ टक्के मदत मिळणार आहे. ३० जून २०१६ ही कर्जमाफीची अंतिम मुदत असणार आहे. आणि २०१२ ते २०१६ या दुष्काळी वर्षातीलच थकबाकीदार यात गृहीत धरले आहेत. सरकार यापेक्षा आणखी बोजा सहन करू शकत नसल्याने पुढील वर्षाची कर्जमाफी दिलेली नाही.

सरसकट कर्जमाफी म्हणजे काय?

ऐतिहासिक अशा शेतकरी संपानंतर राज्य सरकारने हा, ना, ना करत सरसकट कर्जमाफी करून शेतकरी संप तर थांबवला आहे. धरसकटड, घतत्तत:ड आणि धनकषड या तीन शब्दांवरून विरोधकांसह सोशल मिडियानेही सरकारवर टिका केली आहे. कारण सरसकट कर्जमाफी याचा अर्थ आजही शेतकऱ्यांना उमगलेला नाही. सरसकट म्हणजे आधी सरकारने ५ एकरांपर्यंतच्या शेतकऱ्यांचो कर्जमाफी केली होती. परंतु पश्चिम महाराष्ट्रात लेंड होल्डिंग कमी असल्याने अधिक उत्पादन तर विदर्भ-मराठवाडयात लेंड होल्डिंग

जास्त असते आणि उत्पादन कमी असते असे निदर्शनास आणून दिल्याने सरकारने सरसकट कर्जमाफीत एकरांची किंवा जमिनीची मर्यादा नसेल आणि सर्व शेतकरी कर्जमाफीसाठी पात्र असतील असे ठरविले. घटत्वतः ङ म्हणजे सरसकट कर्जमाफी देण्याचे ठरले आहे. सर्व कर्जांचा तपशील गोळा करून मंत्रीमंडळापुढे प्रस्ताव आणला जाईल. यासाठी समिती नेमली जाईल. समितीत सरकारचे मंत्री, सरकारी अधिकारी, शेतकऱ्यांचे प्रतिनिधी, विविध राजकीय पक्षांचे नेते संयुक्तरित्या विचारविनिमय करून धनकषड म्हणजेच अटी ठरविल्या जातील. थोडक्यात काय तर कर्जांची मर्यादा ठरवणे म्हणजे निकष ठरवणे होय. घटत्वतः ङ आणि धनकषड हे शब्द टाकण्याचे कारण खज्या अर्थाने पात्र असणाऱ्यालाच कर्जमाफी मिळावी हेच आहे. कर्जमाफीची मर्यादाच न ठेवल्याने जिरायती शेतकऱ्यांना त्याचा लाभ मिळणार आहे.

स्वामीनाथन आयोगः

स्वामीनाथन आयोगाच्या काही शिफारशी शेतोस पूरक, मारक व अंमलात आणता न येणाऱ्या आहेत. यातील राष्ट्रीय भूमी पीक वापर सल्लागार मंडळ, सामाजिक अन्नधान्य पेंढया, अन्न हमी कायदा, गहू तांदूळ याशिवाय इतर पिकांनाही हमीभाव लावणे म्हणजे सरकारी एकाधिकारास चालना देणे, शेतमाल भाव स्थिरीकरण निधी, बचतगट, शेतकऱ्यांना सरकारी नोकरांसारखे बेतन मिळवून देणे हे मुद्दे अंमलात आणता येणे अशक्य आहेत. अन्नसुरक्षा व अन्नहमी यांमुळे भ्रष्ट व अकार्यक्षम अन्न महामंडळ वाढविण्याचे काम होईल. रोजगार हमी आणि स्वस्त धान्य योजनेमुळे शेतीला मजूर मिळणे कमी होईल याचा विचार झालेला नाही. आज शेतमालाला जास्त किंमत देण्याची मागणी झाल्यावर सरकारकडून आर्थिक बोजा निर्माण होतो असे सांगितले जाते. शेतीमध्ये पैसा मिळत नाही, मालाला किंमत नाही मग शेतकऱ्याने शेती करावची तरी का? शेतीमध्ये किती उत्पादन झाले यापेक्षा शेतकऱ्यांचे उत्पन्न किती वाढले यावरच शेतीचा किती विकास झाला हे ठरविले पाहिजे. शेतकरी समाधानी झाला तरच देशाचा विकास होईल. केवळ उद्योजकांचे भले करून विकास होणार नाही. उद्योगधर्जाजिण्या धोरणात शेतकऱ्यांना मरायला सोडून देणे योग्य होणार नाही. शेतकऱ्यांच्या विकासासाठी शेतीची धोरणे बदलली पाहिजेत. तरच परिस्थिती नियंत्रणात येऊ शकते. अन्यथा चांगले पिकवूनही हाती काहीच लागत नाही, हे अनुभवल्यावर शेतीमधून नाईलाजाने बाहेर पडणाऱ्या निराश तरुणांचे प्रमाण अधिक येणाने वाढणार आहे. आणि देशापुढील हे सर्वांत मोठे संकट ठरणार आहे.

भारतात आर्थिक उदारीकरणाचा सुरुवात होऊन २५ वर्षांचा काळ लोटला आहे. शेतकरी व्यगळता सर्वच समाजघटकांना आणि

व्यवसायांना उदारीकरणाचा लाभ झाला. शेतकरी मात्र लोकनियुक्त सरकाराचा गुलाम आहे. म्हणायला देशात लोकशाही आहे, बहुमताचे सरकार आहे, शेतकरीही बहुमतातच आहेत, मात्र लोकशाहीत शेतकऱ्याची अवस्था एका नोकरासारखी आहे, त्याला तलाठ्यासमोर हात जोडावे लागतात, बँक अधिकाऱ्याच्या खोलीबाहेर भिकाऱ्यासारखे ताटकळत बसावे लागते, तहसील कार्यालयात कारमांसाठी टाचा घासत फिरावे लागते. म्हणजेच आज शेतकरी स्वतंत्र भारताचा नागरिक नाही तर राजाच्या दयेवर चालणाऱ्या प्रजेच्याच अवस्थेत आहे. आजही जीवनावश्यक वस्तू कायदा लागू आहे. शेतीच्या कोणत्याही व्यापारात सरकार केव्हाही निबंध घालू शकते. निर्यातीवर बंदी, जादा दराने आयात, शेतमाल साठवणूक व विक्रीवर बंदी, वायदेबाजारावर बंधने, लेव्हीची पध्दती हे सारे सुरुच आहे. प्रश्न निर्माण होतो तो म्हणजे उत्पादन खर्चापेक्षा कमी भाव मिळूनही शेतकरी जगतो कसा? शरद जोशी नेहमी म्हणत, शेतकरी स्वतःचे भांडवल खाऊनच जगत असतो. आपली जमीन, कार्यशक्ती, जनावरे तो कणाकणाने खात असतो. कुठल्याही आर्थिक अडचणीत त्याला कर्ज काढल्याशिवाय पर्याय नसतो. शेती उत्पादनखर्च भरून निघत नसल्याने फायदा होईल कर्ज फिटेल हे केवळ स्वप्न ठरते. शेतकरी कर्जात जगतो व कर्जात मरतो.

समारोपः

भारतात १९७१-७७ मध्ये इंदिरा गांधींनी सावकारी कर्ज माफ केले होते. लाखो लोकांनी एक पैसाही न देता आपल्या गहाण ठेवलेल्या वस्तू, सोने, भांडी-कुंडी परत घेतली. परंतु शेतकरी व आदिवासी प्रामाणिक होता. त्यांनी काही व्याज भरून आपल्या वस्तू सोडवून नेल्या. इतका प्रामाणिकपणा शेतकऱ्यांजवळ आहे. कर्ज बुडवण्याची दानत त्याची निश्चितच नसते. मात्र राज्यकर्त्यांनीच लोकांना वाईट सवली लावल्या आहेत. पैसे घ्या पण भरू नका. त्यामुळे आज जिल्हा बँका काही अंशी डबघाईस आलेल्या आहेत. याबाबत रिझर्व्ह बँकेने म्हटलेच आहे की कर्ज बुडवेगीरी आम्ही त्यांना शिकवतो. वेळेवर कर्ज घेऊन फेडले तर त्या शेतकऱ्यावर भार राहत नाही. परंतु आम्हीच सांगतो तुम्ही कर्ज भरू नका, माफ होईल. पैसे भरण्यासाठी बँकेत गेलेला शेतकरी यामुळे मागे फिरतो आणि थकवाकीदार बनतो. याआधीच्या महाराष्ट्र सरकारने ७ हजार कोटींची कर्जमाफी दिली होती. मात्र घटत्वतः ङ आणि धनकषड नसल्याने पश्चिम महाराष्ट्रातील शेतकऱ्यांनीच कर्जमाफी उकळली आणि विदर्भ मराठवाड्यातील शेतकऱ्यांनी खरी कर्जमाफी मिळूच शकली नाही, असा दावा केला जातो.

उत्तरप्रदेश सरकारने पहिल्याच मंत्रीमंडळ बैठकीत १ लाख रुपयांपर्यंतच्या कर्जास माफी दिल्यानंतर खज्या अर्थाने महाराष्ट्रातही कर्जमाफीचा विषय शेतकऱ्यांसह विरोधकांना मिळाला. २०१२-२०१६

या काळात दुष्काळ आणि नापिकीमुळे शेतकरी कर्जफेड करू न शकल्याने अशा शेतकऱ्यांना कर्जाच्या खाईतून बाहेर काढण्यासाठी सर्वाधिक कर्जमाफी दिली आहे. सुरुवातीला शेतकऱ्यांना १० हजार तात्पुरते दिले. शेतकऱ्यांचे मध्यम मुदतीचे कर्ज, पुनर्गतीत कर्ज, थकीत कर्ज असे सर्वकाही माफ होणार आहे. त्यासाठी राज्य सरकारच्या तिजोरीवर बोजा पडणार आहे. त्याकरिता काही आर्थिक तरतूदही करण्यात आली आहे. शेतकऱ्यांना स्वयंपूर्ण करण्यासाठी कृषी सन्मान योजनाही आणली आहे. आज जिकडेतिकडे शेतकरी कर्जमाफी मिळण्यासाठी ऑनलाईन अर्ज भरण्यासाठी कागदपत्रांची जुळवाजुळव करीत आहेत. शेतकऱ्यांच्या कर्जमाफीच्या निर्णयाचे श्रेय संपाचे हत्यार प्रथम उपसणाऱ्या पुढतावेकरांना द्यावे, राज्यातील शेतकऱ्यांना, शेतकरी नेत्यांना द्यावे की विरोधी पक्षांना द्यावे हा श्रेयाचा मुद्दा सोडला तर, राज्य सरकारच्या तिजोरीवर मोठा बोजा पडणार असला तरी तो सहन करून शेतकऱ्यांच्या पाठीशी ठामपणे उभे राहण्याचे राज्य सरकारने दिलेले आश्वासन लवकर पूर्णत्वास जाईल आणि खऱ्या अर्थाने कृषीसन्मान होईल हीच आशा करू या.

□□□

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प्रा. शिवाजीराव भोसले यांच्या दृष्टीकोणातून गायीचे अर्थशास्त्र — एक समग्र चिंतन

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प्रस्तावना : —

आपल्या भारतीय संस्कृतीत गायीला 'गोमाता' मानले जावून तिची पुजादेखील केली जाते कारण वैदिक हिंदु संस्कृतीत 'गायीच्या उदारात ३३ कोटी देवी —देवतांचा वास आहे' असे मानले जाते या विधानात कितपत तथ्यांश आहे. शिवाय देवी देवतांचे मुळातच अस्तित्व आहे का? या तात्वीक प्रश्नात सध्या मला पडायचे नाही. परंतु महाराष्ट्रातील ख्यातनाम वक्ते व प्रसिद्ध तत्त्वचिंतक प्राचार्य शिवाजीराव भोसले यांनी जे गायीचे अर्थशास्त्र मांडले, त्यात त्यांनी गायींना धर्म, अर्थ, काम आणि मोक्ष या चार पुरुषार्थांच्या प्राप्तीचे साधन मानले असून आजही त्यांच्या या विधानाचा तात्वीक अर्थ समाजावून देण्याचा व गायीच्या पालनपोषणात येणाऱ्या अडचणींचा शोध तसेच काही राज्यांनी अंमलात आणलेल्या "गोवंश हत्याबंदी" या कायद्याविषयीची तात्वीक व अर्थशास्त्रीय चिकित्सक चर्चा या शोषप्रवृत्तीत मी करण्याचा प्रयत्न करणार आहे.

प्राचार्य शिवाजीराव भोसले यांच्या मते, प्राचीन काळापासून गायीची पुजा केली जाते, गायीला गोमाता मानले जाते. त्याचे कारण हे फक्त अध्यात्मिकच नसून अर्थशास्त्रीय आहे. मानवाच्या जीवनात चतुर्विध पुरुषार्थाला फार महत्वाचे स्थान आहे. धर्म, अर्थ, काम, आणि मोक्ष, या चार पुरुषार्थांची प्राप्ती हे मानवी जीवनाचे अंतिम साध्य आहे. अध्यात्मिक सुखाच्या दृष्टीने 'धर्म' आणि 'मोक्ष' आवश्यक मानले जातात

FT-IR, VOLUMETRIC AND VISCOMETRIC STUDIES OF INTERACTION BETWEEN ALKYL FORMATES AND TERT-BUTANOL AT TEMPERATURE 298.15, 303.15, 308.15 AND 313.15 K.

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ABSTRACT : Densities and viscosities of binary mixtures of tert-butanol with ethyl formate, butyl formate and hexyl formate have been measured over the entire range of composition, at T= (298.15, 303.15, 308.15 and 313.15) K and at atmospheric pressure. The V^E values are positive for all the binary mixtures studied over the entire composition range, while $\Delta\eta$ are negative for all the binary mixtures. These parameters have been fitted to Redlich-Kister polynomial equation. McAllister's multibody model has been used to co-relate the kinematic viscosities of the binary mixtures. Neat FT-IR spectra are also taken.

Key Words: Excess molar volumes, deviation in viscosity, FT-IR, tert-butanol, ethyl formate, butyl formate, hexyl formate.

INTRODUCTION:

Studies on excess molar properties of binary liquid mixtures are of considerable importance in understanding the nature of molecular interaction. Measurements of densities and viscosities of binary liquid mixtures enable one to gather some information about the nature of interaction taking place in the binaries. The literature provides extensive data on the densities and viscosities of liquid mixtures, but a combined study of density, viscosity and FT-IR is quite scarce. FT-IR is very useful in elucidating the structure of molecule/ complex (Sarkar P. C. et.al.1998, Khan L. A. et.al.2008) and provides supporting evidence to the conclusions drawn from the volumetric and viscometric measurements. The effects of molecular size, shape, chain length and degree of molecular association of tert-butanol on the volumetric, viscometric and acoustic properties of binary mixtures containing alkyl formates have been reported earlier. (Ortega J. et.al.2003, Ortega J. et.al.2005) The present work reports the densities, viscosities and FT-IR studies for the binary mixtures of tert-butanol with ethyl formate, butyl formate and hexyl formate at T= (298.15, 303.15, 308.15 and 313.15) K.

MATERIALS AND METHODS :

tert-Butanol (s. d. Fine Chem, purity 99%) was used. Ethyl Formate, Butyl Formate and Hexyl formate were double distilled and the middle fraction was used. The purity of the solvents were further ascertained by comparing their experimental density and viscosity with those reported in the literature values at T/K = 298.15 Table I. Binary mixtures were prepared by mass in air tight stoppered glass bottles. The masses were recorded on an Adairdutt balance to an accuracy of $\pm 1 \times 10^{-4}$ g. Care was taken to avoid evaporation and contamination during mixing. The estimated uncertainty in mole fraction was $< 1 \times 10^{-4}$. Densities were determined by using a 15 cm³ bicapillary pycnometer as described earlier (Hasan M. et.al. 2007, Nikam P. S. et.al. 2008). The pycnometer was calibrated using conductivity water with $\rho = 0.99705 \times 10^3 \text{ kg.m}^{-3}$ as its density (Marsh K. N. 1987) at T/K = 298.15 The pycnometer filled with air bubble free experimental liquids was kept in a transparent walled water bath (maintained

constant to ± 0.01 K) for (10 to 15) min to attain thermal equilibrium. The estimated uncertainty of density measurements of solvent and binary mixtures was $\pm 0.1 \times 10^{-3} \text{ kg.m}^{-3}$. At least three to four measurements were made which had an average deviation of $\pm 0.1 \times 10^{-3} \text{ kg.m}^{-3}$.

The dynamic viscosities were measured using an Ubbelohde suspended level (Nikam P. S. et.al.2000) viscometer calibrated with conductivity water. An electronic digital stop watch with readability of ± 0.01 s was used for the flow time measurements. At least three repetitions of each data reproducible to ± 0.05 s were obtained, and the results were averaged. The dynamic viscosity η of the liquids was calculated by $\eta = \rho (at - b/t)$

(1) where η is the viscosity, ρ is density of the liquid, t is the flow time, a and b are the constants for a given viscometer. The uncertainties in dynamic viscosities are estimated to be of the order of $\pm 0.003 \text{ mPa.s}$. FTIR spectra were recorded on a FTIR spectrometer (Model: SHIMADZU 8400s pc) by using KBr pellet in the region 400–4000 cm^{-1} with 4.0 cm^{-1} resolution. The transmission values were read in steps of 5%. The spectrophotometer possesses out to aligned energy optimization and dynamically aligned interferometer. It is fitted with KBr beam splitter, a DLATGS detector. A base line correction was made for the spectra recorded.

RESULTS AND DISCUSSION

Experimental values of densities and viscosities of mixtures at T= (298.15, 303.15, 308.15 and 313.15) K are listed as a function of mole fraction in Table 2. The density values have been used to calculate V^E using the following equation

$$V^E (\text{m}^3 \text{mol}^{-1}) = (x_1 M_1 + x_2 M_2) / \rho_{12} - (x_1 M_1 / \rho_1) - (x_2 M_2 / \rho_2) \quad (2)$$

where ρ_{12} is the density of the mixture and $x_1 M_1$, ρ_1 and $x_2 M_2$, ρ_2 are the mole fraction, the molecular weight and density of pure components 1 and 2 respectively. The uncertainty in V^E is of $\pm 0.008 \text{ m}^3 \text{mol}^{-1}$. $\Delta\eta$ were calculated using $\Delta\eta (\text{mPa.s.}) = \eta_{12} - x_1 \eta_1 - x_2 \eta_2 \quad (3)$

where η_{12} is the viscosity of the mixture and x_1 , x_2 and η_1 , η_2 are the mole fraction and the viscosity of pure components 1 and 2 respectively. The excess molar volumes and deviation in viscosity were fitted to Redlich-Kister (Redlich O. and Kister,

A. 1948) equation of the type

$$Y = x_1 x_2 \sum a_n (x_1 - x_2)^n \quad (4)$$

where Y is either V^E , or Δn and n is the degree of polynomial. Coefficient a_n were obtained by fitting equation 4 to experimental results using a least-squares regression method. In each case, the optimum number of coefficients is ascertained from an examination of the variation in standard deviation σ was calculated using the relation

$$\sigma(Y) = [\sum (Y_{\text{expt}} - Y_{\text{calc}})^2 / (N - n)]^{1/2} \quad (5)$$

where N is the number of data points and n is the number of coefficients. The determined values of the coefficients a_i along the standard deviation σ are given in Table 3.

The variation of V^E with mole fraction of alkyl formate (ethyl, butyl and hexyl) with tert-butanol at $T/K = 298.15$ K is represented in figure 1. The excess molar volume for the mixture of ethyl formate with tert-butanol (0.882 cm³.mole⁻¹ at 303.15 K) is in good agreement with excess molar volumes (0.880 cm³.mole⁻¹ at 303.15 K) at $x_1 = 0.5$ reported by Ortega et al.3 where as the excess molar volumes for the binary mixture of butyl formate with tert-butanol (0.677 cm³.mole⁻¹ at 303.15 K) is in good agreement with excess molar volumes reported by Ortega et al.4 as (0.677 cm³.mole⁻¹ at 303.15 K) at $x_1 = 0.5$. The V^E for these mixtures are positive over entire composition range at all temperatures indicating that the dispersive forces dominate over the chemical or specific interactions. The positive V^E values may also arise due to the predominance of declustering of butanol in presence of formates. It is seen that as the alkyl part in the formates increases from ethyl to hexyl, the V^E values decrease. This may be due to the fact that the tert-butanol molecules may be fitting in to the interstitial spaces of higher alkyl formates. The molar volumes of tert-butanol and ethyl formate are not much different; hence tert-butanol finds it much difficult to enter the interstitial voids in the ethyl formate net work. But for butyl and hexyl formates the molar volumes are much different from that of tert-butanol and there are chances that the tert-butanol molecules may find it much easier to accommodate themselves in the ester networks of butyl and hexyl formates leading to a decrease in the V^E .

It is a well established fact that alcohols are self-associated (Chen H-W et al.2004, Raja S. S. and Kubendran T. R.2004, Rattan V. K. et al.2004, Ortega J. et al.2004, Chen S-d et al.2005, Rathnam M. V. and Mohite, S.2005) through hydrogen bonding, with the strength and extent decreasing with branching in alcohols, while formates having dipolar nature are also associated through intermolecular hydrogen bonding. Thus, mixing of formates with an alcohol (butanol) can be expected to induce changes in hydrogen-bonding equilibria and electrostatic interactions, with different resultant contributions to the volumes of the mixtures. Weakening of the interactions between the molecules of formates tends to results in an increase in volume. Similarly, the disruption of butanol multimers through breaking of hydrogen-bonds makes a positive contribution to V^E (Treszczanowicz A. J. and Benson, G. C.1978, Gill D. S. et al.1993).

V^E increases with increase of temperature from 298.15 to 313.15 K for all these three binary mixtures, which may be attributed partly to thermal agitation and partly due to the fact that more hydrogen bonds are broken at higher temperatures. Homo and hetero associations are also weakened at higher temperatures leading to an increase in V^E values.

The values of σ for the binary mixtures of ethyl formate, butyl formate and hexyl formate with tert-butanol are negative over entire composition range at all temperatures indicating that the dispersive forces dominate over the chemical or specific interactions. Fig.2 exhibits the variation of σ with x_1 [alkyl formates] for binary mixtures of ethyl formate, butyl formate and hexyl formate with tert-butanol at 298.15 K. It is seen that the σ values are almost the same for all the three binary mixtures of alkyl formate with tert-butanol signifying that the nature of interactions which govern the σ values remain almost the same irrespective of the alkyl moiety in the ester.

The σ values in all the three binary systems studied here show a marked dependence on temperature. These values decrease systematically as the temperature is increased. It can be concluded that the mixture viscosities decrease to a greater extent as compared with the decrease in the viscosities of pure binary components with increase in temperature. Further it is seen that the effect of temperature is more pronounced for than for V^E .

Kinematic viscosities (ν) of the binary liquid mixtures were obtained from their dynamic viscosities and densities. McAllister's three body and four body interaction models (McAllister R. A. and AICHEJ, 1960) have been used to correlate the kinematic viscosities of binary liquid mixtures.

$$\ln \nu = x_1^3 \ln \nu_1 + x_2^3 \ln \nu_2 + 3 x_1^2 x_2 \ln \nu_{12} + 3 x_1 x_2^2 \ln \nu_{21} - \ln [x_1 + (x_2 M_2 / M_1)] \quad (6)$$

$$+ 3 x_1^2 x_2 \ln [(2/3) + (M_2 / 3 M_1)] + 3 x_1 x_2^2 \ln [(1/3) + (2 M_2 / 3 M_1)] + x_2^3 \ln (M_2 / M_1) \quad (6)$$

where ν_{12} and ν_{21} are interaction parameters.

The four body interaction model is given by

$$\ln \nu = x_1^4 \ln \nu_1 + 4 x_1^3 x_2 \ln \nu_{112} + 6 x_1^2 x_2^2 \ln \nu_{1122} + 4 x_1 x_2^3 \ln \nu_{1222} + x_2^4 \ln \nu_2 - \ln [x_1 + (x_2 M_2 / M_1)] + 4 x_1^3 x_2 \ln [(3 + (M_2 / M_1)) / 4] + 6 x_1^2 x_2^2 \ln [(1 + (M_2 / M_1)) / 2] + 4 x_1 x_2^3 \ln [(1 + 3 M_2 / M_1) / 4] + x_2^4 \ln (M_2 / M_1) \quad (7)$$

where ν_{12} , ν_{21} , ν_{112} , ν_{1122} , ν_{1222} , are interaction parameters and M_1 and M_2 are molecular weights of components 1 and 2.

The correlating ability of equations 6 and 7 was tested by calculating the percentage standard deviation ($\sigma\%$) between the experimental and calculated viscosity as

$$\sigma\% = [1/(n-m) \sum \{(100(\nu_{\text{expt}} - \nu_{\text{calc}}) / \nu_{\text{expt}})^2\}]^{1/2} \quad (8)$$

where n represents the number of experimental points and m represents the number of coefficients. Table 4 includes the different parameters for McAllister's three- body and four body models. From table 4, it is clear that McAllister's four-

body interaction model gives a better result than the three-body model for correlating the kinematic viscosities of the binary mixtures studied.

The neat FTIR data of the three binary mixtures are represented in table 5. The IR—OH frequencies at $x_1=0.5$ for all the three binary mixtures are (3372, 3397, 3431 cm^{-1}) for mixtures of alkyl (ethyl, butyl and hexyl) formates with tert-butanol.

As the IR frequency increase, the intermolecular hydrogen bonding in butanols decreases and hence there are more monomer butanol molecules in the mixtures. As the alkyl chain in formates increases, the molar volume also increases and there are more voids or empty space available in the alkyl formate network and the butanol molecules find it much easier to accommodate and geometrically fit into the alkyl formate network. Therefore the trend observed for excess molar volume for alkyl formates with all the tert-butanol is very well supported by the FTIR spectroscopic studies of these mixtures. Figures 3 to 5 show the cut sections for —OH stretching frequency of all the three binary mixtures.

CONCLUSION :

From the density, viscosity and FTIR studies of the binary mixtures, it can be concluded that the dispersive interaction are operative between the components of the mixtures

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Table 1 - Comparison of Experimental Density and Viscosity of pure liquids with Literature Values

Liquid	Temp (K)	$\rho \times 10^3 (\text{kg.m}^{-3})$		$\eta (\text{mPa.s})$	
		Expt	Lit	Expt	Lit
Ethyl Formate	298.15	0.9158	0.91582 ^a	0.385	0.381 ^b
	303.15	0.9091	0.9086 ^c	0.363	0.362 ^b
	308.15	0.9025	0.9026 ^d	0.353	0.345 ^b
	313.15	0.8951	0.8949 ^e	0.325	0.329 ^b
Butyl Formate	298.15	0.8873	0.8869 ^f	0.648	-
	303.15	0.8824	0.8818 ^g	0.591	-
	308.15	0.8771	0.87824 ^h	0.550	-
	313.15	0.8725	0.8744 ⁱ	0.529	-
Hexyl Formate	293.15	0.8821	0.8816 ^j	-	-
	298.15	0.8771	-	0.879	-
	303.15	0.8721	-	0.829	-
	308.15	0.8672	-	0.784	-
	313.15	0.8643	-	0.747	-
tert-Butanol	298.15	0.7812	0.7812 ^k	4.430	4.430 ^l
	303.15	0.7760	0.7757 ^m	3.381	3.381 ^l
	308.15	0.7708	0.7707 ⁿ	2.618	2.622 ^l
	313.15	0.7656	0.7651 ^o	2.081	2.0807 ^l

^aRef.(Blanco A.M. and Ortega J.1998) ^bRef.(Djojoputro H. and Ismadji 2005) ^cRef.(Riddick J.A.et.al.1986), ^dRef.(Rathnam M.V.et.al.), ^eRef.(TRC Thermodynamic Table 1998), ^fRef.(TRC Thermodynamic Table 1965), ^gRef.(Ortega et.al.2007), ^hRef.(Emmerling U. et.al. 1998), ⁱRef.(Huggins M.L.1954), ^jRef.(TRC Data Bases for chemistry and Engineering 1996), ^kRef.(Wang C-C et.al. 2005), ^lRef.(Wang W-L. 1998), ^mRef.(Tu et.al. 2001), ⁿRef.(Fungafoo S. and Viswanath D.S. 1993).



Table 2 – Density ρ , Viscosity η , Excess Volume V^E and Deviation in Viscosity $\Delta\eta$ for Alkyl Formate (1) + tert-Butanol (2) at T= (298.15 to 313.15) K

Ethyl Formate (1)+tert-Butanol(2)							
X_1	ρ	η	V^E	$\Delta\eta$	ρ	η	V^E
	g.cm^{-3}	mPa.s	$\text{cm}^3.\text{mole}^{-1}$	mPa.s	g.cm^{-3}	mPa.s	$\text{cm}^3.\text{mole}^{-1}$
T/K =298.15							
0.0000	0.7812	4.430	0.000	0.000	0.7760	3.381	0.000
0.1001	0.7901	2.919	0.326	-1.106	0.7847	2.329	0.340
0.2000	0.7998	2.032	0.581	-1.589	0.7942	1.706	0.607
0.3003	0.8105	1.538	0.756	-1.677	0.8047	1.351	0.791
0.3995	0.8223	1.279	0.827	-1.535	0.8164	1.130	0.858
0.4999	0.8351	1.068	0.845	-1.340	0.8290	0.964	0.882
0.5993	0.8491	0.928	0.768	-1.078	0.8429	0.844	0.798
0.7000	0.8644	0.762	0.627	-0.837	0.8580	0.693	0.659
0.7991	0.8804	0.605	0.451	-0.593	0.8739	0.559	0.473
0.8999	0.8976	0.458	0.244	-0.332	0.8909	0.444	0.265
1.0000	0.9158	0.385	0.000	0.000	0.9091	0.363	0.000
T/K =303.15							
0.0000	0.7708	2.618	0.000	0.000	0.7656	2.081	0.000
0.1001	0.7793	1.900	0.355	-0.491	0.7739	1.577	0.363
0.2000	0.7886	1.457	0.635	-0.708	0.7829	1.259	0.661
0.3003	0.7989	1.180	0.830	-0.758	0.7930	1.039	0.859
0.3995	0.8104	1.006	0.905	-0.707	0.8042	0.894	0.947
0.4999	0.8229	0.864	0.924	-0.622	0.8165	0.771	0.964
0.5993	0.8367	0.746	0.834	-0.515	0.8301	0.671	0.869
0.7000	0.8518	0.632	0.677	-0.401	0.8450	0.570	0.706
0.7991	0.8675	0.518	0.493	-0.290	0.8605	0.470	0.514
0.8999	0.8844	0.422	0.275	-0.158	0.8772	0.384	0.287
1.0000	0.9025	0.353	0.000	0.000	0.8951	0.325	0.000
Butyl Formate (1) + tert-Butanol (2)							
T/K =298.15							
0.0000	0.7812	4.430	0.000	0.000	0.7760	3.381	0.000
0.1002	0.7920	3.048	0.223	-1.003	0.7868	2.359	0.234
0.2001	0.8026	2.164	0.406	-1.509	0.7974	1.781	0.422
0.2999	0.8131	1.661	0.543	-1.635	0.8080	1.428	0.553
0.4001	0.8236	1.379	0.631	-1.538	0.8185	1.244	0.643
0.5000	0.8340	1.221	0.674	-1.318	0.8290	1.104	0.677
0.6000	0.8445	1.097	0.655	-1.064	0.8395	0.982	0.661
0.6999	0.8551	0.955	0.573	-0.828	0.8500	0.877	0.594
0.7999	0.8657	0.838	0.444	-0.567	0.8607	0.761	0.456
0.8998	0.8764	0.705	0.255	-0.322	0.8714	0.647	0.267
1.0000	0.8873	0.648	0.000	0.000	0.8824	0.591	0.000
T/K =303.15							
0.0000	0.7708	2.618	0.000	0.000	0.7656	2.081	0.000
0.1002	0.7815	1.869	0.240	-0.542	0.7762	1.573	0.260
0.2001	0.7921	1.452	0.430	-0.752	0.7870	1.269	0.434
0.2999	0.8027	1.216	0.561	-0.782	0.7976	1.094	0.574
0.4001	0.8132	1.080	0.652	-0.711	0.8082	0.984	0.661
0.5000	0.8237	0.987	0.685	-0.597	0.8188	0.897	0.690
0.6000	0.8342	0.893	0.669	-0.484	0.8293	0.818	0.682
0.6999	0.8447	0.805	0.601	-0.366	0.8399	0.743	0.608
0.7999	0.8553	0.709	0.474	-0.255	0.8505	0.665	0.488
0.8998	0.8661	0.611	0.270	-0.146	0.8613	0.587	0.291
1.0000	0.8771	0.550	0.000	0.000	0.8725	0.529	0.000

Table 2 Contd

Hexyl Formate (1)+tert-Butanol(2)								
x_1	ρ g.cm ⁻³	η mPa.s	V^E cm ³ .mole ⁻¹	$\Delta\eta$ mPa.s	ρ g.cm ⁻³	η mPa.s	V^E cm ³ .mole ⁻¹	$\Delta\eta$ mPa.s
T/K = 298.15					T/K = 303.15			
0.0000	0.7812	4.430	0.000	0.000	0.7760	3.381	0.000	0.000
0.1002	0.7938	2.944	0.204	-1.130	0.7886	2.424	0.215	-0.701
0.2000	0.8056	2.151	0.335	-1.569	0.8003	1.870	0.362	-1.001
0.3002	0.8167	1.742	0.408	-1.622	0.8114	1.573	0.440	-1.042
0.3997	0.8269	1.539	0.453	-1.472	0.8216	1.385	0.488	-0.976
0.4998	0.8365	1.424	0.462	-1.231	0.8312	1.283	0.501	-0.823
0.5998	0.8456	1.322	0.424	-0.978	0.8404	1.178	0.450	-0.672
0.6991	0.8541	1.176	0.357	-0.771	0.8489	1.079	0.385	-0.518
0.8000	0.8622	1.023	0.269	-0.566	0.8571	0.983	0.283	-0.356
0.9005	0.8698	0.896	0.160	-0.336	0.8647	0.891	0.176	-0.192
1.0000	0.8771	0.879	0.000	0.000	0.8721	0.829	0.000	0.000
T/K = 308.15					T/K = 313.15			
0.0000	0.7708	2.618	0.000	0.000	0.7656	2.081	0.000	0.000
0.1002	0.7833	1.958	0.228	-0.476	0.7781	1.615	0.232	-0.332
0.2000	0.7949	1.574	0.397	-0.677	0.7896	1.356	0.421	-0.458
0.3002	0.8061	1.369	0.467	-0.698	0.8008	1.193	0.498	-0.488
0.3997	0.8163	1.251	0.522	-0.634	0.8111	1.102	0.545	-0.446
0.4998	0.8260	1.148	0.527	-0.553	0.8208	1.039	0.555	-0.375
0.5998	0.8352	1.080	0.482	-0.438	0.8301	0.979	0.500	-0.302
0.6991	0.8437	0.986	0.422	-0.350	0.8386	0.926	0.445	-0.222
0.8000	0.8520	0.904	0.309	-0.247	0.8469	0.856	0.336	-0.158
0.9005	0.8597	0.818	0.190	-0.148	0.8548	0.797	0.187	-0.083
1.0000	0.8672	0.784	0.000	0.000	0.8623	0.747	0.000	0.000



Table 3 - Parameters and Standard Deviations σ of Eqs. 4 and 5 for a Alkyl (ethyl, butyl and hexyl) Formates (1) with tert-Butanol (2)

System	T/K	a_0	a_1	a_2	a_3	σ
Ethyl Formate (1) + tert-Butanol(2)						
V^E ($m^3 mol^{-1}$)	298.15	3.3429	-0.6323	-0.2968	-	0.0076
	303.15	3.4767	-0.8496	-0.2113	0.4967	0.0097
	308.15	3.6392	-0.9653	-0.2530	0.6324	0.0096
	313.15	3.7992	-1.0159	-0.3231	-1.0159	0.0091
$\Delta\eta$ (mPa.s)	298.15	-5.3067	4.8787	-4.1821	0.7874	0.0093
	303.15	-3.599	3.1739	-2.8079	0.7744	0.0061
	308.15	-2.4788	2.2324	-1.7588	-	0.0083
	313.15	-1.7102	1.4221	-0.0161	-	0.0044
Butyl Formate(1) + tert-Butanol (2)						
V^E ($m^3 mol^{-1}$)	298.15	2.6782	0.2097	-0.0514	-	0.0028
	303.15	2.7112	0.2138	0.1019	-	0.0024
	308.15	2.7487	0.2172	0.1432	-	0.0026
	313.15	2.7568	0.2332	0.4356	-	0.0050
$\Delta\eta$ (mPa.s)	298.15	-5.3108	4.7962	-3.2152	-	0.0091
	303.15	-3.5091	3.2023	-2.8384	0.6084	0.0093
	308.15	-2.3842	2.3768	-2.2091	0.5801	0.0047
	313.15	-1.627	1.714	-0.0161	-	0.0072
Hexyl Formate(1) + tert-Butanol(2)						
V^E ($m^3 mol^{-1}$)	298.15	1.8013	-0.3133	0.3138	-	0.0062
	303.15	1.9369	-0.321	0.3271	-	0.0090
	308.15	2.075	-0.324	0.3780	-	0.0084
	313.15	2.2052	-0.3533	0.2520	-	0.0094
$\Delta\eta$ (mPa.s)	298.15	-4.893	4.9554	-5.0449	0.8271	0.0072
	303.15	-3.3102	3.0737	-2.5784	0.7100	0.0058
	308.15	-2.1702	2.2272	-2.0159	-	0.0090
	313.15	-1.4958	1.6497	-0.0161	-	0.0071

Table 4 - McAllister 3 Body and 4 body Interaction Parameters for mixtures of Alkyl Formates with Butanols

System	Temp	McAllister 3 Body			McAllister 4 Body			
		u_{12}	u_{21}	$\sigma \%$	u_{1122}	u_{1122}	u_{2221}	$\sigma \%$
Ethyl Formate + tert-Butanol	298.15	1.037	1.2318	5.32	0.645	2.335	1.182	1.72
	303.15	1.0075	1.1127	3.73	0.623	1.936	1.127	1.26
	308.15	0.8806	1.0661	1.89	0.646	1.239	1.279	0.62
	313.15	0.7784	1.017	1.77	0.578	1.137	1.168	0.62
Butyl Formate + tert-Butanol	298.15	1.1809	1.3591	3.88	0.794	3.041	1.246	2.23
	303.15	1.1343	1.1742	3.84	0.776	2.531	1.141	1.37
	308.15	1.1192	0.9876	2.27	0.842	1.673	1.17	0.63
	313.15	1.0250	0.9658	1.61	0.813	1.444	1.133	0.34
Hexyl Formate + tert-Butanol	298.15	1.4296	1.3221	6.63	0.92	4.316	1.165	1.59
	303.15	1.4319	1.2683	2.82	0.931	3.496	1.168	1.60
	308.15	1.2649	1.1969	2.38	1.002	2.183	1.337	0.55
	313.15	1.2472	1.069	1.38	1.04	1.79	1.233	0.25

Table 5: Neat FT-IR frequencies (cm^{-1}) of -OH groups of alkyl (ethyl, butyl and hexyl) Formates (1) with tert-Butanol.(2)

Ethyl Formates (1) with tert-Butanol (2)		Butyl Formates (1) with tert-Butanol (2)		Hexyl Formates (1) with tert-Butanol (2)	
x_1	-OH	x_1	-OH	x_1	-OH
Ethyl Formate	--	Butyl Formate	--	Hexyl Formate	--
0.3001	3373.61	0.3000	3381.33	0.3000	3381.33
0.3995	3377.47	0.4001	3393.86	0.3998	3400.62
0.4998	3371.68	0.5000	3396.76	0.4998	3431.48
0.5998	3375.54	0.6000	3434.37	0.5998	3437.26
0.7000	3379.40	0.6999	3433.41	0.6992	3437.26
0.7990	3431.48	0.8000	3431.48	0.7999	3533.00
tert-butanol	3375.54	tert-butanol	3375.54	tert-butanol	3375.54

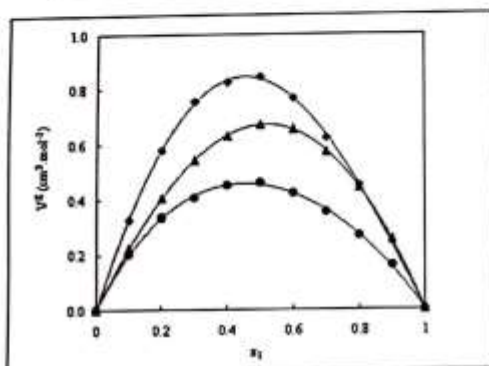


Fig.1 $-V^E$ values at 298.15 K for Alkyl(x_1): (♦) Ethyl formate; (▲) Butyl formate; (●) Hexyl formate + tert-Butanol

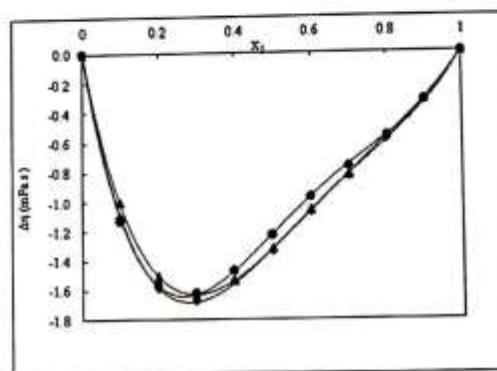


Fig.2 $-\Delta\eta$ values at 298.15 K for Alkyl formates (x_1): (♦) Ethylformate; (▲) Butyl formate; (●) Hexyl formate + tert-Butanols ($1-x_1$)

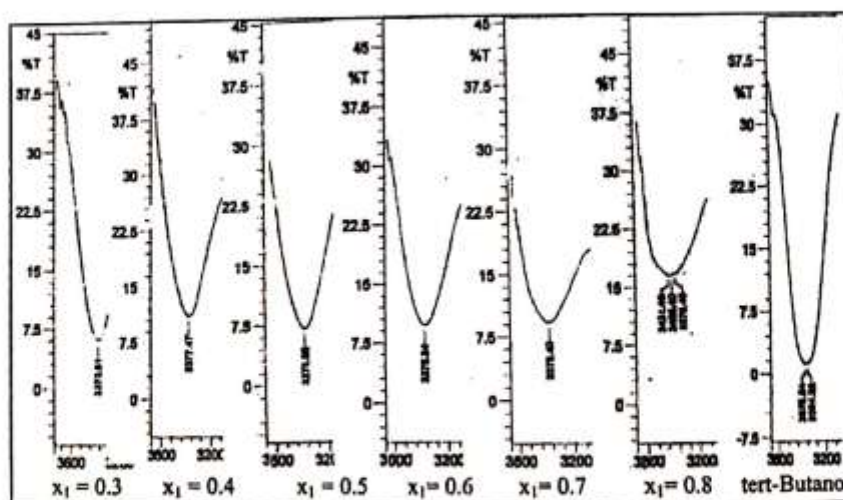


Fig.3-FTIR Spectrum for -OH frequency (cm^{-1}) of EthylFormate (x_1) with tert- Butanol

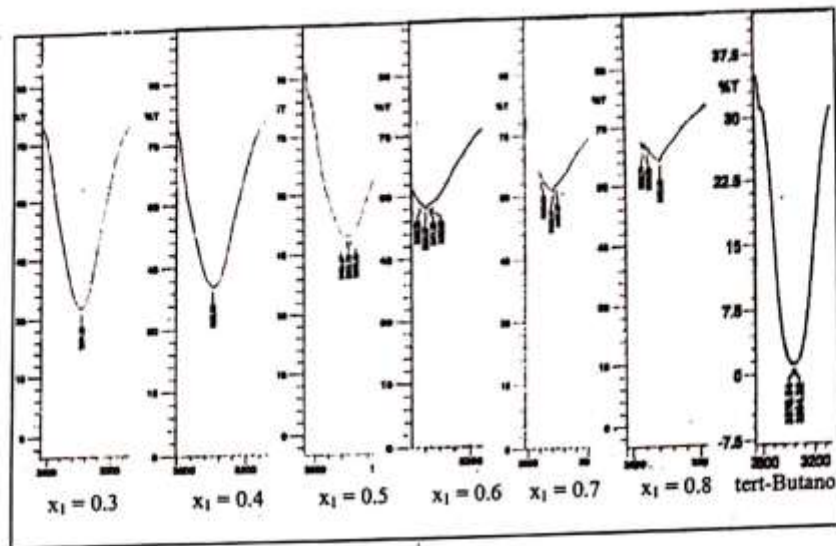


Fig.4 -FTIR Spectrum for -OH frequency (cm^{-1}) of Butyl Formate (x_1) with tert- Butanol

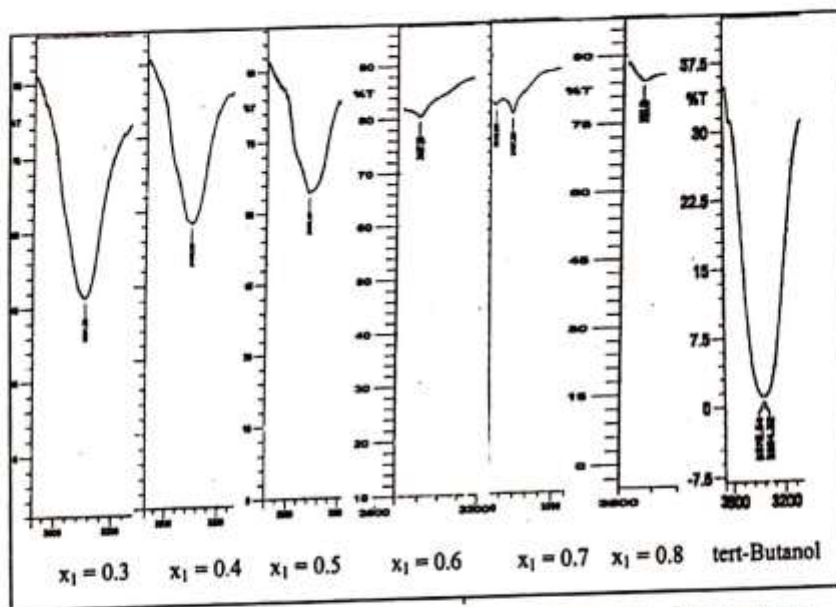


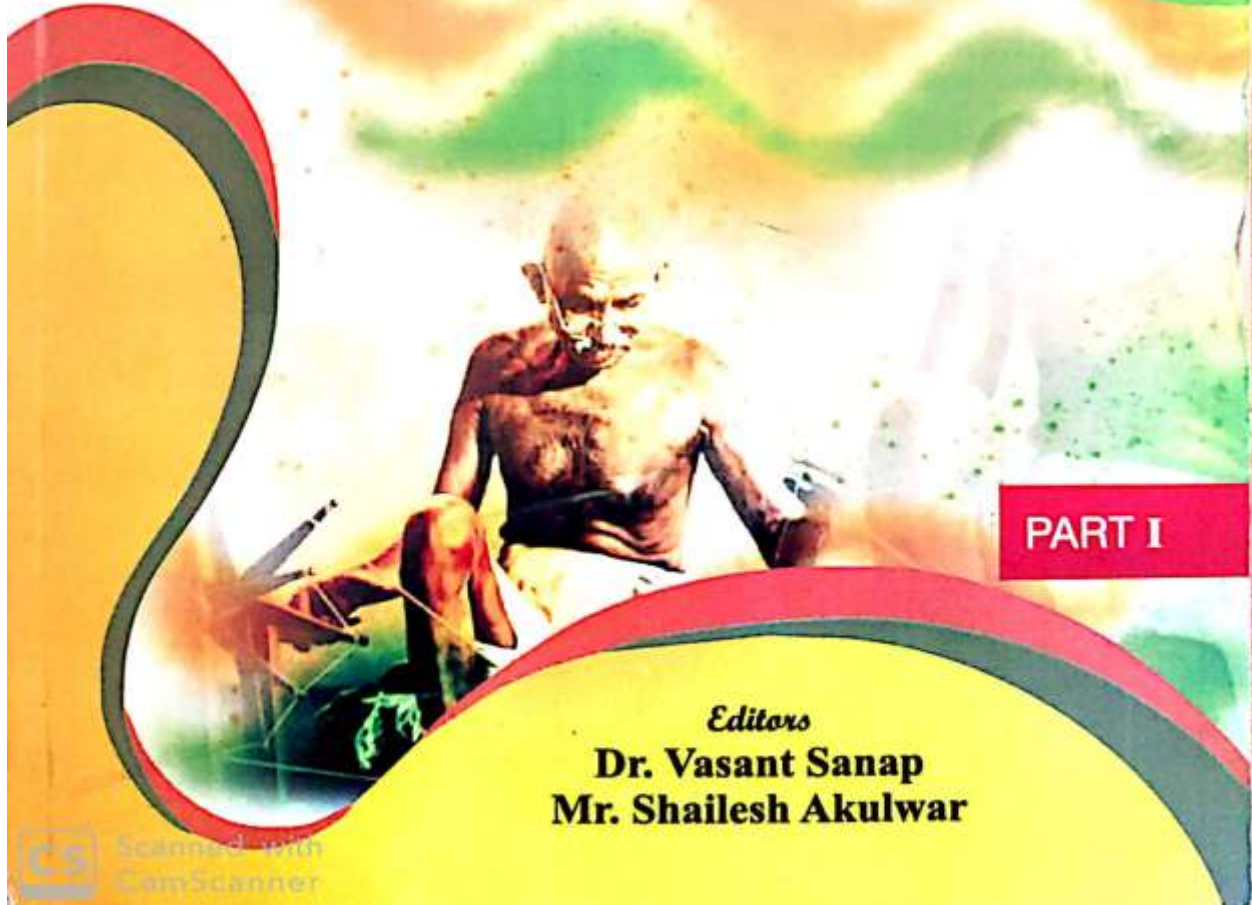
Fig.5- FTIR Spectrum for -OH frequency (cm^{-1}) of HexylFormate (x_1) with tert- Butanol

RELEVANCE OF GANDHIAN THOUGHTS

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PART I

Editors

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Scanned with
CamScanner

Mahatma Gandhi's Philosophy of Life Regarding Violence and Non-violence

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"Non-violence and cowardice are contradictory terms. Non-violence is the greatest virtue, cowardice the greatest vice. Non-violence springs from love, cowardice from hate. Non-violence always suffers, cowardice would always inflict suffering. --Mahatma Gandhi"

Introduction: British rule was well established in India when Mahatma Gandhi was born on October 2, 1869. Mahatma means Great Soul. He was indeed a great soul. He was the architect of the Satyagraha movement, the firm resistance against tyranny through mass civil disobedience truly founded on *Ahimsa* (total non violence). *Satya* (truth) implies love, and *Agraha* (firmness) implies force. When put together, this describes a force that is born of truth with love or nonviolence. His nonviolence movement, the only revolution of its kind, ultimately succeeded in getting independence for India in 1947 from the British.

Mahatma Gandhi, a man with many facets, could be the most needed inspiration to humankind. He was a consummate artist and an accomplished craftsman, a resolute scientist and astute thinker. *Satyagraha*, for example, is an art as well as a science. Mahatma Gandhi is the most significant and relevant proponent of nonviolence and peace for the modern world marked by so much violence and war. According to Gandhi, most of us who claim to be for nonviolence and peace are in fact very violent and contribute to and are complicit with our world of violence and war. Gandhi's philosophical approach to nonviolence is integrally related to his approach to truth. According to Gandhi, modern human beings live violent, immoral, and unspiritual lives of untruth. Gandhi challenges us to rethink and transform our basic assumptions, values, and ways of living toward greater *Satya* and *Ahimsa*.

Gandhism: Gandhism consists of the ideas, which Mahatma Gandhi put forth before human world. Along with that, to the maximum possible extent, Mahatma Gandhi treated his individual life in accordance with these ideas. Clearly, Gandhism is a mixture of

Relevance of Gandhian Thoughts

Gandhi's concepts and practices. The basic groundship of Gandhism happens to be non-violence. The non-violence is the most ancient eternal value. This non-violence is the ground of ancient-most civilization and culture of India. Mahatma Gandhi said on this very account while making his concepts and practices based on non-violence, "I have nothing new to teach you... Truth and non-violence are as old as hill." As we know, non-violence and truth are two sides of the same coin. After knowing Gandhism, it is imperative for us to know clearly the concept of non-violence also as it accords the ground for Gandhism.

Origin of Violence: There is a killer instinct in every human being. Violent behaviors in humans have biological, evolutionary underpinnings that found throughout the animal kingdom and commonly occur both within species and between species. For example, antagonistic interactions within species such as social competition for status, food and sex tend to occur within social groups. They also tend to be ritualized, both in humans and other animals, for example escalating from arousal, display, menace, and ritualized attack to violence- but rarely killing, as there are various means for breaking off the engagement such as submission, fleeing, or, within human groups, restraint by others. By contrast, predator-prey interactions, typically involving arousal, stalk, attack, and kill sequences tend to occur between different species, although they can also occur within species. Violence is a complex and multidimensional concept with implications for a variety of disciplines; it comes in different forms and varying degrees of intensity. The agents and victims of violence belong to different categories. Some violence is defensive, but much of it is aggressive. Its effects are varied as are its causes. Some forms of violence are clearly pathological. Certain acts of violence are self-directed while others are directed at others. Some practices of violence are legally licensed while some others are expressly prohibited. Therefore, it is not easy to have an agreed on definition of violence. Violence appears to be a heterogeneous concept difficult to clearly define and delineate.

The Concept of Non Violence: The question that comes into our mind is what is non-violence? Ordinarily, we attribute non-violence as a dictum that prescribes non-snatching of anyone's life. Really, this is not complete derivation pertaining to the concept of non-violence. Non-violence is quite opposite to violence. As such, it would be better to know the position relating to violence in order to know non-violence and to be in knowledge of its meaning. According to a Jain scholar, "Whenever, we hurt some other living being through our thought, utterance or action under non-cordial stipulation and non-apt learning,

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such an impure spirit or act of destroying life of some other one, including the impure tendency, utterance or presuming, is taken to be full of vice of violence. In such a situation, even if there is no sort of violence externally, it intrinsically ipso facto remains a tendency of violence."

As a situation opposite to violence is non-violence, we can firmly state, "Total non-violence consists in not hurting some other one's intellect, speech or action per own thought, utterance or deeds and not to deprive some one of his life." We can clearly say this in a few words as follows: Abstinence in toto from violence is non-violence. Gandhi said, "Non-violence is not a concrete thing as it has generally been enunciated. Undoubtedly, it is a part of non-violence to abstain from hurting some living being, but it is only an iota pertaining to its identity. Non-violence is an active force for the highest order".

The *Satyagrahi* was enjoined to see that he was in no way a party to exploitation and injustice. It is a technique of conversion, not of coercion. In fact, violence in any shape or form, against anyone or the Government was considered 'suicidal'. A non violent person would lay down his life to prevent, violence. There should be no reliance on the sword, as according to him, violence always springs out of vengeance which comes out of fear of harm. Above all, there is no word like enemy in the vocabulary of a follower of *Ahimsa*. *Ahimsa* cannot be a weak weapon. Non-violence is a dynamic concept always hopeful, confident and optimistic about its potentialities. It is through this technique that Gandhi could reach the mass mind so easily and quickly and with much unprecedented effect.

Gandhiji was a staunch champion of non violence. His views on non-violence are extensively discussed, but what he said about violence received only scant attention. However, a more wholesome understanding of Gandhi is possible only when we study them together. The reason for this becomes obvious once we recognize that non-violence, according to Gandhi is not identical with absence or avoidance of violence. We are repeatedly reminded by Gandhi that non-violence is a positive force. A good description of nonviolence is "live with goodwill". We can define non violence as "Non-violence means an ocean of compassion, it means shedding from us every trace of ill-will for others". It is a spiritual force that controls violence and has the potential for "magical transformation" of the adversary. Gandhi pointed out that violence is the law of the beast in us. Abstaining from violence is controlling the beast in us. Practicing nonviolence is awakening the spiritual being within.

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Path of Non-Violence: Gandhiji stated the path of glory through the non violence. In context of non-violence being perpetual, Mahatma Gandhi states, "...When we peruse the era from beginning unto now relating to the period for which we gain historical evidence, we find that man has been ultimately treading path of non-violence". It is, as such, that non-violence came into existence along with man. "In case it has not been with man from the very beginning, there might have been self-doom by man". However, it has not been that and not only human race is alive in such a huge number but there has been gradual enhancement in development and nearness in spite of presence of various obstacles and nuisances. This could never have been, but because non-violence is perpetual, it happened.

Truth and Non-Violence: Non-violence is governing because it is perpetual and permanent. It is on this accord that Mahatma Gandhi says, as I have already enunciated that 'Truth and Non-violence' are two sides of the same coin. Both have same value. Difference consists in approach only. On one side there is non-violence, on other side is truth". The derivation is that Truth stays with permanence or that Truth is permanent. Non-violence on account of being permanently present stays to be true. Mahatma Gandhi integrally combines non-violence with God. According to him, "It is impossible to tread path of 'Truth and Non violence' unless one has vital faith in God. God is that alive force which incorporates all remaining forces of the world. This force does not depend upon anyone and it exists even when all other forces in the world come to an end. In case I do not believe unto this all glittering light, that incorporates everything, I fail to understand as to how be I alive!"

Non-Violence and Cowardice: Mahatma Gandhi always believed in active non-violence. He always desisted from inaction like a brave man. It is a truth relating to non-violence that it is not a weapon of a weak person. It has no place for cowardice. In own words of Mahatma Gandhi, "...Non-violence should not be mistaken to be a true battle against every sort of evil". He further states, "In contrast, non-violence of my conception is true battle against evil; it is active confrontation and not a device of tit for tat." He clarified to those who were keen to take non-violence to be a weapon of the weak or those who terming it as concrete and was upbringing non-action, "...Non-violence and cowardice are not at all inter-related. I can think of a person to be coward at heart even if he is totally armed. In case it is not taken as cowardice to be equipped with arms, it is certainly symbolical of fearfulness. Pure non-violence is impossible without pure bravery". He clearly said at innumerable occasions in time of national struggle for freedom that was being bravely carried out with fearlessness under his

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very leadership. "Non-violence is an active force. There is no possibility of cowardice or weakness in it". Further he adds "There can be hope of a violent person being non-violent one day but there cannot be such a hope in relation to a coward".

Non-Violence and Democracy: In fact, Mahatma Gandhi takes real democracy to be that admits governmental interference at the minimum, which has peace at the maximum and all progress on the basis of equality. It is possible only when non-violence is imparted the supreme status in practice as well as in principle and at social as well as individual plane. Only such a democracy can be successful in its real goal. Presently, the democratic system in operation in worldly nations is not according to Gandhian principle. We are not getting what Mahatma Gandhi ultimately cherished from democracy. If it was so, these nations could be devoid of atmosphere of violence and presence of fear. There could not have been corruption and divided human society. It is already emphasized that there could not have been problems pertaining to terrorism, communalism, regionalism and problems relating to languages. More than this all, there could not have been observance of ethical and moral degradation in public life. Such degradation is being observed constantly. The main cause after all these things remain that all activities of these nations are not non-violent. There cannot be any possibility of violence while there is Gandhism in democracy. Violence is not sacred, pure or welfaristic from any point of view. Whatever is gained on the basis of it is impure and temporary. It is on this accord that it cannot pace with democracy even for a moment. Mahatma Gandhi says, "Democracy and violence can never be mutual". Basis of democracy is non-violence in toto. And, there cannot be any diminution in it. Non-violence should be real; not merely titular. Democracy shall be pro-people only while so. Mahatma Gandhi said in this context, "If they are to be truly made democratic, they must be valiantly non-violent". In case of absence of this attribute, democracy shall be there for namesake only and it would be better for it to...clearly be supporter of dictatorship.

As we have analyzed, Mahatma Gandhi is in favor of spontaneous development of non-violence. To make democracy ultimately in accordance with non-violence remains to be his goal. This is possible. He rightly said in this regard, "... Non-violence is not merely an individual concept. It is social concept also. It must be developed in this form".

Does Gandhi Live in the Hearts of Indians?: Yes there is no doubt that! Gandhi lives in the hearts of Indians as it has been reflected time and again politicians and social activists getting support when they adopt Gandhi's tenets of peace and non-violence. The recent Anna

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Hazare's crusade against corruption is an example to prove. The support to Anna Hazare is an indication that Gandhi lives in the hearts of the people. It is not the Anna who got the support from people but it is Gandhi who got support. It is not Anna's methods that got support but Gandhi's methods of non-violence and Satyagraha. It substantiates the truth that Gandhi lives in the hearts of people. He is not only a national leader but also an international leader who influenced many including 5 Nobel laureates for Peace – Martin Luther King, Nelson Mandela, Dalai Lama, Aung San Suu Kyi, and Barack Obama. Gandhi remains relevant not only now but in future and as long as civilization exists. People have to live with peace and prosperity. They have to live with fraternity and brotherhood and which is possible only through Gandhi's principles of non-violence, peace and love.

Conclusion: Non-violence as an intrinsic as well as an instrumental value bears the same relationship as the one between *purusha* and the mind in *Yoga*. In phenomenal states of consciousness, violence and non-violence become contextual and they take on instrumental character. From a spiritual perspective they present themselves in abstract and absolute forms. Non-violence becomes an intrinsic value. It is this value that is reflected in our value judgements, though blemished to a degree by the contextual constraints. Gandhi's philosophy of life may be described in one word *sarvodaya* (literally rise of all). *Sarvodaya* is Gandhi's slogan for cultivating altruism. Altruism consists in finding one's happiness in the happiness of others. Gandhiji believed that humans are intrinsically altruistic. Non-violence is the attitude that one needs to cultivate and practice for realization of altruism in one's being. Nonviolence is the countervailing condition that enables the person to transcend the existential roadblocks, achieve self-realization and become altruistic. In the words of Mahatma Gandhi – *"An opponent is entitled to the same regard for his principles as we would expect others to have for ours. Non-violence demands that we should see every opportunity to win over opponents"*.

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25. FT-IR, Volumetric and Viscometric Studies of Interaction between Alkyl Formates and n-butanol at Temperature 298.15, 303.15, 308.15 and 313.15 K

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Abstract

Densities and viscosities of binary mixtures of n-butanol with ethyl formate, butyl formate and hexyl formate have been measured over the entire range of composition, at $T = (298.15, 303.15, 308.15 \text{ and } 313.15) \text{ K}$ and at atmospheric pressure. The V^E values are positive for all the binary mixtures studied over the entire composition range, while $\Delta\eta$ are negative for all the binary mixtures. These parameters have been fitted to Redlich-Kister polynomial equation. McAllister's multibody model has been used to co-relate the kinematic viscosities of the binary mixtures. Neat FT-IR spectra are also taken.

Key Words: Excess molar volumes, deviation in viscosity, FT-IR, n-butanol, ethyl formate, butyl formate, hexyl formate.

Introduction

Studies on excess molar properties of binary liquid mixtures are of considerable importance in understanding the nature of molecular interaction. Measurements of densities and viscosities of binary liquid mixtures enable one to gather some information about the nature of interaction taking place in the binaries. The literature provides extensive data on the densities and viscosities of liquid mixtures, but a combined study of density, viscosity and FT-IR is quite scarce. FT-IR is very useful in elucidating the structure of molecule/ complex¹⁻² and provides supporting evidence to the conclusions drawn from the volumetric and viscometric measurements. The effects of molecular size, shape, chain length and degree of molecular association of n-butanol on the volumetric, viscometric and acoustic properties of binary mixtures containing alkyl formates have been reported earlier³⁻⁴. The present work reports the densities, viscosities and FT-IR studies for the binary mixtures of n-butanol with ethyl formate, butyl formate and hexyl formate at $T = (298.15, 303.15, 308.15 \text{ and } 313.15) \text{ K}$.

Experimental

n-Butanol (s. d. Fine Chem) was refluxed over freshly ignited calcium oxide for 4 hours. The alcohol was decanted from the lime, refluxed with magnesium turnings and then fractionally distilled. The middle fraction which boiled at 112.6°C was collected. Ethyl Formate, Butyl Formate and Hexyl formate were double distilled and the middle fraction was used. The purity of the solvents were further ascertained by comparing their experimental density and viscosity with those reported in the literature values at T/K = 298.15 Table 1. Binary mixtures were prepared by mass in air tight stoppered glass bottles. The masses were recorded on an Adairdutt balance to an accuracy of $\pm 1 \times 10^{-4}$ g. Care was taken to avoid evaporation and contamination during mixing. The estimated uncertainty in mole fraction was $< 1 \times 10^{-4}$. Densities were determined by using a 15 cm³ bicapillary pycnometer as described earlier.⁵⁻⁶ The pycnometer was calibrated using conductivity water with $\rho = 0.99705 \times 10^{-3} \text{ kg.m}^{-3}$ as its density⁷ at T/K = 298.15 The pycnometer filled with air bubble free experimental liquids was kept in a transparent walled water bath (maintained constant to ± 0.01 K) for (10 to 15) min to attain thermal equilibrium. The estimated uncertainty of density measurements of solvent and binary mixtures was $\pm 0.1 \times 10^{-3} \text{ kg.m}^{-3}$. At least three to four measurements were made which had an average deviation of $\pm 0.1 \times 10^{-3} \text{ kg.m}^{-3}$.

The dynamic viscosities were measured using an Ubbelohde suspended level⁸ viscometer calibrated with conductivity water. An electronic digital stop watch with readability of ± 0.01 s was used for the flow time measurements. At least three repetitions of each data reproducible to ± 0.05 s were obtained, and the results were averaged. The dynamic viscosity η of the liquids was calculated by

$$\eta = \rho (at - b/t) \quad (1)$$

where η is the viscosity, ρ is density of the liquid, t is the flow time, a and b are the constants for a given viscometer. The uncertainties in dynamic viscosities are estimated to be of the order of $\pm 0.003 \text{ mPa.s}$.

FTIR spectra were recorded on a FTIR spectrometer (Model: SHIMADZU 8400s pc) by using KBr pellet in the region $400 - 4000 \text{ cm}^{-1}$ with 4.0 cm^{-1} resolution. The transmission values were read in steps of 5%. The spectrophotometer possesses out to aligned energy optimization and dynamically aligned interferometer. It is fitted with KBr beam splitter, a DLATGS detector. A base line correction was made for the spectra recorded.

Results and Discussion: Experimental values of densities and viscosities of mixtures at T= (298.15, 303.15, 308.15 and 313.15) K are listed as a function of mole fraction in Table 2. The density values have been used to calculate V^E using the following equation

$$V^E (\text{m}^3 \text{mol}^{-1}) = (x_1 M_1 + x_2 M_2) / \rho_{12} - (x_1 M_1 / \rho_1) - (x_2 M_2 / \rho_2) \quad (2)$$

where ρ_{12} is the density of the mixture and x_1 , M_1 , ρ_1 and x_2 , M_2 , ρ_2 are the mole fraction, the molecular weight and density of pure components 1 and 2 respectively. The uncertainty in V^E is of $\pm 0.008 \text{ m}^3 \text{mol}^{-1}$. $\Delta\eta$ were calculated using

$$\Delta\eta (\text{mPa.s.}) = \eta_{12} - x_1 \eta_1 - x_2 \eta_2 \quad (3)$$

where η_{12} is the viscosity of the mixture and x_1 , x_2 and η_1 , η_2 are the mole fraction and the viscosity of pure components 1 and 2 respectively. The excess molar volumes and deviation in viscosity were fitted to Redlich-Kister⁹ equation of the type

$$Y = x_1 x_2 \sum a_i (x_1 - x_2)^i \quad (4)$$

where Y is either V^E , or $\Delta\eta$ and n is the degree of polynomial. Coefficient a_i were obtained by fitting equation 4 to experimental results using a least-squares regression method. In each case, the optimum number of coefficients is ascertained from an examination of the variation in standard deviation σ .

σ was calculated using the relation

$$\sigma(Y) = [\sum (Y_{\text{exp}} - Y_{\text{calc}})^2 / (N-n)]^{1/2} \quad (5)$$

where N is the number of data points and n is the number of coefficients. The determined values of the coefficients a_i along the standard deviation σ are given in Table 3.

The variation of V^E with mole fraction of alkyl formate (ethyl, butyl and hexyl) with n-butanol at T/K = 298.15 K is represented in figure 1. The excess molar volume for the mixture of n-butanol with ethyl formate (0.328 at 298.15 K) is in good agreement with excess molar volumes (0.326 at 298.15 K) at $x_1 = 0.5$ reported by Ortega et al.³ where as the excess molar volumes for the binary mixture of butyl formate with n-butanol (0.184 at 298.15 K) is in good agreement with excess molar volumes reported by Ortega et al.⁴ as (0.181 at 298.15 K) at $x_1 = 0.5$.

The V^E for these mixtures are positive over entire composition range at all temperatures indicating that the dispersive forces dominate over the chemical or specific interactions. The positive V^E values may also arise due to the predominance of declustering of butanol in presence of formates.

It is seen that as the alkyl part in the formates increases from ethyl to hexyl, the V^E values decrease. This may be due to the fact that the n-butanol molecules may be fitting in to the

interstitial spaces of higher alkyl formates. The molar volumes of n-butanol and ethyl formate are not much different; hence n-butanol finds it much difficult to enter the interstitial voids in the ethyl formate net work. But for butyl and hexyl formates the molar volumes are much different from that of n-butanols and there are chances that the n-butanol molecules may find it much easier to accommodate themselves in the ester networks of butyl and hexyl formates leading to a decrease in the V^E .

It is a well established fact that alcohols are self-associated¹⁰⁻¹⁵ through hydrogen bonding, with the strength and extent decreasing with branching in alcohols, while formates having dipolar nature are also associated through intermolecular hydrogen bonding. Thus, mixing of formates with an alcohol (butanol) can be expected to induce changes in hydrogen-bonding equilibria and electrostatic interactions, with different resultant contributions to the volumes of the mixtures. Weakening of the interactions between the molecules of formates tends to result in an increase in volume. Similarly, the disruption of butanol multimers through breaking of hydrogen-bonds makes a positive contribution to V^E ¹⁶⁻¹⁷.

V^E increases with increase of temperature from 298.15 to 313.15 K for all these three binary mixtures, which may be attributed partly to thermal agitation and partly due to the fact that more hydrogen bonds are broken at higher temperatures. Homo and hetero associations are also weakened at higher temperatures leading to an increase in V^E values.

The values of $\Delta\eta$ for the binary mixtures of ethyl formate, butyl formate and hexyl formate with n-butanol are negative over entire composition range at all temperatures indicating that the dispersive forces dominate over the chemical or specific interactions. Fig.2 exhibits the variation of $\Delta\eta$ with x_1 [alkyl formates] for binary mixtures of ethyl formate, butyl formate and hexyl formate with n-butanol at 298.15 K. It is seen that the $\Delta\eta$ values are almost the same for all the three binary mixtures of alkyl formate with n-butanol signifying that the nature of interactions which govern the $\Delta\eta$ values remain almost the same irrespective of the alkyl moiety in the ester.

The $\Delta\eta$ values in all the three binary systems studied here show a marked dependence on temperature. These values decrease systematically as the temperature is increased. It can be concluded that the mixture viscosities decrease to a greater extent as compared with the decrease in the viscosities of pure binary components with increase in temperature. Further it is seen that the effect of temperature is more pronounced for $\Delta\eta$ than for V^E .

Kinematic viscosities (ν) of the binary liquid mixtures were obtained from their dynamic viscosities and densities. McAllister's three body and four body interaction models ¹⁸ have been used to correlate the kinematic viscosities of binary liquid mixtures.

$$\begin{aligned} \ln \nu = & x_1^3 \ln \nu_1 + x_2^3 \ln \nu_2 + 3 x_1^2 x_2 \ln \nu_{12} + 3 x_1 x_2^2 \ln \nu_{21} - \ln [x_1 + (x_2 M_2 / M_1)] \\ & + 3 x_1^2 x_2 \ln [(2/3) + (M_2 / 3 M_1)] + 3 x_1 x_2^2 \ln [(1/3) + (2 M_2 / 3 M_1)] + \\ & x_2^3 \ln (M_2 / M_1) \end{aligned} \quad (6)$$

where ν_{12} and ν_{21} are interaction parameters.

The four body interaction model is given by

$$\begin{aligned} \ln \nu = & x_1^4 \ln \nu_1 + 4 x_1^3 x_2 \ln \nu_{1112} + 6 x_1^2 x_2^2 \ln \nu_{1122} + 4 x_1 x_2^3 \ln \nu_{2221} + x_2^4 \ln \nu_2 \\ & - \ln [x_1 + (x_2 M_2 / M_1)] + 4 x_1^3 x_2 \ln \{ [3 + (M_2 / M_1)] / 4 \} + 6 x_1^2 x_2^2 \ln \{ [1 + \\ & (M_2 / M_1)] / 2 \} + 4 x_1 x_2^3 \ln \{ [(1 + 3 M_2 / M_1)] / 4 \} + x_2^4 \ln (M_2 / M_1) \end{aligned} \quad (7)$$

where ν_{12} , ν_{21} , ν_{1112} , ν_{1122} , ν_{2221} are interaction parameters and M_1 and M_2 are molecular weights of components 1 and 2.

The correlating ability of equations 6 and 7 was tested by calculating the percentage standard deviation (σ %) between the experimental and calculated viscosity as

$$\sigma \% = [1/(n-m) \sum \{ (100(\nu_{\text{expt}} - \nu_{\text{calcd}}) / \nu_{\text{expt}})^2 \}^{1/2}] \quad (8)$$

where n represents the number of experimental points and m represents the number of coefficients. Table 4 includes the different parameters for McAllister's three- body and four body models. From table 4, it is clear that McAllister's four-body interaction model gives a better result than the three- body model for correlating the kinematic viscosities of the binary mixtures studied.

The neat FTIR data of the three binary mixtures are represented in table 5. The IR -OH frequencies at $x_1=0.5$ for all the three binary mixtures are (3358, 3377, 3397 (mean) cm^{-1}) for mixtures of alkyl (ethyl, butyl and hexyl) formates with n-butanol.

As the IR frequency increase, the intermolecular hydrogen bonding in butanols decreases and hence there are more monomer butanol molecules in the mixtures. As the alkyl chain in formates increases, the molar volume also increases and there are more voids or empty space available in the alkyl formate network and the butanol molecules find it much easier to accommodate and geometrically fit into the alkyl formate network. Therefore the trend observed for excess molar volume for alkyl formates with all the n- butanol is very well supported by the FTIR spectroscopic studies of these mixtures.

Figures 3 (a) to 3 (i) show the cut sections for -OH stretching frequency of all the three binary mixtures.

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Table 1 - Comparison of Experimental Density and Viscosity of pure liquids with

Literature Values

Liquid	Temp (K)	$\rho \times 10^{-3} (\text{kg m}^{-3})$		$\eta \text{ (mPa.s)}$	
		Expt	Lit	Expt	Lit
Ethyl Formate	298.15	0.9158	0.91582 ^a	0.385	0.381 ^b
	303.15	0.9091	0.9086 ^c	0.363	0.362 ^b
	308.15	0.9025	0.9026 ^d	0.353	0.345 ^b
	313.15	0.8951	0.8949 ^e	0.325	0.329 ^b
Butyl Formate	298.15	0.8873	0.8869 ^e	0.648	-

Hexyl Formate	303.15	0.8824	0.8818 ^f	0.591	-
	308.15	0.8771	0.87824 ^g	0.550	-
	313.15	0.8725	0.8744 ^h	0.529	-
	293.15	0.8821	0.8816 ⁱ	-	-
	298.15	0.8771	-	0.879	-
	303.15	0.8721	-	0.829	-
	308.15	0.8672	-	0.784	-
n-Butanol	313.15	0.8643	-	0.747	-
	298.15	0.8063	0.80626 ^j	2.565	2.5647 ^k
	303.15	0.8024	0.80240 ^j	2.267	2.268 ^m
	308.15	0.7985	0.79850 ^j	1.986	1.982 ⁿ
	313.15	0.7945	0.79447 ^j	1.777	1.780 ^o

^aRef.19, ^bRef.20, ^cRef.21, ^dRef.22, ^eRef.23, ^fRef.24, ^gRef.25, ^hRef.26, ⁱRef.27, ^jRef.28, ^kRef.29, ^lRef.30, ^mRef.31, ⁿRef.32

Table 2.1- Density, Viscosity, Excess Volume and Deviation in Viscosity for Ethyl Formate with n-Butanol

Ethyl Formate (1) + n-Butanol(2)									
X ₁	ρ	η	V ^E	Dh	ρ	η	V ^E	Dh	
	g·cm ⁻³	mPa·s	cm ³ ·mole ⁻¹	mPa·s		g·cm ⁻³	mPa·s	cm ³ ·mole ⁻¹	mPa·s
T/K = 298.15					T/K = 303.15				
0.0000	0.8063	2.565	0.000	0.000	0.8024	2.267	0.000	0.000	
0.0983	0.8148	1.942	0.121	-0.409	0.8106	1.767	0.131	-0.313	
0.1982	0.8239	1.507	0.214	-0.626	0.8194	1.403	0.231	-0.487	
0.3010	0.8338	1.209	0.275	-0.700	0.8290	1.142	0.298	-0.552	
0.4036	0.8441	1.008	0.318	-0.677	0.8390	0.959	0.345	-0.540	
0.4916	0.8534	0.882	0.328	-0.611	0.8481	0.842	0.351	-0.489	
0.6012	0.8656	0.756	0.309	-0.498	0.8599	0.726	0.340	-0.396	
0.7038	0.8776	0.648	0.266	-0.383	0.8717	0.630	0.285	-0.297	
0.8002	0.8894	0.550	0.205	-0.271	0.8832	0.543	0.224	-0.200	
0.8998	0.9022	0.456	0.118	-0.147	0.8958	0.453	0.124	-0.101	
1.0000	0.9158	0.385	0.000	0.000	0.9091	0.363	0.000	0.000	
T/K = 308.15					T/K = 313.15				
0.0000	0.7985	1.986	0.000	0.000	0.7945	1.777	0.000	0.000	
0.0983	0.8064	1.560	0.142	-0.265	0.8020	1.456	0.158	-0.178	
0.1982	0.8149	1.257	0.251	-0.405	0.8101	1.200	0.281	-0.289	
0.3010	0.8241	1.043	0.335	-0.451	0.8189	0.996	0.375	-0.344	
0.4036	0.8338	0.891	0.386	-0.436	0.8282	0.850	0.434	-0.341	
0.4916	0.8427	0.790	0.388	-0.393	0.8368	0.747	0.437	-0.316	
0.6012	0.8542	0.683	0.376	-0.321	0.8480	0.650	0.416	-0.254	
0.7038	0.8658	0.589	0.312	-0.248	0.8592	0.574	0.353	-0.181	
0.8002	0.8770	0.503	0.250	-0.176	0.8701	0.504	0.283	-0.111	

0.8998	0.8894	0.420	0.137	-0.097	0.8823	0.424	0.150	-0.046
1.0000	0.9025	0.353	0.000	0.000	0.8951	0.325	0.000	0.000

Table 2.2 - Density, Viscosity, Excess Volume and Deviation in Viscosity for Butyl Formate with n-Butanol

Butyl Formate (1) + n-Butanol(2)								
X_1	ρ	η	V^E	D_h	ρ	η	V^E	D_h
	g cm^{-3}	mPa.s	$\text{cm}^3 \cdot \text{mole}^{-1}$	mPa.s	g cm^{-3}	mPa.s	$\text{cm}^3 \cdot \text{mole}^{-1}$	mPa.s
T/K = 298.15					T/K = 303.15			
0.0000	0.8063	2.565	0.000	0.000	0.8024	2.267	0.000	0.000
0.1000	0.8155	1.928	0.076	-0.445	0.8115	1.735	0.081	-0.364
0.2002	0.8245	1.554	0.129	-0.627	0.8203	1.423	0.144	-0.508
0.2999	0.8332	1.317	0.160	-0.673	0.8288	1.222	0.186	-0.542
0.4000	0.8416	1.148	0.184	-0.650	0.8371	1.074	0.209	-0.523
0.4999	0.8498	1.027	0.184	-0.580	0.8451	0.963	0.221	-0.466
0.6000	0.8577	0.928	0.178	-0.487	0.8530	0.869	0.203	-0.392
0.7000	0.8654	0.843	0.154	-0.380	0.8606	0.789	0.179	-0.305
0.7987	0.8728	0.766	0.116	-0.268	0.8679	0.715	0.142	-0.213
0.9000	0.8802	0.705	0.063	-0.135	0.8753	0.650	0.076	-0.109
1.0000	0.8873	0.648	0.000	0.000	0.8824	0.591	0.000	0.000
T/K = 308.15					T/K = 313.15			
0.0000	0.7985	1.986	0.000	0.000	0.7945	1.777	0.000	0.000
0.1000	0.8073	1.547	0.099	-0.295	0.8031	1.420	0.113	-0.232
0.2002	0.8159	1.290	0.168	-0.409	0.8117	1.199	0.175	-0.328
0.2999	0.8243	1.120	0.205	-0.435	0.8200	1.047	0.217	-0.356
0.4000	0.8324	0.994	0.235	-0.418	0.8281	0.946	0.240	-0.332
0.4999	0.8403	0.895	0.242	-0.373	0.8359	0.858	0.252	-0.295
0.6000	0.8480	0.809	0.232	-0.315	0.8436	0.779	0.235	-0.249
0.7000	0.8555	0.736	0.204	-0.245	0.8510	0.709	0.212	-0.194
0.7987	0.8628	0.667	0.150	-0.172	0.8582	0.643	0.164	-0.137
0.9000	0.8700	0.606	0.093	-0.088	0.8654	0.576	0.100	-0.078
1.0000	0.8771	0.550	0.000	0.000	0.8725	0.529	0.000	0.000

Table 2.3- Density, Viscosity, Excess Volume and Deviation in Viscosity for Hexyl Formate with n-Butanol

Hexyl Formate (1) + n-Butanol(2)								
X_1	ρ	η	V^E	D_h	ρ	η	V^E	D_h
	g cm^{-3}	mPa.s	$\text{cm}^3 \cdot \text{mole}^{-1}$	mPa.s	g cm^{-3}	mPa.s	$\text{cm}^3 \cdot \text{mole}^{-1}$	mPa.s
T/K = 298.15					T/K = 303.15			
0.0000	0.8063	2.565	0.000	0.000	0.8024	2.267	0.000	0.000

0.1002	0.8165	2.024	0.066	-0.372	0.8123	1.803	0.090	-0.320
0.2000	0.8258	1.690	0.104	-0.538	0.8213	1.524	0.148	-0.455
0.2998	0.8343	1.457	0.119	-0.603	0.8295	1.347	0.187	-0.489
0.3998	0.8420	1.303	0.132	-0.588	0.8369	1.229	0.226	-0.463
0.4999	0.8490	1.203	0.141	-0.519	0.8438	1.129	0.237	-0.419
0.5997	0.8555	1.113	0.129	-0.441	0.8503	1.051	0.213	-0.354
0.6989	0.8614	1.042	0.119	-0.345	0.8561	0.988	0.206	-0.274
0.7998	0.8670	0.973	0.094	-0.244	0.8618	0.918	0.153	-0.199
0.9000	0.8721	0.916	0.072	-0.132	0.8669	0.865	0.119	-0.108
1.0000	0.8771	0.879	0.000	0.000	0.8721	0.829	0.000	0.000
T/K = 308.15					T/K = 313.15			
0.0000	0.7985	1.986	0.000	0.000	0.7945	1.777	0.000	0.000
0.1002	0.8081	1.608	0.111	-0.258	0.8034	1.482	0.180	-0.192
0.2000	0.8170	1.403	0.166	-0.343	0.8118	1.311	0.289	-0.260
0.2998	0.8249	1.233	0.230	-0.393	0.8194	1.170	0.385	-0.298
0.3998	0.8323	1.135	0.256	-0.370	0.8266	1.077	0.433	-0.288
0.4999	0.8391	1.050	0.269	-0.335	0.8334	0.995	0.440	-0.267
0.5997	0.8455	0.982	0.246	-0.283	0.8398	0.933	0.412	-0.226
0.6989	0.8514	0.925	0.212	-0.221	0.8458	0.878	0.355	-0.179
0.7998	0.8569	0.866	0.177	-0.159	0.8515	0.825	0.281	-0.128
0.9000	0.8621	0.823	0.115	-0.081	0.8570	0.785	0.160	-0.065
1.0000	0.8672	0.784	0.000	0.000	0.8623	0.747	0.000	0.000

Table 3. - Parameters and Standard Deviations σ of Eqs. 4 and 5 for a Alkyl (ethyl, butyl and hexyl) Formates (1) with n-Butanol (2)

System	Temp	a_0	a_1	a_2	a_3	σ
Ethyl Formate + n-Butanol						
$V^E \cdot 10^6$ ($\text{m}^3 \text{mol}^{-1}$)	298.15	1.2977	-0.0427	0.0533		0.0024
	303.15	1.4088	-0.0566	0.0281		0.0032
	308.15	1.5664	-0.0501	-0.0083		0.0050
	313.15	1.7618	-0.0595	-0.0455		0.0055
Dh (mPa.s)	298.15	-2.4123	1.859	-1.1018		0.0004
	303.15	-1.9318	1.5015	-0.6108		0.0004
	308.15	-1.5518	1.1942	-0.7457		0.0004
	313.15	-1.2475	0.9356	-0.0161		0.0014
Butyl Formate + n-Butanol						
$V^E \cdot 10^6$ ($\text{m}^3 \text{mol}^{-1}$)	298.15	0.7452	-0.0761	0.0435		0.0022
	303.15	0.87	-0.0303	0.0149		0.0027
	308.15	0.9571	-0.053	0.1515		0.0038
	313.15	0.978	-0.0719	0.2953		0.0041
Dh (mPa.s)	298.15	-2.299	1.5931	-1.4198	0.8631	0.0051
	303.15	-1.843	1.2869	-1.1982	0.7496	0.0052
	308.15	-1.4744	1.0188	-0.9975	0.6487	0.0041
	313.15	-1.1721	1.0271	-0.0161		0.0056

Hexyl Formate +n-Butanol						
$V^E \cdot 10^6$ ($m^3 mol^{-1}$)	298.15	0.5252	0.0058	0.3446		0.0056
	303.15	0.8885	0.126	0.3553		0.0119
	308.15	1.0206	0.0145	0.3075		0.0098
	313.15	1.7396	-0.1176	0.2003		0.0064
Dh (mPa.s)	298.15	-2.081	1.6033	-1.0926		0.0061
	303.15	-1.6521	1.3929	-1.1151		0.0091
	308.15	-1.3191	0.8378	-0.8366	0.5751	0.0098
	313.15	-1.044	0.7922	-0.0161		0.0085

Table 4 - McAllister 3 Body and 4 body Interaction Parameters for mixtures of Alkyl Formates with n-Butanols

System	Temp	McAllister 3 Body			McAllister 4 Body			
		u_{12}	u_{21}	$\sigma \%$	u_{1122}	u_{1221}	u_{2221}	$\sigma \%$
Ethyl Formate + n-Butanol	298.15	0.8489	1.1029	1.49	0.603	1.447	1.131	1.28
	303.15	0.9151	1.0429	1.27	0.648	1.282	1.126	1.26
	308.15	0.8000	1.0023	0.80	0.646	0.968	1.212	0.40
	313.15	0.9139	0.9552	2.17	0.827	0.689	1.344	0.24
Butyl Formate + n-Butanol	298.15	1.0552	1.1284	1.53	0.906	1.45	1.375	0.09
	303.15	1.0121	1.0766	1.53	0.856	1.398	1.284	0.09
	308.15	0.9542	1.0159	1.02	0.804	1.323	1.189	0.14
	313.15	0.9060	1.0032	1.18	0.756	1.322	1.132	0.18
Hexyl Formate + n-Butanol	298.15	1.246	1.3508	1.33	0.863	3.134	1.171	1.75
	303.15	1.2064	1.255	1.85	0.856	2.797	1.127	1.33
	308.15	1.1494	1.1866	0.9	1.018	1.694	1.342	0.23
	313.15	1.0880	1.186	0.64	0.983	1.587	1.328	0.19

Table 5 -Neat FT-IR frequencies (cm^{-1}) of -OH groups of alkyl (ethyl, butyl and hexyl) Formates (1) with n-Butanol.(2)

Ethyl Formate(1)with n-butanol(2)		Butyl Formate(1)with n-butanol(2)		Hexyl Formate(1)with n-butanol(2)	
X_1	-OH	X_1	-OH	X_1	-OH
Ethyl Formate	---	Butyl Formate	---	Hexyl Formate	---
0.3009	3348.54	0.2998	3356.25	0.2999	3354.32
0.4036	3350.46	0.3999	3373.61	0.3999	3358.18
0.4916	3358.18	0.5000	3377.47	0.4999	3362.04, 3433.11
0.6011	3362.04	0.6001	3429.55	0.5997	3410.26
0.7037	3365.90	0.6998	3431.48	0.6988	3437.26
0.8002	3435.34	0.7987	3437.26	0.7998	3437.26
n-Butanol	3340.82	n-Butanol	3340.82	n-Butanol	3340.82

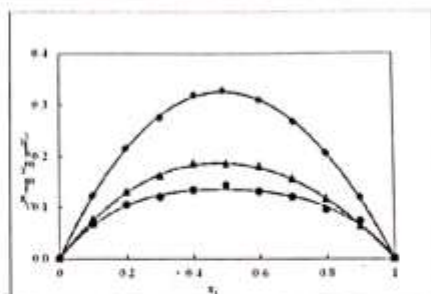


Fig 1- V^E values at 298.15 K for Alkyl formates (x_1): (♦) Ethyl formate; (▲) Butyl formate; (●) Hexyl formate + n-Butanol ($1-x_1$).

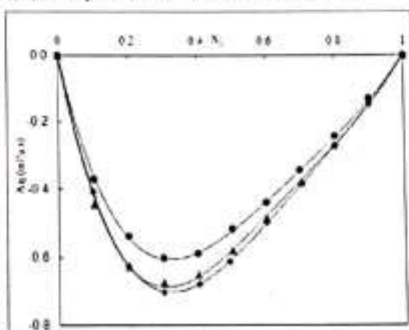


Fig.2 - $\Delta\eta$ values at 298.15 K for Alkyl formates (x_1): (♦) Ethyl formate; (▲) Butyl formate; (●) Hexyl formate + n-Butanol ($1-x_1$)

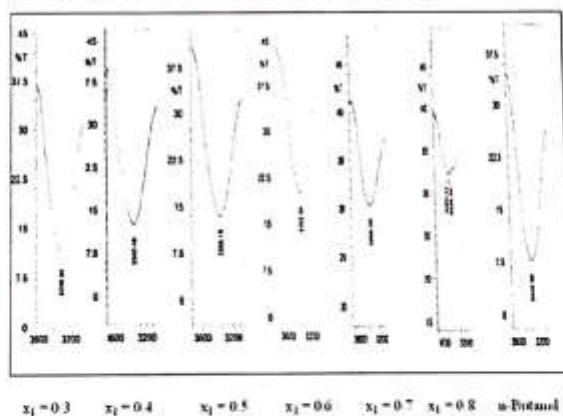


Fig.3(a) FTIR Spectrum for -OH frequency (cm^{-1}) of Ethyl Formate (x_1) with n- Butanol

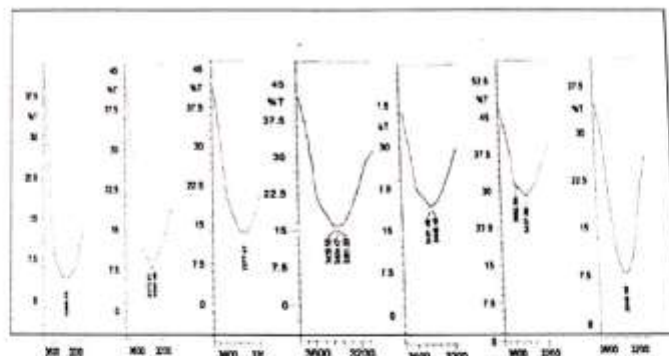
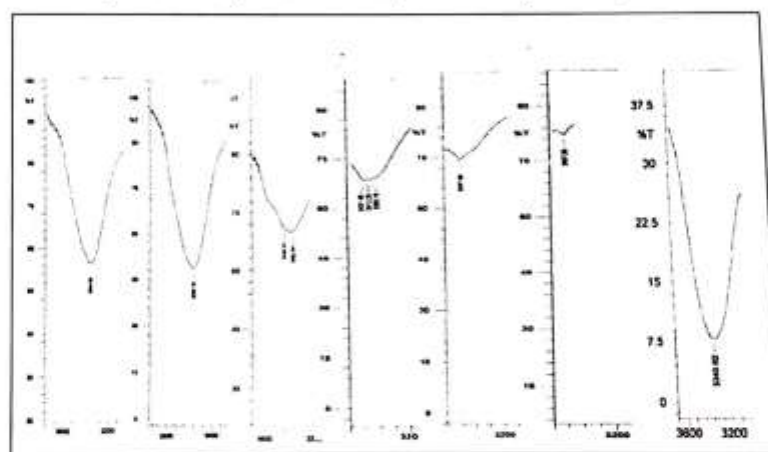


Fig.3 (b) FTIR Spectrum for -OH frequency (cm^{-1}) of Butyl Formate (x_1) with n- Butanol
 $x_1 = 0.3$ $x_1 = 0.4$ $x_1 = 0.5$ $x_1 = 0.6$ $x_1 = 0.7$ $x_1 = 0.8$ n-butanol



$x_1 = 0.3$ $x_1 = 0.4$ $x_1 = 0.5$ $x_1 = 0.6$ $x_1 = 0.7$ $x_1 = 0.8$ n-butanol
 Fig.3(c) FTIR Spectrum for -OH frequency (cm^{-1}) of Hexyl Formate (x_1) with n- Butanol

PREVALENCE OF SOIL-TRANSMITTED HELMINTHIC INFECTION AMONG SCHOOL CHILDREN'S OF RYAN INTERNATIONAL SCHOOL, AURANGABAD DISTRICT (M.S), INDIA

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ABSTRACT

Soil-transmitted helminth (STH) infections represent a major public health problem in poor and developing countries. Stool samples were examined for helminth eggs by quantitative (Kato-Katz) technique to determine the prevalence and intensity of intestinal parasitic infection. 98 schoolchildren aged 9-10 years were enrolled. The prevalence of STH infections was 42 (42.85%). Detected parasite was *A. lumbricoides* 42 (42.85%). Socio economic status played a significant role in this study. Children from Ryan International School with higher environmental sanitation carried no parasites. A total of 14 (38.88%) females were infected while 28 (45.16%) of the males were infected. A higher percentage rate occurred among males than females though no association was made between the sexes. 56 (57.14) were found not infected.

KEY WORDS: Aurangabad prevalence, School-children, Soil-transmitted helminthiasis.

INTRODUCTION

The World Health Organization (WHO) estimates that more than one billion of the world's population is chronically affected by STH infections, which are closely correlated with poverty, poor environmental hygiene and impoverished health services. Intestinal helminthiasis are among the most common communicable disease of school-age children in certain communities and tend to occur at highest intensity in this age group (Olsen 1998). In particular, there is evidence to support the relationship between helminth infections, malnutrition and child development, with negative consequences for cognitive function and learning ability. The objectives of this study were to identify the prevalence of soil-transmitted helminth infections in the population of Ryan International School children's and to evaluate its relation to age and gender.

MATERIALS AND METHODS

Study area and population

Ninety eight school children, age 9-10 years in Ryan International School, Aurangabad district, Maharashtra state was randomly selected and investigated for their intestinal helminthic infections between December 2004 and December 2006.

Sampling method

The pupils were educated on the causes of intestinal helminthic infections among school aged children and they were convinced that every child ought to be free from such infections, thus the necessity of participating in the research work was appreciated by them. Thereafter, wide mouth corked sterile bottles were given to the pupils for the collection of their stool samples at home and structured questionnaires were distributed among the participating pupils for the collection of demographic information such name (optional), age, sex, type of toilet and water facility used, number of individuals in the house, parents occupation, religion, food were habits, pet/domestic animals reared, regularity of deworming etc. and accordingly labelled (ID). Defecating site (open or modern sanitary latrine) were recorded for socio-economic conditions. The children's age were obtained from school record. The pupils were taught how to collect stool samples with the aid of their teachers, the questionnaires were correctly filled. The height and weight of the pupils were taken in the morning of the following day as they submitted their stool samples between 7.30 and 8.30 am. The stool samples were properly labeled and were carried in a cold box filled with ice packs and transported to the private laboratory for analysis. The samples that could not be analysed immediately were preserved using 10% formalin until they were examined (Cheesbrough, 1998).

Analysis of samples

Stool analysis was performed using the Kato-Katz technique. (World Health Organisation, 2003). All the slides were read by one medical doctor specialized in parasitology and consistency of the reading was assured by second readings

performed in 20% of the slides randomly selected. Intensity of infections for each worm was defined according to the thresholds proposed by WHO Experts Committee in 1987. The following data were collected for each child: weight, height, infection for *A. lumbricoides*, *T. trichiura* and hook-worm.

Statistics

Most of the collected data were analyzed descriptively and some were statistically analyzed using χ^2 test, to assess the significance levels of any differences found.

RESULTS

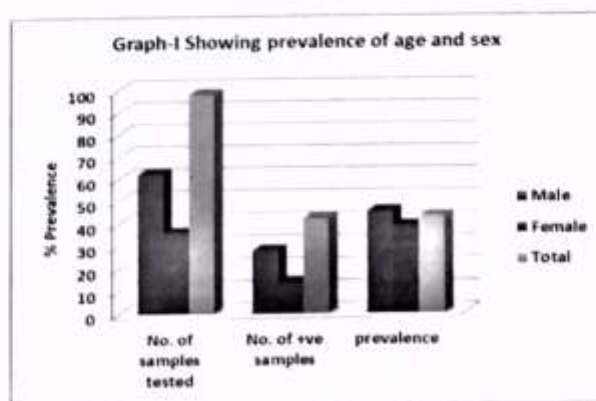
A total of 98 schoolchildren were invited to participate and 86 (67.4%) provided proper stool samples and complete information. Among these, 28 (45.16%) were males and 14 (38.88%) females were infected. The mean age of the children was 9-10 years. An overall prevalence of 42.85% (42 out of 98 children). The predominant parasite involved was *Ascaris lumbricoides* which was observed in 42 (42.85%) of the students (Table 2). Among these 56 (57.14%) was found not infected.

Table 1: Intestinal Helminthic infection in School Children according to age & sex.

Age (Years)	No. of samples tested			No. of infected cases					
	M	F	T	Male	%	Female	%	Total	%
9-10	62	36	98	28	45.16	14	38.88	42	42.85

Table 2: Prevalence of *A. lumbricoides* in infected school children

Age (Years)	Helminths	Total	%
9-10	<i>Ascaris lumbricoides</i>	42	42.85



DISCUSSION

Soil-transmitted helminths remain prevalent throughout the developing world where levels of personal and environmental sanitation and maternal education are low Pearson (2002). In our study, 42.85% of the children were

infected with one of these helminths. Similar results have been given by Lindo *et al.* (2002). Majority of the incidences reported in various parts of the developing world fall between 17% and 76%. Andrade *et al.* (2001), and Waniso (1994). However both extremely high Carme B, *et al.* (2002) and low incidences Fernando SD *et al.* (2002), have also been reported. *A. lumbricoides* prevalence superceded all parasites by showing a positivity of 42.85%. However, incidences lower than 30% have been reported in The zonal-level prevalence of *Ascaris lumbricoides* 9.9%, hookworm 9.7%, and *Trichuris trichiura* was 2.6 respectively (King, 2013).

Higher parasitic infections were observed among males compared to females in this study although the difference was not statistically significant. This pattern of parasitism with respect to gender of the students could best be attributed to higher hygiene level normally observed among the females of this age bracket compared to their male's counterpart. The males in this age group are involved in recreation and sporting activities that exposes their skin to contact with soil thereby exposing them to *Ascaris* infection. Males are generally more active and playful and are less careful and less discriminatory about what they eat which may make the spread of the infection easier and faster among the male students. This could also explain why the prevalence of infections was higher in males (45.16%) than in females (38.88%) showed in Table-1.

Investigators from elsewhere have reported higher prevalences either in females (Rajeswari *et al.*, 1994) or males. The differences in findings among the studies can be explained by variations in geography, socio-economic conditions, and cultural practices of the population under consideration. The category of the study population, the methods employed for stool examination, and the time of study may also have contributed to the differences.

However, our study showed a 42.85% prevalence rate, a higher helminthic infection rate than a study in suburban Nakhon Prathom Province, which found a 0.5% infection rate (Ngrenngarnlert *et al.*, 2007). In the border area of Nan, Kanchanaburi and Srakaew the study showed a similar prevalence of 55.8%, 49.4% and 49.5%, respectively (Maipanich *et al.*, 2004). Eighty seven percent of people wear shoes when they go out or go to work. Our study tried to use various techniques for determining parasitic infection.

The prevalence of *A. lumbricoides* was similar to the study conducted in rural inhabitants of north Cheju (Byong Seol, (1972) but not comparable with the studies conducted by Wani (2008) in Kashmir valley, India where the prevalence of *Ascaris lumbricoides* was highest (68.30%), followed by *Trichuris trichiura* (27.92%).

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CONCLUSION

Infections could be minimized simply by giving them proper health education in classroom which will make them aware of mode of transmission of infection to which they are prone and also help in protecting themselves from parasitic infection by taking precautionary measures.

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Percentage prevalence and morphological details of *Stylonychia pustulata* (Ehrenberg, 1830) in the fresh waters of Nashik district

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ABSTRACT

The ciliates are one of the most important groups of Protozoa, common everywhere in waters of lake, pond, oceans and soils with many ecto and endosymbiotic members, as well as some obligate opportunistic parasites. Free living ciliates are found in fresh, marine, estuarine waters and in the soil. The present species described as *Stylonychia pustulata* Ehrenberg (1830), (O. F. Muller, 1786) Ehrenberg, 1835 (O. F. Muller, 1786) Ehrenberg, 1838, *S. pustulata* (Deshmukh, 2010) has found in fresh water ponds, ditches and streams, especially more abundantly in rain water bodies of Nashik district.

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Introduction

The ciliates are one of the most important groups of Protozoa, common almost everywhere there is water (lake, pond, and oceans) and soils with many ecto and endosymbiotic members, as well as some obligate opportunistic parasites. Free living ciliates are found in fresh, marine, estuarine waters and in the soil.

An excellent source is a shallow semi permanent pond in a farm yard. Any stream large or small, or any freshwater hole, temporary or permanent, water at the base of aquatic plants is likely to be a valuable source of material. Such places as moist crotches or bark (crevices) in trees or any other moist or water containing silt, floating algal mats provide food. Cilia covering the body of the organism or a part of it, a major defining characteristic of this group and hence the phylum name "Ciliophora".

The ciliates possess a marked variety of motile systems based on ciliary motion. Thus, the organisms are able to move through the environment in search of prey often with remarkable agility and swiftness, or when sedentary, to create a flow of water carrying food to the organism. The arrangement of hair like organelles on the cell surface and the degree of coordinated action made possible by close proximity of the cilia varies considerably among the groups.

A cirrus is a composite group of cilia (a few to hundreds of cilia) often tapering toward the distal end and acting in unison. Typically they are found in localized regions on the cell surface. When the cirri are largely localized on the ventral and anterior surfaces, the ciliates are characterized as hypotrichs, signifying that the cirri are positioned beneath the cell. In other species, cilia are arranged in spirals (e.g. Spirotrichs) or in ribbon like assemblages near the anterior (sometimes broader end) of the cell. Although many ciliates exhibit rapid and impressive locomotion, others such as suctorians are sedentary and lack cilia during most of their life cycle. These feeding (trophont) stages are anchored to the substratum by a stalk or other form of holdfast.

Ciliates in general have great power of regeneration, and the process like reproduction is more complex, a missing part can be replaced by simple growth. Unlike eukaryotes, ciliates have two different nuclei; large polyploid macronucleus and smaller diploid micronucleus. The former is important for protein synthesis, and latter for reproduction. The macro nuclei must be regenerated from the micronuclei. In most, this occurs during sexual reproduction which is not usually through syngamy but through conjugation. Joblet (1645-1723), has done pioneer work on ciliature, nuclei and contractile vacuoles in ciliates. In the eighteenth century Muller (1773, 1776 and 1786) gave the first extensive taxonomic account of all protozoa.

Extensive studies have been made during the last 80 years, with numerous outstanding and noteworthy contributions in the field of Protozoology, covering cytology, cytochemistry, structure, life cycle transmission, evolution, and ultrastructure; and inter relationship a verity of protozoa.

Although all ciliates conform, more or less, to the principle of nuclear dimorphism, they vary greatly in shape, size and number of nuclei. The macronucleus may be single compact, rounded or kidney shaped,

In reproduction by binary fission, the macro and micronuclei, either or both, divide; so that the parental nuclei are equally represented in both daughters; During sexual process of conjugation, two individual (the conjugant) unite temporarily. Micronucleus, or micronuclei, of both divide twice. All but one of the resulting micronuclei in each conjugant degenerate and disappear while the remaining one divides unequally forming two pronuclei. The smaller one is active, migratory, male pronucleus and the bigger one stationary, female, pronucleus. The male pronucleus migrates into the other conjugant and fuses with its stationary pronucleus forming a zygote nucleus or syncaryon. The two conjugants then, separate and are known as the exconjugant. These differ from ordinary individuals in having only a single nucleus, for the old macronucleus by now is in the process of losing its identity and being absorbed into the cytoplasm. The way in which the macronucleus disappears, varies considerably in different ciliates. During subsequent

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divisions the syncaryon gives rise to both macro and micronuclei.

Endoplasm is the seat of the main metabolic processes. The endoplasm is completely enclosed by cortex except at two places where it is brought into contact, temporarily or permanently, with the outside world. These are the cell mouth (cytostome) and cell anus (cytoproct). Food is taken in by the cytostome and surrounded by a vacuole into which digestive enzymes are secreted. The vacuole circulates slowly in the interior of animal during which time its contents are digested and absorbed through its wall and finally brought to the site of cytoproct which opens to discharge the undigested matter. In some ciliates the part of the endoplasm immediately adjoining the mouth forms a fairly well defined oesophagus like tube and among some groups of holotrichs this is surrounded by a series of parallel rods (trichites) of unknown origin, sometimes elaborate enough to form a basket like structure.

One or more contractile vacuoles are present typically in freshwater ciliates to regulate ion balance of the cytoplasm and expel excess water. Various extrusomes (ejectile organelles) occur beneath the surface of the cell including mucocysts that secrete surface substances either to coat the cell to improve its immediate environment, provide material for cyst walls or aid in the capture of prey.

Most ciliates feed on smaller organisms, such as bacteria, algae and detritus swept into the mouth by modified oral cilia. Feeding consist of two processes each of which may limit the actual rate of feeding. The first one is the process of phagocytosis, i.e. the enclosure of a food particle in a membrane covered vacuole in which digestion takes place. In ciliates this occurs at a special site on the cell surface called cytostome or cell mouth. Cytostome is simply a two dimensional aperture and most commonly permanently open. It is covered by a single unit membrane from which food vacuoles are formed. Food materials first pass into the endoplasm of the organism via a more or less distinct cytopharynx. It may open directly to the exterior or be sunken into a depression or cavity or some kind, such as atrium, vestibulum or buccal or peristomial cavity.

The cytostome is often associated with various organelles in the surrounding cytoplasm in particular bundles of microtubules. Later play a role in the transport of captured particles on the surface surrounding the cytostome. A variety of ciliary's and other organelles serve to concentrate or retain food particles.

Material and Methods-

For the study, the water samples were collected from different parts of Nashik dist (Deola, Kalwan Nandgaon, Sargana, Satana) of Maharashtra state. Water samples were collected in wide mouth, sterilized glass bottles. Due care was taken and the samples were collected from where the submerged plants and decaying leaves were present. Mostly the samples were collected during morning and evening. The temperature of the sample bottles were maintained with the help of ice bags.

Rapid movements of ciliates make it difficult to identify ciliate species. To immobilize their movements methyl cellulose solution was used.

Culture methods -

For cultivation various media are used such as

- Hay infusion
- Wheat infusion
- Rice infusion

Hay infusion was good for *Stylonychia* and many other ciliates species. Rice grain infusion is also best for the *Vorticella*, *Stylonychia* and *Coleps* species.

Water sample is obtained from different water bodies contains a mixer of organism, by adding any type of culture media (Wheat or rice infusion) can generally rise the number of certain ciliate species (by rising the bacterial population present) in the water sample, but often lower the number of species. However the rough sample containing several ciliates and unknown bacterial and algal floras can be obtained for several weeks. Selection of a particular ciliate species and culturing it in the isolation of organisms other than its prey may obtain a greater degree of control over a culture.

The choice of culture medium depends largely upon what the ciliate feeds. Many feed upon bacteria and that is why many of the media commonly used are designed to encourage the growth of bacterial populations. Different culture media and methods published by Mackinnon and Hawes (1961), Kirby (1950) and committee on cultures, Society of Protozoologist (1958).

Culture were examined under low power and then in to high power microscope taking care to focus at all levels in the culture watching for movements of any kind. Movements of ciliates were also trapped in video camera for the proper understanding. Dry silver impregnation was used to study infraciliature of the ciliates. For the permanent slides the ciliates were fixed in terms of number of individuals and species composition. Methyl cellulose has been found too many advantages, as it arrest the movement, ciliates can be identified by their appearance. The species identification has been made mainly on the basis of arrangement of cilia, size and shape of body and structure of macro and micronucleus.

Discussion and Results-

Percentage of prevalence of *Stylonychia pustulata* in fresh water during the period of January 2007 to December 2008, for the two years

Table 1. Showing month wise prevalence of *Stylonychia* Sp. in freshwaters of Nashik District during the year 2007

Sr No	Month	Total No. of samples Examined	No. of +ve samples	% of Total Prevalence
1	Jan-07	45	6	13.33
2	Feb-07	55	7	12.73
3	Mar-07	47	6	12.77
4	Apr-07	60	6	10.00
5	May-07	61	5	8.20
6	Jun-07	67	15	22.39
7	Jul-07	54	21	38.89
8	Aug-07	57	20	35.09
9	Sep-07	58	12	20.69
10	Oct-07	60	11	18.33
11	Nov-07	64	10	15.63
12	Dec-07	49	7	14.29
	TOTAL	677	126	18.61

Graph 1. Showing month wise % of total prevalence of *Stylonychia* in freshwaters of Nashik District during the year Jan. to Dec. 2007

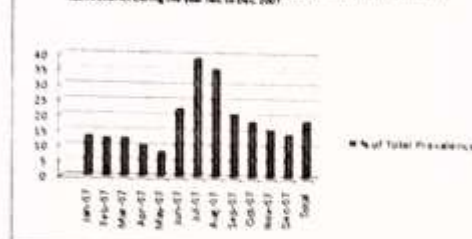
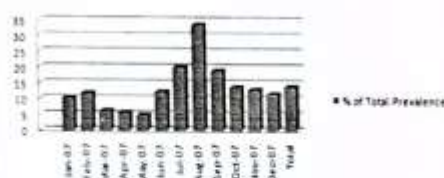


Table 2. Showing month wise prevalence of *Stylonychia* in freshwaters of Nashik District During the year 2008

Sl No	Month	Total No. of samples Examined	No. of +ve Hosts	% of Total Prevalence
1	Jan-08	68	7	10.29
2	Feb-08	84	10	11.90
3	Mar-08	79	5	6.33
4	Apr-08	69	4	5.80
5	May-08	62	3	4.84
6	Jun-08	89	11	12.36
7	Jul-08	94	19	20.21
8	Aug-08	80	27	33.75
9	Sep-08	89	17	19.10
10	Oct-08	87	12	13.79
11	Nov-08	69	9	13.04
12	Dec-08	77	9	11.69
	Total	947	133	14.04

Graph 1. Showing month wise % of total prevalence of *Stylonychia* in freshwaters of Nashik District During the year Jan. to Dec. 2008



During the period of two years (Jan.2007 to Dec. 2008) a total number of water samples 1624 were examined, 259 of these were positive with free living ciliate *Stylonychia pustulata*.

In the first year (Jan.2007 to Dec.2007) 677 fresh water samples were examined, 126 of these were positive with free living ciliates. The percentage of prevalence of free living ciliates was about 18.61%.

In the second year (Jan.2008 to Dec.2008) 947 fresh water samples were examined, 133 of these were positive. The percentage of prevalence of free living ciliate *Stylonychia* was about 14.04%.

A month wise analysis in first year (Jan.2007 to Dec.2007) shows the maximum percentage of prevalence during August (33.75%) and minimum in May which was only 8.20% and minimum to moderate in remaining months.

During the period of Jan. 2008 to Dec.2008) maximum percentage of prevalence of this ciliate was showed again during July (33.75%) and lowest in May (4.84%) and minimum to moderate in remaining months.

The pattern in both the years suggests that the peak is soon after the monsoon rain. The percentage then gradually reduces at the end of the winter months and reaches a low with the onset of summer. The details of the number of water samples examined and the month wise prevalence is shown in Table No1 and 2.

Description of the species

Synonym of *Stylonychia* was described by O. F. Muller (1786) later Kerona, the Andre, (1916) had given the name *Prosopenu*. Ehrenberg, (1838) included this genus in Family Oxytrichidae. The species which are included in genus *Stylonychia* are inflexible, elongate, oval, dorso-ventrally flattened body with a large and powerful AZM supported anteriorly by a collar. 2 rows of marginal cirri not continuous posteriorly, but 3 long, strong and prominent caudal cirri present.

The genus has the typical fronto-ventral and transverse arrangement of cirri with 3 strong anterior frontal cirri. The dorsal surface has several longitudinal rows of short cilia. Macronucleus in two parts each with an adjacent micronucleus. Several species have been recorded.

Undulating membrane is present in *Stylonychia* pattern. One right and one left row of marginal cirri, distinctly separate posteriorly. Presence of six dorsal kineties, caudal cirri present and often distinctly elongated, which have, however, a more slender and flexible body and intersecting undulating membranes. There are two (two distinct segments) of one macronucleus macronuclei present which are oval in shape with single spherical to ovoid micronucleus each.

The genus *Stylonychia* has following species

S. pustulata Ehrenberg, 1838

S. mytilus Ehrenberg, 1838

S. putrina Stokes, 1885

S. notomorphia Stokes, 1885

Description of the *Stylonychia pustulata*

The present species described as *Stylonychia pustulata* Ehrenberg (1830), (O. F. Muller, 1786) Ehrenberg, 1835 (O. F. Muller, 1786) Ehrenberg, 1838, *S. pustulata* (Deshmukh, 2010). Present author has found this species in fresh water ponds, ditches and streams, especially more abundantly in rain water bodies of Nashik district.

Body is inflexible and elliptical. It measures about 44 to 125um in length and 22um to 81um in width. Both anterior and posterior ends are rounded and more or less parallel. Macronuclear segments two which are ovoid in shape. Each macronucleus is measures about 14 to 16um in length and 6 to 8um in width, lying left of the median. Micronuclei are two in number, they are small spherical, each in close contact with one of the macronuclear segments.

Contractile vacuole is single. It measures about 9um to 11um in length, present at the middle of the body. Endoplasm was seen bright yellow in colour in living condition. Food vacuoles are few to moderate in number. The large size food vacuole is measures about 27 to 32um in length.

Movement moderately slow, gliding, and often standing still for sometimes, rotation, around the longer axis on disturbance. The presences of various cirri are the organs of swimming and gliding locomotion. Marginal cirri are measures about 12 to 16um long. Right marginal row is composed of many more cirri than the left one. Three anterior frontal cirri enlarged, which measures 19-23 um in length. Four posterior cirri, arranged in an oblique hook-shaped row, and one enlarged buccal cirrus. Two postoral and three ventral cirri are present. Transverse cirri are five in number they measures about 20-24 um in length. The Caudal cirri are three in number; they are 16-25 um in length, very stiff and projecting laterally.

Comments

Body of present species is ovoid to reniform, inflexible and elliptical, with short dorsal bristles. Three long stiff caudal cirri are present and hence it is belongs to genus *Stylonychia*. This genus is first reported by Ehrenberg, 1830. Later many workers reported different species of this genus. Kudo (1966), Bick (1972), Berger & Foissner (1997), Lynn & Small (2000), reported the different species of the same genus. *Stylonychia pustulata* was identified by the shape of the body, the arrangement and the number of cortical elements, the mode of locomotion and morphological similarities in number and the positions of cirri. Movement moderately slow, gliding, and often standing still for sometimes, rotation, around the longer axis on disturbance.

Table 3: Comparison of different species of genus *Stylonychia* with present species, *S. pustulata*

Sl No	Particulars	1 <i>S. pustulata</i> Ehrenberg, (1838)	2 <i>S. mytilus</i> Ehrenberg, (1838)	3 <i>S. putrina</i> Stokes, (1885)	4 <i>S. notomorpha</i> Stokes, (1885)	5 <i>S. pustulata</i> Deshmukh, (2010)	6 <i>S. pustulata</i> Present authors
1	Body shape	Ovoid	Elongate	Elongate	Elongate	Ovoid	Ovoid
2	Body dimensions	L- 150 um	L- 100 to 300um	L- 125 to 150um	L- 125um	L- 55 to 65um W- 30 to 38um	L-44 to 125um W- 22 to 81um
3	Macronuclei	2, ovoid	2	2, ovoid	2, ovoid	2, ovoid	2, ovoid
4	AZM	1/3 body length	1/3-1/2 body length	1/3-1/2 body length	1/3-1/2 body length	1/3 body length	1/3 of body length
5	Habitat	Fresh water	Fresh water	Fresh water	Fresh water	Muddy soil	Fresh water

AZM - Adoral zone of membranelle

Body of present species is ovoid and hence similar to previously described species *S. pustulata* but differs from *S. mytilus* (Ehrenberg, 1838) which is elongate and has anterior end wider than the posterior. *S. putrina* (Stokes, 1885) is elongate and anterior end is not wider than posterior but anterior end is somewhat conical and rounded posterior end while in present species anterior end is rounded and posterior is broadly pointed and hence present species is also separates from *S. putrina*. It also distinguishes from *S. notomorpha* (Stokes, 1885) which has somewhat conically rounded anterior end and body laterally narrowed in some cases.

In body dimensions when compared with other species of *Stylonychia*, present species found to be small among all the previous ones (Table.....). Present species has 3 to 8 frontal, 2 post oral, 3 to 5 ventral, 5 transverse and 3 caudal cirri and hence similar to all the species of genus *Stylonychia* which also has 3 frontal, 3 ventral, 5 transverse and 3 caudal cirri.

AZM in present species also covers the one-third part of the body length and hence this species resembles that of *S. pustulata* but differs from *S. putrina* (Stokes, 1885), *S. mytilus* (Ehrenberg, 1838) in which AZM extends one-third to one-half the body length. It also separates from *S. notomorpha* (Stokes, 1885) in which AZM extends up to one-half the body length.

Present species has two ovoid macronuclei and hence similar to all the species of genus *Stylonychia*.

Present author compared present species with all the species of genus *Stylonychia* and found morphologically close similar to *S. pustulata* (Ehrenberg, 1838) in body outline, length of AZM and hence redescribed as a *Stylonychia pustulata*.

Figure - *Stylonychia pustulata*

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New *Furocercous* Larval Trematode from Bhegu-Dhanoli Dam, Nashik District (M.S), India

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ABSTRACT: Nashik District has many fresh water streams, few rivers and Earthen dams like Chankapur, Bhegu-Dhanoli, Ozurkhol, Gangapur etc. Many species of gastropod Mollusca are found to inhabit the freshwater of this rivers and dams. Among them many species of genus and *Melania*, *Lymnaea* and *viviparus* commonly occur, which show infection of larval trematodes parasites in their digestive glands and ginstads. Very little information is available about larval trematodes parasites found in this region. Hence, it was thought worthwhile to examine these species of snails for infection of trematodes parasites.

KEY WORDS: Larval trematodes, parasite, fresh water snail, new species.

INTRODUCTION:

Larval trematodes commonly are responsible for a number of disease conditions in humans and many other vertebrates. They have a heteroxenous life cycle with freshwater snail as their first intermediate host. The adult stages are found in different vertebrate definitive hosts including amphibians, fishes, reptiles, birds and mammals. Disease characteristics of fluke infections vary with the parasite species and the site or organ of infection and are linked with the life cycle events like larval penetration, egg laying, etc.

Many species of freshwater snails serve as intermediate hosts for digenetic trematodes. Consequently, the distribution of freshwater snails accounts for the occurrence of different trematodes taxa in a particular region. As the parasites are mostly host specific, higher heterogeneity of the

host promotes higher heterogeneity of the parasites [3, 4]. Similarly, higher snail diversity leads to higher trematode diversity. Apart from that, conditions influencing the proliferation of snail population will inevitably enhance the existence of trematode parasites in their intermediate host. Some riverine habitats provide physicochemical conditions that favor the proliferation of freshwater snail fauna, for this reason, environmental conditions in different habitats, in different climatic zones may support the trematode life cycle differently.

Trematodes show distinct and direct relationship with the temperature in their transmission process [8, 5]. Cercarial output is directly influenced by the temperature due to both stimulating effect of temperature increasing the emergence from the snail and the acceleration of

cercarial production within the snail host [5]. The combined effect of the two will increase the cercariae release in great numbers. However, under high temperature conditions some cercariae encyst within snails. Even though, snail populations grant higher trematode diversity, trematodes can affect snail populations by directly reducing the egg production or by increasing snail mortality rates [4].

Snail species are the first intermediate hosts for the majority group of digenetic trematode. Snail infection occurs through ingestion of the eggs or penetration by free-swimming miracidia. Inside the first intermediate host, the process of polyembryony occurs and several different intramolluscan larval stages (i.e., sporocyst, redia, and cercaria) are formed by asexual reproduction. After emerging from the snail tissue, the larvae of trematodes (cercariae) may find the suitable secondary intermediate host or definitive host by means of passive transmission (metacercaria) or active penetration, respectively.

The daily cycles of cercarial emergence are recognized as an adaptive mechanism to enhance parasite transmission. Several hypotheses have been proposed to explain the functional significance of these daily cycles [7,] (Shostak and Esch, 1990). The most accepted hypothesis suggests that cercarial emergence is timed to coincide with the presence of the next host, particularly for those cercarial species in which the target hosts do not regularly cohabit with the molluscan host producing the cercariae [2].

The present paper deals with a new furcocercous larval trematodes from Bhagu-Dhanoli dam, Nashik district of Maharashtra. The furcocercous larval trematodes treated in this paper, as a result of comparative studies discussed later, proved to be new species and have been named, respectively, *Cercaria laterolophocerca*. However, it differs from others in having fin fold along the left margin of the body, presence of small eye-spots located in anterior part of the body and furcal rami very short. Considering these specific differences, the cercaria is considered as a new species.

MATERIAL AND METHODS:

The observed cercaria belonging to subgroup ocellata was collected from the digestive gland of the snail host, *Lymnaea auricularia* from Bhagu-Dhanoli dam. Cercaria showed 42-44% infection during March to May.

Host: - Snail (*Lymnaea auricularia*)

Locality: - Bhagu-Dhanoli Dam, Nashik District, M.S.

RESULT AND DISCUSSION:

Description:

The body of cercaria was pyriform and greenish in color. The surface of the body bears under developed fin-fold with fin-rays. It moves with contribution and extension of the body. It also shows lashing movements of tail. The length of the cercaria was 0.462 mm including tail-stem. The main body measured 0.165 long and 0.056 mm wide. Excluding fin -fold. It has oval-shaped anterior protrudible penetrating organ covered with anteriorly directed spines. It measured 0.043 mm long and 0.036 mm wide. Cercaria has rounded ventral sucker located in the posterior half of the body measured 0.036 mm wide. Cercaria has rounded ventral sucker located in the posterior half of the body and measured 0.010 mm in diameter.

The terminal mouth leads directly into a rhabdocoel gut, pharynx being absent. It has pairs of salivary glands extending to the acetabular zone one behind the other of which anterior pair is paracetabular and posterior pair is postacetabular in position. Salivary gland cells are pyriform, nucleated with their ducts opening in penetrating organ. Larva shows a pair of black coloured small eye spots situated at about anterior third part of the body. Small cystogenous gland cells are distributed from eyespot level to the posterior end of the body.

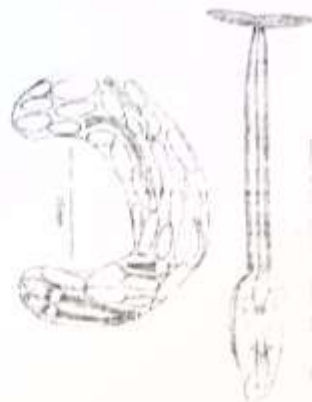
The tail stem is much longer than the body length measuring 0.298 mm long and 0.028 mm wide. Distally the tail terminates into two short rami with fin fold along the margin and measures 0.059 mm long. The tail stems shows delicate tegument beneath which is a layer of well developed circular muscle fibres. Excretory system

shows small bilobed bladder with anterior excretory tubules running up to posterior margin of second pair of salivary glands. The caudal excretory tubule runs through the entire tail stem and bifurcates into rami opening at their tips.

Cercariae emerge from the sporocyst which is elongated and measures 1.92 mm long and 0.351 mm wide. The sporocyst contains 4-6 well developed Cercariae and many germ balls at various stages of development.

It is a distome furcocercous Cercariae which belongs to group I, series-II and included in ocellata subgroup. The present form resembles with *C. indicae* XXV, *C. indicae* XXXVI [6, 1] in general body shape, pair of salivary glands, position of ventral sucker and tail shape. However, it differs from others in having fin fold along the left margin of the body, presence of small eye-spots located in anterior part of the body and furcal rami very short. Considering these specific differences, the cercaria is considered as a new species and the name *cercaria lateralophocerca* n. sp. is proposed for it.

Fig- cercaria lateralophocerca



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IMPACT OF LOCAL ENVIRONMENTAL CONDITIONS ON FEEDING AND DIGESTION OF *LAMELLIDENS MARGINALIS* FROM A POND IN GIRNA RIVER NEAR CHANKAPUR DAM, NASHIK, INDIA

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ABSTRACT : The first rainfall in June is the period of longer day length show the phases of absorption and fragmentation spherules predominate till the end of monsoon (June to September). While in post monsoon period the phase of holding occurs (October new-moon). After post-monsoon, results in predominance of absorption phase (October full-moon, November new-moon, December new-moon). This is the period of greater food availability with speedy current of clear water over the habitat of *lamellidens marginalis* results in much food intake. During winter (December full moon) phase of re-organization of the tubules appears. This is the period of shorter day length, lower temperature and mild water current and low food availability. This condition is followed by holding phase (January, new moon-I). After this period absorption phase is interrupted by holding phase (from January full-moon to May new-moon). It may be due to increase in day length, rise in temperature, no water current over the animal bed, declining food availability in the medium resulting in reoccurrence of holding phase. No fragmentation spherules phase is seen from post monsoon onwards. In general more food is taken up and utilized by the animals in monsoon season. Later on the fluctuation in the environmental parameters are more with regard to temperature, rainfall, nature of water current and food availability. So, it results, in low food intake. The process of new tubule formation occurs particularly March new-moon I during the growing period. Since the samples have been collected on every new-moon and full-moon days over a period of twelve months but their appears to; be no direct co relation with lunar periodicity and cytological cyclic changes in the phases of digestive tubules. Hence it is assumed that lunar periodicity has no direct impact on the feeding and digestion in these mussels. The significant local environmental variables in different seasons may influences vary from genus to genus and lotic to lentic habitat of the animals.

Key words : Girna river, *lamellidens marginalis*, new-moon, full-moon, holding, absorption, fragmentation spherules, reorganization.

INTRODUCTION

The process of digestion in bivalve may be of the stomach and extracellular digestion in stomach and extra cellular digestion in stomach by dissolution of the crystalline style. (Morton, 1973). The digestive tubule in the digestive diverticula goes to the phases of absorption, digestion, breakdown and reformation. Studies on the bivalve gut and the process of feeding and digestion have indicated that various cell types in the digestive tubules of bivalve undergoes a pattern of cytological and structural changes in accordance with rhythm of environment (Morton, 1983). In the present study a habitat of *Lamellidens marginalis* is a narrow oval pond in the downstream vicinity of the Chankapur dam. The flow of water in the pond is mainly from the opening of the gates of dam. In rainy season pond gets flooded with muddy fast current of water. In the remaining period of year, moderate flow or calm, clear water in the pond. Thus the pond remains full of water throughout the year. In this study attempt has been made to find out whether such a pattern of cytological, cyclic changes exists in

Lamellidens marginalis with respect to local environmental conditions of the animal habitat.

Lamellidens marginalis inhabit in narrow oval pond about 100 x30 mt. created due to southward passage of Girna river away from the Chankapur Dam. This dam was construction during the year 1974-75. The flow of water in the pond is mainly from the opening of one of the gates of the dam once in a month throughout the year. During peak monsoon the pond get flooded due to frequent opening of the gates of the dam, with muddy fast current of water stirring the whole water of the pond thoroughly. In remaining period of year, moderate clear water current stirs the pond slowly. Thus throughout the year pond remains full of water.

MATERIALS AND METHODS

The collected animals of each lot (June 2013 to May 2014) were brought to the laboratory. The shell valves were removed and animals were fixed in Bouin's Hollande fixative for 48 hours. The renewal of fixative was done at every 15 to 20 hours. Then animals were dissected for

Table 1 : Local environmental conditions of the habitat of *lamellidens marginalis* in the pond of Girna river near Chankapur dam, dist-Nashik.

Month	Day length (hours)		Temp (Oc)		Rainfall(mm)	Humidity(%)	
	NM	FM	Min.	Max.		Min.	Max.
June-2013	13.10	13.12	21.50	30.0	162	75	85
July	13.9	13.2	21.60	25.40	188	90	98
August	12.51	12.37	20.80	27.05	138	71	93
September	12.21	12.07	21.40	30.20	241	83	97
October	11.51	11.36	21.50	31.10	16	49	91
November	11.21	11.09	13.80	30.04	-	33	67
December	11.0	10.56	06.05	31.60	-	25	85
January	10.57	11.03	11.02	29.0	-	32	91
February	11.14	11.19	09.0	30.02	10	40	89
March	11.42	11.58	17.01	35.30	-	24	70
April	12.13	12.30	17.00	39.07	-	16	69
May-2014	12.44	12.56	17.0	42.0	-	25	72

Table 2 : Cytological changes in the digestive tubules of *lamellidens marginalis* in the habitat of Girna river, Chankapur, Dist. Nashik.

Month	Date	Fortnight	Phase of tubule
June	8/06/2013	New-moon	Absorption
	23/06/2013	Full-moon	Fragmentation spherules
July	8/07/2013	New-moon	Absorption
	22/07/2013	Full-moon	Fragmentation spherules
August	6/08/2013	New-moon	Fragmentation spherules
	21/08/2013	Full-moon	Fragmentation spherules
September	5/09/2013	New-moon	Absorption
	19/09/2013	Full-moon	Fragmentation spherules
October	4/10/2013	New-moon	Holding
	18/10/2013	Full-moon	Absorption
November	3/11/2013	New-moon	Absorption
	17/11/2013	Full-moon	Holding
December	2/12/2013	New-moon	Absorption
	17/12/2013	Full-moon	Re-organization
January	01/01/2014	New-moon-I	Holding
	16/01/2014	Full-moon	Absorption
	30/01/2014	New-moon-II	Absorption
February	14/02/2014	Full-moon	Holding
March	1/03/2014	New-moon-I	Holding
	16/03/2014	Full-moon	Absorption
	30/03/2014	New-moon-II	Absorption
April	15/04/2014	Full-moon	Absorption
	29/04/2014	New-moon	Holding
May	14/05/2014	Full-moon	Holding
	28/05/2014	New-moon	Absorption

hepatopancreas tissues. These tissues were processed through ethyl alcohol and toluene. Then material is embedded in paraffin wax (58-60°C). The above mentioned paraffin wax block preparation procedure was repeated for each lot. The sections of each lots of hepatopancreas tissue were taken at 6 μ m. The spreading of the section wax ribbon is done on micro slides as per the lot. The processed micro slides were labelled by glass marker and stored in slide boxes for staining. The micro slides of each lot are processed for Mallory's staining procedure and sections are mounted in DPX. After drying the micro slides are cleaned, labelled, observed and selected micro slides are separated for photo micrography. By observing the micro slides of each fortnight and result of work is finalized.

RESULTS

1. Local environmental conditions of the habitat of *lamellidens marginalis* during the study period i.e. from June 2013 to May 2014.

The data of local environmental conditions that is day length, rainfall, temperature and humidity of the habitat of *lamellidens marginalis* in the pond of Girna river near Chankapur dam, Dist-Nashik are given in Table 1. The values are collected in every fortnight for a period of one year from June 2013 to May 2014.

The day length is more than 12 hours from April new moon (12.13h) to September full-moon (12.7 h), while in the remaining period of the year the day length is less than 12 hours. The highest day length is recorded in June full-moon (13.12 h), while lowest day length is recorded in December full-moon (10.56 h) in peak winter season. The data of the rainfall reveals that the rainfall starts in June and goes on increasing in July while slight decline in

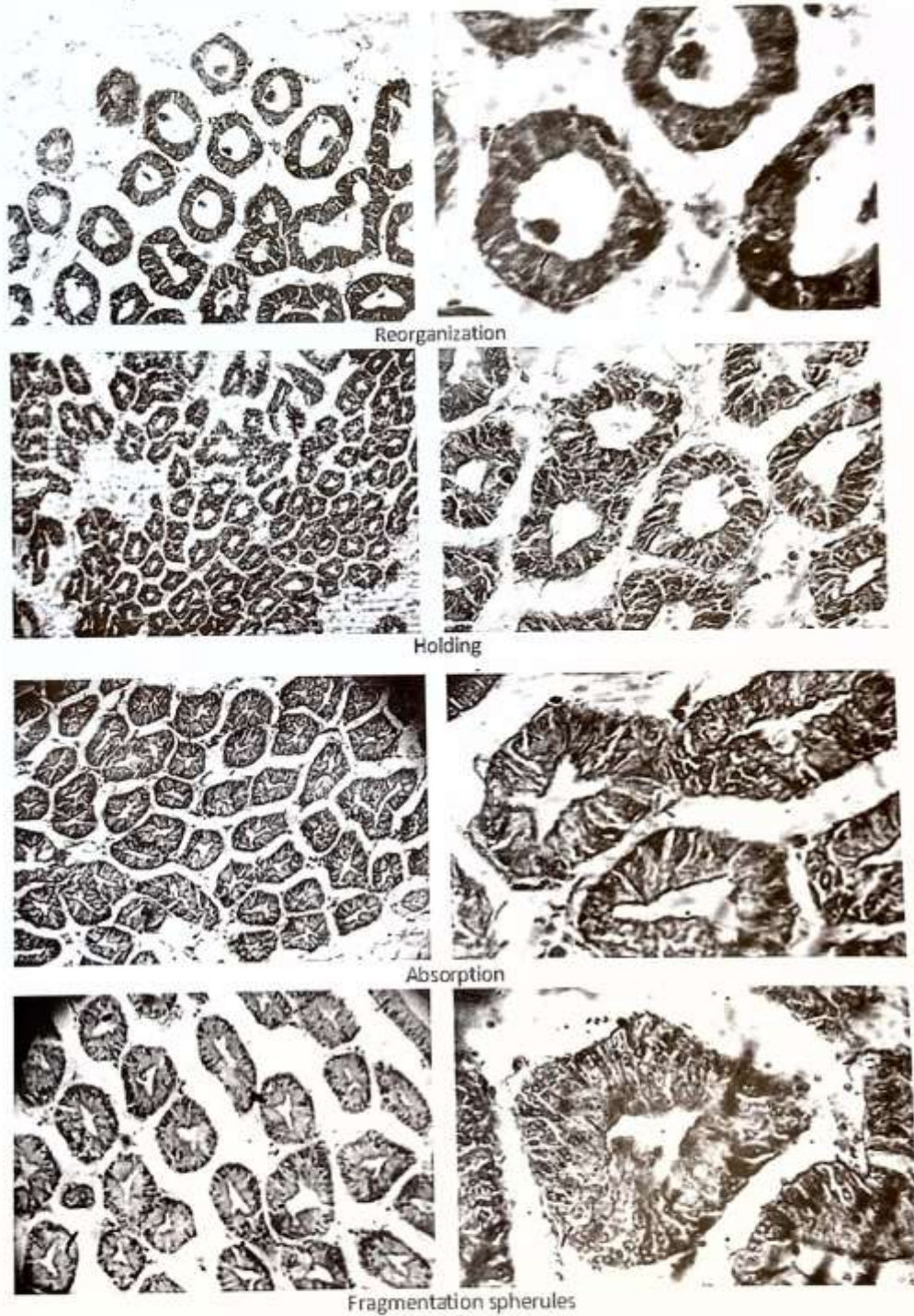


Plate 1 : The digestive tubules stages of *Lamellidens marginalis*.

August and reaches highest in September (241 mm), and obtained lowest in October (16 mm). The monsoon is over after October but few showers in February. The temperature increases from March to May and decreases minimum in December to February. There is slight fluctuation in minimum and maximum temperature is from June to October while broad range in minimum and maximum from November to May. The minimum temperature is recorded in December (6.05°C), while maximum value in May (42°C). In December (peak winter) there is broad fluctuation in minimum and maximum temperature. The highest value of humidity is recorded in June to February except the November, while minimum value is obtained in March to May.

2. Cytological Changes in the Digestive tubules

In the histological preparation of digestive diverticula is found to be more or less constant in different specimens in a given fortnight. It is also observed that in different environmental conditions the digestive tubules are generally typical in all the animals in the fortnight samples. The structure of the digestive tubules (Morton, 1970; Robinson *et al.*, 1981) can be interpreted as in four phases: holding (type-I), absorption (type-II), fragmentation spherules (type-III) and reorganization/ reconstitution (type-IV). In the present study the pattern of digestion within the population of *lamellidens marginalis* has been analyzed in the sequence of events occurring in four phases (Plate-1). Since the samples were collected every new moon, and full-moon days over a period of one year cycle, the quantitative examination of tubules did not reveal homogenous but synchronously cycling. However synchronization in certain phases of digestive tubules could be made with the change in the environmental parameters and food availability occurring in different seasons. The digestive tubule of *lamellidens marginalis* has been shown to be composed of two types of cells, the digestive cells and the basophil cells (Tantiwisawarui *et al.*, 2011). In *lamellidens marginalis* the two cell types are distinguished as basophil cells lying in groups in the crypts of the tubules that separate larger group of digestive cells (Plate-2). The basophil cells stain much darker than the digestive cells in Mallory's triple stain and consequently easy to recognize. This group of basophil cells eventually form a new tubule by mitotic division observed in March new moon-I, which eventually leave the old tubule, leaving one or two young cells in the old tubules to repopulate the empty old tubule.

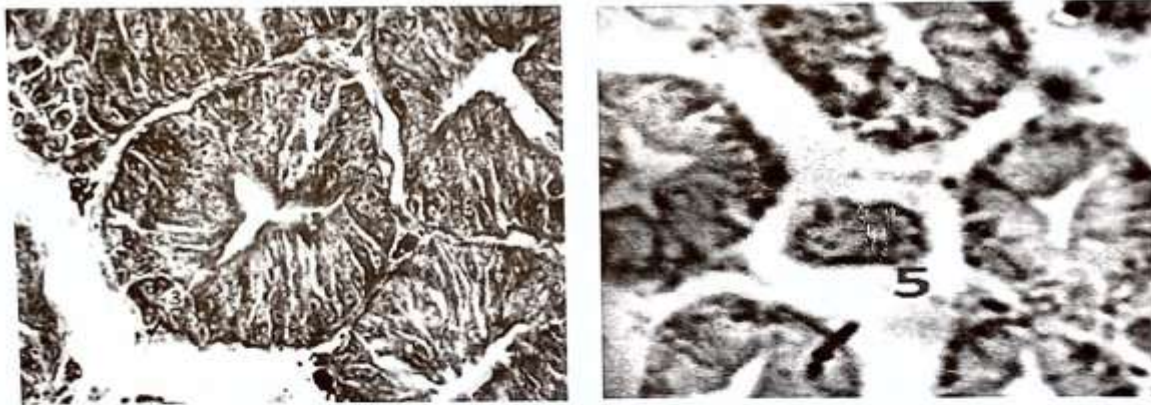
The cytological changes in the digestive tubules correspond to feeding and digestive sequence predominating in different fortnight of monsoon, post monsoon winter and summer. Before the arrival of food

in the lumen of digestive tubules are in a holding phase, the digestive cells having low appearance. This phase is observed in October new-moon, November full-moon, January new moon-I, February full-moon, March new-moon-I, April new-moon and May full-moon. On the arrival of food the digestive tubules shows the absorption phase. At this stage the digestive cells increases in height as the cells fill up with small particles (Loba Da Cunha, 2000). This phase is observed in June new-moon, July new-moon, September new-moon, October full-moon, November new-moon, December new-moon, January full-moon, January new-moon -II, March full-moon, March new-moon-II, April full-moon, May new-moon. Following the absorption and intracellular digestion, the digestive cells undergoes a process of breakdown in which the apices of the cells are pinched off to form fragmentation spherules. This phase is predominant in June full-moon, July full-moon, August new-moon, August full-moon, September full-moon. The fragmentation spherules phase is succeeded by a phase of reorganization or reconstitution during which the digestive cells resumed their low profile and resort to the holding phase. This phase was predominant in December full-moon. No fragmentation spherules were seen during re-organization, holding and absorption phases.

The digestive cells are responsible for the absorption and intracellular digestion of most of the food ingested. Assimilated food is presumably passed out from the bases of the digestive cells into the bathing haemocoelic blood, where as the waste material products of digestion are packed as fragmentation spherules to be budded off apically into the tubule lumen and returned to the stomach for discharge from alimentary canal.

DISCUSSION AND CONCLUSION

The morphological differences in digestive gland tubules are due to changes in the digestive cells, which make the tubule as food is received and digested intracellularly (Owen, 1974; Purchon, 1971). The studies of Morton (1970, 1983), not only support the view that bivalve is discontinuous feeder but also shows that the structural changes in diverticula are accordance with the rhythm of the environment. In present study, with beginning of the rainy season (June) till the end of heavy rainfall (September) the digestive tubules in the *lamellidens marginalis* shows mostly absorption and fragmentation spherules phases. This can be related to abundant food and the cells rapidly fill up with food particles. Due to heavy rainfall and speedy current of water over the animal bed stirring the detritus material in the pond water, which is available to mussels shows continuous cycle of digestive tubules. This is probably



1. Nest of young cells, 2. Digestive cells, 3. Basophilic cells, 4. Amoebocytes, 5. New tubule

Plate 2 : Structure of digestive tubule.

shows that the absorption of food could occur simultaneously with the breakdown of the cell and elimination of large amount of waste material. While in winter and summer from October to May only absorption and holding phases in the structure of the digestive tubules are seen. These phases are considered to occur due to less food availability and fluctuation in environmental parameters (McQuiston, 1969; Koukouzika *et al.*, 2009). From January full-moon to June new-moon period of absorption phase of the digestive tubules is extended in *lamellidens marginalis* due to reduced water current and decrease food availability making the tubules to remain in either holding or absorption phase.

With the close of monsoon from November new-moon the absorption phase again extended till December new-moon. This is possibly correlated with longer feeding period under short supply of food. In this winter period, short day length low temperature, weak water current over animal bed, the digestive cells appear partly full of food and breakdown is not complete. It is pertinent to mention here that the temperature decreases with the onset of winter i. e. from November, and no feeding occurs for a short period in December full-moon, during which the tubules show the reorganization phase and prepare for holding phase in subsequent period of the peak winter season. It is likely that under such situations starvation effects can be imposed upon the animals (Winstead, 1995). With the beginning of bright sunny days leading to calm water in pond, to clear cycle exists before and after the reorganization of tubules. The absorption and fragmentation spherule dominant before reorganization, while in later period is holding and absorption and absorption phases.

Morton (1977) summarized the process of feeding and digestion in *Crassostrea gigas* which are influenced

by tidal variations, seasonal and local environmental changes. In the present study in *lamellidens marginalis* have shown that an apparent cyclic pattern of feeding and digestion relative to freshwater current over the animal bed in monsoon and post monsoon is possibly related to greater pumping of water and long feeding. In this season the greater pumping of water and long feeding is possibly related to greater water currents that occur due to rainfall. In winter and summer it is possibly related to comparatively lesser pumping of water caused short feeding that occurred during hours of day light. The day light is longer during summer and shorter in monsoon, mostly could due to raining (Morton, 1971; Riisgards *et al.*, 2003). The seasonal rhythm becoming one with the seasonal pattern of water current over the animal bed which might be modified by the semi seasonal winter and summer pattern of water current over the animal habitat, and seasonal variation of water current create the complex pattern of feeding and digestion as seen in *lamellidens marginalis* from Girna river (Hawkin *et al.*, 1996; Kittner and Riisgards, 2005).

The study reveals that more food is taken up and utilized by the animals from June full-moon i.e. the beginning of monsoon till the December new-moon. Later on with the variation of the environmental conditions and decreased food availability in surrounding water occurs low food intake. The environmental conditions are more evident with regards to the temperature and water current over animal bed in the pond of Girna river. The samples have been collected on every new-moon and full-moon days over a period of twelve months, there appears to be no direct co-relation with the lunar periodicity and cyclic changes in the phases of the digestive tubules. Hence it is assumed that the lunar periodicity has no direct impact on the feeding and digestion in these mussels. Increased

holding phase may result in the succeeding period of dominance in winter for lesser utilization of the digestive enzymes and lesser body tissues to breakdown and reform. The food availability at this time decreases from the surrounding water. The process of new tubules formation occurs particularly in March new-moon I during growing period (Morton, 1969). So the processes feeding and digestion in fresh water bivalve like *lamellidens marginalis* the possibly may co-related with seasonal variations.

The first rainfall in June is the period of longer day length show the phases of absorption and fragmentation spherules predominate till the end of monsoon (June to September). While in post monsoon period the phase of holding occurs (October new-moon). After post-monsoon, results in predominance of absorption phase (October full-moon, November new-moon, December new-moon). This is the period of greater food availability with speedy current of clear water over the habitat of *lamellidens marginalis* results in much food intake. During winter (December full moon) phase of re-organization of the tubules appears. This is the period of shorter day length, lower temperature, mild water current and low food availability. This condition is followed by holding phase (January, new moon-I). After this period absorption phase is interrupted by holding phase (from January full-moon to May new-moon). It may be due to increase in day length, rise in temperature, no water current over the animal bed, declining food availability in the medium resulting in reoccurrence of holding phase. No fragmentation spherules phase is seen from post monsoon onwards. In general more food is taken up and utilized by the animals in monsoon season. Later on the fluctuation in the environmental parameters are more with regard to temperature, rainfall, nature of water current and food availability. So, it results, in low food intake. The significant local environmental variables in different seasons may influences vary from genus to genus and lotic to lentic habitat of the animals.

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3. Study of Photovoltaic Characteristics of Indium Sulfide Thin Films Useful for Solar Cell Applications

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Abstract

Deposition of In_2S_3 was carried out in acidic bath. With the same depositing parameter In_2S_3 film is used for fabrication of solar cell. The compact layer of Titania (TiO_2) nanostructured films was made available for the fabrication of SSSC. TiO_2 deposited by doctor blade method on FTO substrate which acts as photo anode. The surface area of TiO_2 was kept 0.25 cm^2 . In_2S_3 was deposited on FTO / TiO_2 by chemical bath deposition method at room temperature in acidic bath. Without any further treatment prepared films were further used for the synthesis of photo electrode of SSSCs. efficiency of fabricated solar cell in acidic bath is 0.034 % .

Keywords: Indium sulfide, Thin film, CBD, Photovoltaic characteristics,

1. Introduction

Photovoltaic cell is most useful approach to generate an electrical power from solar radiation. Third generation solar cell specially designed to provide low cost, simple fabrication technology and to overcome the SQ limit photo conversion efficiency [1]. In organic heterojunction solar cell charge separation occurs at the junction and maximum efficiency is around 7 % but it has vast potential [2-4]. However because of being eco-friendly and effective technology for solar energy conversion DSSC received great attention [5-8]. The use of semiconductor materials in solar cells as sensitizers was started from 1990's [9-12]. Because of high cost and low stability of DSSC, narrow band gap semiconductor sensitized solar cells are the best alternatives to enhance the conversion efficiency [13]. SSSC achieve higher conversion efficiency due to multiple electron-hole pair generation [14]. Hence sensitized semiconductor has been regard as superb alternative to replace DSCs.

It is reported that $\text{TiO}_2/\text{In}_2\text{S}_3$ fabricated solar cell shows quite low energy conversion efficiency which less than 1%. [15]. In_2S_3 sensitized solar cell were prepared by chemical bath deposition method achieved efficiency as shown in table [16].

Table .1: Photovoltaic performance parameter of In_2S_3 sensitized TiO_2 solar cell .

Photoanode	V_{oc} (mV)	J_{sc} (mA/cm^2)	FF %	Efficiency (%)
$\text{TiO}_2/\text{In}_2\text{S}_3$	504	0.42	11	0.02
$\text{TiO}_2/\text{In}_2\text{S}_3$ (annealed)	362	0.52	39	0.07
$\text{TiO}_2/\text{In}_2\text{S}_3/\text{Y}_2\text{O}_3$	524	0.92	65	0.32
$\text{TiO}_2/\text{In}_2\text{S}_3$ (annealed)/ Y_2O_3	557	0.75	66	0.27

2. Experimental Work

2.1 Material and Method

All chemicals used in this work were commercially available, and used without further purification. These chemicals are indium sulphate, 80 % hydrazine hydrate, thioacetamide, and triethanolamine. Films deposited on glass substrate and ITO coated glass substrates which are available in the market . This work, focus on the chemically synthesis of indium sulfide thin films deposit by chemical bath deposition (CBD) techniques.

2.2. Procedure

2.2.1 Synthesis of In_2S_3 Film

Deposition of InS was carried out in acidic bath. The solution was prepared in 25 ml beaker by sequential addition of 5 ml of 0.1 M indium sulphate and 0.1 ml of 0.15 M triethanolamine. The solution was stirred well. Then under the continuous stirring 0.2 ml of 80% hydrazine hydrate was added and 5 ml of 0.1 M thioacetamide solution was mixed to the bath. Acetic acid was added drop wise to the bath so that the initial pH of the solution was about 4. Clean glass substrates and ITO coated glass substrates were placed vertically in reactive solution separately. Without any further treatment prepared films were further used for the synthesis of photoelectrode of SSSCs

2.1.2 Synthesis of $\text{TiO}_2/\text{In}_2\text{S}_3$ Semiconductor Sensitized Solar Cell

The compact layer of Titania (TiO_2) nanostructured films was made available for the fabrication of SSSC. TiO_2 deposited by doctor blade (DB) method on FTO substrate which is acts as photoanode [17]. The surface area of TiO_2 was kept 0.25 cm^2 . In_2S_3 was deposited on FTO / TiO_2 by chemical bath deposition method at room temperature in acidic bath

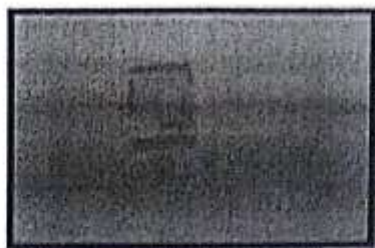


Fig. 1: Actual photographs of In_2S_3 films deposited on TiO_2 by CBD method in acidic bath on FTO-coated glass substrates.

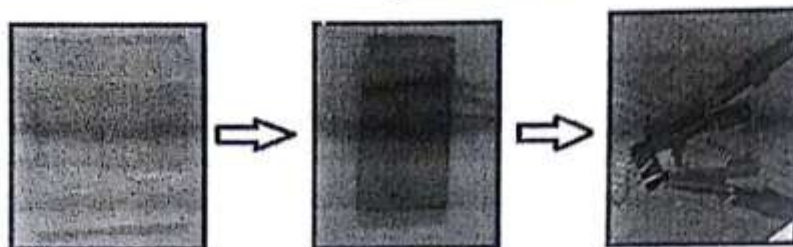


Fig.2: Actual photographs of depositing In_2S_3 on TiO_2 in acidic bath on FTO-coated glass substrates and fabricating it for SSSC.

3. Results and Discussion

Figure 3 shows the EDX spectrum of In_2S_3 films synthesized on to glass substrate by CBD in alkaline bath. The average elemental atomic percentage ratio of In: S was about 36:63 which shows good agreements for chemical stoichiometric of the In_2S_3 thin film, which conforms the deposition of indium sulphide.

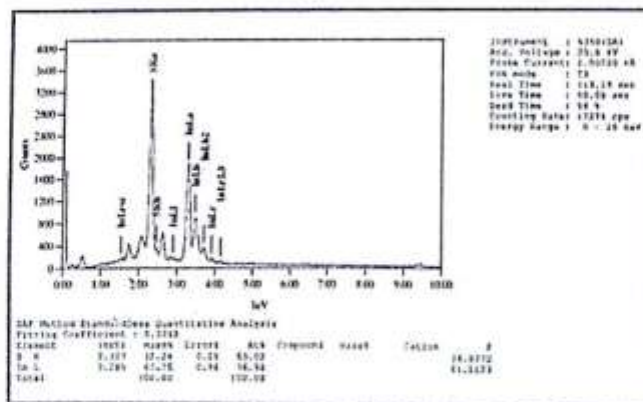


Fig 3. Typical EDS spectra of In_2S_3 film deposited on glass substrate

Photo-Current Density- Photo Voltage (J-V) Characteristic

The active surface area of each device was maintained about 0.25cm². Cell voltage corresponds to the difference between redox potential of the electrolyte and conduction band energy level of the semiconductor [18]. Voltage and current measurements were done by using Keithly-2602 source meter.

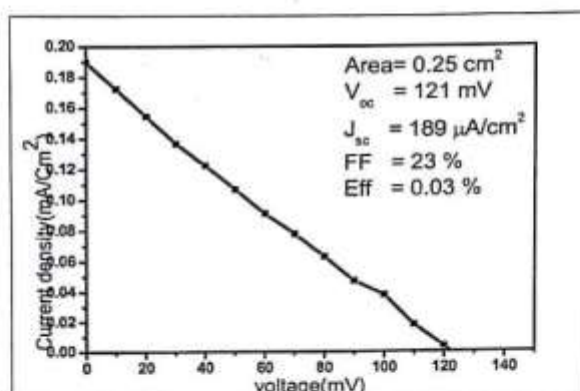


Fig.4.: Photo-current density- photo voltage (J-V) characteristics of SSSC based on FTO TiO₂ / In₂Se₃/ Pt.

Fig.4 shows the J-V curves measured for In₂S₃ sensitized TiO₂ photoelectrode. All the output parameters namely, open-circuit voltage (V_{oc}) short circuit current densities (J_{sc}), fill factor (FF) and photovoltaic efficiency (η) are given in the table 5.2. It is observed that the J_{sc} and conversion efficiency is 0.034% for In₂S₃ sensitized TiO₂ photoelectrode.

Table 2: Photovoltaic parameters of TiO₂/ In₂S₃ based SSSC for the films deposited on FTO coated glass substrates.

Sample	Area (cm ²)	V _{oc} (mV)	J _{sc} (mA/cm ²)	FF (%)	Efficiency (%)
TiO ₂ /In ₂ S ₃ /Acidic	0.25	121	0.189	23	0.034

Among this the best performance with J_{sc} = 0.189 mA and V_{oc} = 0.121 is observed for the film deposited in acidic bath with In₂S₃ sensitization. It is reported that the change in V_{oc} may be the influenced by the negative band edge movement of the FTO layer and electron recombination Occurred by the passivation of sub-band-edge surface states [19,20].

Conclusions

The In_2S_3 sensitized thin films were successfully synthesized deposited by chemical method in acidic and alkaline bath In_2S_3 deposited by CBD for SSSC over TiO_2 surface. The SSSC fabricated with the In_2S_3 films deposited on TiO_2 by CBD method at room temperature in acidic bath on FTO-coated glass substrates. Because of efficient charge transport and reduced the recombination losses SSSCs shows good performance with efficiency 0.034 % which is close to the best reported.

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PREVALENCE OF SOIL-TRANSMITTED HELMINTHIC INFECTION AMONG SCHOOL CHILDREN'S OF RYAN INTERNATIONAL SCHOOL, AURANGABAD DISTRICT (M.S), INDIA

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ABSTRACT

Soil-transmitted helminth (STH) infections represent a major public health problem in poor and developing countries. Stool samples were examined for helminth eggs by quantitative (Kato-Katz) technique to determine the prevalence and intensity of intestinal parasitic infection. 98 schoolchildren aged 9-10 years were enrolled. The prevalence of STH infections was 42 (42.85%). Detected parasite was *A. lumbricoides* 42 (42.85%). Socio economic status played a significant role in this study. Children from Ryan International School with higher environmental sanitation carried no parasites. A total of 14 (38.88%) females were infected while 28 (45.16%) of the males were infected. A higher percentage rate occurred among males than females though no association was made between the sexes. 56 (57.14) were found not infected.

KEY WORDS: Aurangabad prevalence, School-children, Soil-transmitted helminthiasis.

INTRODUCTION

The World Health Organization (WHO) estimates that more than one billion of the world's population is chronically affected by STH infections, which are closely correlated with poverty, poor environmental hygiene and impoverished health services. Intestinal helminthiasis are among the most common communicable disease of school-age children in certain communities and tend to occur at highest intensity in this age group (Olsen 1998). In particular, there is evidence to support the relationship between helminth infections, malnutrition and child development, with negative consequences for cognitive function and learning ability. The objectives of this study were to identify the prevalence of soil-transmitted helminth infections in the population of Ryan International School children's and to evaluate its relation to age and gender.

MATERIALS AND METHODS

Study area and population

Ninety eight school children, age 9-10 years in Ryan International School, Aurangabad district, Maharashtra state was randomly selected and investigated for their intestinal helminthic infections between December 2004 and December 2006.

Sampling method

The pupils were educated on the causes of intestinal helminthic infections among school aged children and they were convinced that every child ought to be free from such infections, thus the necessity of participating in the research work was appreciated by them. Thereafter, wide mouth corked sterile bottles were given to the pupils for the collection of their stool samples at home and structured questionnaires were distributed among the participating pupils for the collection of demographic information such name (optional), age, sex, type of toilet and water facility used, number of individuals in the house, parents occupation, religion, foot wear habits, pet/domestic animals reared, regularity of deworming etc. and accordingly labelled (ID). Defecating site (open or modern sanitary latrine) were recorded for socio-economic conditions. The children's age were obtained from school record. The pupils were taught how to collect stool samples with the aid of their teachers, the questionnaires were correctly filled. The height and weight of the pupils were taken in the morning of the following day as they submitted their stool samples between 7.30 and 8.30 am. The stool samples were properly labeled and were carried in a cold box filled with Ice packs and transported to the private laboratory for analysis. The samples that could not be analysed immediately were preserved using 10% formalin until they were examined (Cheesbrough, 1998).

Analysis of samples

Stool analysis was performed using the Kato-Katz technique. (World Health Organisation, 2003). All the slides were read by one medical doctor specialized in parasitology and consistency of the reading was assured by second readings

performed in 20% of the slides randomly selected. Intensity of infections for each worm was defined according to the thresholds proposed by WHO Experts Committee in 1987. The following data were collected for each child: weight, height, infection for *A. lumbricoides*, *T. trichiura* and hook-worm.

Statistics

Most of the collected data were analyzed descriptively and some were statistically analyzed using χ^2 test, to assess the significance levels of any differences found.

RESULTS

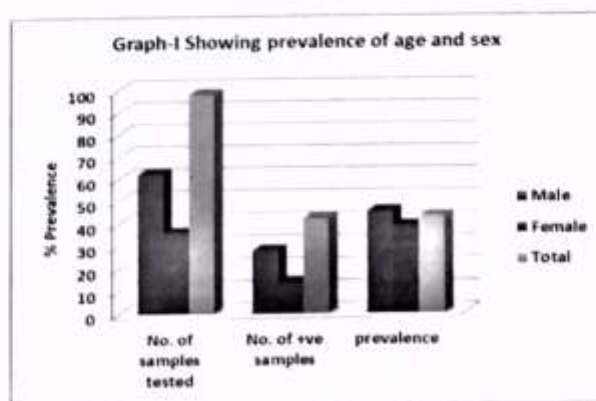
A total of 98 schoolchildren were invited to participate and 86 (67.4%) provided proper stool samples and complete information. Among these, 28 (45.16%) were males and 14 (38.88%) females were infected. The mean age of the children was 9-10 years. An overall prevalence of 42.85% (42 out of 98 children). The predominant parasite involved was *Ascaris lumbricoides* which was observed in 42 (42.85%) of the students (Table 2). Among these 56 (57.14%) was found not infected.

Table 1: Intestinal Helminthic infection in School Children according to age & sex.

Age (Years)	No. of samples tested			No. of infected cases					
	M	F	T	Male	%	Female	%	Total	%
9-10	62	36	98	28	45.16	14	38.88	42	42.85

Table 2: Prevalence of *A. lumbricoides* in infected school children

Age (Years)	Helminths	Total	%
9-10	<i>Ascaris lumbricoides</i>	42	42.85



DISCUSSION

Soil-transmitted helminths remain prevalent throughout the developing world where levels of personal and environmental sanitation and maternal education are low Pearson (2002). In our study, 42.85% of the children were

infected with one of these helminths. Similar results have been given by Lindo *et al.* (2002). Majority of the incidences reported in various parts of the developing world fall between 17% and 76%. Andrade *et al.* (2001), and Wario (1994). However both extremely high Carme B. *et al.* (2002) and low incidences Fernando ND *et al.* (2002), have also been reported. *A. lumbricoides* prevalence superceded all parasites by showing a positivity of 42.85%. However, incidences lower than 30% have been reported in The zonal-level prevalence of *Ascaris lumbricoides* 9.9%, hookworm 9.7%, and *Trichuris trichiura* was 2.6 respectively (King, 2013).

Higher parasitic infections were observed among males compared to females in this study although the difference was not statistically significant. This pattern of parasitism with respect to gender of the students could best be attributed to higher hygiene level normally observed among the females of this age bracket compared to their male's counterpart. The males in this age group are involved in recreation and sporting activities that exposes their skin to contact with soil thereby exposing them to *Ascaris* infection. Males are generally more active and playful and are less careful and less discriminatory about what they eat which may make the spread of the infection easier and faster among the male students. This could also explain why the prevalence of infections was higher in males (45.16%) than in females (38.88%) showed in Table-1.

Investigators from elsewhere have reported higher prevalences either in females (Rajeswari *et al.*, 1994) or males. The differences in findings among the studies can be explained by variations in geography, socio-economic conditions, and cultural practices of the population under consideration. The category of the study population, the methods employed for stool examination, and the time of study may also have contributed to the differences.

However, our study showed a 42.85% prevalence rate, a higher helminthic infection rate than a study in suburban Nakhon Prathom Province, which found a 0.5% infection rate (Ngrengarnler *et al.*, 2007). In the border area of Nan, Kanchanaburi and Srakaew the study showed a similar prevalence of 55.8%, 49.4% and 49.5%, respectively (Maipanich *et al.*, 2004). Eighty seven percent of people wear shoes when they go out or go to work. Our study tried to use various techniques for determining parasitic infection.

The prevalence of *A. lumbricoides* was similar to the study conducted in rural inhabitants of north Cheju (Byong Seol, (1972) but not comparable with the studies conducted by Wani (2008) in Kashmir valley, India where the prevalence of *Ascaris lumbricoides* was highest (68.30%), followed by *Trichuris trichiura* (27.92%).

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CONCLUSION

Infections could be minimized simply by giving them proper health education in classroom which will make them aware of mode of transmission of infection to which they are prone and also help in protecting themselves from parasitic infection by taking precautionary measures.

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Percentage prevalence and morphological details of *Stylonychia pustulata* (Ehrenberg, 1830) in the fresh waters of Nashik district

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ABSTRACT

The ciliates are one of the most important groups of Protozoa, common everywhere in waters of lake, pond, oceans and soils with many ecto and endosymbiotic members, as well as some obligate opportunistic parasites. Free living ciliates are found in fresh, marine, estuarine waters and in the soil. The present species described as *Stylonychia pustulata* Ehrenberg (1830), (O. F. Muller, 1786) Ehrenberg, 1835 (O. F. Muller, 1786) Ehrenberg, 1838, *S. pustulata* (Deshmukh, 2010) has found in fresh water ponds, ditches and streams, especially more abundantly in rain water bodies of Nashik district.

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Introduction

The ciliates are one of the most important groups of Protozoa, common almost everywhere there is water (lake, pond, and oceans) and soils with many ecto and endosymbiotic members, as well as some obligate opportunistic parasites. Free living ciliates are found in fresh, marine, estuarine waters and in the soil.

An excellent source is a shallow semi permanent pond in a farm yard. Any stream large or small, or any freshwater hole, temporary or permanent, water at the base of aquatic plants is likely to be a valuable source of material. Such places as moist crotches or bark (crevices) in trees or any other moist or water containing silt, floating algal mats provide food. Cilia covering the body of the organism or a part of it, a major defining characteristic of this group and hence the phylum name "Ciliophora".

The ciliates possess a marked variety of motile systems based on ciliary motion. Thus, the organisms are able to move through the environment in search of prey often with remarkable agility and swiftness, or when sedentary, to create a flow of water carrying food to the organism. The arrangement of hair like organelles on the cell surface and the degree of coordinated action made possible by close proximity of the cilia varies considerably among the groups.

A cirrus is a composite group of cilia (a few to hundreds of cilia) often tapering toward the distal end and acting in unison. Typically they are found in localized regions on the cell surface. When the cirri are largely localized on the ventral and anterior surfaces, the ciliates are characterized as hypotrichs; signifying that the cirri are positioned beneath the cell. In other species, cilia are arranged in spirals (e.g. Spirotrichs) or in ribbon like assemblages near the anterior (sometimes broader end) of the cell. Although many ciliates exhibit rapid and impressive locomotion, others such as suctorians are sedentary and lack cilia during most of their life cycle. These feeding (trophont) stages are anchored to the substratum by a stalk or other form of holdfast.

Ciliates in general have great power of regeneration, and the process like reproduction is more complex, a missing part can be replaced by simple growth. Unlike eukaryotes, ciliates have two different nuclei; large polyploid macronucleus and smaller diploid micronucleus. The former is important for protein synthesis, and latter for reproduction. The macro nuclei must be regenerated from the micronuclei. In most, this occurs during sexual reproduction which is not usually through syngamy but through conjugation. Joblet (1645-1723), has done pioneer work on ciliature, nuclei and contractile vacuoles in ciliates. In the eighteenth century Muller (1773, 1776 and 1786) gave the first extensive taxonomic account of all protozoa.

Extensive studies have been made during the last 80 years, with numerous outstanding and noteworthy contributions in the field of Protozoology, covering cytology, cytochemistry, structure, life cycle transmission, evolution, and ultrastructure; and inter relationship a verity of protozoa.

Although all ciliates conform, more or less, to the principle of nuclear dimorphism, they vary greatly in shape, size and number of nuclei. The macronucleus may be single compact, rounded or kidney shaped.

In reproduction by binary fission, the macro and micronuclei, either or both, divide; so that the parental nuclei are equally represented in both daughters. During sexual process of conjugation, two individual (the conjugant) unite temporarily. Micronucleus, or micronuclei, of both divide twice. All but one of the resulting micronuclei in each conjugant degenerate and disappear while the remaining one divides unequally forming two pronuclei. The smaller one is active, migratory, male pronucleus and the bigger one stationary, female, pronucleus. The male pronucleus migrates into the other conjugant and fuses with its stationary pronucleus forming a zygote nucleus or syncaryon. The two conjugants then, separate and are known as the exconjugant. These differ from ordinary individuals in having only a single nucleus, for the old macronucleus by now is in the process of losing its identity and being absorbed into the cytoplasm. The way in which the macronucleus disappears, varies considerably in different ciliates. During subsequent

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divisions the syncaryon gives rise to both macro and micronuclei.

Endoplasm is the seat of the main metabolic processes. The endoplasm is completely enclosed by cortex except at two places where it is brought into contact, temporarily or permanently, with the outside world. These are the cell mouth (cytostome) and cell anus (cytoproct). Food is taken in by the cytostome and surrounded by a vacuole into which digestive enzymes are secreted. The vacuole circulates slowly in the interior of animal during which time its contents are digested and absorbed through its wall and finally brought to the site of cytoproct which opens to discharge the undigested matter. In some ciliates the part of the endoplasm immediately adjoining the mouth forms a fairly well defined oesophagus like tube and among some groups of holotrichs this is surrounded by a series of parallel rods (trichites) of unknown origin, sometimes elaborate enough to form a basket like structure.

One or more contractile vacuoles are present typically in freshwater ciliates to regulate ion balance of the cytoplasm and expel excess water. Various extrusomes (ejectile organelles) occur beneath the surface of the cell including mucocysts that secrete surface substances either to coat the cell to improve its immediate environment, provide material for cyst walls or aid in the capture of prey.

Most ciliates feed on smaller organisms, such as bacteria, algae and detritus swept into the mouth by modified oral cilia. Feeding consist of two processes each of which may limit the actual rate of feeding. The first one is the process of phagocytosis, i.e. the enclosure of a food particle in a membrane covered vacuole in which digestion takes place. In ciliates this occurs at a special site on the cell surface called cytostome or cell mouth. Cytostome is simply a two dimensional aperture and most commonly permanently open. It is covered by a single unit membrane from which food vacuoles are formed. Food materials first pass into the endoplasm of the organism via a more or less distinct cytopharynx. It may open directly to the exterior or be sunken into a depression or cavity or some kind, such as atrium, vestibulum or buccal or peristomial cavity.

The cytostome is often associated with various organelles in the surrounding cytoplasm in particular bundles of microtubules. Later play a role in the transport of captured particles on the surface surrounding the cytostome. A variety of ciliary's and other organelles serve to concentrate or retain food particles.

Material and Methods-

For the study, the water samples were collected from different parts of Nashik dist (Deola, Kalwan Nandgaon; Sargana, Satana) of Maharashtra state. Water samples were collected in wide mouth, sterilized glass bottles. Due care was taken and the samples were collected from where the submerged plants and decaying leaves were present. Mostly the samples were collected during morning and evening. The temperature of the sample bottles were maintained with the help of ice bags.

Rapid movements of ciliates make it difficult to identify ciliate species. To immobilize their movements methyl cellulose solution was used.

Culture methods -

For cultivation various media are used such as

- Hay infusion
- Wheat infusion
- Rice infusion

Hay infusion was good for *Stylonychia* and many other ciliates species. Rice grain infusion is also best for the *Vorticella*, *Stylonychia* and *Coleps* species.

Water sample is obtained from different water bodies contains a mixer of organism, by adding any type of culture media (Wheat or rice infusion) can generally rise the number of certain ciliate species (by rising the bacterial population present) in the water sample, but often lower the number of species. However the rough sample containing several ciliates and unknown bacterial and algal floras can be obtained for several weeks. Selection of a particular ciliate species and culturing it in the isolation of organisms other than its prey may obtain a greater degree of control over a culture.

The choice of culture medium depends largely upon what the ciliate feeds. Many feed upon bacteria and that is why many of the media commonly used are designed to encourage the growth of bacterial populations. Different culture media and methods published by Mackinnon and Hawes (1961), Kirby (1950) and committee on cultures, Society of Protozoologist (1958).

Culture were examined under low power and then in to high power microscope taking care to focus at all levels in the culture watching for movements of any kind. Movements of ciliates were also trapped in video camera for the proper understanding. Dry silver impregnation was used to study infraciliature of the ciliates. For the permanent slides the ciliates were fixed in terms of number of individuals and species composition. Methyl cellulose has been found too many advantages, as it arrest the movement, ciliates can be identified by their appearance. The species identification has been made mainly on the basis of arrangement of cilia, size and shape of body and structure of macro and micronucleus.

Discussion and Results-

Percentage of prevalence of *Stylonychia pustulata* in fresh water during the period of January 2007 to December 2008, for the two years

Table 1. Showing month wise prevalence of *Stylonychia* Sp. in freshwaters of Nashik District during the year 2007

Sr No	Month	Total No. of samples Examined	No. of +ve samples	% of Total Prevalence
1	Jan-07	45	6	13.33
2	Feb-07	55	7	12.73
3	Mar-07	47	6	12.77
4	Apr-07	60	6	10.00
5	May-07	61	5	8.20
6	Jun-07	67	15	22.39
7	Jul-07	54	21	38.89
8	Aug-07	57	20	35.09
9	Sep-07	58	12	20.69
10	Oct-07	60	11	18.33
11	Nov-07	64	10	15.63
12	Dec-07	49	7	14.29
	TOTAL	677	126	18.61

Graph 1. Showing month wise % of total prevalence of *Stylonychia* in freshwaters of Nashik District during the year Jan. to Dec. 2007

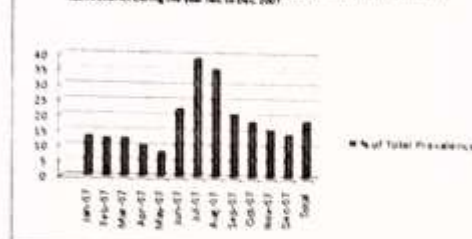
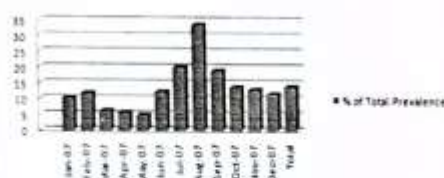


Table 2. Showing month wise prevalence of *Stylonychia* in freshwaters of Nashik District During the year 2008

Sl No	Month	Total No. of samples Examined	No. of +ve Hosts	% of Total Prevalence
1	Jan-08	68	7	10.29
2	Feb-08	84	10	11.90
3	Mar-08	79	5	6.33
4	Apr-08	69	4	5.80
5	May-08	62	3	4.84
6	Jun-08	89	11	12.36
7	Jul-08	94	19	20.21
8	Aug-08	80	27	33.75
9	Sep-08	89	17	19.10
10	Oct-08	87	12	13.79
11	Nov-08	69	9	13.04
12	Dec-08	77	9	11.69
	Total	947	133	14.04

Graph 1. Showing month wise % of total prevalence of *Stylonychia* in freshwaters of Nashik District During the year Jan. to Dec. 2008



During the period of two years (Jan.2007 to Dec. 2008) a total number of water samples 1624 were examined, 259 of these were positive with free living ciliate *Stylonychia pustulata*.

In the first year (Jan.2007 to Dec.2007) 677 fresh water samples were examined, 126 of these were positive with free living ciliates. The percentage of prevalence of free living ciliates was about 18.61%.

In the second year (Jan.2008 to Dec.2008) 947 fresh water samples were examined, 133 of these were positive. The percentage of prevalence of free living ciliate *Stylonychia* was about 14.04%.

A month wise analysis in first year (Jan.2007 to Dec.2007) shows the maximum percentage of prevalence during August (33.75%) and minimum in May which was only 8.20%, and minimum to moderate in remaining months.

During the period of Jan. 2008 to Dec.2008) maximum percentage of prevalence of this ciliate was showed again during July (33.75%) and lowest in May (4.84%) and minimum to moderate in remaining months.

The pattern in both the years suggests that the peak is soon after the monsoon rain. The percentage then gradually reduces at the end of the winter months and reaches a low with the onset of summer. The details of the number of water samples examined and the month wise prevalence is shown in Table No1 and 2.

Description of the species

Synonym of *Stylonychia* was described by O. F. Muller (1786) later Kerona, the Andre, (1916) had given the name *Prosopseu*. Ehrenberg, (1838) included this genus in Family Oxytrichidae. The species which are included in genus *Stylonychia* are inflexible, elongate, oval, dorso-ventrally flattened body with a large and powerful AZM supported anteriorly by a collar. 2 rows of marginal cirri not continuous posteriorly, but 3 long, strong and prominent caudal cirri present.

The genus has the typical fronto-ventral and transverse arrangement of cirri with 3 strong anterior frontal cirri. The dorsal surface has several longitudinal rows of short cilia. Macronucleus in two parts each with an adjacent micronucleus. Several species have been recorded.

Undulating membrane is present in *Stylonychia* pattern. One right and one left row of marginal cirri, distinctly separate posteriorly. Presence of six dorsal kineties, caudal cirri present and often distinctly elongated, which have, however, a more slender and flexible body and intersecting undulating membranes. There are two (two distinct segments) of one macronucleus macronuclei present which are oval in shape with single spherical to ovoid micronucleus each.

The genus *Stylonychia* has following species

S. pustulata Ehrenberg, 1838

S. mytilus Ehrenberg, 1838

S. putrina Stokes, 1885

S. notomorphia Stokes, 1885

Description of the *Stylonychia pustulata*

The present species described as *Stylonychia pustulata* Ehrenberg (1830), (O. F. Muller, 1786) Ehrenberg, 1835 (O. F. Muller, 1786) Ehrenberg, 1838, *S. pustulata* (Deshmukh, 2010). Present author has found this species in fresh water ponds, ditches and streams, especially more abundantly in rain water bodies of Nashik district.

Body is inflexible and elliptical. It measures about 44 to 125um in length and 22um to 81um in width. Both anterior and posterior ends are rounded and more or less parallel. Macronuclear segments two which are ovoid in shape. Each macronucleus is measures about 14 to 16um in length and 6 to 8um in width, lying left of the median. Micronuclei are two in number, they are small spherical, each in close contact with one of the macronuclear segments.

Contractile vacuole is single. It measures about 9um to 11um in length, present at the middle of the body. Endoplasm was seen bright yellow in colour in living condition. Food vacuoles are few to moderate in number. The large size food vacuole is measures about 27 to 32um in length.

Movement moderately slow, gliding, and often standing still for sometimes, rotation, around the longer axis on disturbance. The presences of various cirri are the organs of swimming and gliding locomotion. Marginal cirri are measures about 12 to 16um long. Right marginal row is composed of many more cirri than the left one. Three anterior frontal cirri enlarged, which measures 19-23 um in length. Four posterior cirri, arranged in an oblique hook-shaped row, and one enlarged buccal cirrus. Two postoral and three ventral cirri are present. Transverse cirri are five in number they measures about 20-24 um in length. The Caudal cirri are three in number; they are 16-25 um in length, very stiff and projecting laterally.

Comments

Body of present species is ovoid to reniform, inflexible and elliptical, with short dorsal bristles. Three long stiff caudal cirri are present and hence it is belongs to genus *Stylonychia*. This genus is first reported by Ehrenberg, 1830. Later many workers reported different species of this genus. Kudo (1966), Bick (1972), Berger & Foissner (1997), Lynn & Small (2000), reported the different species of the same genus. *Stylonychia pustulata* was identified by the shape of the body, the arrangement and the number of cortical elements, the mode of locomotion and morphological similarities in number and the positions of cirri. Movement moderately slow, gliding, and often standing still for sometimes, rotation, around the longer axis on disturbance.

Table 3: Comparison of different species of genus *Stylonychia* with present species, *S. pustulata*

Sl No	Particulars	1 <i>S. pustulata</i> Ehrenberg, (1838)	2 <i>S. mytilus</i> Ehrenberg, (1838)	3 <i>S. putrina</i> Stokes, (1885)	4 <i>S. notomorpha</i> Stokes, (1885)	5 <i>S. pustulata</i> Deshmukh, (2010)	6 <i>S. pustulata</i> Present authors
1	Body shape	Ovoid	Elongate	Elongate	Elongate	Ovoid	Ovoid
2	Body dimensions	L- 150 um	L- 100 to 300um	L- 125 to 150um	L- 125um	L- 55 to 65um W- 30 to 38um	L-44 to 125um W- 22 to 81um
3	Macronuclei	2, ovoid	2	2, ovoid	2, ovoid	2, ovoid	2, ovoid
4	AZM	1/3 body length	1/3-1/2 body length	1/3-1/2 body length	1/3-1/2 body length	1/3 body length	1/3 of body length
5	Habitat	Fresh water	Fresh water	Fresh water	Fresh water	Muddy soil	Fresh water

AZM - Adoral zone of membranelle

Body of present species is ovoid and hence similar to previously described species *S. pustulata* but differs from *S. mytilus* (Ehrenberg, 1838) which is elongate and has anterior end wider than the posterior. *S. putrina* (Stokes, 1885) is elongate and anterior end is not wider than posterior but anterior end is somewhat conical and rounded posterior end while in present species anterior end is rounded and posterior is broadly pointed and hence present species is also separates from *S. putrina*. It also distinguishes from *S. notomorpha* (Stokes, 1885) which has somewhat conically rounded anterior end and body laterally narrowed in some cases.

In body dimensions when compared with other species of *Stylonychia*, present species found to be small among all the previous ones (Table.....). Present species has 3 to 8 frontal, 2 post oral, 3 to 5 ventral, 5 transverse and 3 caudal cirri and hence similar to all the species of genus *Stylonychia* which also has 3 frontal, 3 ventral, 5 transverse and 3 caudal cirri.

AZM in present species also covers the one-third part of the body length and hence this species resembles that of *S. pustulata* but differs from *S. putrina* (Stokes, 1885), *S. mytilus* (Ehrenberg, 1838) in which AZM extends one-third to one-half the body length. It also separates from *S. notomorpha* (Stokes, 1885) in which AZM extends up to one-half the body length.

Present species has two ovoid macronuclei and hence similar to all the species of genus *Stylonychia*.

Present author compared present species with all the species of genus *Stylonychia* and found morphologically close similar to *S. pustulata* (Ehrenberg, 1838) in body outline, length of AZM and hence redescribed as a *Stylonychia pustulata*.

Figure - *Stylonychia pustulata*

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IMPACT OF LOCAL ENVIRONMENTAL CONDITIONS ON FEEDING AND DIGESTION OF *lamellidens marginalis* FROM A POND IN GIRNA RIVER NEAR CHANKAPUR DAM, NASHIK, INDIA

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ABSTRACT : The first rainfall in June is the period of longer day length show the phases of absorption and fragmentation spherules predominate till the end of monsoon (June to September). While in post monsoon period the phase of holding occurs (October new-moon). After post-monsoon, results in predominance of absorption phase (October full-moon, November new-moon, December new-moon). This is the period of greater food availability with speedy current of clear water over the habitat of *lamellidens marginalis* results in much food intake. During winter (December full moon) phase of re-organization of the tubules appears. This is the period of shorter day length, lower temperature and mild water current and low food availability. This condition is followed by holding phase (January, new moon-I). After this period absorption phase is interrupted by holding phase (from January full-moon to May new-moon). It may be due to increase in day length, rise in temperature, no water current over the animal bed, declining food availability in the medium resulting in reoccurrence of holding phase. No fragmentation spherules phase is seen from post monsoon onwards. In general more food is taken up and utilized by the animals in monsoon season. Later on the fluctuation in the environmental parameters are more with regard to temperature, rainfall, nature of water current and food availability. So, it results, in low food intake. The process of new tubule formation occurs particularly March new-moon I during the growing period. Since the samples have been collected on every new-moon and full-moon days over a period of twelve months but their appears to be no direct relation with lunar periodicity and cytological cyclic changes in the phases of digestive tubules. Hence it is assumed that lunar periodicity has no direct impact on the feeding and digestion in these mussels. The significant local environmental variables in different seasons may influences vary from genus to genus and lotic to lentic habitat of the animals.

Key words : Girna river, *lamellidens marginalis*, new-moon, full-moon, holding, absorption, fragmentation spherules, reorganization.

INTRODUCTION

The process of digestion in bivalve may be of the stomach and extracellular digestion in stomach and extra cellular digestion in stomach by dissolution of the crystalline style. (Morton, 1973). The digestive tubule in the digestive diverticula goes to the phases of absorption, digestion, breakdown and reformation. Studies on the bivalve gut and the process of feeding and digestion have indicated that various cell types in the digestive tubules of bivalve undergoes a pattern of cytological and structural changes in accordance with rhythm of environment (Morton, 1983). In the present study a habitat of *Lamellidens marginalis* is a narrow oval pond in the downstream vicinity of the Chankapur dam. The flow of water in the pond is mainly from the opening of the gates of dam. In rainy season pond gets flooded with muddy fast current of water. In the remaining period of year, moderate flow or calm, clear water in the pond. Thus the pond remains full of water throughout the year. In this study attempt has been made to find out whether such a pattern of cytological, cyclic changes exists in

Lamellidens marginalis with respect to local environmental conditions of the animal habitat.

Lamellidens marginalis inhabit in narrow oval pond about 100 x 30 mt. created due to southward passage of Girna river away from the Chankapur Dam. This dam was construction during the year 1974-75. The flow of water in the pond is mainly from the opening of one of the gates of the dam once in a month throughout the year. During peak monsoon the pond get flooded due to frequent opening of the gates of the dam, with muddy fast current of water stirring the whole water of the pond thoroughly. In remaining period of year, moderate clear water current stirs the pond slowly. Thus throughout the year pond remains full of water.

MATERIALS AND METHODS

The collected animals of each lot (June 2013 to May 2014) were brought to the laboratory. The shell valves were removed and animals were fixed in Bouin's Hollande fixative for 48 hours. The renewal of fixative was done at every 15 to 20 hours. Then animals were dissected for

Table 1 : Local environmental conditions of the habitat of *lamellidens marginalis* in the pond of Girna river near Chankapur dam, dist-Nashik.

Month	Day length (hours)		Temp (Oc)		Rainfall(mm)	Humidity(%)	
	NM	FM	Min.	Max.		Min.	Max.
June-2013	13.10	13.12	21.50	30.0	162	75	85
July	13.9	13.2	21.60	25.40	188	90	98
August	12.51	12.37	20.80	27.05	138	71	93
September	12.21	12.07	21.40	30.20	241	83	97
October	11.51	11.36	21.50	31.10	16	49	91
November	11.21	11.09	13.80	30.04	-	33	67
December	11.0	10.56	06.05	31.60	-	25	85
January	10.57	11.03	11.02	29.0	-	32	91
February	11.14	11.19	09.0	30.02	10	40	89
March	11.42	11.58	17.01	35.30	-	24	70
April	12.13	12.30	17.00	39.07	-	16	69
May-2014	12.44	12.56	17.0	42.0	-	25	72

Table 2 : Cytological changes in the digestive tubules of *lamellidens marginalis* in the habitat of Girna river, Chankapur, Dist. Nashik.

Month	Date	Fortnight	Phase of tubule
June	8/06/2013	New-moon	Absorption
	23/06/2013	Full-moon	Fragmentation spherules
July	8/07/2013	New-moon	Absorption
	22/07/2013	Full-moon	Fragmentation spherules
August	6/08/2013	New-moon	Fragmentation spherules
	21/08/2013	Full-moon	Fragmentation spherules
September	5/09/2013	New-moon	Absorption
	19/09/2013	Full-moon	Fragmentation spherules
October	4/10/2013	New-moon	Holding
	18/10/2013	Full-moon	Absorption
November	3/11/2013	New-moon	Absorption
	17/11/2013	Full-moon	Holding
December	2/12/2013	New-moon	Absorption
	17/12/2013	Full-moon	Re-organization
January	01/01/2014	New-moon-I	Holding
	16/01/2014	Full-moon	Absorption
	30/01/2014	New-moon-II	Absorption
February	14/02/2014	Full-moon	Holding
March	1/03/2014	New-moon-I	Holding
	16/03/2014	Full-moon	Absorption
	30/03/2014	New-moon-II	Absorption
April	15/04/2014	Full-moon	Absorption
	29/04/2014	New-moon	Holding
May	14/05/2014	Full-moon	Holding
	28/05/2014	New-moon	Absorption

hepatopancreas tissues. These tissues were processed through ethyl alcohol and toluene. Then material is embedded in paraffin wax (58-60°C). The above mentioned paraffin wax block preparation procedure was repeated for each lot. The sections of each lots of hepatopancreas tissue were taken at 6 μ m. The spreading of the section wax ribbon is done on micro slides as per the lot. The processed micro slides were labelled by glass marker and stored in slide boxes for staining. The micro slides of each lot are processed for Mallory's staining procedure and sections are mounted in DPX. After drying the micro slides are cleaned, labelled, observed and selected micro slides are separated for photo micrography. By observing the micro slides of each fortnight and result of work is finalized.

RESULTS

1. Local environmental conditions of the habitat of *lamellidens marginalis* during the study period i.e. from June 2013 to May 2014.

The data of local environmental conditions that is day length, rainfall, temperature and humidity of the habitat of *lamellidens marginalis* in the pond of Girna river near Chankapur dam, Dist-Nashik are given in Table 1. The values are collected in every fortnight for a period of one year from June 2013 to May 2014.

The day length is more than 12 hours from April new moon (12.13h) to September full-moon (12.7 h), while in the remaining period of the year the day length is less than 12 hours. The highest day length is recorded in June full-moon (13.12 h), while lowest day length is recorded in December full-moon (10.56 h) in peak winter season. The data of the rainfall reveals that the rainfall starts in June and goes on increasing in July while slight decline in

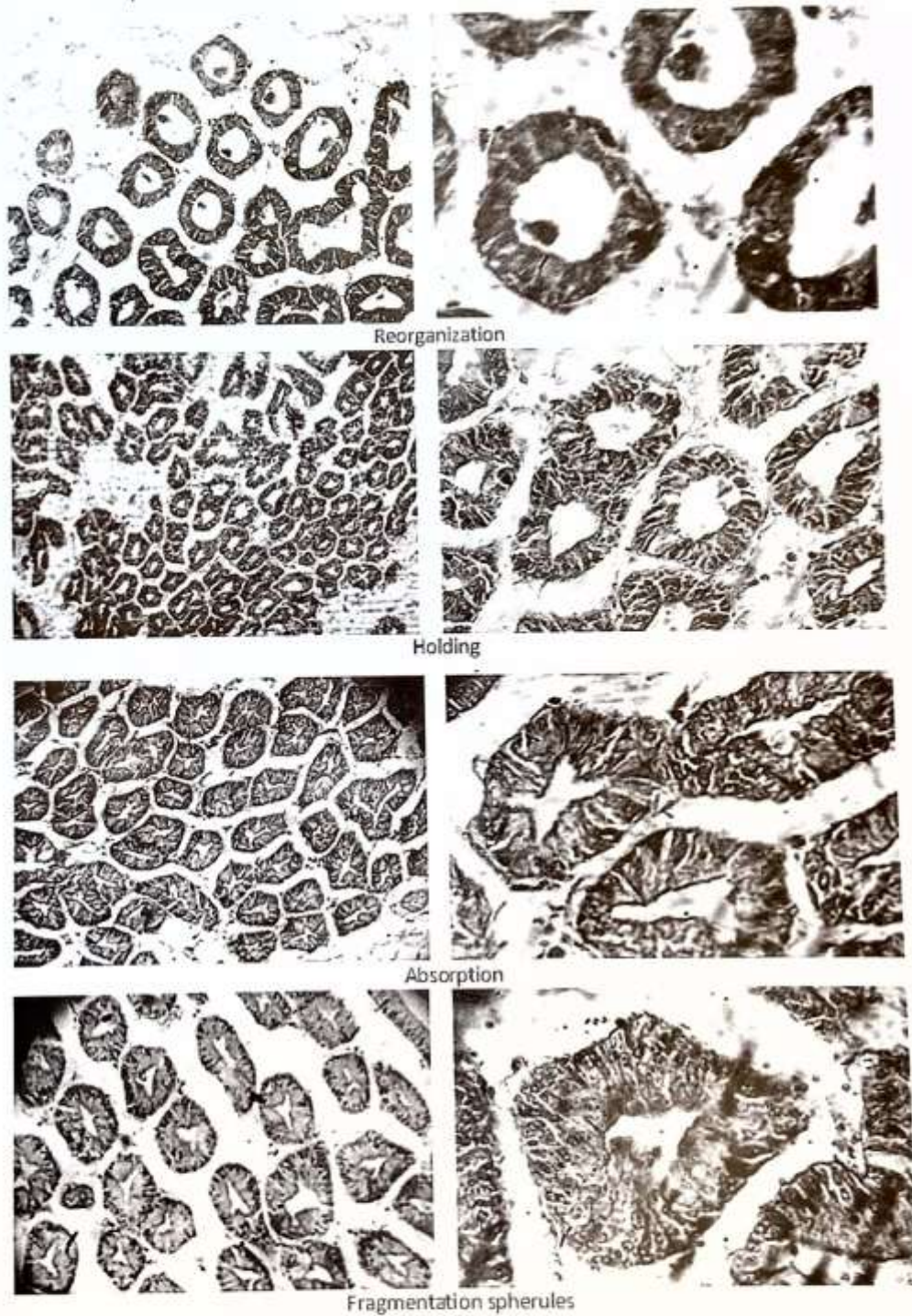


Plate 1 : The digestive tubules stages of *Lamellidens marginalis*.

August and reaches highest in September (241 mm), and obtained lowest in October (16 mm). The monsoon is over after October but few showers in February. The temperature increases from March to May and decreases minimum in December to February. There is slight fluctuation in minimum and maximum temperature is from June to October while broad range in minimum and maximum from November to May. The minimum temperature is recorded in December (6.05°C), while maximum value in May (42°C). In December (peak winter) there is broad fluctuation in minimum and maximum temperature. The highest value of humidity is recorded in June to February except the November, while minimum value is obtained in March to May.

2. Cytological Changes in the Digestive tubules

In the histological preparation of digestive diverticula is found to be more or less constant in different specimens in a given fortnight. It is also observed that in different environmental conditions the digestive tubules are generally typical in all the animals in the fortnight samples. The structure of the digestive tubules (Morton, 1970; Robinson *et al.*, 1981) can be interpreted as in four phases: holding (type-I), absorption (type-II), fragmentation spherules (type-III) and reorganization/ reconstitution (type-IV). In the present study the pattern of digestion within the population of *lamellidens marginalis* has been analyzed in the sequence of events occurring in four phases (Plate-1). Since the samples were collected every new moon, and full-moon days over a period of one year cycle, the quantitative examination of tubules did not reveal homogenous but synchronously cycling. However synchronization in certain phases of digestive tubules could be made with the change in the environmental parameters and food availability occurring in different seasons. The digestive tubule of *lamellidens marginalis* has been shown to be composed of two types of cells, the digestive cells and the basophil cells (Tantiwisawarui *et al.*, 2011). In *lamellidens marginalis* the two cell types are distinguished as basophil cells lying in groups in the crypts of the tubules that separate larger group of digestive cells (Plate-2). The basophil cells stain much darker than the digestive cells in Mallory's triple stain and consequently easy to recognize. This group of basophil cells eventually form a new tubule by mitotic division observed in March new moon-I, which eventually leave the old tubule, leaving one or two young cells in the old tubules to repopulate the empty old tubule.

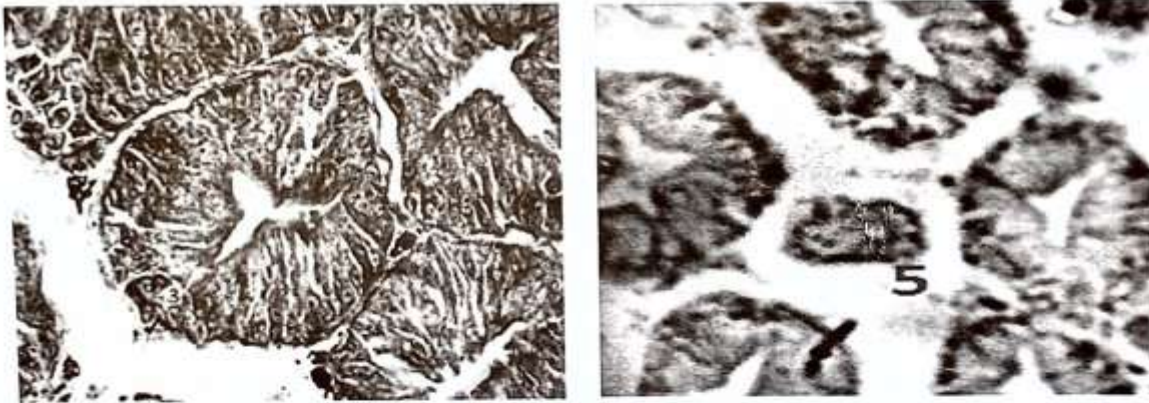
The cytological changes in the digestive tubules correspond to feeding and digestive sequence predominating in different fortnight of monsoon, post monsoon winter and summer. Before the arrival of food

in the lumen of digestive tubules are in a holding phase, the digestive cells having low appearance. This phase is observed in October new-moon, November full-moon, January new moon-I, February full-moon, March new-moon-I, April new-moon and May full-moon. On the arrival of food the digestive tubules shows the absorption phase. At this stage the digestive cells increases in height as the cells fill up with small particles (Loba Da Cunha, 2000). This phase is observed in June new-moon, July new-moon, September new-moon, October full-moon, November new-moon, December new-moon, January full-moon, January new-moon -II, March full-moon, March new-moon-II, April full-moon, May new-moon. Following the absorption and intracellular digestion, the digestive cells undergoes a process of breakdown in which the apices of the cells are pinched off to form fragmentation spherules. This phase is predominant in June full-moon, July full-moon, August new-moon, August full-moon, September full-moon. The fragmentation spherules phase is succeeded by a phase of reorganization or reconstitution during which the digestive cells resumed their low profile and resort to the holding phase. This phase was predominant in December full-moon. No fragmentation spherules were seen during re-organization, holding and absorption phases.

The digestive cells are responsible for the absorption and intracellular digestion of most of the food ingested. Assimilated food is presumably passed out from the bases of the digestive cells into the bathing haemocoelic blood, where as the waste material products of digestion are packed as fragmentation spherules to be budded off apically into the tubule lumen and returned to the stomach for discharge from alimentary canal.

DISCUSSION AND CONCLUSION

The morphological differences in digestive gland tubules are due to changes in the digestive cells, which make the tubule as food is received and digested intracellularly (Owen, 1974; Purchon, 1971). The studies of Morton (1970, 1983), not only support the view that bivalve is discontinuous feeder but also shows that the structural changes in diverticula are accordance with the rhythm of the environment. In present study, with beginning of the rainy season (June) till the end of heavy rainfall (September) the digestive tubules in the *lamellidens marginalis* shows mostly absorption and fragmentation spherules phases. This can be related to abundant food and the cells rapidly fill up with food particles. Due to heavy rainfall and speedy current of water over the animal bed stirring the detritus material in the pond water, which is available to mussels shows continuous cycle of digestive tubules. This is probably



1. Nest of young cells, 2. Digestive cells, 3. Basophilic cells, 4. Amoebocytes, 5. New tubule

Plate 2 : Structure of digestive tubule.

shows that the absorption of food could occur simultaneously with the breakdown of the cell and elimination of large amount of waste material. While in winter and summer from October to May only absorption and holding phases in the structure of the digestive tubules are seen. These phases are considered to occur due to less food availability and fluctuation in environmental parameters (McQuiston, 1969; Koukouzika *et al.*, 2009). From January full-moon to June new-moon period of absorption phase of the digestive tubules is extended in *lamellidens marginalis* due to reduced water current and decrease food availability making the tubules to remain in either holding or absorption phase.

With the close of monsoon from November new-moon the absorption phase again extended till December new-moon. This is possibly correlated with longer feeding period under short supply of food. In this winter period, short day length low temperature, weak water current over animal bed, the digestive cells appear partly full of food and breakdown is not complete. It is pertinent to mention here that the temperature decreases with the onset of winter i. e. from November, and no feeding occurs for a short period in December full-moon, during which the tubules show the reorganization phase and prepare for holding phase in subsequent period of the peak winter season. It is likely that under such situations starvation effects can be imposed upon the animals (Winstead, 1995). With the beginning of bright sunny days leading to calm water in pond, to clear cycle exists before and after the reorganization of tubules. The absorption and fragmentation spherule dominant before reorganization, while in later period is holding and absorption and absorption phases.

Morton (1977) summarized the process of feeding and digestion in *Crassostrea gigas* which are influenced

by tidal variations, seasonal and local environmental changes. In the present study in *lamellidens marginalis* have shown that an apparent cyclic pattern of feeding and digestion relative to freshwater current over the animal bed in monsoon and post monsoon is possibly related to greater pumping of water and long feeding. In this season the greater pumping of water and long feeding is possibly related to greater water currents that occur due to rainfall. In winter and summer it is possibly related to comparatively lesser pumping of water caused short feeding that occurred during hours of day light. The day light is longer during summer and shorter in monsoon, mostly could due to raining (Morton, 1971; Riisgards *et al.*, 2003). The seasonal rhythm becoming one with the seasonal pattern of water current over the animal bed which might be modified by the semi seasonal winter and summer pattern of water current over the animal habitat, and seasonal variation of water current create the complex pattern of feeding and digestion as seen in *lamellidens marginalis* from Girna river (Hawkin *et al.*, 1996; Kittner and Riisgards, 2005).

The study reveals that more food is taken up and utilized by the animals from June full-moon i.e. the beginning of monsoon till the December new-moon. Later on with the variation of the environmental conditions and decreased food availability in surrounding water occurs low food intake. The environmental conditions are more evident with regards to the temperature and water current over animal bed in the pond of Girna river. The samples have been collected on every new-moon and full-moon days over a period of twelve months, there appears to be no direct co-relation with the lunar periodicity and cyclic changes in the phases of the digestive tubules. Hence it is assumed that the lunar periodicity has no direct impact on the feeding and digestion in these mussels. Increased

holding phase may result in the succeeding period of dominance in winter for lesser utilization of the digestive enzymes and lesser body tissues to breakdown and reform. The food availability at this time decreases from the surrounding water. The process of new tubules formation occurs particularly in March new-moon I during growing period (Morton, 1969). So the processes feeding and digestion in fresh water bivalve like *lamellidens marginalis* the possibly may co-related with seasonal variations.

The first rainfall in June is the period of longer day length show the phases of absorption and fragmentation spherules predominate till the end of monsoon (June to September). While in post monsoon period the phase of holding occurs (October new-moon). After post-monsoon, results in predominance of absorption phase (October full-moon, November new-moon, December new-moon). This is the period of greater food availability with speedy current of clear water over the habitat of *lamellidens marginalis* results in much food intake. During winter (December full moon) phase of re-organization of the tubules appears. This is the period of shorter day length, lower temperature, mild water current and low food availability. This condition is followed by holding phase (January, new moon-I). After this period absorption phase is interrupted by holding phase (from January full-moon to May new-moon). It may be due to increase in day length, rise in temperature, no water current over the animal bed, declining food availability in the medium resulting in reoccurrence of holding phase. No fragmentation spherules phase is seen from post monsoon onwards. In general more food is taken up and utilized by the animals in monsoon season. Later on the fluctuation in the environmental parameters are more with regard to temperature, rainfall, nature of water current and food availability. So, it results, in low food intake. The significant local environmental variables in different seasons may influences vary from genus to genus and lotic to lentic habitat of the animals.

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PREVALENCE AND OBSERVATION OF INTESTINE-DWELLING GREGARINES INCLUDING ONE NEW SPECIES IN THE MILLIPEDE *TRIGONIULUS CORALLINUS* COLLECTED FROM NASHIK DISTRICT OF MAHARASHTRA, INDIA

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ABSTRACT

The intestine of a millipede species, *Trigoniulus corallinus*, was noted to be heavily infected with gregarine parasites. Millipedes used in this study were randomly collected from Nashik district of Maharashtra from January 2007 to December 2008. Among 1794 millipedes examined, our results showed that the total prevalence rate for cephaline gregarines was 59.92%. In some cases, more than two species of different gregarines were found to have simultaneously parasitized a single millipede. Distribution of gregarines was more concentrated in the anterior and middle parts of the intestine than in the posterior part. The predominant forms observed in the millipede's intestine were free sporadins. The shape, size, and movement of these gregarines are described.

KEY WORDS: gregarine, millipede, *Trigoniulus corallinus*

INTRODUCTION

Millipedes are a major group of detritivores in tropical and temperate broadleaf forests. They are important in nature as they play the ecological role of deposit feeders that enhance the rate of decomposition for other smaller deposit feeders as well as decomposers. However, their own physiological conditions might be distorted if they were to be infected by gregarine parasites. Gregarines are protozoan parasites found in the intestinal tracts of many invertebrates, especially arthropods and annelids, which often show extremely heavy infections. Although unimportant economically as parasites, their generalized life cycle makes them significant objects for study as aids to understanding the important sporozoan parasites of humans, domestic mammals, and birds (Schmidt, 1992). They are frequently found in mosquitoes in Taiwan (Yen *et al.*, 1994; Chen and Yang, 1996; Chen *et al.*, 1997). Infection by cephaline gregarine is common and widespread in millipedes. Uttange and Desai (1961) observed new gregarine (protozoa) in the gut of termites from Dharwar. They belong to the family Gregarinidae, suborder Septatina, order Eugregarinida, class Conoidasida, and Sub-phylum Apicomplexa (Margulis *et al.*, 1993). Obata (1953) reported some gregarines from Japanese Insects. Ganapati and Narasimhamurti (1956) find out a new cephaline gregarine, *Stenophora xenoboli* n. sp. parasitic in the gut of the Millipede *Xenobolus* sp. Lipa (1967a) studied the gregarines of arthropods in Poland. Levine (1979) depicted the life cycle of gregarines and described as many as 120 species of gregarines from the eight genera that can infect millipedes, *Amphoroides*, *Cnemidospora*, *Fonsecaia*, *Hyalosporina*, *Monodictus*, *Phleobum*, *Spirosoma*, and *Stenodictus*. Due to Nashik district's subtropical climates, millipedes here are abundant and widespread mainly in the rainy season. In 2000, Gilis Kaya overviewed the classification of the Phylum Apicomplexa. The present study includes the prevalence percentage and observation of intestine-dwelling gregarines in the millipede *Trigoniulus corallinus* from Nashik District, Maharashtra State, India.

MATERIAL AND METHODS

Millipede collection and maintenance

Trigoniulus corallinus (Gervais, 1842), was collected randomly from the various areas of the Nashik district in the period of January 2007 to December 2008 irrespective of age, sex, or reproductive status. They were dissected directly after bringing in the laboratory.

Observation of gregarines from millipedes

After careful dissection, the intestines were taken out from millipedes and cut into three parts, the anterior, middle, and posterior, with each part comprising one-third of the intestines. After pounding each part of the intestine into pieces in 0.6% saline, the stages or forms of the gregarines in the intestine were studied in fresh preparations after extraction or in fixed and stained thin smears. Gregarines were isolated from the residues of intestines, placed in glass



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slide, covered with a cover slip and examined with a compound microscope under $40\times$ and $100\times$ magnifications. All different stages of gregarines in the gut were observed and counted. The length and width of the protomerites and deutomerites were measured. The types of movement exhibited by the gregarines were also observed and recorded. Gregarines were identified according to their characteristic features as described by Clopton (2002).

RESULTS

Prevalence of Gregarines in Millipedes

The study of prevalence was based on the species of millipede *Trigonulus corallinus*, collected from various places of Nashik district. (M.S). In case of millipedes the survey is not possible throughout the year, because the millipedes are available only in rainy season (June to November). So author has could study the prevalence of gregarines only for six months. During the period of two years (Jan. 2007 to Dec. 2008) total 1794 *Trigonulus corallinus* were examined. In the first year (Jan. 2007 to Dec. 2007) total 996 animals were examined, 662 of these were positive for gregarine infection. The percentage of prevalence was 66.47%. In the second year (Jan. 2008 to Dec. 2008) total 798 animals were examined, 413 of these were positive for gregarine infection. The percentage of prevalence was 51.75%. A month wise analysis of the percentage of the prevalence of gregarines in *T. corallinus* for first year (January to December, 2007) shows the maximum percentage of prevalence during August to October (72.96%, 70.85%, 70.29%), minimum in June (38%) and moderate in July and November (62.72% and 45.05%). In the second year (January to December, 2008) the maximum percentage of prevalence was observed during August (60.35%), minimum in November (39.24%) and moderate in June, July, September and October. The pattern in both the years suggests that the peak is in monsoon season, the prevalence reduces in the starting of winter. The details of the number of animals examined and the month wise prevalence are shown in Table No. 1 and 2.

Table 1. Showing the month wise prevalence of gregarines in millipede (*Trigonulus corallinus*) during the period from January 2007 To December 2007.

Sr. No.	Months	Total No. of Host Examined	No. of +ve Hosts	Prevalence %
1	Jan-07	----	----	----
2	Feb-07	----	----	----
3	Mar-07	----	----	----
4	Apr-07	----	----	----
5	May-07	----	----	----
6	Jun-07	50	19	38.00
7	Jul-07	285	193	67.72
8	Aug-07	270	197	72.96
9	Sep-07	199	141	70.85
10	Oct-07	101	71	70.29
11	Nov-07	91	41	45.05
12	Dec-07	----	----	----
	Total	996	662	66.47

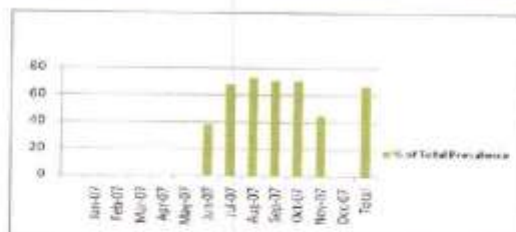


Figure 1. Total prevalence percentage of Gregarines in *Trigonulus corallinus* during January to December 2007.

In total, 1794 rusty millipedes were randomly collected and studied. Figure 1 shows the host of the gregarines, *Trigoniulus corallinus*. Our results show that *T. corallinus* collected from the Nashik district area was highly infected with gregarines with a total prevalence rate of 59.92%. Most of the gregarines were found in the anterior and middle parts of the alimentary canal known as the midgut of the millipede. The shapes of the gregarines appeared to be round, egg-like, or stick-like. The body of a complete trophozoite consists of two major parts, a short anterior protomerite and a long posterior deutomerite containing the nucleus. Their epimerites were usually not detected. The shape of the nuclei was round, crescent, or irregular. The colour of the cytoplasm was dark or light under the light microscopes and white or colourless under the dissecting microscope. In the deutomerite, there was usually one nucleus located near the centre or posterior end of the parasite body. However, the location of the nucleus varied in certain species as shown in figures. The shape of the nucleus was either round or crescent. According to the morphometric measurements and the position of the nucleus as described by Clopton (2002), two families of gregarines could be identified from our collections (Table 4). The family Monoductidae includes one suspected species, *Monoductus chondromorphi* (Bhandari, 2010), which ranged from 34.5 to 37.5 μ in length and 7.5 to 10 μ width with a Elongated, slightly broad at anterior end and dark cytoplasm. Cephalont in early stages are seen vase like or look like bottle shape, with hat like protomerite. The total length of cephalont is from 34.95 to 39.61 μ and the width is 13.98 to 18.64 μ . The nucleus is somewhat spherical and placed at right side to the posterior end. It measures 4.66 μ in length and 6.99 μ width. The body of the mature sporont is elongated, it shows protomerite and deutomerite. These three parts are divided by a transverse membranous septum. The epimerite is small and knob like. The protomerite is hemispherical or sub-globular. The collar like structure is present on either side of protomerite.

Table 2. Showing the month wise prevalence of gregarines in millipede (*Trigoniulus corallinus*) during the period from Jan. 2008 to Dec. 2008.

Sr No	Months	Total No. of Host Examined	No. of +ve Hosts	Prevalence %
1	Jan-08	—	—	—
2	Feb-08	—	—	—
3	Mar-08	—	—	—
4	Apr-08	—	—	—
5	May-08	—	—	—
6	Jun-08	161	71	44.10
7	Jul-08	160	89	55.63
8	Aug-08	227	137	60.35
9	Sep-08	97	50	51.55
10	Oct-08	74	35	47.30
11	Nov-08	79	31	39.24
12	Dec-08	—	—	—
	Total	798	413	51.75

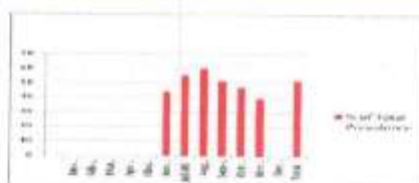


Figure 2. Total prevalence percentage of Gregarines in Trigoniulus corallinus during January to December 2008.

Table-3. Infection rate of gregarines in Trigoniulus corallines

Year	No. of <i>T. corallinus</i> hosts examined	No. positive hosts	Percentage (%)
Jan. to Dec. 2007	996	662	66.47
Jan. to Dec. 2008	798	413	51.75



It measures 6 to 9.5 μ in length and 7.5 to 10 μ is width. The total length of sporont 34.5 to 37.5 and 7.5 to 10 μ is width. Deutomerite is elongated width stick like body. It measures about 26.5 to 28.5 μ in length. The anterior end of deutomerite is slightly broad and gradually tapering rounded towards the posterior end. The ectoplasm and endoplasm is not clearly distinguished. The nucleus is light in colour, roughly spherical and ovoidal or irregular in shape. It measures about 6.9 to 10 μ in diameter. It is located at the posterior end of the deutomerite. Gametocyst are round in shape, mature gametocyst develops single spore duct. Through which sporocyst are extruded in mass. Sporocysts are broad spindle shaped; each sporocyst measures up to 10 $\times$ 6 μ . In table no 3 showed the Infection rate of gregarines in *Trigoniulus corallines*

The family Stenophoridae included two forms *Stenophora nruthunjayi* (Rodgi and Amoji, 1969) and *Stenophora indica* n. sp. The *S. nruthunjayi* is measured more than 70 to 125 μ in length and 37.5 to 65 μ in width in length with dark cytoplasm and had a Elongated, broad, egg shaped deutomerite. Early cephalont is bottle like, compressed at middle of the body and rounded at both the ends, but triangular posteriorly in some cases. It measures about 40 μ to 55.5 μ in length and 30 μ to 37 μ in width. Body shows protomerite and deutomerite. The protomerite is ball shaped, spherical in shape 6 to 10.5 μ in length and 9 to 12.5 μ in width. The deutomerite is compressed at the middle region in many cases which measures about 34 to 45 μ in length and the width is 30 to 37 μ . The nucleus is roughly rounded 5 to 7.5 μ in diameter located at posterior side of the deutomerite. The early sporont is cylindrical and elongated in shape. Anterior end is with inverted bowl shaped protomerite which is similar to the protomerite in mature sporont. The length of protomerite is 7 to 14.5 μ and the width is about 9 to 15 μ . The nucleus is rounded placed at the middle of the deutomerite which measures about 9 to 11 μ in diameter. A mature sporont is slightly elongated and egg shaped in its general body shape. Anterior end is slightly broader than the posterior. It is relatively small gregarine, measures about 70 μ to 125 μ in length and 37.5 μ to 65 μ in width. The protomerite of the adult sporont is bell shaped ("hood shaped" in of *C. kelaarti*, Gulbhile, 2005) being broad at $\frac{1}{2}$ rd distance from the septum with a clear indentation in the middle. An apical pore is clearly seen at the tip of the protomerite. The protomerite is broader than its length. The length is 10-17.5 μ and its width 15-25 μ . The deutomerite is elongated, broad and egg shaped. It includes spherical nucleus which is usually located in the middle of the deutomerite it measures about 10 to 12 μ in diameter. Both anterior and posterior end of the body are slightly tapering.

S. indica n.sp. is ranged from 87.5 to 117.5 μ in length and 12.5 to 25 μ in width with a stick-shaped body, and a crescent-shaped nucleus with dark cytoplasm. The small cephalonts are found in the gut smears. Its body is divided in to three parts, epimerite, protomerite and deutomerite. The cephalont is elongated, small and rounded at the posterior end. It measures 40 to 58 μ in length, 12.5 to 17.5 μ in width. The epimerite is spherical, knob like. The protomerite is ball like but with straight septum about 10 μ in diameter. The deutomerite is elongated. It is 35 to 51.5 μ in length and 12.5 to 17.5 μ in width. The nucleus is spherical placed at the posterior side of the deutomerite. It measures 7 to 11.5 μ in length and 5.5 to 7 μ in width. The fully mature sporont is elongated; broad anterior end and slightly tapering, rounded posterior end. It measures about 87.5 to 117 μ in length and 15.5 to 25 μ in width. The body of the sporont divided in to protomerite and deutomerite. These parts are separated by an endoplasmic indentation. There is clear distinction between ectoplasm and endoplasm. The ectoplasm forms outer covering of the body it is thin and dark and the endoplasm is dense and yellowish brown in colour. The shape of the protomerite is roughly triangular, with rounded ends. It measures about 10 to 15 μ length and 15 to 17.5 μ in width. The deutomerite is elongated, looks like the lady's finger, slightly tapering. The anterior end is slightly broader than the posterior rounded end. It measures about 77.5 to 105 μ in length and 12.5 to 25 μ in width. The nucleus is dark granular, horse shoe shaped or crescent shaped, placed in the anterior one third of the deutomerite. It measures about 10 to 15 μ in length and 7.5 to 12.5 μ in width. Gametocysts are oval, measures about 45 to 65 μ in diameter. Sporocysts are not found. The measurement of sporonts of all the three species is shown in Table 4. Most of time the gregarines remained motionless, but two types of gregarine movements were observed. One was a creepy gliding movement, in which gregarines moved forward a rather long distance without changing their shapes. The other was a rapid springing movement, in which the cytoplasm flow produced a protomerite extrusion toward the deutomerite, and then they returned to their original shape along with a slight movement forward. Only few gregarines exhibited this springing movement after a long period of inactivity during the observation.

The shape, size, colour, and intracellular structures of the sporonts are important characteristics for species identification of gregarines. The ratios of certain parts of gregarines are also helpful in identification (Clopton, 1999).

The results show that three forms in two families could be detected in *T. corallinus*. Among them, *Monoductus chondromorphi* (Bhandari, 2010) was likely to be *Monoductus lunatus* as morphologically described by Clopton (2002). *Stenophora mruthunjayi* (Rodgi and Amoji, 1969) and *Stenophora indica* n. sp. shows few similar characters to *Stenophora mruthunjayi* in size and in the colour of their cytoplasm. After the comparison of the present species with the various species of *Stenophora*, it shows some distinguishing characters, the shape of the body (sporont) is ellipsoidal in *S. ellipsodi* and *S. cassidiformis*. It is leaf like in *S. mahabaleshwari* and cylindrical to elongated in *S. akiyoshiensis*.

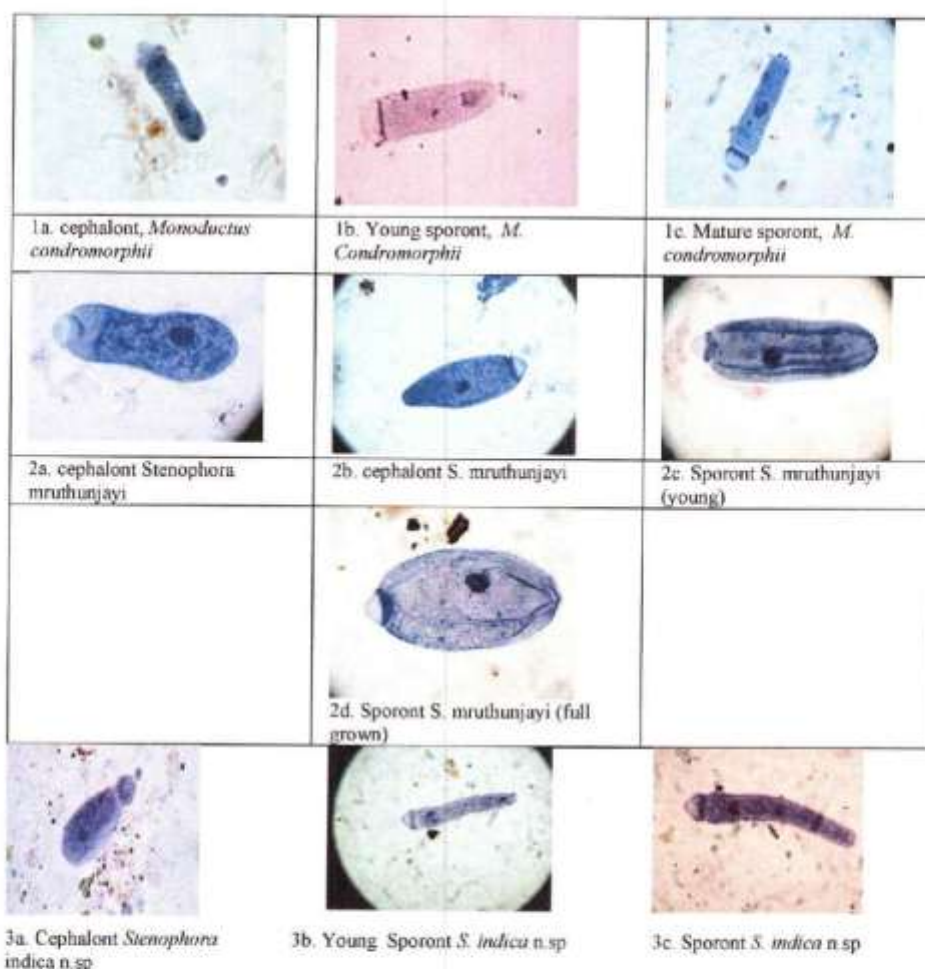


Figure 3. showing various stages of gregarine species

1 a, b and c. *Monoductus chondromorphi* (Bhandari, 2010); 2 a, b c and d. *Stenophora mruthunjayi* (Rodgi and Amoji, 1969) ; 1 a, b and c. *Stenophora indica* n.sp.

Table 4 Comparison of the *Stenophora indica* n.sp. with the species of *Stenophora*

Sr No	Particulars	1 <i>S. ellipsoidi</i> Chakraverty (1934)	2 <i>S. papillata</i> K. and R. (1955)	3 <i>S. cassidiformis</i> 1967	4 <i>S. conjugata</i> (1961)	5 <i>S. akijochiensis</i> n. sp. Hyoma hoshide (1969)
1	Body shape and size (sporangium)	Ellipsoidal, L- 250 to 375µ W- 50 to 95µ	Elongated, L- 724µ W- 95µ	Ellipsoidal, L- 120 to 180µ W- 45 to 70µ	Elongated L- 360µ W- 80µ	Cylindrical, elongated ovoidal L- 200 to 250µ W- 50 to 60µ
2	Epimerite	Rounded	Ball like and hyaline	Ball or knob shaped	Ball like hyaline	Dome shaped, sub globular
3	Protomerite	Bottle shaped	Short button like, without its upper knob, with apparent pore	Ball or knob shaped	Dome like with drown out papilla with apparent pore	Dome shaped, sub globular
4	Deutomerite	---	---	---	---	---
5	Nucleus	Elliptical	Spindle shaped	Spherical	Boat shaped	Ellipsoidal
6	Gametocyst	Spherical	Oval	Somewhat spherical	Spherical	---
7	Sporocyst	Spindle shaped	Oval	Spherical	Tears drop like	---
8	Host	<i>Diplopoda</i>	<i>Thyropogus nigrolabiatus</i>	<i>Strongylosoma</i>	<i>Thyropogus nigrolabiatus</i>	<i>Skeleropratus</i>

Table 4. Continued...

Sr No	Particulars	6 <i>S. mahabaleshwari</i> Amaji and Rudgi (1972)	7 <i>S. ozaki</i> (Guthrie, 2005)	8 <i>S. nematoides</i> (Bhandari 2010)	9 <i>S. bristilli</i> n. sp. Bhandari (2010)	10 <i>Stenophora indica</i> n.sp. Present author
1	Body shape and size (sporangium)	Leaf like L- 80 to 280 µ W- 20 to 135µ	Elongated L- 125 to 280µ W- 40 to 76µ	Elongated, broad in middle L- 167 to 307.56µ W- 32.62 to 53.59µ	Elongated curved L- 228.34 to 314.55µ W- 30.29 to 48.93µ	Elongated, slightly broad at ant. end L- 87.5 to 117.5µ W- 12.5 to 23µ
2	Epimerite	Dome shaped	---	---	Fine bristles	Ball like, only seen in cephalont
3	Protomerite	Pot shaped	Ball or knob shaped	rectangular L- 11.65 to 20.17µ W- 12.65 to 18.17µ	Semi oval or bulbous L- 9.32 to 11.65µ W- 23.3 to 48.93µ	Somewhat triangular L- 10 to 15µ W- 15 to 17.5µ
4	Deutomerite	---	Elongated, swollen at 2/3 from the anterior end, blunt at posterior	Elongated, slightly broader in the middle of the body	Extremely elongated, slightly curved and rounded at the posterior end L- 167.76 to 244.71µ W- 23.3 to 48.93µ	Elongated, lady's finger like, slightly broad anterior L- 77.5 to 105µ W- 12.5 to 25µ
5	Nucleus	Ovoidal	Spherical	Ovoidal or spherical situated slightly posterior end of the deutomerite L- 6.99 to 11.65µ W- 11.98 to 16.31µ	Spherical dark granular 11.65µ diameter	Horse shoe shaped crescent shaped anterior to the deutomerite L- 10 to 15µ W- 10 to 12.5µ
6	Gametocyst	Spherical	Oval	---	Somewhat oval	Elongate ovoid
7	Sporocyst	Spherical	Spherical	---	---	---
8	Host	<i>Strongylosoma</i>	<i>Chondromorpha severini</i>	<i>Chondromorpha severini</i>	<i>Chondromorpha severini</i>	<i>Trigonulus corallinus</i>

The shape of the body is elongated in *S. ozaki*, *S. nematoides*, *S. bristilli* and the species of present author. In table 5 showed the measurements of gregarine species found in the intestines of *Trigonulus corallinus*. The ball like epimerite is seen only in the cephalont which is similar to *S. ellipsoidi*, *S. papillata* and *S. conjugata*, but it is different than the epimerite of *S. mahabaleshwari* and *S. bristilli* where they are dome shaped and bristle like respectively.

Table 5. Measurements of gregarine species found in the intestines of *Trigonulus corallines*

Family	Name of the species	L	W	PL	PW	DL	DW
Monodactylidae	<i>Monodactylus chondromorphi</i>	34.5 to 37.5µ	7.5 to 10µ	6 to 9.5µ	7.5 to 10µ	26.5 to 28.5µ	7.5 to 10µ
Stenophoridae	<i>Stenophora nuthanjsyi</i>	70 to 125µ	37.5 to 65µ	10 to 37.5µ	15 to 25µ	40 to 55.5µ	30 to 37µ
	<i>Stenophora indica</i> n. sp.	87.5 to 117.5µ	12.5 to 25µ	10 to 15µ	15 to 17.5µ	77.5 to 105µ	12.5 to 25µ

* L, total length; W, maximum width; PL, protomerite length; PW, protomerite width; DL, deutomerite length; DW, deutomerite width. All measurements other than ratios are in micrometers

The protomerite is bottle shaped in *S. ellipsoidi*, button like in *S. papillata*, knob like in *S. cassidiformis* and in *S. ozaki*, dome like in *S. conjugata* and *S. akiyoshiensis*, pot like in *S. mahabaleshwari*, rectangular in *S. nematoides* and semi oval in *S. bristili*. In the present species protomerite is roughly triangular which is different than that of previous ones. The nucleus is elliptical in *S. ellipsoidi* and *S. akiyoshiensis*, spindle shaped in *S. papillata*, spherical in *S. cassidiformis*, *S. ozaki* and *S. bristili*. The nucleus is boat shaped in *S. conjugata*, ovoidal in *S. mahabaleshwari* and in *S. nematoides*. The shape of the nucleus in the present species particularly in the mature sporont is very typical. It is semilunar, crescent or horse shoe shaped. The shape of the gametocyst is ovoid. When we compare the body dimensions of this species with the previous one, it is observed that it is smallest in all. Due to its distinct shape of the body with triangular protomerite, and distinct horse shoe shaped nucleus, its millipede host is also different than that of the hosts of previous species; it is considered new to science and designated as *Stenophora indica* n. sp.

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Haematological investigation and severity of haemoglobin deficiency in rural population around vajapur tehsil of aurangabad district (M.S.)

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ABSTRACT

The present study intends to evaluate the haematological parameters among the rural population of Vajapur tehsil. During a period of four months i.e. June 2011 to September 2011. During this period of four month total number of 800 samples was examined for Haemoglobin deficiency (Anaemia), out of which 381 samples of male and 419 samples of female of different age groups. The percentage being about 65.09% and 84% in both male and female population were anaemic in rural population of Vajapur tehsil.

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Introduction

Common Name: Haemoglobin. Alternative Name: Hemoglobin

The haemoglobin level is expressed as the amount of hemoglobin in grams (gm) per decilitre (dl) of whole blood, a decilitre being 100 millilitres. The normal ranges for haemoglobin depend on the age and, beginning in adolescence, the sex of the person. The normal ranges are: Newborns: 17-22 gm/dl, One (1) week of age: 15-20 gm/dl, One (1) month of age: 11-15 gm/dl, Children: 11-13 gm/dl, Adult males: 14-18 gm/dl, Adult women: 12-16 gm/dl, Men after middle age: 12.4-14.9 gm/dl, Women after middle age: 11.7-13.8 gm/dl. All of these values may vary slightly between laboratories. Some laboratories do not differentiate between adult and "after middle age" hemoglobin values. Low hemoglobin is referred to as being anemic. There are many reasons for anemia. Some of the more common reasons are loss of blood (traumatic injury, surgery, bleeding colon cancer), nutritional deficiency (iron, vitamin B12, folate), bone marrow problems (replacement of bone marrow by cancer, suppression by chemotherapy drugs, kidney failure), and abnormal hemoglobin (sickle cell anemia).

Rural India contains over 68% of India's total population with half of it living below poverty line, struggling for better and easy access to health care and services. Health issues confronted by the rural people are diverse and many - from severe malaria to uncontrolled diabetes, from a badly infected wound to cancer. The National Rural Health Mission (NRHM) was launched in April 2005 by the Government of India. The goal of the NRHM is to provide effective healthcare to rural people with a focus on 18 states, which have poor public health indicators and/or weak infrastructure. According to WHO there should be one qualified doctors for every 3500 people and one well equipped hospital for every 10000 people but till we are far away from these in rural area.

Studies from India have consistently shown an association between anaemia and under-nutrition and the occurrence of anaemia in undernourished children and in those belonged to the poor socioeconomic status are a well-documented fact. But studies have also revealed that anaemia was a major health problem among the well-nourished school children who belonged to the upper and middle socio-economic classes also. The low-cost food that is generally affordable to the poor is low in nutritional value and high in fats, sugars and additives and therefore, obesity is oftentimes a sign of poverty and malnutrition.

The rural populations, who are the prime victims of the policies, work in the most hazardous atmosphere and live in abysmal living conditions. Unsafe and unhygienic birth practices, unclean water, poor nutrition, subhuman habitats, and degraded and unsanitary environments are challenges to the public health system. The majority of the rural population are smallholders, artisans and labourers, with limited resources that they spend chiefly on food and necessities such as clothing and shelter. They have no money left to spend on health. The rural peasant worker, who strives hard under adverse weather conditions to produce food for others, is often the first victim of epidemics. This present paper attempts to review critically the current health status of India, with a special reference to the vast rural population of the beginning of the twenty first century.

Vajapur, situated on the Nira river about 40 miles west of Aurangabad in 19° 56' 41 north latitude and 74° 46' 14 east longitude, is a municipal town and headquarters of the tahsil of the same name. The people of Vajapur taluka majorly dependent on farming, literacy percentage is about 80%. This area is comes under low rain fall so socioeconomically these people are backward.

Material and method:-

During the course of present investigation, spread over four months (from June 2011 to September 2011). During this period



Table 01: Prevalence of anaemia in male and females of Vaijapur Tehsil, based on different age groups.

Age groups (years)	Male		% of Anaemia	Female		% of Anaemia
	<13g/dl	>13g/dl		<12g/dl	>12g/dl	
0 to 15	85	06	93.40	53	09	85.43
16 to 30	79	71	52.66	189	39	82.89
31 to 45	38	30	55.88	58	11	84.05
46 to 60	28	15	65.11	31	06	83.78
61 onward	18	11	62.06	21	02	91.30

of four month total number of 800 samples was examined, out of which 381 samples of male and 419 samples of female of different age groups. an extensive survey was carried out to record the incidence of haemoglobin percentage in rural population around Vaijapur tehsil in Aurangabad region. For this study blood samples were collected from different Villages around Vaijapur tehsil and were examined for Haemoglobin deficiency. Measurements were done with a CBC automatic blood cell counter of Triverton Company in pathological laboratory.

Haemoglobin deficiency (Anaemia) was defined as an Hb of <13g/dl in males and an Hb of < 12g/dl in females. Mild anaemia was defined as an Hb of 10-12.9 g/dl in males and an Hb of 10-11.9 g/dl in females. Moderate anaemia was defined as an Hb of 7-9.9 g/dl and severe anaemia as an Hb of < 7 g/dl in both males and females.

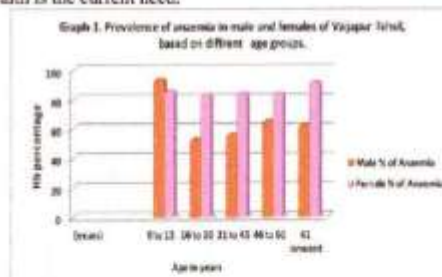
Results and Discussion:-

During the present study a comparative analysis has been made of the prevalence of anaemic condition in different age groups male and female population. The study was based on samples collected from various villages of Vaijapur tehsil in Aurangabad district of Maharashtra, during a period of four months i.e. June 2011 to September 2011. During this period of four month total number of 800 samples was examined, out of which 381 samples of male and 419 samples of female of different age groups. The percentage being about 65.09% and 84% in both male and female respectively. The five different age groups i.e. 0-15 years, 16-30 years, 31-45 years, 46-60 years and 61 to onwards were studied for prevalence of anaemic condition. Prevalence of anaemia in male and female population of different population are shown as follows, Prevalence of anaemia in male population of different age groups are shown as follows, 0-15 years old male is 93.40% (below 13 gm/dl), 16-30 years old male shows 55.66%, 31-45 year old male 55.88%, 46-60 year old 65.11% and 61 onward person shows 62.06% anaemic person.

Prevalence of anaemia in female population of different age group are as follows 0-15 year old female shows 85.43% (below 12 Hb/dl) like this 16-30 year old female shows 82.89%, 31-45 year old female shows 84.05% , 46-60 year old female shows 83.78 % and 61 to onward female shows 91.30% anaemic female. The above data shows that 65.09% male population and 84% female population were anaemic in rural population of Vaijapur tehsil.

The above data calls for greater participation of the government in the health care of rural population. To improve the prevailing situation, the problem of rural health is to be addressed both at the macro (national and state) and micro level (district and regional), in a holistic way, with genuine efforts to bring the poorest of the population to the centre of the fiscal policies. A paradigm shift from the current "biomedical model"

to a 'sociocultural model' is required, to meet the needs of the rural population. A comprehensive revised National Health Policy addressing the existing inequalities, and work towards promoting a long-term perspective plan exclusively for rural health is the current need.



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Prevalence and Morphological details of Intestine Dwelling Ciliate *Nyctotherus spirostreptae* from Millipede, *Chondromorpha kelaarti*

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Abstract

Nyctotherus spirostreptae shows its diversity in various hosts. A new species which has been first time reported by Lalpotu, from intestine of *Periplaneta americana* (1976). Later the same species is described by Bhandari (2010) from millipede *Trigonotulus corallines*. The present species is again re-described in the intestine of Millipede, *Chondromorpha kelaarti* by present author. It shows similarity to both the previous individuals of the species, only it is slightly larger than Bhandari's species and smaller than that of Lalpotu (n. sp. 1976). Percentage of prevalence was observed for a period of two years, January 2007 to December 2008, it was 47.24% and 55.16% respectively.

Key words- Prevalence, Intestine, *Nyctotherus spirostreptae*, *Chondromorpha kelaarti*

Introduction

Genus- *Nyctotherus* Leidy, (1849)

The genus *Nyctotherus* belongs to Class Spirotrichea, Subclass Polymenophora, Order Clevelandellida (de Puytorac and Grain, 1976) and Family Nyctotheridae (Amero, 1972). It is first time reported by Leidy, (1849), in the millipede host. Later several forms were described by various authors in various hosts. Grasse (1928) suggested the splitting up of this genus *Nyctotherus* and *Nyctotheroides* to accommodate forms with and without a karyophore respectively. Corliss (1961) elevated these subgenera to a generic level. Amero and Sena (1967), they also suggested the splitting up of this genus into three subgenera as *Recurviperistomatus*, *Curviperistomatus* and *Nyctotherus* on the nature of cytopharynx. They listed 33 species of this genus *Nyctotherus*. Early workers like Puytorac *et al.* (1967, 1968) Albaret (1968, 1970) and Earl (1970) also reported different *Nyctotherus* species and related new genus like *Metanyctotherus*, *parascucophora* and *Sicuophora*. Earl (1972) also established a new superfamily Plagiotomoidae to place different genus (above described genera) and also named two families, Plagiotomidae (Butschli, 1887) and Clevelandellidae (Kidder 1938).

Corliss (1979) described *Nyctotherus* in class Polyhymenophora (Jankowski 1967), Subclass Spirotrichea Butschli, (1889), Order Heterotrichida Stein (1859), and Suborder – Clevelandellina (de Puytorac and Grain (1976) with family Nyctotheridae Amero (1972).

According to recent literature, Bhatia *et al.*, (1936) has given a key for the identification of the species of the genus *Nyctotherus*.

- Cytopharynx not reaching beyond the middle of the body.
- Cytopharynx directed obliquely backwards and not reaching the middle.
- Cytopharynx shorter than the peristome.



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- (i) Body bean shaped with concave right margin. Length 26 to 28 μ Macronucleus globular and contains 4-5 chromatin masses.
N. faba (Schaudinn)
- (ii) Body peculiar shaped. Length 40-50 μ ; macronucleus globular with 4 chromatin masses.
N. africanus (Castellani)
- (iii) Body ovoid, narrower and rounded anteriorly and broader and stunted posteriorly. Length 90 - 400 μ , macronucleus bean shaped.
N. giganteus (Kranse)
- (iv) Body egg shaped, Length 100 - 140 μ . Macronucleus egg shaped.
N. velox (Leidy)
- (v) Body ovoid. Cytopharynx slightly curved length 60 - 70 μ . Macronucleus ovoid or slightly horse - shoe shaped.
N. termis (Dobell)
- (vi) Body reniform. Cytopharynx slightly curved like a semicircle, with a diverticulum at its junction with the cytostome. Length 120 - 170 μ Macronucleus reniform of horse shoe shaped.
N. papillatus (Dobell)
- (vii) Cytopharynx reaching beyond the middle of the body, cytopharynx shorter than the transverse diameter of the body. Cytopharynx slightly curved with the concavity directed forwards. Body elongated length 170 μ . Macronucleus elongated oval.
N. kemp (Ghosh)
- (viii) Cytopharynx broadly curved posteriorly. Body is oviform, Length is 30 - 120 μ m. Macronucleus is discoidal.
N. haematobius ENTZ
- (ix) Body ovoid. Anterior end narrow, posterior end wide but tapering to a point length 112 to 152 μ for small forms and 200 - 268 μ for large ones macronucleus tetrahedral.
N. piscicola (Daday)
- (x) Body egg shaped length 100 μ . Macronucleus egg shaped.
N. duboisii (Kunstler)
- (xi) Body kidney shaped, length 160 μ - 180 μ (Bezz) or 77 to 111 μ (Stein) breadth 2/3 - 3/4 of the body length. Macronucleus kidney shaped.
N. cordiformis (Stein).

The systematic position of ciliates in millipede,

Phylum:- Ciliophora.

Class:- Spirotrichea.

Subclass:- Polymenophora

Order:- Clevelandellida - de Puytorac and Gain, (1976)

Family:- Nyctotheridae - Amaro, (1972)

Genus:- *Nyctotherus* - Leidy, (1849)

Species:- *N. Spirostreptae*, Lalpotu, (1976), Bhandari (2010)



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Material and Methods

The hosts were collected from different parts of hilly regions of Nashik dist (Deola, Nandgaon; Surgana, Kalwan Satana) of Maharashtra state. Due care was taken and the hosts were collected in moist soil with decaying leaves were present and the temperature was maintained by using ice bags around them. Mostly the hosts were collected during morning and evening. Due to the great variability in temperature and humidity the millipedes were only available in the period of June to November. Especially they were found abundant in rainy season.

The faecal samples were obtained from different parts of host intestine like fore gut mid gut and hind gut. The drops of faecal samples were observed under 45X and then 100X under microscope. Rapid movements of ciliates make it difficult to identify ciliate species. To immobilize their movements, methyl cellulose solution was used. Methyl cellulose has been found to have many advantages, as it arrests the movement, ciliates can be identified by their appearance. For the preparation of permanent slides, the positive samples were stained by tungstic-phosphoric acid haematoxylin.

The Dry silver impregnation was also used to study infracillature of the ciliates. The species identification has been made mainly on the basis of arrangement of cilia, size and shape of body and structure of macro, micronucleus cyto-pharynx and cytopyge.

Prevalence of Ciliate *Nyctotherus* in Millipedes, *Chondromorpha kelaarti*

During the period of two years (Jan.2007 to Dec.2008) a total 798 animals (*Chondromorpha kelaarti*) were examined, 310 of these were positive for ciliates infection.

In the **first year** (Jan.2007 to Dec.2007) total 381 animals were examined 180 of these were positive. The percentage of prevalence was being 47.24%.

A month wise analysis in first year (Jan.2007 to Dec.2007) shows the maximum percentage of prevalence during October (70.29%), minimum in November (31.94%) and moderate in remaining months.

In **second year** (Jan.2008 to Dec.2008) maximum percentage of prevalence was recorded during September (74.36%), minimum in June (45%) and moderate in remaining months.

The pattern in both the year suggests that the peak is after the monsoon rain. The percentage then gradually reduces in starting of the winter months and reaches a low with the onset of summer. The details of the number of animals examined and the month wise prevalence are shown in **Table No. 1 and 2**.

Description of the species

The ciliates were collected from the intestine of millipede *Chondromorpha kelaarti*. The hosts were collected from the Nashik district. During the study a number of hosts of above species were examined under the laboratory conditions. While examining, most of the infection was found in the middle part of intestine.

Fully mature ciliates are ovoidal in shape, both the ends are rounded. The total length of the body is 75 to 89.5 μ and width is 42 to 61.5 μ . The peristomal groove starts from just near the anterior end of the body and runs along the ventral surface for some distance which measures about 39 μ in length, leads into cytopharynx. The peristomal groove is larger than the cytopharynx. The cytopharynx is short measures about 34.5 μ in length. It is straight, tubular or slightly curved in the middle region. The macronucleus is somewhat ovoidal in shape. It is broader than the length, and situated at the anterior surface of the body it measures 13 to 19.5 μ in length and 17.5 to 22 μ in width. The micronucleus is not seen. The endoplasm is granular and ectoplasm is thin and dark. A fairly big contractile vacuole which measures about 17 μ in diameter is located posterior to the cytopharynx. The cytopyge is a slit like opening present at the posterior end of the body as shown in Plate No. 2.



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Comments:- The genus *Nyctotherus* was first introduced by Leidy (1849) when he investigated *N. velvax* from the intestine of the millipede *Spiroboleus (Uolus marginatus)*.

It is seen from available literature that at least 20 species of *Nyctotherus* are described by different workers from millipedes of different genera all over the world. In India six species are so far described from millipedes belonging to the genera *Thropygus* and *Gongylorhynchus*. These are *N. diplopoda*, *N. thropygus*, *N. gangylorhynchus* Karandikar and Rodgi (1956), *N. nigrolabialis*, *N. georgi* Amoji and Rodgi (1970) and, the *N. spirostreptae* (n. sp.) is described by Lalpotu (1976) in *Spirostreptus* millipede. Again the same species is described by Bhandari (2010) from millipede *Trigontulus coralinus* and in *Chondromorpha kelaarti* by present author. The present species is similar to both the previous species, only it is slightly larger than Bhandari's species and smaller than that of Lalpotu (n. sp. 1976).

The single contractile vacuole is present in all of three, but it is slightly larger in size than that of the Bhandari's species. The slit like cytopyge is again matches with both of the previous species. Even though the localities and the host species are different the above individuals shows close morphological similarities to each other. Except some minor differences like their hosts are different Lalpotu first time described it from *Spirostreptus*. Bhandari has investigated from *Trigontulus coralinus* while present author described it from the host *Chondromorpha kelaarti*. Almost all the characters of present species are match to the *N. spirostreptae* (n. sp. Lalpotu, 1976 and Bhandari, 2010), hence it is re-described here as *N. spirostreptae* as shown in Table No. 3

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TABLE 1

Showing the monthwise prevalence of ciliates in Millipedes (*Chondromorpha kelaarti*) during the period from Jan.2007 to Dec.2007

Sr No	Months	Total No. of Host Examined	No. of +ve Hosts	% of Total Prevalence
1	Jan-07	-----	-----	-----
2	Feb-07	-----	-----	-----
3	Mar-07	-----	-----	-----
4	Apr-07	-----	-----	-----
5	May-07	-----	-----	-----
6	Jun-07	19	11	57.89
7	Jul-07	71	37	52.11
8	Aug-07	65	39	60.00
9	Sep-07	67	42	62.69
10	Oct-07	87	28	70.29
11	Nov-07	72	23	31.94
12	Dec-07	-----	-----	-----
	Total	381	180	47.24

TABLE 2

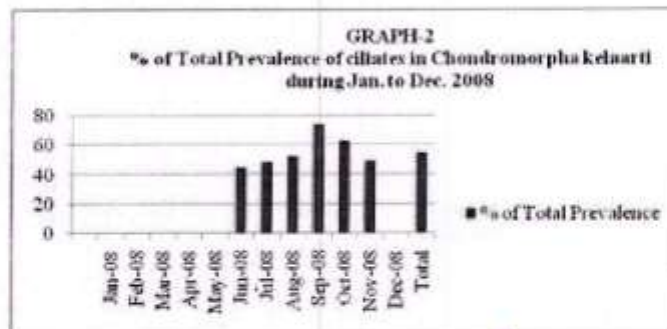
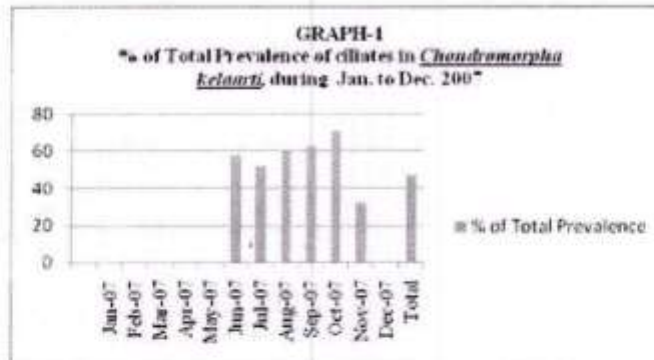
Showing the month wise prevalence of ciliates in Millipedes (*Chondromorpha kelaarti*) during the period from Jan.2008 to Dec.2008

Sr.No	Months	Total No. of Host Examined	No. Of +ve Hosts	% of Total Prevalence
1	Jan-08	-----	-----	-----
2	Feb-08	-----	-----	-----
3	Mar-08	-----	-----	-----
4	Apr-08	-----	-----	-----
5	May-08	-----	-----	-----
6	Jun-08	60	27	45.00
7	Jul-08	47	23	48.94
8	Aug-08	74	39	52.70
9	Sep-08	39	29	74.36
10	Oct-08	110	69	62.73
11	Nov-08	87	43	49.43
12	Dec-08	-----	-----	-----



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	Total	417	230	55.16
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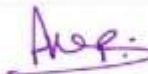
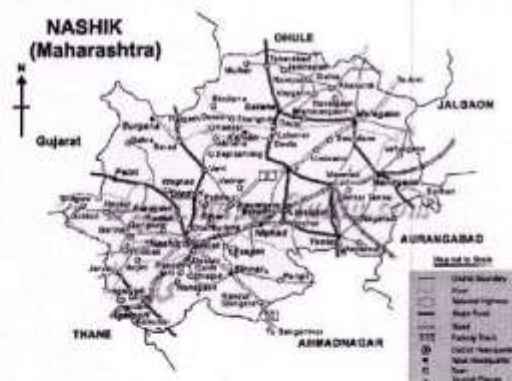

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Table 3- Comparison of the present species with the species of *Nyctotherus*

Sr. No.	No. Species	1	2	3
	Comparative characters	<i>N. spirostreptae</i> Lalpotu (1976)	<i>N. spirostreptae</i> Bhandari (2010)	<i>N. spirostreptae</i> Present author
1	Body shape and dimensions	Ovoidal, ant. end slightly narrow, post. end is broad L- 75.6 to 126 μ W- 47.3 to 81.9 μ	Ovoidal, L- 69.9 to 76.89 μ W- 49 to 53.59 μ	Ovoidal, L- 75 to 89.5 μ W- 42 to 61.5 μ
2	Peristomal groove	Anterior end run ventrally, leads to cytopharynx	Anterior end run ventrally, leads to cytopharynx	Anterior end run ventrally, leads to cytopharynx
3	Cytopharynx	Straight slightly curved at the middle of the body	Straight slightly curved at the middle of the body	Tubular, slightly curved
4	Macronucleus	Somewhat oval	Somewhat oval L- 11.65 to 16.31 μ W- 16.31 to 20.62 μ	Oval, length is less than width L- 13 to 19.5 μ W- 17.5 to 22 μ
5	Micronucleus			
6	Contractile vacuoles	Single	Single, 10 μ diameter	Single large 17.5 μ in diameter
7	Cytopyge	Slit like	Slit like	Slit like
8	Host	<i>Sprostreptus</i>	<i>Trigoniulus corallinus</i>	<i>Chondromorpha kelaarti</i>
9	Locality	Parbhani dist.	Aurangabad dist.	Nashik dist.

Topography-**Plate- 1** showing Map of Nashik District of Maharashtra, India

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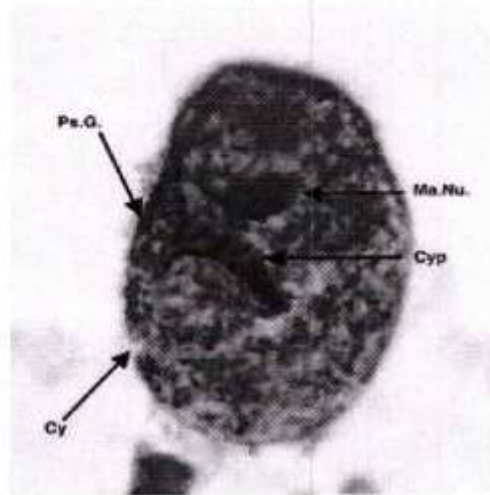
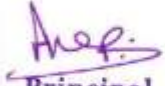


Plate 2. *Nyctotherus spirostreptae* W.M.




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Acute Toxicity of Indo-Sulphin to a fresh water Gastropod *Thira Lineata* Changes in Rate of Respiration

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Abstract: Toxicity of sunithion to the fresh water field crab has been studied by Bhagya Laxmi and Ramamurti (1981). Aness (1975) and Verma et al., (1978) observed the toxicity of some organophosphate compounds. The oxygen consumption has been estimated by Alam and Lomte (1984) after exposing the gastropods.

Viviparus bengalensis in zinc sulphate Lowry, O. H.; Rosenbrough, N. J.; Farr, A. L. and Randall, R. J. et. al. (1951, 1983) have observed the effects of carbaryl on oxygen consumption of the fish, *Channa punctatus* Chaudari et.al. (1988) have observed rate of oxygen consumption.

Considering the studies on pesticide pollution on the fresh water gastropod *Thiara* on the fresh water gastropod

Thiara Lineata the present investigation has under taken with the view to understand the acute toxicity and the effect on the rate of oxygen consumption.

Organophosphate compounds are now extensively use in place of organochloride compounds on account of their lesser residuals toxicity, but the prevention of aquatic animals' mortality remains an important object of water pollution research. Kaviraj and konar (1982) have studied the effects of heavy metals on acute toxicity of mercury, chromium and cadmium and cadmium to the fish, *Tilapia Mossambica*. Mone and Akarte (1987) have studied the effects of cythion or Malathion on the estuarine Clam *Catulasia optima*.

I. Introduction

The fresh water environment is becoming increasingly polluted with various pesticides since they are applied directly to aquatic fauna. They increase the agriculture production. None of the pesticides since they are applied directly they increase the agriculture production and none of the pesticides are specific to target species and so these chemicals causes deleterious effects or even system. The pesticides are causing undesirable effects to the organisms (Johnson 1968) are particularly susceptible to these pollutants.

II. Material And Methods

The Snail *Thiara Lineata* were collected from Girna river near kalwan. Animals were brought to the laboratory and they were cleansed to remove algae, biomass and mud etc. they maintained in laboratory conditions for a period of five days in de-chlorinated water, during no food was provided. The analysis of physico-chemical parameters of water was determined periodically from the laboratory tap water and the river water. The physico-chemical parameters like temperature, pH, total carbonates by the standard techniques of APHAC (1985)

The healthy specimens were ranging from 2.0 to 2.2 cm in length and 0.6 to 0.8 cm in width was used for experimentation.

The Indo-sulphin 32 EC was dissolved so as to get the appropriate concentrations for the exposure periods.

All the experiments were conducted in natural day light rhythms. The aeration had been withdrawn during toxic exposures. During the experimentation water of the control and experimental groups were renewed twice in a day with an interval of 12 to 13 hours. A concurrent control was run simultaneously, before each change of static biological behavior and mortality of snails were recorded.

The acute toxicity tests were performed by using Indo-sulphin 34cc for a period of 24, 48, 72, and 96, hours it is an organophosphate pesticide manufactured by VOLRHO INDIA LIMITED Secunderabad.

After exposing the animals for 24, 48, 72 and 96 hours to the pesticides survivals and the behavior of gastropods were recorded. The criteria for the mortality recorded were observed by the observation like failure of snails to respond to producing the foot into the shell, when it is pricked by needles. The percentage mortality was calculated and then it has been converted in to the profit values by means of profit table and the concentration were converted into long concentrations the graph using long concentration and profit mortality (Bailey.).



Acute Toxicity of Indo-Sulpin to a fresh water Gastropod *Thana Lineata* Changes in Rate of

The regression equation is calculated with long concentration and profit mortality by using formula $Y = bx + a$ from this equation the values of LC_{50} for 24, 48, 72 and 96 hrs were calculated. The LC_1 value also determined with the help of same regression equation.

The rate of oxygen consumption has been estimated by using oxygen electrode which has been provided by century instrument 1965pvt. Ltd. Chandigarh. All the five values of respiration are subjected for the statistical analysis from "t" test (Dowdswell 1957)

III. Results

The physico-chemical parameters of the water for holding the animals and used as diluents is given in table No.1

The water does not contain any toxic substance to the snails as hence no mortality was recorded in controlled group.

The animals were exposed for ten different concentration of Indo-sulphin the animals were exposed from the range of 0.0001 to 0.015 ppm for a period of 24, 48, 72 and 96 hrs depending during the experimentation and they are considered as the behavior changes

Gastropod partly opened operculum and slightly protruded food Gastropod attached to substratum with extend foot and tentacles out of the shell.

The gust period to the death the gastropods retracted the body inside the shell at its max extent and they could not extend even when they are subjected to mechanical stimulus.

The regression equations calculated LC_{50} and LC_1 value and the exposure periods (ie. 24, 48, 72, and 96 hrs.) are given table -2 for 24 hrs calculated LC_{50} value 150-0.0125 ppm. And LC_1 Value is 0.0027 PPM

For 72 hours of exposure calculated LC_{50} Value is 0.0058 ppm. And calculated LC_1 value is 0.0017 for 96 hours of exposure to Indo-sulphine the calculated value is 0.00013 ppm.

The rate of oxygen consumption was estimated in controlled LC_1 and LC_{50} groups after exposing the animals for the period of 24, 48, 72 and 96 hrs to Indo sulphine

The effect of Indo-sulphine on the rate of oxygen consumption of fresh water gastropod *Thana Lineata* from kalwan at Nashik District.

The rate of oxygen consumption in LC_1 and LC_{50} exposed groups were fluctuated from 0.167 ± 0.014 to 0.426 ± 0.030 mg/ gm / 1/ h. In LC_1 group it is fluctuated from 0.2991 ± 0.482 to 0.426 ± 0.030 mg/ gm / 1/ h/

The oxygen consumption was decreased to its max in LC_{50} exposed group after 96 hrs of exposure period (58.63 %) P (0.01)

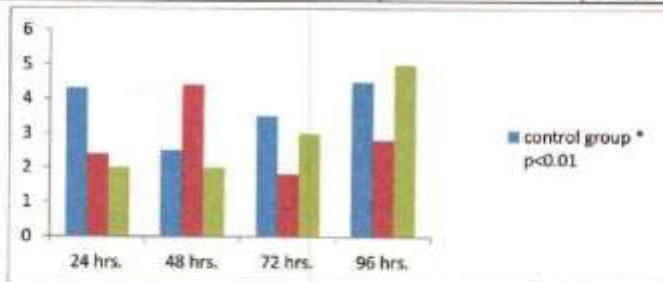
Table no -1

Physico-chemical parameters of riverine and tap water used for experimentation

Sr. No.	Parameters	Content
1	Temperature	20.0 - 22.1 C
2	pH	7.1 - 7.5
3	Dissolved	8.82 - 9.0 mg / l
4	Total carbonate	11.3 - 11.5 ppm

Table no 2

Sr.No	Period of exposure	Calculated LC_1 ppm.	Calculated LC_{50} ppm.	Regression Equation
1	24 hrs	0.0034	0.0142	$Y = 0.266x + 0.1756$
2	48 hrs	0.0027	0.0125	$Y = 0.3812x - 1.3043$
3	72 hrs	0.0017	0.0059	$Y = 0.2185x - 3.003$
4	96 hrs	0.0020	0.0021	$Y = 0.5264x - 2.2940$



IV. Discussion

Many chemical presides like organophosphate pesticides have been used in agriculture fields since long time such careless use of dangerous chemicals has laid to environment and occupation hazards.

Which has been well established through recent researches with the increase in industrialization and urbanization the utilization of pesticides accumulation in different body parts of the aquatic animals obviously effect different physiological activity of consumer. This may be lead into chronic diseases and ultimately death may occur to avoid this pollution maintaining device must be maintained in certain places. The pesticide must be used in minimum quantities.

But the careless used of pesticides resulted in the contamination of most of the fresh water bodies causing many fold hazards to several non target organisms many pesticides are considered hazardous because of their ability to keep and immobilized in the bodies of aquatic organisms in low concentration (Eisler 1961) the different toxicity of pesticides to aquatic organisms (Verma etc 1979) Warner (1967) in the review of bioassay using behavioral changes suggested that region of such test provide the most sensitive indicator yet develop. In the present study it has been observed that there were considerable changes in the behavioral pattern of the gastropods.

In the experimental group the content of excreta and mucus decreases. In the present study the LC_{50} value for Indosulphane 35 EC are 0.0143 0.0126 ppm. for 24hrs, 28 hrs, 72 hrs, 96 hrs respectively.

V. Summaray

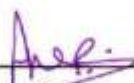
The present investigation has been carried out in order to assess the acute toxicity of Indosulphane to *Thiara Lineata* and changes in respiratory rate due to each the static bioassay tests were conducted for the periods of 24, 48, 72, & 96 hrs. The regression line is obtained by using log concentration and profit mortality values.

The LC_{50} values are determined for 24, 48, 72, & 96 hrs it was further observed that the rate of oxygen consumption significantly decreased due to the pesticide toxicity. The results are discuses in the light of available literature.

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Percentage prevalence and morphological details of *Stylonychia pustulata* (Ehrenberg, 1830) in the fresh waters of Nashik district

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ABSTRACT

The ciliates are one of the most important groups of Protozoa, common everywhere in waters of lake, pond, oceans and soils with many ecto and endosymbiotic members, as well as some obligate opportunistic parasites. Free living ciliates are found in fresh, marine, estuarine waters and in the soil. The present species described as *Stylonychia pustulata* Ehrenberg (1830), (O. F. Muller, 1786) Ehrenberg, 1835 (O. F. Muller, 1786) Ehrenberg, 1838, *S. pustulata* (Deshmukh, 2010) has found in fresh water ponds, ditches and streams, especially more abundantly in rain water bodies of Nashik district.

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Introduction

The ciliates are one of the most important groups of Protozoa, common almost everywhere there is water (lake, pond, and oceans) and soils with many ecto and endosymbiotic members, as well as some obligate opportunistic parasites. Free living ciliates are found in fresh, marine, estuarine waters and in the soil.

An excellent source is a shallow semi permanent pond in a farm yard. Any stream large or small, or any freshwater hole, temporary or permanent, water at the base of aquatic plants is likely to be a valuable source of material. Such places as moist crotches or bark (crevices) in trees or any other moist or water containing silt, floating algal mats provide food. Cilia covering the body of the organism or a part of it, a major defining characteristic of this group and hence the phylum name "Ciliophora".

The ciliates possess a marked variety of motile systems based on ciliary motion. Thus, the organisms are able to move through the environment in search of prey often with remarkable agility and swiftness, or when sedentary, to create a flow of water carrying food to the organism. The arrangement of hair like organelles on the cell surface and the degree of coordinated action made possible by close proximity of the cilia varies considerably among the groups.

A cirrus is a composite group of cilia (a few to hundreds of cilia) often tapering toward the distal end and acting in unison. Typically they are found in localized regions on the cell surface. When the cirri are largely localized on the ventral and anterior surfaces, the ciliates are characterized as hypotrichs, signifying that the cirri are positioned beneath the cell. In other species, cilia are arranged in spirals (e.g. Spirotrichs) or in ribbon like assemblages near the anterior (sometimes broader end) of the cell. Although many ciliates exhibit rapid and impressive locomotion, others such as suctorians are sedentary and lack cilia during most of their life cycle. These feeding (trophont) stages are anchored to the substratum by a stalk or other form of holdfast.

Ciliates in general have great power of regeneration, and the process like reproduction is more complex, a missing part can be replaced by simple growth. Unlike eukaryotes, ciliates have two different nuclei; large polyploid macronucleus and smaller diploid micronucleus. The former is important for protein synthesis, and latter for reproduction. The macro nuclei must be regenerated from the micronuclei. In most, this occurs during sexual reproduction which is not usually through syngamy but through conjugation. Joblet (1645-1723), has done pioneer work on ciliature, nuclei and contractile vacuoles in ciliates. In the eighteenth century Muller (1773, 1776 and 1786) gave the first extensive taxonomic account of all protozoa.

Extensive studies have been made during the last 80 years, with numerous outstanding and noteworthy contributions in the field of Protozoology, covering cytology, cytochemistry, structure, life cycle transmission, evolution, and ultrastructure; and inter relationship a verity of protozoa.

Although all ciliates conform, more or less, to the principle of nuclear dimorphism, they vary greatly in shape, size and number of nuclei. The macronucleus may be single compact, rounded or kidney shaped,

In reproduction by binary fission, the macro and micronuclei, either or both, divide; so that the parental nuclei are equally represented in both daughters. During sexual process of conjugation, two individual (the conjugant) unite temporarily. Micronucleus, or micronuclei, of both divide twice. All but one of the resulting micronuclei in each conjugant degenerate and disappear while the remaining one divides unequally forming two pronuclei. The smaller one is active, migratory, male pronucleus and the bigger one stationary, female, pronucleus. The male pronucleus migrates into the other conjugant and fuses with its stationary pronucleus forming a zygote nucleus or syncaryon. The two conjugants then, separate and are known as the exconjugant. These differ from ordinary individuals in having only a single nucleus, for the old macronucleus by now is in the process of losing its identity and being absorbed into the cytoplasm. The way in which the macronucleus disappears, varies considerably in different ciliates. During subsequent



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divisions the syncaryon gives rise to both macro and micronuclei.

Endoplasm is the seat of the main metabolic processes. The endoplasm is completely enclosed by cortex except at two places where it is brought into contact, temporarily or permanently, with the outside world. These are the cell mouth (cytostome) and cell anus (cytoproct). Food is taken in by the cytostome and surrounded by a vacuole into which digestive enzymes are secreted. The vacuole circulates slowly in the interior of animal during which time its contents are digested and absorbed through its wall and finally brought to the site of cytoproct which opens to discharge the undigested matter. In some ciliates the part of the endoplasm immediately adjoining the mouth forms a fairly well defined oesophagus like tube and among some groups of holotrichs this is surrounded by a series of parallel rods (trichites) of unknown origin, sometimes elaborate enough to form a basket like structure.

One or more contractile vacuoles are present typically in freshwater ciliates to regulate ion balance of the cytoplasm and expel excess water. Various extrusomes (ejectile organelles) occur beneath the surface of the cell including mucocysts that secrete surface substances either to coat the cell to improve its immediate environment, provide material for cyst walls or aid in the capture of prey.

Most ciliates feed on smaller organisms, such as bacteria, algae and detritus swept into the mouth by modified oral cilia. Feeding consist of two processes each of which may limit the actual rate of feeding. The first one is the process of phagocytosis, i.e. the enclosure of a food particle in a membrane covered vacuole in which digestion takes place. In ciliates this occurs at a special site on the cell surface called cytostome or cell mouth. Cytostome is simply a two dimensional aperture and most commonly permanently open. It is covered by a single unit membrane from which food vacuoles are formed. Food materials first pass into the endoplasm of the organism via a more or less distinct cytopharynx. It may open directly to the exterior or be sunken into a depression or cavity or some kind, such as atrium, vestibulum or buccal or peristomial cavity.

The cytostome is often associated with various organelles in the surrounding cytoplasm in particular bundles of microtubules. Later play a role in the transport of captured particles on the surface surrounding the cytostome. A variety of ciliary's and other organelles serve to concentrate or retain food particles.

Material and Methods-

For the study, the water samples were collected from different parts of Nashik dist (Deola, Kalwan Nandgaon; Surgana, Satana) of Maharashtra state. Water samples were collected in wide mouth, sterilized glass bottles. Due care was taken and the samples were collected from where the submerged plants and decaying leaves were present. Mostly the samples were collected during morning and evening. The temperature of the sample bottles were maintained with the help of ice bags.

Rapid movements of ciliates make it difficult to identify ciliate species. To immobilize their movements methyl cellulose solution was used.

Culture methods -

For cultivation various media are used such as

- Hay infusion
- Wheat infusion
- Rice infusion

Hay infusion was good for *Stylonychia* and many other ciliates species. Rice grain infusion is also best for the *Vorticella*, *Stylonychia* and *Coleps* species.

Water sample is obtained from different water bodies contains a mixer of organism, by adding any type of culture media (Wheat or rice infusion) can generally rise the number of certain ciliate species (by rising the bacterial population present) in the water sample, but often lower the number of species. However the rough sample containing several ciliates and unknown bacterial and algal floras can be obtained for several weeks. Selection of a particular ciliate species and culturing it in the isolation of organisms other than its prey may obtain a greater degree of control over a culture.

The choice of culture medium depends largely upon what the ciliate feeds. Many feed upon bacteria and that is why many of the media commonly used are designed to encourage the growth of bacterial populations. Different culture media and methods published by Mackinnon and Hawes (1961), Kirby (1950) and committee on cultures, Society of Protozoologist (1958).

Culture were examined under low power and then in to high power microscope taking care to focus at all levels in the culture watching for movements of any kind. Movements of ciliates were also trapped in video camera for the proper understanding. Dry silver impregnation was used to study infraciliature of the ciliates. For the permanent slides the ciliates were fixed in terms of number of individuals and species composition. Methyl cellulose has been found too many advantages, as it arrest the movement, ciliates can be identified by their appearance. The species identification has been made mainly on the basis of arrangement of cilia, size and shape of body and structure of micro and micronucleus.

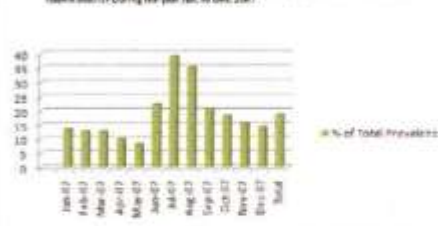
Discussion and Results-

Percentage of prevalence of *Stylonychia pustulata* in fresh water during the period of January 2007 to December 2008, for the two years

Table 1. Showing month wise prevalence of *Stylonychia* Sp. in freshwaters of Nashik District during the year 2007

Sr No	Month	Total No. of samples Examined	No. of +ve samples	% of Total Prevalence
1	Jan-07	45	6	13.33
2	Feb-07	55	7	12.73
3	Mar-07	47	6	12.77
4	Apr-07	60	6	10.00
5	May-07	61	5	8.20
6	Jun-07	67	15	22.39
7	Jul-07	54	21	38.89
8	Aug-07	57	20	35.09
9	Sep-07	58	12	20.69
10	Oct-07	60	11	18.33
11	Nov-07	64	10	15.63
12	Dec-07	49	7	14.29
	Total	677	126	18.61

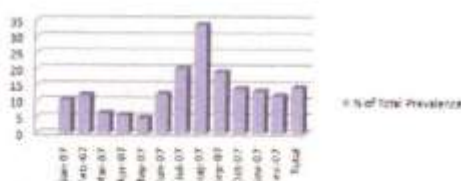
Graph. 3. Showing month wise % of total prevalence of *Stylonychia* in the freshwaters of Nashik District During the year Jan. to Dec. 2007



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Table 2. Showing month wise prevalence of *Stylonychia* in freshwaters of Nashik District During the year 2008

Sr No	Month	Total No. of samples Examined	No. of +ve Hosts	% of Total Prevalence
1	Jan-08	68	7	10.29
2	Feb-08	84	10	11.90
3	Mar-08	79	5	6.33
4	Apr-08	69	4	5.80
5	May-08	62	3	4.84
6	Jun-08	89	11	12.36
7	Jul-08	94	19	20.21
8	Aug-08	80	27	33.75
9	Sep-08	89	17	19.10
10	Oct-08	87	12	13.79
11	Nov-08	69	9	13.04
12	Dec-08	77	9	11.69
	Total	947	133	14.04

Graph 2. Showing monthly % of total prevalence of *Stylonychia* in freshwaters of Nashik District During the year Jan. to Dec. 2008

During the period of two years (Jan.2007 to Dec. 2008) a total number of water samples 1624 were examined, 259 of these were positive with free living ciliate *Stylonychia pustulata*.

In the first year (Jan.2007 to Dec.2007) 677 fresh water samples were examined, 126 of these were positive with free living ciliates. The percentage of prevalence of free living ciliates was about 18.61%.

In the second year (Jan.2008 to Dec.2008) 947 fresh water samples were examined, 133 of these were positive. The percentage of prevalence of free living ciliate *Stylonychia* was about 14.04%.

A month wise analysis in **first year** (Jan.2007 to Dec.2007) shows the maximum percentage of prevalence during August (33.75%) and minimum in May which was only 4.80%, and minimum to moderate in remaining months.

During the period of Jan. 2008 to Dec.2008) maximum percentage of prevalence of this ciliate was showed again during July (33.75%) and lowest in May (4.84%) and minimum to moderate in remaining months.

The pattern in both the years suggests that the peak is soon after the monsoon rain. The percentage then gradually reduces at the end of the winter months and reaches a low with the onset of summer. The details of the number of water samples examined and the month wise prevalence is shown in **Table No1 and 2.**

Description of the species

Synonym of *Stylonychia* was described by O. F. Muller (1786) later Kerona, the Andre, (1916) had given the name *Prosopsema*. Ehrenberg, (1838) included this genus in Family Oxytrichidae. The species which are included in genus *Stylonychia* are inflexible, elongate, oval, dorso-ventrally flattened body with a large and powerful AZM supported anteriorly by a collar, 2 rows of marginal cirri not continuous posteriorly, but 3 long, strong and prominent caudal cirri present.

The genus has the typical fronto-ventral and transverse arrangement of cirri with 3 strong anterior frontal cirri. The dorsal surface has several longitudinal rows of short cilia. Macronucleus in two parts each with an adjacent micronucleus. Several species have been recorded.

Undulating membrane is present in *Stylonychia* pattern. One right and one left row of marginal cirri, distinctly separate posteriorly. Presence of six dorsal kineties, caudal cirri present and often distinctly elongated, which have, however, a more slender and flexible body and intersecting undulating membranes. There are two (two distinct segments of one macronucleus) macronuclei present which are oval in shape with single spherical to ovoid micronucleus each.

The genus *Stylonychia* has following species

S. pustulata Ehrenberg, 1838

S. nytilus Ehrenberg, 1838

S. putrina Stokes, 1885

S. notomorphia Stokes, 1885

Description of the *Stylonychia pustulata* -

The present species described as *Stylonychia pustulata* Ehrenberg (1830), (O. F. Muller, 1786) Ehrenberg, 1835 (O. F. Muller, 1786) Ehrenberg, 1838, *S. pustulata* (Deshmukh, 2010). Present author has found this species in fresh water ponds, ditches and streams, especially more abundantly in rain water bodies of Nashik district.

Body is inflexible and elliptical. It measures about 44 to 125um in length and 22um to 81um in width. Both anterior and posterior ends are rounded and more or less parallel. Macronuclear segments two which are ovoid in shape. Each macronucleus is measures about 14 to 16um in length and 6 to 8um in width, lying left of the median. Micronuclei are two in number, they are small spherical, each in close contact with one of the macronuclear segments.

Contractile vacuole is single. It measures about 9um to 11um in length, present at the middle of the body. Endoplasm was seen bright yellow in colour in living condition. Food vacuoles are few to moderate in number. The large size food vacuole is measures about 27 to 32um in length.

Movement moderately slow, gliding, and often standing still for sometimes, rotation, around the longer axis on disturbance. The presences of various cirri are the organs of swimming and gliding locomotion. Marginal cirri are measures about 12 to 16um long. Right marginal row is composed of many more cirri than the left one. Three anterior frontal cirri enlarged, which measures 19-23 um in length. Four posterior cirri, arranged in an oblique hook-shaped row, and one enlarged buccal cirrus. Two postoral and three ventral cirri are present. Transverse cirri are five in number they measures about 20-24 um in length. The Caudal cirri are three in number; they are 16-25 um in length, very stiff and projecting laterally.

Comments

Body of present species is ovoid to reniform, inflexible and elliptical, with short dorsal bristles. Three long stiff caudal cirri are present and hence it is belongs to genus *Stylonychia*. This genus is first reported by Ehrenberg, 1830. Later many workers reported different species of this genus. Kudo (1966), Hick (1972), Berger & Foissner (1997), Lynn & Small (2000), reported the different species of the same genus. *Stylonychia pustulata* was identified by the shape of the body, the arrangement and the number of cortical elements, the mode of locomotion and morphological similarities in number and the positions of cirri. Movement moderately slow, gliding, and often standing still for sometimes, rotation, around the longer axis on disturbance.



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Table 3: Comparison of different species of genus *Stylonychia* with present species, *S. pustulata*

Sr. No.	Particulars	1 <i>S. pustulata</i> Ehrenberg, (1838)	2 <i>S. mytilus</i> Ehrenberg, (1838)	3 <i>S. putrina</i> Stokes, (1885)	4 <i>S. notomorphus</i> Stokes, (1885)	5 <i>S. pustulata</i> Deshmukh, (2010)	6 <i>S. pustulata</i> Present authors
1	Body shape	Ovoid	Elongate	Elongate	Elongate	Ovoid	Ovoid
2	Body dimensions	L- 150 μ m	L- 100 to 300 μ m	L- 125 to 150 μ m	L- 125 μ m	L- 55 to 65 μ m W- 30 to 38 μ m	L- 44 to 125 μ m W- 22 to 81 μ m
3	Macronuclei	2, ovoid	2	2, ovoid	2, ovoid	2, ovoid	2, ovoid
4	AZM	1/3 body length	1/3-1/2 body length	1/3-1/2 body length	1/3-1/2 body length	1/3 body length	1/3 of body length
5	Habitat	Fresh water	Fresh water	Fresh water	Fresh water	Muddy soil	Fresh water

AZM - Adoral zone of membranelle

Body of present species is ovoid and hence similar to previously described species *S. pustulata* but differs from *S. mytilus* (Ehrenberg, 1838) which is elongate and has anterior end wider than the posterior. *S. putrina* (Stokes, 1885) Deshmukh, 2010) is elongate and anterior end is not wider than posterior but anterior end is somewhat conical and rounded posterior end while in present species anterior end is rounded and posterior is broadly pointed and hence present species is also separates from *S. putrina*. It also distinguishes from *S. notomorphus* (Stokes, 1885) which has somewhat conically rounded anterior end and body laterally narrowed in some cases.

In body dimensions when compared with other species of *Stylonychia*, present species found to be small among all the previous ones (Table.....). Present species has 3 to 8 frontal, 2 post oral, 3 to 5 ventral, 5 transverse and 3 caudal cirri and hence similar to all the species of genus *Stylonychia* which also has 3 frontal, 3 ventral, 5 transverse and 3 caudal cirri.

AZM in present species also covers the one-third part of the body length and hence this species resembles that of *S. pustulata* but differs from *S. putrina* (Stokes, 1885), *S. mytilus* (Ehrenberg, 1838) in which AZM extends one-third to one-half the body length. It also separates from *S. notomorphus* (Stokes, 1885) in which AZM extends up to one-half the body length.

Present species has two ovoid macronuclei and hence similar to all the species of genus *Stylonychia*.

Present author compared present species with all the species of genus *Stylonychia* and found morphologically close similar to *S. pustulata* (Ehrenberg, 1838) in body outline, length of AZM and hence redescribed as a *Stylonychia pustulata*.

Figure - *Stylonychia pustulata*

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Study of Percentage Prevalence and Morphology of Ciliated Protozoan, *Amphileptus Claparedei* from Fresh Waters of Nashik District of Maharashtra, India

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ABSTRACT-

Six species of free-living ciliates are found in different fresh-water habitats. They are *Amphileptus claparedei*, *Paramecium caudatum*, *Paramecium bursaria*, *Colepshirtus*, *Vorticella convallaria* and *Chilodonellacucullulus*. *Amphileptus claparedei* is one of the most commonly happened ciliate in the fresh water bodies of Nashik district.

Total 1624 water samples were examined, 879 of these were positive with free living ciliates. The percentage prevalence of 361 positive water samples for first year January to December 2007 was 53.32% while percentage prevalence for the second year, January to December 2008 of 518 positive water samples was 54.70%.

For both the years, it has shown that the maximum percentage of prevalence has found during the period of August and September which is 73.68% & 70.69% for the year 2007 and 74.47% & 71.25% for 2008. The lowest that is 31.15% in May 2007 while in the year 2008 the lowest percentage is shown in February, March and April i.e. 38.10%, 36.71%, 39.13 % respectively, minimum to moderate in remaining months for both the years.

The pattern in both the years suggests

that the peak is soon after the monsoon rain. The percentage then gradually reduces at the end of the winter months and reaches a low with the onset of summer.

The body of the present species is species is slightly flattened and flask shaped with bluntly pointed measures about 80 to 130 μ in length and 32 to 47 μ in width.

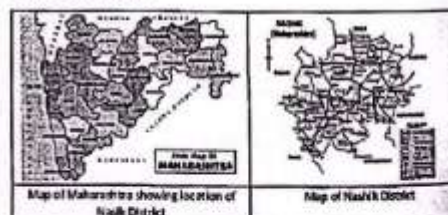
Key words- *Amphileptus claparedei*, percentage prevalence, morphology

INTRODUCTION

Protozoa (in Greek proto = first and zoa = animals) is a diverse group of single-celled, microscopic or near-microscopic eukaryotes (organisms whose cells have nuclei) that commonly show characteristics usually associated with animals, most notably mobility and heterotrophy. An organism belonging to this group are known as a protozoan (plural protozoans) or protozoon (plural protozoa).

An excellent source is a shallow semi-permanent pond in a farm yard. The marshes and sloughs on the shore of the lakes are often rich sources of food. Any stream large or small, or any freshwater hole, temporary or permanent, water at the base of aquatic plants is likely to be a valuable source of material. Such places as moist crotches or bark (crevices) in trees or any other moist or water containing silt, floating algal mats provide food.

TOPOGRAPHY-



MATERIAL AND METHODS

For the study of free living ciliates the water samples were collected from different water bodies of Nashikdist (from Deola, Nandgaon; Surgana, Satana) of Maharashtra



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state.

Water samples were collected in wide mouth, sterilized glass bottles. Due care was taken and the samples were collected from where the submerged plants and decaying leaves were present. Mostly the samples were collected during morning and evening. The temperature of the sample bottles were maintained with the help of ice bags. Rapid movements of ciliates make it difficult to identify ciliate species. To immobilize their movements methyl cellulose solution was used.

Culture methods -

a. Hay infusion- It is one of the methods for the culturing of free living ciliates which gives best result. Hay infusion is suitable medium which supplies nutrients and growth substances which makes ciliates faster multiplication and abundance in their population. Hay infusion (Kirby, 1950) Kasthuribal Saxena and Nasreen recommended the use of hay infusion as an intrinsic and effective culture medium for raising the population of different ciliate species.

Six gram of hay was cut in to small pieces and taken in beaker containing one litre of distilled water and boiled for 15 to 30 minutes and filtered. The filtrate was kept aside for overnight. Next day it was ready to use.

b. Wheat infusion- This is also a cheapest and successful method for ciliate culture; boil the distilled water with few whole wheat grains for 10 to 15 minutes. Cool the content and add the collected sample water in the content. Now the culture was kept aside for two to three days. The result was soon showing the number of ciliates in the beaker.

c. Rice infusion- It is also a successful method especially for stalk ciliates. Whole rice grain or two three crushed rice grains directly add in sample water containing ciliates (not in the powder form).

Water sample is obtained from different water bodies contains a mixer of organism, by adding any type of culture media (Wheat or rice

infusion) can generally rise the number of certain ciliate species (by rising the bacterial population present) in the water sample.

The choice of culture medium depends largely upon what the ciliate feeds. Many feed upon bacteria and that is why many of the media commonly used are designed to encourage the growth of bacterial populations. Different culture media and methods published by Mackinnon and Hawes (1961), Kirby (1950) and committee on cultures, Society of Protozoologist (1958).

Culture were examined under low power and then in to high power microscope taking care to focus at all levels in the culture watching for movements of any kind. Movements of ciliates were also trapped in video camera for the proper understanding. Dry silver impregnation was used to study infracillature of the ciliates. For the permanent slides the ciliates were fixed in terms of number of individuals and species composition. Methyl cellulose has been found too many advantages, as it arrest the movement, ciliates can be identified by their appearance. The species identification has been made mainly on the basis of arrangement of cilia, size and shape of body and structure of macro and micronucleus.

RESULTS AND DISCUSSIONS-

Percentage of prevalence of free living fresh water ciliates:-

During the period of two years (Jan.2007 to Dec. 2008) a total number of water samples 1624 were examined, 879 of these were positive with free living ciliates.

In the first year (Jan.2007 to Dec.2007) 677 fresh water samples were examined, 361 of these were positive with free living ciliates. The percentage of prevalence of free living ciliates was about 53.32%.

In the second year (Jan.2008 to Dec.2008) 947 fresh water samples were examined, 518 of these were positive with free living ciliates. . The percentage of prevalence



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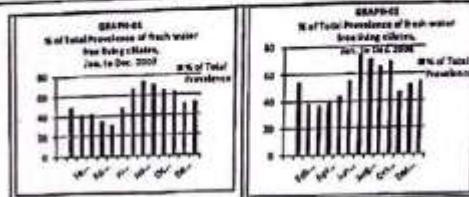
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of free living ciliates was about 54.70%.

A month wise analysis in first year (Jan.2007 to Dec.2007) shows the maximum percentage of prevalence of free living ciliates during August and September (73.68%, 70.69%), lowest in May (31.15%) and minimum to moderate in remaining months.

In second year (Jan.2008 to Dec.2008) maximum percentage of prevalence of fresh water free living ciliates was showed again during August and September (74.47%, 71.25%), lowest in February, March and April (38.10%, 36.71%, 39.13 %) and minimum to moderate in remaining months.

The pattern in both the years suggests that the peak is soon after the monsoon rain. The percentage then gradually reduces at the end of the winter months and reaches a low with the onset of summer. The details of the number of animals examined and the month wise prevalence is shown in Table No1 and 2.



Systematics of *A. clapedei* Stein, 1859

Domain: Eukaryota

Kingdom: Protozoa Goldfuss, 1818, Rown, 1858

Subkingdom: Bilclata

Infrakingdom: Alveolata Cavalier & Smith, 1991

Phylum: Ciliophora Doflein, 1901, Copeland, 1956

Subphylum: Intramacronucleata Lynn, 1996

Class: Litostomatea, Small & Lynn, 1981

Subclass: Haptoria, Corliss, 1974

Order: Pleurostomatida Schewiakoff, 1896

Family: Amphileptidae Butschli, 1889

Genus: *Amphileptus* Ehrenberg, 1830

Species: *A. clapedei* Stein, 1859

Genus *Amphileptus* Ehrenberg, 1830

Genus *Amphileptus* is belongs to class Litostomatea, Subclass Haptoria and family Amphileptidae. The organisms of this genus has flask shaped body and somewhat compressed. There is uniform and complete ciliation on the body. Slit like cytostome not reaching the middle of the body. These ciliates usually lack the trichocyst borders. Contractile vacuoles are many. In some species one terminal or subterminal contractile vacuole is present. Number and position of contractile vacuoles vary from species to species. Usually two or more macronuclei are present; occasionally one macronucleus is present while sometime instead of compact macronuclei, there are 200-300 macronuclear nodules are present. A small spherical micronucleus usually situated between two macronuclei.

Locomotion is by gliding slowly on substrate, or swimming with slow rotation around longitudinal axis. This species is commonly found in fresh and marine water.

Sr No	Month	No. of water Samples examined	No. of free water samples	% of Total Prevalence
1	Jan-07	45	23	51.11
2	Feb-07	55	23	41.82
3	Mar-07	47	20	42.55
4	Apr-07	60	21	35.00
5	May-07	61	19	31.15
6	Jun-07	67	33	47.76
7	Jul-07	54	36	66.67
8	Aug-07	57	42	73.68
9	Sep-07	58	41	70.69
10	Oct-07	60	39	65.00
11	Nov-07	64	41	64.06
12	Dec-07	49	25	51.02
Total		677	361	53.32

Sr No	Month	No. of water Samples examined	No. of free water samples	% of Total Prevalence
1	Jan-08	68	37	54.41
2	Feb-08	84	32	38.10
3	Mar-08	75	28	36.71
4	Apr-08	69	27	39.13
5	May-08	62	27	43.55
6	Jun-08	89	48	53.93
7	Jul-08	94	70	74.47
8	Aug-08	86	67	77.91
9	Sep-08	88	68	77.27
10	Oct-08	67	60	89.55
11	Nov-08	69	32	46.37
12	Dec-08	77	40	51.95
Total		947	518	54.70

विद्यवायु: Interdisciplinary Model:



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This genus *Amphileptus* has consists of *A. claparedei* Stein, 1859, *A. pleurosigma* Stokes, 1884 Foissner, 1984, *A. lanceolatus* Dragesco, 1965, *A. litonotiformis* Song, 1991, *A. marinus* Kahl, 1931 Song et al., 2004, *A. sikorai* Lin et al., 2005, *A. yuianus* Lin et al., 2005, *A. guil* Lin et al., 2005, *A. aeschtae* Lin et al., 2007, *A. eigner* Lin et al., 2007 and *A. houli* Lin et al., 2009.

Description of the species, *Amphileptus claparedei* Stein, 1859

Body of present species is slightly flattened and flask shaped with bluntly pointed posterior end. Anterior end is rounded, short neck like and somewhat bend towards the ventral side. Body measures 80 to 130 μ in length and 32 to 47 μ in width.

Cytostome is large, wide and is about two-fifth from the ventral margin. There is no trichocyst and dorsal ciliary rows are not distinct. There are two ovoidal macronuclei situated in the middle of the body and measured 17.5 to 37.7 μ in length and 15 to 25 μ in width. A small spherical micronucleus has been situated in between these two macronuclei. Presence of single contractile vacuole in many individuals but some show even 3 to 4 rounded contractile vacuoles which are irregularly distributed in the cytoplasm. Present author collected this species from fresh water.

Microscopy-

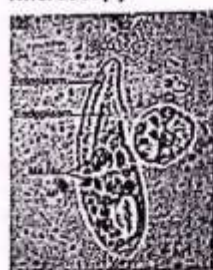


Figure 1- W.M and T.S. of *Amphileptus claparedei*



Figure 2 - Showing Micronucleus, food vacuole and contractile vacuole

Comments-

Present species has flask shaped body

with complete and uniform ciliation. Slit like cytostome not reaching the middle of the body and there is no trichocyst borders and hence it is a member of genus *Amphileptus*. Ehrenberg (1830) first reported this genus and later reported by many other workers. Wrzensniowski (1870) reported the *Hemiohryss* species which is the synonym for *Amphileptus*. After that Stokes (1884) recorded *Hemiohryss pleurosigma*. Later Foissner (1984) recorded the same species and named it as *Amphileptus pleurosigma* which is the synonym of the *Hemiohryss pleurosigma*. Dragesco (1965) and Biernack (1963) also reported the species of this genus. Lin et al. (2005, 2007, and 2009) reported many species from marine water. Song (1991), Kahl (1931), Song et al. (2004) also recorded different species of the genus *Amphileptus* from marine water. H Pan, L Li, X Lin, J Li, SA Al-Farraj (2014): *Journal of Eukaryotic Biology*, Wiley Online Library are discussed the different species *Aphileptus*. R. Chen, X Lin, A Warren in 2011, are described new *pleurostomatid* ciliate, *Amphileptus salignus* n. sp. from mangrove wetlands in Southern China. X lin, W Song A Warren, 2005 are described the morphology and infraciliature *A. guil* sp. and *A. yuianus* n. sp. Deshmukh (2010) also reported this species from fresh water.

Present species shows rounded, neck like and bended anterior end and bluntly pointed posterior end hence similar to *A. claparedei*, *A. lanceolatus* and *A. pleurosigma* but differs from *A. pleurosigma* in the shape which has both the sides narrow. In the present species anterior end is narrow and broad posterior end. Present species also differs from *A. sikorai*, *A. aeschtae*, *A. eigner*, *A. guil*, *A. houli*, *A. litonotiformis*, *A. marinus*, *A. yuianus* in body shape. But the body shape matches to the species of Stein, (1859) and Deshmukh (2010).

In present species usually 3 to 6 contractile vacuoles are observed in the cytoplasm which are irregularly distributed along



the body and hence resembles that of *A. clappareidei* described by Stein, 1859 (many) and Deshmukh, 2010 (3 to 4). It differs from *A. inuleta* which has 4 rows of contractile vacuoles laterally placed and has elongate neck. In present species occasionally one large terminal contractile vacuole was also observed and hence resembles to *A. yulianus* and *A. lanceolatus* which also have a terminally positioned contractile vacuole while differs from *A. pleurosigma* which has many contractile vacuoles along dorsal and ventral edges of the body. It also separates from *A. litonotiformis* which has single subterminally placed contractile vacuole while *A. meleagris* has single contractile vacuole located at the posterior end with a lateral row of 8 or more contractile vacuoles. Present species also differs from *A. aeschtae* which has 5 to 13 contractile vacuoles positioned along the margin of the posterior two-third of body. *A. eigner* is often with 5 to 8, sometimes up to 15 contractile vacuoles distributed along the posterior part of the ventral margin while 3 to 7 contractile vacuoles are present in *A. gui* and *A. houi* has 2 contractile vacuoles near ventral margin, one mid-body positioned, the other in the posterior one-fourth of the cell and hence present species also differs from these three species. Present species also differs from *A. marinus* has 3 to 7 contractile vacuole positioned near ventral margin in posterior two-fifth to one-half of the cell and *A. sikorai* possesses 2 or 3 vacuoles, always grouped along the mid-body region.

Present species has two, oval macronuclei and similar to all species of the genus *Amphileptus* except *A. aeschtae* which has about 200 to 300 macronuclear nodules which are ovoid to spherical in shape and present species also distinguished from *A. houi* as it has one macronucleus.

Present author observed a spherical micronucleus situated in between two macronuclei and resembles to *A. lanceolatus*,

A. clappareidei, *A. yulianus* but present species differs from *A. yulianus* in body shape. This species also separates from *A. lanceolatus* in number of contractile vacuoles which has one terminal contractile vacuole with satellite vacuoles. It also differs from *A. marinus* which has several micronuclei while Lin et al. (2005) did not observe micronucleus in *A. sikorai* and hence present species separates from *A. sikorai*. After comparison of the present species with all the species of the genus *Amphileptus* it is seen that it resembles with *A. clappareidei*. Described Sien (1859) and redescribed by Deshmukh (2010) Difference between the previously described species and present one is only in body dimensions. Present author observe this species larger than the Deshmukh's species but smaller than previous ones and hence re-described it here as *Amphileptus clappareidei*. Present species is compared with other same species, studied by some other authors as shown in Table No. 03

Table 03: Comparison of present species with the species of genus *Amphileptus*.

Sl. No.	Species	Body length (µm)	Body width (µm)	Contractile vacuoles	Macronuclei	Micronuclei	Other features
1	<i>A. clappareidei</i>	1.4-1.8	0.5-0.7	1-2	2	1	
2	<i>A. yulianus</i>	1.1-1.5	0.4-0.6	1-2	2	1	
3	<i>A. lanceolatus</i>	0.8-1.2	0.3-0.5	1-2	2	1	
4	<i>A. pleurosigma</i>	1.5-2.0	0.6-0.8	Many	2	1	
5	<i>A. litonotiformis</i>	1.2-1.6	0.4-0.6	1	2	1	
6	<i>A. meleagris</i>	1.0-1.4	0.3-0.5	1	2	1	
7	<i>A. aeschtae</i>	1.2-1.6	0.4-0.6	5-13	2	1	
8	<i>A. eigner</i>	1.0-1.4	0.3-0.5	5-15	2	1	
9	<i>A. gui</i>	1.0-1.4	0.3-0.5	3-7	2	1	
10	<i>A. houi</i>	1.0-1.4	0.3-0.5	2	2	1	
11	<i>A. marinus</i>	1.0-1.4	0.3-0.5	3-7	2	1	
12	<i>A. sikorai</i>	1.0-1.4	0.3-0.5	2-3	2	1	
13	<i>A. clappareidei</i> (Present)	1.4-1.8	0.5-0.7	1-2	2	1	

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26. Study of Population Frequency and Morphological Details of Commonly Found Gregarine Stenophora Mruthunjayi in Intestines of Millipede Species, Trigoniulus Corallines from Nashik District of Maharashtra

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Abstract

The intestine of a millipede species, *Trigoniulus corallinus*, was noted to be heavily infected with gregarine parasites. Millipedes used in this study were randomly collected from Nashik district of Maharashtra from January 2007 to December 2008. Among 1794 millipedes examined, our results showed that the total prevalence rate for cephaline gregarines was 59.92%. In some cases, more than two species of different gregarines were found to have simultaneously parasitized a single millipede. Distribution of gregarines was more concentrated in the anterior and middle parts of the intestine than in the posterior part. The predominant forms observed in the millipede's intestine were free sporadins of *Stenophora mruthunjayi*. The shape, size, and movement of these gregarine *Stenophora mruthunjayi* are described in the present paper.

The dimensions of the gregarines were observed on the base of organisms selected at random from different smears with an ocular micrometer. Total 15 organisms of different size of each individual *Stenophora mruthunjayi* were measured. The slides, live photographs, video shootings of live species are also observed.

Key Words: gregarine, millipede, *Stenophora mruthunjayi*

Topography

Map of Maharashtra showing location of Nashik District



Map of Nashik District



Introduction

Millipedes are a major group of detritivores in tropical and temperate broadleaf forests. They are important in nature as they play the ecological role of deposit feeders that enhance the rate of decomposition for other smaller deposit feeders as well as decomposers. However, their own physiological conditions might be distorted if they were to be infected by gregarine parasites. Gregarines are protozoan parasites found in the intestinal tracts of many invertebrates, especially arthropods and annelids, which often show extremely heavy infections. Although unimportant economically as parasites, their generalized life cycle makes them significant objects for study as aids to understanding the important sporozoan parasites of humans, domestic mammals, and birds (Schmidt, 1992). They are frequently found in mosquitoes in Taiwan (Yen et al., 1994; Chen and Yang, 1996; Chen et al., 1997). Infection by cephaline gregarine is common and widespread in millipedes. Uttange and Desai (1961) observed new gregarine (protozoa) in the gut of termites from Dharwar. They belong to the family Gregarinidae, suborder Septatina, order Eugregarinida, class Conoidasida, and Sub-phylum Apicomplexa (Margulis et al., 1993). Obata (1953) reported some gregarines from Japanese Insects. Ganapati and Narasimhamurti

(1956) find out a new cephaline gregarine, *Stenophora xenoboli* n. sp. parasitic in the gut of the Millipede *Xenobolus* sp. Lipa (1967a) studied the gregarines of arthropods in Poland. Levine (1979) depicted the life cycle of gregarines and described as many as 120 species of gregarines from the eight genera that can infect millipedes, *Amphoroides*, *Cnemidospora*, *Fonsecaia*, *Hyalosporina*, *Monoductus*, *Phleobum*, *Spirosoma*, and *Stenoductus*. Due to Nashik district's subtropical climates, millipedes here are abundant and widespread mainly in the rainy season. In 2000, Gilis Kaya overviewed the classification of the Phylum Apicomplexa. The present study includes the prevalence percentage and observation of intestine-dwelling gregarines in the millipede *Trigoniulus corallinus* from Nashik District, Maharashtra State, India.

Material and Methods

Millipede Collection and Maintenance

Trigoniulus corallinus (Gervais, 1842), was collected randomly from the various areas of the Nashik district in the period of January 2007 to December 2008 irrespective of age, sex, or reproductive status. They were dissected directly after bringing in the laboratory.

The smears containing cysts were collected from the gut of host by means of micropipette and transferred to a moist chamber to which the ringer solution was added. Further developmental stages of the cysts were subjected to repeated microscopic examination at definite intervals (8 hours) and the intermediate stages were recorded along with time for sporulation. Some of the advanced cysts were pressed under the cover glass examined for gametes.

The dimensions of the gregarines were based on the organisms selected at random from different smears with an ocular micrometre. Total 15 organisms of different size of each species were measured.

Results

Prevalence of Gregarines in Millipedes

The study of prevalence was based on the species of millipede *Trigoniulus corallinus*, collected from various places of Nashik district. (M.S). In case of millipedes the survey is not possible throughout the year, because the millipedes are available only in rainy season (June to November). So author has could study the prevalence of gregarines only for six months. During the period of two years (Jan. 2007 to Dec. 2008) total 1794 *Trigoniulus corallinus* were examined. In the first year (Jan. 2007 to Dec. 2007) total 996 animals were examined, 662 of these were positive for gregarine infection. The percentage of prevalence was 66.47%. In the second year (Jan. 2008 to Dec. 2008) total 798 animals were examined, 413 of these were positive for gregarine infection. The percentage of prevalence was 51.75%. A month wise

analysis of the percentage of the prevalence of gregarines in *T. corallinus* for first year (January to December, 2007) shows the maximum percentage of prevalence during August to October (72.96%, 70.85%, 70.29%), minimum in June (38%) and moderate in July and November (62.72% and 45.05%). In the second year (January to December, 2008) the maximum percentage of prevalence was observed during August (60.35%), minimum in November (39.24%) and moderate in June, July, September and October. The pattern in both the years suggests that the peak is in monsoon season, the prevalence reduces in the starting of winter. The details of the number of animals examined and the month wise prevalence are shown in Table No. 1 and 2.

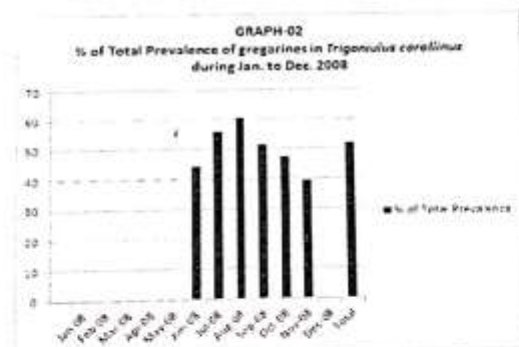
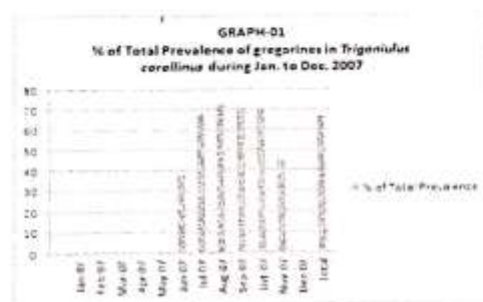
TABLE 01:
 SHOWING THE MONTHWISE PREVALENCE OF GREGARINES IN MILLIPEDE
 (*Trigoninulus corallinus*) during the period from Jan.2007 To Dec.2007

Sr No	Months	Total No.of Host Examined	No.of +ve Hosts	% of Total Prevalence
1	Jan-07	-----	-----	-----
2	Feb-07	-----	-----	-----
3	Mar-07	-----	-----	-----
4	Apr-07	-----	-----	-----
5	May-07	-----	-----	-----
6	Jun-07	50	19	38.00
7	Jul-07	285	193	67.72
8	Aug-07	270	197	72.96
9	Sep-07	199	141	70.85
10	Oct-07	101	71	70.29
11	Nov-07	91	41	45.05
12	Dec-07	-----	-----	-----
	Total	996	662	66.47

TABLE 02
 SHOWING THE MONTHWISE PREVALENCE OF GREGARINES IN MILLIPEDE
 (*Trigoninulus corallinus*) during the period from Jan.2008 To Dec.2008

Sr No	Months	Total No.of Host Examined	No.of +ve Hosts	% of Total Prevalence
1	Jan-08	-----	-----	-----
2	Feb-08	-----	-----	-----
3	Mar-08	-----	-----	-----

4	Apr-08	-----	-----	-----
5	May-08	-----	-----	-----
6	Jun-08	161	71	44.10
7	Jul-08	160	89	55.63
8	Aug-08	227	137	60.35
9	Sep-08	97	50	51.55
10	Oct-08	74	35	47.30
11	Nov-08	79	31	39.24
12	Dec-08	-----	-----	-----
	Total	798	413	51.75



Systematic Position

Stenophora Sp.

Domain: Eukaryota

Kingdom: Protozoa Goldfuss, 1818, Rown, 1858

Subkingdom:- Biciliata

Infrakingdom - Alveolata Cavalier & Smith, 1991
 Phylum - Myxozoa
 Sub-Phylum - Apicomplexa Levine, (1970)
 Class - Conoidasida Levine, 1988
 Subclass - Gregarinasina -Lankester, (1866)
 Order - Eugregarinorida Léger, 1900 or
 Eugregarinida - Doflein, (1901)
 Suborder - Septatina - Delage and Herouard, (1896)
 Super family - Stenophoricae Levine, 1984
 Family - Stenophoridae Léger & Duboscq, 1904
 Genus - Stenophora - Labbe, (1889)
 Species - *S. mnuthunjayi*
S. indica (n. sp.)
 Genus - Stenophora, (Labbe, 1899)

Literature survey on the cephaline gregarines from the millipedes reveal that Leidy (1849a, 1853) was the first to report the occurrence of *Gregarina larvata*, *G. julimarginati* and *G. julipusilli* from *Julus* sp. Lankester (1863) considered these three gregarines as polymorphic forms of a single species, *Gregarina juli*. This species was later included in his newly created genus *Stenocephalus* by Schneider (1875).

Labbe (1899) after studying some gregarines from the millipedes (Julidae) renamed the genus *Stenocephalus* Schneider as *Stenophora*. He established the generic characters of this new genus which are as follow:

- (1) Sporont and trophozoites are solitary.
- (2) Sporont's body consists of two parts: protomerite and deutomerite.
- (3) Cyst formation by pairing of two sporonts and dehiscing by simple rupture.
- (4) Sporocysts liberated singly, possessing an episore and with or without an equatorial line.
- (5) Early developmental stages intracellular.

Some additional characters of taxonomic importance were brought to light by the following workers.

Crawley (1903a, 1903b) emphasized the importance of the proportion of the protomerite length to the total body length which Leger and Duboscq (1903, 1904) expressed into PL:DL ratio. Apart from this the later authors stressed the systematic value of shape of the protomerite

and shape and size of the nucleus. They created a new family stenophoridae to include the genus Stenophora, Labbe.

Ellis (1912c, 1913a, b) recording four new species of Stenophora emphasized the importance of ratio of width of the protomerite and width of the deutomerite (PW/DW). Later, Watson (1915, 1916) reviewed all the gregarines of the genus Stenophora. She emphasized the following features of specific importance.

- (1) Presence or absence of papilla at the tip of the protomerite.
- (2) Presence or absence of the epimerite.
- (3) Presence or absence of the 'apical pore' or 'apparent pore' at the apex of the protomerite of the sporont.

Pinto (1990) described six species of Stenophora from diplopodes belonging to the genus Rhinocricus in Brazil as on next page.

Ray (1933) and Chakravarty (1934, 1936) adding to our knowledge of the life history of the Stenophora species threw light on the hyaline nature of the epimerite.

Karandikar and Rodgi (1955) apart from describing some new species of Stenophora worked out the detailed life history of these species along with other species belonging to genera Hyalosporina, Chakravarty & Monoductus Ray and Chakravarty, these authors have emphasized the inclusion of following additional points for taxonomic considerations.

- (1) Protomerite variable in form, may be bell-jar like, dome shaped, bulbous, bottom shaped, conical or biconvex. It may be hyaline or Steined, fully or partially, in the permanent preparations, with respect to the density of the endoplasmic granules.
- (2) Nucleus variable in form and position. It may be spherical, ovoidal, ellipsoidal, spindle shaped or falciform. The nucleus may be located anteriorly centrally or posteriorly.
- (3) PL: DL and DW ratios variable and are of specific importance.

Other contribution have come from workers like Hukui (1950, 1952), Tuzet and manier (1954), Ganapati and Narasimhamurti (1956, 1959), Tuzet et al. (1957), Rodgi and Ball (1961), Theodorides, Desportes (1963) and Lipa and Stachurska (1968). Since the establishment of the genus Stenophora Labbe about fifty species appear to have been recorded. The chronological list of these parasites along with their hosts as well as localities is given in the chart.

Stenophora mruthunjayi Rodgi and Amoji, (1969)

The species, Stenophora mruthunjayi (Rodgi & Amoji, 1969) is found in gut of millipede host, Trigonulous coralinus in the locality of Nashik district, (M.S.).

Description of the Species

Stenophora mruthunjayi was first described by Rodgi & Amoji (1969) as a new species in *Chondromorpha kelaarti*. Later Gulbhile (2005) had redescribed the same species in the same host. Same species has been redescribed by the present author in the different millipede host *Trigoniulus coralinus*.

The Cephalont

Early cephalont is bottle like, compressed at middle of the body and rounded at both the ends, but triangular posteriorly in some cases. It measures about 40 μ to 55.5 μ in length and 30 μ to 37 μ in width. Body shows protomerite and deutomerite. The protomerite is ball shaped, spherical in shape 6 to 10.5 μ in length and 9 to 12.5 μ in width. The deutomerite is compressed at the middle region in many cases which measures about 34 to 45 μ in length and the width is 30 to 37 μ . The nucleus is roughly rounded 5 to 7.5 μ in diameter located at posterior side of the deutomerite.

The Early Sporont

The early sporont is cylindrical and elongated in shape. Anterior end is with inverted bowl shaped protomerite which is similar to the protomerite in mature sporont. The length of protomerite is 7 to 14.5 μ and the width is about 9 to 15 μ . The nucleus is rounded placed at the middle of the deutomerite which measures about 9 to 11 μ in diameter.

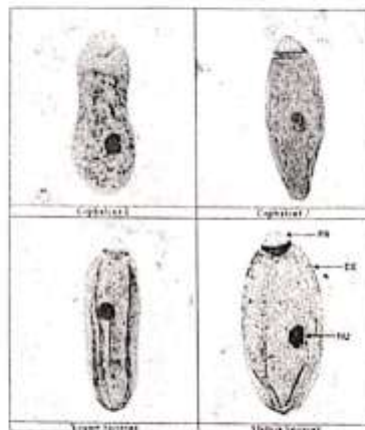
The Mature Sporont

A mature sporont is slightly elongated and egg shaped in its general body shape. Anterior end is slightly broader than the posterior. It is relatively small gregarine, measures about 70 μ to 125 μ in length and 37.5 μ to 65 μ in width.

The protomerite of the adult sporont is bell shaped ("hood shaped" in of *C. kelaarti*, Gulbhile 2005) being broad at $\frac{1}{3}$ rd distance from the septum with a clear indentation in the middle. An apical pore is clearly seen at the tip of the protomerite. The protomerite is broader than its length. The length is 10-17.5 μ and its width 15-25 μ .

The deutomerite is elongated, broad and egg shaped. It includes spherical nucleus which is usually located in the middle of the deutomerite it measures about 10 to 12 μ in diameter. Both anterior and posterior end of the body are slightly tapering.

Plate No. 1



Comments

After the comparison of this gregarine species with the earlier described *Stenophora* species in millipedes (*Chondromorpha kelaarti*), present author concluded that the species is *S. Mruthunjayi* which is already described by Rodgi and Amoji (1969) and Gulbhile (2005). There are some minor differences between these three species (Rodgi – Amoji, Gulbhile and present author).

The present species shows the close similarity *S. Mruthunjayi* (Rodgi-Amoji and Gulbhile) than the previously described species of genus *Stenophora*.

The body shape and size is much larger in *S. ellipsoidal* (Chakraborty, 1934), *S. papillata* (K. & R, 1935), *S. conjugata*, (1961), *S. akiyoshiensis* (Hyoma 1969), and *S. bristili* (Bhandari, 2010), it is leaf like in *S. mahabaleshwari* (Amoji and Rodgi 1972), ovate in *S. mruthunjayi* (Gulbhile 2005). The body of present species is egg shaped, broad anterior end and slightly taper posterior end shows the similarity to *S. mruthunjayi* (Gulbhile, 2005).

The epimerite of sporont is ball like in *S. papillata* and *S. conjugata*, rounded in *S. ellipsoidal*; dome shaped in *S. mahabaleshwari*, the epimerite is not seen in sporont of present species.

Protomerite is bottle shaped in *S. ellipsoidal*; button like in *S. papillata*, ball and knob like in *S. cassidiformis*, dome shaped in *S. conjugata* and *S. akiyoshiensis*, pot shaped in *S. mahabaleshwari* and bell shaped in the present species. It measures about 10 to 25 μ in length and 15 to 25 μ in width in *S. mruthunjayi* (Gulbhile, 2005), semioval and bulbous in *S. Bristili*.

(Bhandari, 2010). The protomerite of the present species is broader than length, measures about 10 to 17.5 μ in length and 15 to 26 μ in width, matches with the Gulbhile's species.

The deutomerite is elongated and broad in present species, measures about 70 to 115 μ in length and 37.5 to 65 μ in width, which is closely similar to the Gulbhil's species (*S. mruthunjayi*).

The nucleus is elliptical in *S. ellipsoidal* and *S. akiyoshiensis*, spindle shaped in *S. papillata*, boat shaped in *S. cojugata*, oval in *S. mahabaleshwari*, and *S. bristalli*. The nucleus is oval, located middle to anterior half of deutomerite in *S. mruthunjayi* (Gulbhile). In the present species the position and the size of the nucleus are again shows similarity to the *S. mruthunjayi* (Gulbhile 2005).

After the comparison of the present species with previous species it is seen that the species is very close to Gulbhile's species, so it is considered as *Stenophora mruthunjayi* and redescribed here, only their hosts are different.

Table No. 3.

Table 29 - Comparison of the present species with the species of *Stenophora*.

No.	Particular	<i>S. ellipsoidal</i> (Bhandari 2010)	<i>S. papillata</i> (K. and K. 1972)	<i>S. cojugata</i> (1962)	<i>S. akiyoshiensis</i> (S. S. 1972)	<i>S. mahabaleshwari</i> (S. S. 1972)	<i>S. bristalli</i> (S. S. 1972)	<i>S. mruthunjayi</i> (Gulbhile 2005)	<i>S. mruthunjayi</i> (Present work)
1	Protomerite	10 to 17.5 μ long, 15 to 26 μ wide	10 to 17.5 μ long, 15 to 26 μ wide	10 to 17.5 μ long, 15 to 26 μ wide	10 to 17.5 μ long, 15 to 26 μ wide	10 to 17.5 μ long, 15 to 26 μ wide	10 to 17.5 μ long, 15 to 26 μ wide	10 to 17.5 μ long, 15 to 26 μ wide	10 to 17.5 μ long, 15 to 26 μ wide
2	Deutomerite	70 to 115 μ long, 37.5 to 65 μ wide	70 to 115 μ long, 37.5 to 65 μ wide	70 to 115 μ long, 37.5 to 65 μ wide	70 to 115 μ long, 37.5 to 65 μ wide	70 to 115 μ long, 37.5 to 65 μ wide	70 to 115 μ long, 37.5 to 65 μ wide	70 to 115 μ long, 37.5 to 65 μ wide	70 to 115 μ long, 37.5 to 65 μ wide
3	Nucleus	Elliptical	Spindle shaped	Boat shaped	Oval	Elliptical	Spindle shaped	Oval	Oval
4	Position of Nucleus	Middle to anterior half of deutomerite	Middle to anterior half of deutomerite	Middle to anterior half of deutomerite	Middle to anterior half of deutomerite	Middle to anterior half of deutomerite	Middle to anterior half of deutomerite	Middle to anterior half of deutomerite	Middle to anterior half of deutomerite
5	Size of Nucleus	10 to 17.5 μ long, 15 to 26 μ wide	10 to 17.5 μ long, 15 to 26 μ wide	10 to 17.5 μ long, 15 to 26 μ wide	10 to 17.5 μ long, 15 to 26 μ wide	10 to 17.5 μ long, 15 to 26 μ wide	10 to 17.5 μ long, 15 to 26 μ wide	10 to 17.5 μ long, 15 to 26 μ wide	10 to 17.5 μ long, 15 to 26 μ wide
6	Host	Millipede	Millipede	Millipede	Millipede	Millipede	Millipede	Millipede	Millipede
7	Location	Karnataka	Karnataka	Karnataka	Karnataka	Karnataka	Karnataka	Karnataka	Karnataka
8	Collector	S. S. 1972	S. S. 1972	S. S. 1972	S. S. 1972	S. S. 1972	S. S. 1972	S. S. 1972	S. S. 1972
9	Year	1972	1972	1972	1972	1972	1972	1972	1972
10	Publication	Journal of Zoology	Journal of Zoology	Journal of Zoology	Journal of Zoology	Journal of Zoology	Journal of Zoology	Journal of Zoology	Journal of Zoology
11	Page	96-99	96-99	96-99	96-99	96-99	96-99	96-99	96-99
12	Figure	Fig. 1-4	Fig. 1-4	Fig. 1-4	Fig. 1-4	Fig. 1-4	Fig. 1-4	Fig. 1-4	Fig. 1-4
13	Table	Table 1	Table 1	Table 1	Table 1	Table 1	Table 1	Table 1	Table 1
14	Figure	Fig. 1-4	Fig. 1-4	Fig. 1-4	Fig. 1-4	Fig. 1-4	Fig. 1-4	Fig. 1-4	Fig. 1-4
15	Table	Table 1	Table 1	Table 1	Table 1	Table 1	Table 1	Table 1	Table 1
16	Figure	Fig. 1-4	Fig. 1-4	Fig. 1-4	Fig. 1-4	Fig. 1-4	Fig. 1-4	Fig. 1-4	Fig. 1-4
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