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Fish Health Maintenance in Aquaculture and Prevention and Control of Infectious Disease of Fish

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Abstract

Aquaculture is rapidly growing part of agriculture worldwide. The relationship between microorganisms and fish can be either mutualistic or pathogenic. In the majority of cases, fish diseases caused by pathogenic bacteria are among the most prevalent epidemics in the aquaculture industry. It makes up around 53 percent of total fish production globally. This increased growth of production is achieved despite facing many challenges in the aquaculture environment. Among production limiting challenges, the infectious disease takes the lion share by causing multibillion-dollar loss annually. To reduce the impact of the fish disease, it is necessary to address health constraints based on scientifically proven and recommended ways. This review aims at pointing out some of the best approaches to prevention and control of infectious disease in aquaculture. Among the effective prevention and control strategies, vaccination is one of the key practices. Types of vaccines for use in fish include attenuated vaccines, DNA vaccines, recombinant technology vaccines whole killed vaccines, peptide subunit, recombinant protein, attenuated vaccines, and synthetic peptide vaccines. Administration techniques of vaccines in fish include oral, injection, or immersion methods. Antibiotics are also in use in aquaculture despite their side effects in the development of drug resistance by microorganisms. Chemical and Biological disease control strategies such as using Medicinal plants probiotics and prebiotics are widely in use. Biosecurity measures in aquaculture can keep the safety of a facility from certain disease-causing agents that are absent in particular system. Farm-level biosecurity measures include strict quarantine measures, egg disinfection, traffic control, water treatments, clean feed, and disposal of mortalities. In conclusion, rather than trying to treat every disease case, it is advisable to follow a preventive approach before the event of any disease outbreaks. With the rapid development of technology, products, and techniques, the identification of the causative agents and the development of new therapies are no longer strenuous tasks. Despite these advancements, farm or facility biosecurity followed by good aquaculture practices are still considered effective prevention options than the cure.

Key words: Fish health management, Fish vaccines, Mucosal vaccines, Vaccine administration, Vaccine development.

Introduction

Current efforts to develop vaccines, particularly for aquacultured species, have turned largely to biotechnology because it provides the means to inexpensively produce sufficient quantities of the immunoprotective antigen. Fisheries play a great role in food security and livelihood and are a source of income and social development in developing countries. Recently the sector attracted great attention and it is growing rapidly through the development of aquaculture [1]. New technological advances and increased demands for fish as a source of animal protein are the main reasons for the industry's growth. Because of expansion of the industry, the culture methods have become more intensive for producing higher yields [2]. Aquaculture production of fish makes up forty-four percent of total fish production in 2014 which is 74 million tons of fish worth of 160 billion dollars.

Almost all fish produced from aquaculture is for human consumption.

To overcome losses because of infectious diseases in aquaculture, it is necessary to act upon every health constraint based on scientifically proven and recommended as well as locally applicable ways. Challenges in aquaculture because of climate change, limited water sources, and the growth drive the need for epidemiological approaches in keeping aquatic animal health safe [3]. As "prevention is better than treatment," it is advisable to focus on preventing the occurrence of disease rather than treating it [4]. The uses of improved husbandry/management practices, movement restrictions, genetically resistant stock, dietary supplements, nonspecific immune stimulants, vaccine, probiotics prebiotics, medicinal plant products, water disinfection biological control, antimicrobial compounds, water disinfection, and

control of movement are the best approaches in control of infectious diseases of fish [5].

A single approach to prevention and control of aquaculture health is not successful alone. Rather a combination of different strategies is effective. Setting up a national or regional information exchange between farmers and responsible parties is compulsory. Besides applying all these strategies, surveillance for diseases and having sensitive and specific diagnostic tests are invaluable to assure healthy fish. This review has the aim of summarizing some of the best approaches to prevention and control of infectious disease of fish in an aquaculture environment.

The Role of Vaccines

Advancing vaccination is one of the most important, and probably the priority, approaches to prevention and control of infectious disease of fish. Treating many of the bacterial infections in aquatic animals using antimicrobials only is impossible [6]. There are improvements in fish vaccination recently. Some of the improvements include immunization of large stock at a time and the development of multivalent vaccines [7]. Vaccination is widely in use in almost all food-producing animals. In aquaculture, it reduces the use of antibiotics and protects fish from infectious diseases. It also avoids the risk of drug resistance. Protection at stock level because of herd immunity can be achieved and the need for licensing and registration of new vaccine is much easier than antibiotics [8]. There are few important considerations that should be taken into account before application of vaccination in fish. These considerations include the following points: fish species to be vaccinated, status of the immune system of the fish, production cycle, and life history of the aquaculture system, which diseases need to control in aquaculture, when do these diseases occur (seasonal distribution of diseases in the aquarium), farming technology (handling and mechanization), environment (temperature and salinity), stress factors, nutrition, and cost benefit.

Historical Overview of Fish Vaccination

Fish vaccination was started by vaccinating against *Aeromonas salmonicida* infection in Cutthroat in 1942. Currently, vaccines in use are the conventional type of vaccines because of lack of advanced information on the immunology of fish. Vaccines available are oil adjuvant, injectable vaccines. The salmon genome is now fully sequenced, the genome and several other fish species as well. These findings can lead to novel vaccine development strategies in near future [9]. Vaccines against intracellular bacterial and viral pathogens will be one of the big challenges for the coming years. DNA vaccine will play a role in such cases.

Types of Fish Vaccines

Modern vaccines can be classified as killed, attenuated, DNA, synthetic peptide, recombinant

vector, genetically modified, and subunit vaccines. Whole organism vaccines showed a better advantage than other types of vaccines. However, most of the vaccines do not completely prevent disease.

The antigens are weak in most conventional vaccines that they cannot induce immunity in the recipient. In addition, they may not be easy for development to prevent emerging pathogens, the presence of antigenic shift and antigenic drift, during immune evasion of the host by pathogenic organisms, and microbes which cannot be grown by in vitro propagation, and development of these vaccines is a slow and time-consuming process, which sometimes poses difficulty in timely countering of emerging and reemerging pathogens. That is why advanced technologies of vaccine designing strategies are developed for the discovery of newer types of effective vaccines [10].

A. Attenuated Vaccines

These are also conventional vaccines which are used in food-producing animals and humans to prevent disease [11]. They are prepared by repeated laboratory passage, physical and chemical attenuation of the organisms to lose their virulence without killing them. Laboratory studies have shown the effectiveness of live vaccines in fish. They induce mucosal, cellular, and humoral immunity. Attenuated organism replicates in the target host without any clinical signs.

B. Killed Vaccines

Killed vaccines are conventional types of vaccines prepared by killing the infectious agent and using it as an antigen to induce an immune response. Most of the commercial vaccines currently used in aquaculture are killed vaccine types. The advantages of these vaccines are as follows: they are easy to design, are stable in storage, and are less expensive and there are no virulence issues. Preparation strategy of these vaccines is that they most of the time target the outer surface of microorganisms or inner parts without avoiding the ability to replicate when administered to the host [12]. Infectious hematopoietic necrosis virus, *A. salmonicida*, and *V. salmonicida* are some diseases that can be prevented by killed vaccines.

C. Deoxyribonucleic Acid (DNA) Vaccines

DNA vaccine is designed first by identifying and cloning a protective antigen from the pathogen. For example, for some pathogenic viruses of fish like VHSV and IHNV, protective antibodies are known to be against surface glycoprotein of the viruses. Therefore, the glycoprotein gene and the regulatory sequences that allow expression in eukaryotic cells was an option for the development of DNA vaccines. To administer as a vaccine the plasmid is produced in bacterial culture, purified, and quality-assured. After this process, a DNA vaccine will be administered and taken by cells of the host to produce the glycoprotein. This situation

leads to detection of the antigen by the immune system of the fish .

DNA vaccines in fish have been well studied for salmonid rhabdoviruses IHNV and VHSV. These vaccines have been found to be effective in salmon aquaculture industry to reduce the impact of these viruses. In addition, the two virus DNA vaccines have been also tried for other viral diseases of fish like spring viraemia of carp virus and hirame rhabdovirus. Even though most of DNA vaccines have been developed for viral diseases of fish, DNA vaccine was tried to prevent bacterial kidney diseases of salmon caused by *Renibacterium salmoninarum*. However, this vaccine was not found to be effective [13].

D. Recombinant Vector Vaccines

Recombinant vector vaccines are the result of biotechnological advancement prepared by taking only the immunogenic regions of a pathogen and expressing it in a heterologous host. The immunogenic part of the organism taken and expressed to carriers. The proteins are then produced in large quantities in vitro and then purified for use as a vaccine. Being easy to produce in large quantities of proteins and effectively expressing the antigenic protein are the main factors considered during vector selection. Infectious salmon anemia and infectious hematopoietic necrosis disease viruses have been expressed in vectors as a vaccine to protect salmon [14].

E. Genetically Modified Vaccines

In vitro passaging of organisms results in a build-up of genome mutations that make the organism weaken. Genetically, microorganisms may be attenuated by molecular approaches that involve removal of genes responsible for its pathogenicity. Live attenuated vaccine will replicate to a lower titer and can stimulate humoral and cellular immunity. *Aeromonas salmonicida* in salmon can be prevented by these preparations [14].

F. Subunit Vaccines

When culturing of the organism is difficult, these vaccines become useful by taking immunogenic part and using it as a vaccine. Subunit vaccines are safe for use but their immunogenic nature is very poor compared to inactivated, whole organism vaccines. Adjuvants are therefore needed to improve immunogenicity [15].

G. Synthetic Peptide Vaccines

These types of vaccines are produced from short sequences of amino acids prepared synthetically to act as antigens. These can be used as a suitable antigenic site. Studies showed that vaccinating fish with peptides is less practicable because of lack of understanding the fish immune response to different antigens and being not potent enough and thus requires a carrier molecule [16]. These vaccines have been in use as prevention of infectious disease like nodavirus, viral hemorrhagic septicaemia, rhabdovirus, and birnavirus.

H. Methods of Administering Vaccines to Fish

Successful vaccination depends upon both the development of protective vaccines and their correct use. Besides deciding which diseases to vaccinate is necessary to clearly understand how to administer vaccines and when to administer a booster dose (booster dose) must be considered. For best protection, vaccination should be carried out sometime before exposure to the pathogen, to give immunity plenty of time to develop. Water temperature may be an important factor when deciding when to vaccinate, as well as the size of fish, being the major feature regulating the development of immune competence [16].

I. Immersion Vaccination

When applying immersion, vaccines are applied to the surfaces of the fish. The antigen uptake is via the gills, the skin, and the lateral line. The fish may be dipped for a short period of time in concentrated vaccine solution. The vaccine solution may also be sprayed onto the fish. Immersion vaccination is particularly convenient for small fish and fingerlings, which are impractical to handle for injection; the other advantage is that it causes minimal stress in fish; a solution of vaccine can be reused. Its disadvantages are it is labor-intensive and it is expensive to buy tanks and specialized equipment is required.

J. Oral Vaccination

Oral vaccination is easy to apply and avoids stress in fish. The vaccine is incorporated to the feed during production, or it may be coated with pellets or encapsulated. Oral vaccination is recommended for secondary or booster vaccinations. Disadvantages of oral vaccination include that it may not give a uniform protection and requires a large dose, and it may have additional cost of encapsulation [17].

Injection Vaccination

Vaccination by injection is the delivery method generally resulting in best protection and is the only choice for adjuvant vaccines. The advantages of injecting a vaccine are attaining high protection and needing relatively minimal dose because correct dosage calculation is easy and economical for larger fish, and a multivalent vaccine can be administered. The disadvantages of this administration are as follows: not suitable for small fishes, adhesion formation, stress in fish and feed intake reduction, damage during injection which may cause multiple deaths in fish, and not being administered in very young stock due to immunity development may not be sufficient [18]. Active surveillance involves surveys to know the status of a particular disease in question. Evidence of disease in a specified population, and, in some instances, provides the data to prove that the specified population is free of a specific disease. Results of active surveillance may be biased unless properly designed and analyzed. Appropriate analyses can provide valid measures of

incidence and prevalence of disease in particular area. Its advantages include information better in quality, it is faster and cheaper to collect information than passive surveillance [14].

Importance Diagnostic Tests in Prevention and Control of Infectious Disease in Aquaculture

Diagnosing aquatic animals by the clinical sign is almost impossible because fishes live in water and move fast that make them impossible to visualize closely and inspect them for any clinical deviations. This makes rapid and accurate diagnostic methods to be important for the prevention and control of infectious disease. Diagnostic tests for identification of fish disease include conventional microbiological, immunoserological, and molecular methods. Rapid and accurate molecular-based methods have become important diagnostic tools. Lateral flow immunoassays, DNA microarray, proteins, or glycans can also be immobilized on a solid surface of the microarray to probe different target molecules labeled with fluorescence [19]. In diagnosing disease of fish, the detection of the pathogen in a tissue sample is conducted by lethal sampling rather than detection of antibodies that are an indicator of a particular disease, but in case of high valued fishes like ornamental fish, nonlethal sampling is recommended.

Diagnostic tests are not expected to be 100 percent sensitive and specific. To avoid misclassification, diagnostic test protocols should be selected and interpreted based on their performance under the conditions of use. In the context of biosecurity programs, diagnostic tests are used to detect the emergence and follow the progression of infectious agents in fish stocks. There are four main biosecurity-related objectives for which diagnostic tests are commonly used: to demonstrate freedom from infection in an aquaculture for obtaining or maintaining infection-free certification, to screen fish before introduction to the receiving facility, to detect infected fish as early as possible during a quarantine period, and to confirm suspicious or clinical case [20].

Challenges in Prevention and Control of Fish Disease

In relative terms, it is fair to say that infectious disease control in aquaculture is more complicated than terrestrial animal disease control due to environment where fish lives, and the nature of the fish themselves because fish cannot be observed close enough like we do in terrestrial animal, the environment can facilitate disease transmission quickly, fish are not caged easily without stress, they often gather in groups, and disease is often difficult to detect and characterize [5]. The other important challenge is in diagnosing disease of fish; in terrestrial animal disease diagnosis, the individual animal is the unit of interest. The scenario is not the same in aquaculture disease investigation because of the nature of the water where fish lives. A disease

can transmit quickly and the whole tank may be the source of disease to healthy stock. In this case, the unit of interest is not a single fish rather the whole tank need to be investigated and diagnosed. Samples should be collected not only from fishes but also from water to measure important characteristics like pH, soil bottom conditions, and turbidity which makes aquatic animal diagnosis complicated and challenging [13].

Conclusion

It is important that these issues are addressed as the industry continues to grow globally. Exciting opportunities exist for rapid development of fish vaccines in the future, with continued reduction in cost of technologies (e.g. of whole genome sequencing), regulations changing (e.g. DNA vaccines can now be authorised in Europe), the introduction of novel antigen expression and delivery systems (such as virus-like particles, VLPs), development of novel adjuvants and advancements in the elucidation of basic mechanisms of mucosal immunity. Development of effective mucosal vaccines and optimisation of their delivery will facilitate novel vaccine development, and enable the aquaculture industries in LMIC to use vaccination routinely in the future. In addition, effective use of emergency (autogenous) vaccines will assist in tackling emerging disease challenges. Generally, the use of a combination of immunoprophylaxis, biosecurity measures, and use of only legally approved antibiotics can result in ultimate health protection of fish in aquaculture.

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Effect of Domestic Activities on Water Quality Parameters of Gharni River Dist -Latur, Maharashtra

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Abstract

The present paper deals with the study of domestic activities on water quality parameters of Gharni River Dist Latur. The work was carried on 2022 (January to Dec) . The study of water quality has gained importance in recent years. The healths, hygiene, industrial and agricultural problems of the inhabitants are related with water resources of the surroundings. In the present study the Physico-chemical parameters were monthly analysed for a year. The parameters like water temperature, conductivity and turbidity, total dissolve solids, pH, dissolved oxygen, B.O.D and phosphate.

Key words -: Domestic activity, Water quality, Gharni River.

Introduction

An ecosystem is a mixture of biotic and abiotic components in a harmonious manner thus maintain population and healthy communities of interacting organisms. Any extraneous influence shifts this balance and variation appears through either changes in abiotic or biotic or both seasonal fluctuations of various physic-chemical factors mediated due to various factors like morphometry etc and plays important role in distribution, periodicity, quantitative composition of biota in aquatic ecosystem.

Before this many workers does the work on physic-chemical changes of various water bodies like Kumar (1983), Walia (1983), Ruttner (1953),. The present work was studied one year i.e. 2022 (January to December).

Materials And Methods

The samples were collected from Gharni river at two sampling stations (A and B) . A stations near Bori, B station near Ujed during the period of one year. The samples were brought to the laboratory and analysed. The samples analysed for conductivity, turbidity, TDS,pH, D.O. , B.O.D. , and phosphate. The temperature and pH were recorded on the site. The samples were collected in two liter plastic bottles during

morning and analysed according standard method given APHA (1985).

Result And Discussion

- 1. Temperature-:** It is measured on the spot with the help of thermometer. The water temperature shows higher values at station A and Station B because station A and B receives domestic waste from the locality. Biodegradation of organic wastes also increase the water temperature.
- 2. Conductivity-:** It depends upon the pollutants discharged in the river more types of sewage discharge results in to more conductivity similar reports have also been from Zaffer Javed (1991) in Godavari River.
- 3. Turbidity-:** Due to discharge of domestic and agricultural wastes turbidity of the river more similar results observed by Sharma and Pandey (1098) in Ram Ganga River Muradabad.
- 4. Total Dissolved Solid-:** In the present study increased values of T.D.S. were noted at station because in the month of summer less flow of water may be responsible to increase concentration of pollutants where as during rainy season flooded river diluted most of the pollutants might be the cause of reduced

level of T.D.S. similar finding have been reported Mohanta and Patra (2000).

5. **pH:-** It was measure on the spot by pH meter. The pH values were recorded highest at station A due to discharge of domestic wastes than station B.
6. **Dissolved Oxygen:-** The higher values were recorded at A and B, The increase temperature is responsible for B.O.D. at station B than A may be due to addition of organic matter in water due to domestic activity.
7. **Phosphate:-** Its higher values were recorded at A and B due to significant source of pollution at station A.

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Effect of 2, 4, D on Seed Germination and Plant Growth of *Sorghum cernnum*, *Triticum aestivum*, *Vigna radiata* and *Cicer arietinum*

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Abstract

Presoaking is an ancient treatment to increasing seed germination and plant growth index. This treatment was used to examine the seed germination and plant growth index of four crop seeds i. e. *Sorghum*, *Triticum*, *Vigna* and *Cicer*. Seeds of these four crop presoaked in 000 consider as control and 500, 1000, 1500 and 2000ppm concentration solution of 2, 4, D for constant period of 4 hour. It was shown that there was decline germination % in all four crops except *Sorghum* 1500ppm solution. *Sorghum* gave best response in plant growth index in all four concentration. *Triticum* was found insignificant to increase plant growth and other parameters except 1500ppm solution. In *Cicer* increased the plant length in 1500 and 2000ppm solution and the number of leaves were increased statistically in all four concentrations as compare to control.

2, 4, D as it shows significant decrease in the germination. It is found inhibitory. Because 2, 4, D is an herbicide it might have shown the inhibitory effect on the metabolism. It is found effective in *Cicer* to increase number of leaves.

Key words: Germination, 2, 4, D, *Sorghum*, *Triticum*, *Vigna* and *Cicer*.

Introduction

2, 4-D plays an important role in the metabolisms. Previously many investigators were used it as growth stimulatory hormone various supplementary MS medium in tissue culture. Though its main role is herbicide but earlier it is used as growth promoting hormone. Williams and Leonard, (1959), observed the effect of 2, 4-D on Rose clover seed germination. The Amine and ester are the formulations of 2, 4-D did not reduce the germination of seed of rose clover when applications made during and early bud stages. But the seed and forage yields were reduced by both formulations. The ester formulation found more toxic than amine. Both when applied during bloom stage the germination and seed production were decreased drastically and when applied during seeds were ripe it was found effective.

Moffett *et al* (1980) studied the effect of 2, 4-D spraying on cotton. In cotton crop the honey bees are visit to flower and help to produce hybrid variety. In the sense of increase in nectar concentration in the flower 2, 4-D 1 ppm / 187 L water was sprayed on crop at the beginning of bloom increased the volume of floral nectar. And higher concentration found to crop and when plants started to flowering the spraying 2, 4-D was found more effective to increase the volume of nectar. But

1ppm concentration was not found effective to increasing the cotton yield and sugar concentration of Flower.

Result might be different when bees are not visiting to flowers. But application of 2, 4-D could not affect germination or weight of seeds produced or caused damage to seedling grown from the sprayed plants.

In 1969 Maum and Cavers studied the effect 2, 4-D on spraying on Curly Dock. He noted that the lithium salt of 2, 4-D in (1000 ppm) concentration was sprayed on Curly Dock (*Rumex Crispus* L.) 12 days before anthesis, at anthesis 7 days after anthesis and 34 days after anthesis. He found that the treatment of 12 days before anthesis was completely prevented the formation of viable seeds 2% seeds had minute embryos after treatment at anthesis but even the seeds did not germinate. Embryos were present 91% of the seeds from the plant treated 7 days after anthesis. Thus embryos ranged from 0.5 to 2.5 mm. the total weight of seeds obtained was significantly less than the control and only 5 to 15 % of these seeds were capable of germination. Spraying the inflorescences 34 days after anthesis did not affect the number of seeds produced or seed viability. Almost all plants remained alive after the harvest.

Hsueh, Lou (1947) noted that when 2, 4-D was applied as 1000, 2000 and 3000 ppm and 5000

ppm concentration on soil before the seeds sowing. The 3000 ppm concentration was found effective to control the barnyard weed. But the higher concentration 5000 ppm was more effective to prevent the growth of barnyard weed. Beside PGRs and other growth regulators physiologists also gave stress on micronutrient role in plant growth metabolism. Some workers recorded the effect of micronutrients.

Govil *et al* (1983), observed the effect of argon+ laser light and seed soaking treatment on green gram seed. For that experiment they put the seeds in a dark room under Argon+ laser light for (0, 1, 2, 5, 10 and 40 min) respectively and immediately soaked in distilled water, after 12 hours were grown under natural light condition 25⁰ C for 7 days. They observed that the shoot length and root length were increased upto the time of 5 min, but it was decreased as the time was increased. Chlorophyll content RNA, DNA and protein contents are significantly increased in 5 min. exposure, prolonged exposure showed decreased values. Total inhibition was recorded in 40 min exposure. They concluded that 5 min exposure of seeds to argon+ laser increased the morphological and biochemical parameters of in *Vigna radiata*.

Sing and *et al* (2003) observed the effect of lead on growth and nitrate assimilation of *Vigna radiata* (L.) Welczek seedlings in a salt affected environment. They observed that when seeds of green gram were showed drastic increasing in seedling growth and nitrate assimilation when seeds are exposed in 1.0 mM lead solution and 6 Ec NaCl solutions. The higher endogenous Na⁺ levels were

Material And Method

The chemicals were purchased from Unik Agro –Chemical Stores, Kolhapur. Seeds of green gram, gram, wheat and jowar were obtained from Naldurg market Ta. Tujapur, Dist. Osmanabad (Marathwada, Maharashtra). Ten seeds of each crop was taken and their dry weight was taken on Electronic balance in Laboratory. The seeds of each

accumulated in the roots and leaves of seedlings in presence of the two stresses. But the levels of endogenous lead get reduced in presence of NaCl in both roots and

shoots. Roots accumulated more pb²⁺ and Na⁺ than the leaves. The two stresses affect synergistic manner during the early growth phase of the seedlings.

Choudhari and Kar, (2008), demonstrated the effect of Propyle Gallate, Hydrogen peroxidase and Ethylene in *Vigna radiata*. In their experiment they soaked the seeds in 1, 10, and 50mM in propyle gallate and in 10 mM and 50 mM sucrose solution and in water solution for a different period 6, 8, 10 and 12 hours respectively and also combined solution of propyle gallate and Hydrogen peroxidase. They observed that higher concentration of propyle galcate (10 and 50 mM) caused total inhibition even after 48 hours. In cross check sucrose solution the 100% germination was recorded in sucrose solution where as fresh and dry weight also good in sucrose and water solution. When seeds were pretreated with propyle gallate and transferred in to water the germination also lower then control. In combined treatment of propyle gallate and Hydrogen peroxidase show 70 % germination Hydrogen peroxidase was found to be effective in all aspects of seed germination in *Vigna radiata*. In combination of Ethylene and PG and triple combination PG, ethylene and hydrogen peroxidase the germination rate was same to control rate. They suggested that the inhibition of propyle gallate could be possible by the recovery of ethylene and hydrogen peroxidase.

variety was presoaked in 2, 4-D, solution of 000, and 500, 1000 1500 and 2000 ppm concentration for a constant period of four hours under room temperature. Then seeds were removed from chemicals and soaked in 1% HgCl₂ solution for five mints to avoid fungal infection.

Sr. No	Conc.	No of Seeds	Dry wt. of Seeds (gm)	% of Germination	Plant length	Shoot length	Root length	No. of leaves	Fresh wt. (gm)	Dry wt. (gm)
1	0	10	0.59	60	27.41	6.56	20.85	6	3.72	2.61
2	500	10	0.55	70	34.82	8.94	25.88	6	2.90	1.68
3	1000	10	0.46	40	28.47	6.85	21.62	6	1.61	0.98
4	1500	10	0.61	80	33.26	9.23	24.03	6	3.10	2.09
5	2000	10	0.49	40	35.77	7.30	28.47	6	1.15	0.89
SD			0.064	17.889	3.784	1.228	3.121		1.075	0.732
SE			0.029	8.000	1.692	0.549	1.396		0.481	0.327
C										
D			0.080	22.241	4.704	1.527	3.880		1.337	0.910

Table no. 01- effect of 2, 4 -D on seed germination of *Sorghum cernuum*

Seeds then sown in 12x21 cm polythene bags which were poured in black soil ,then kept in 5x5M randomized plots in Arts ,Commerce and Science, College, Ladies Hostel Campus, Naldurg. The experiment was repeated in four replicates. The irrigation was done according to the need .The seeds soaked in distilled water for a period of 4 hours was consider as control. The germination was recorded after seven days. The shoot length, root length, fresh weight, number of leaves and dry weight were measured after 30 days. The same experiment was repeated with different combinations of PGRs and other chemicals. Data from each experimental stage were analysed separately by an analysis of variance and means compared with control experiment.

As per the table no. (01), it shows that the germination was decreased significantly as per the

increase in the concentration, but it was better than control. Plant length and root length were significantly increased in 500, 1500 and 2000 ppm concentration respectively. Shoot length was significantly increased in at concentration of 500 and 1500 ppm, root length was grater that shoots length. While number of leaves and biomass was no show any significant variable difference as compared with control.2, 4-D as it show significant decrease in the germination, it is found inhibitory for germination. Because 2, 4-D is a herbicide and it might have shown inhibitory effect in germination. But it shows best in stimulated growth of plant length, shoot, length and root length at low concentration. The similar result was not recorded previously.

Table no. 02- effect of 2, 4 -D on seed germination of *Triticum aestivum*

Sr. No.	Conc.	No of Seeds	Dry wt. of Seeds (gm)	% of Germination	Plant length	Shoot length	Root length	No. of leaves	Fresh wt. (gm)	Dry wt. (gm)
1	0	10	0.53	70	32.52	6.32	26.02	6	1.85	0.90
2	500	10	0.49	20	23.25	3.08	19.45	6	0.98	0.50
3	1000	10	0.55	40	30.42	5.45	24.97	6	1.23	0.73
4	1500	10	0.47	40	39.97	7.08	32.17	6	1.48	0.88
5	2000	10	0.00	00	0.00	0.00	0.00	0	0.00	0.00
SD			0.230	26.077	15.312	2.875	12.329		0.698	0.373
SE			0.103	11.662	6.848	1.286	5.514		0.312	0.167
CD			0.286	32.421	19.037	3.575	15.328		0.868	0.463

It was found that the germination was found to be decrease as per the increase in the concentration, plant length was moderate as a result of treatment, shoot length, root length, number of leaves and dry weight were not show any significant difference. 2, 4-D as it shows the significant decrease in the

germination of wheat seeds. It is found inhibitory. Because it is a herbicide and it might have shown the inhibitory effect on the metabolism. The results were obtained in present study were not recorded previously.

Table no. 03- effect of 2, 4- D on seed germination of *Vigna radiata*

Sr. No.	Conc.	No of Seeds	Dry wt. of Seeds (gm)	% of Germination	Plant length	Shoot length	Root length	No. of leaves	Fresh wt. (gm)	Dry wt. (gm)
1	0	10	0.51	40	28.65	16.55	12.10	7	6.85	4.08
2	500	10	0.61	20	36.70	9.30	27.40	6	1.87	0.95
3	1000	10	0.56	60	22.40	8.80	13.96	6	4.65	2.78
4	1500	10	0.47	40	26.62	7.25	19.37	6	4.25	2.52
5	2000	10	0.55	20	26.55	7.4	19.15	6	2.05	1.82
SD			0.053	16.733	5.275	3.842	5.956		2.057	1.164
SE			0.024	7.484	2.359	1.718	2.664		0.920	0.520
CD			0.066	20.804	6.559	4.777	7.405		2.557	1.447

It show the % germination was significantly decreased as per the concentration was increased. Plant length and root length was found insignificant

but it was significantly increased in at 500 ppm concentration, shoot length ,number of leaves and

dry weight were did not show any significant difference.

2, 4-D as it show the significant decrease in % germination of green gram seed. It is found inhibitory because 2, 4-D is an herbicide and it might have shown the inhibitory effect on metabolism. The result obtained in present study was not recorded previously.

Table no. 04- effect of 2, 4 -D on seed ermination of *Cicer arietinum*

Sr. No.	Conc.	No of Seeds	Dry wt. of Seeds (gm)	% of Germination	Plant length	Shoot length	Root length	No. of leaves	Fresh wt. (gm)	Dry wt. (gm)
1	0	10	1.83	50	35.50	12.50	23.00	15	2.50	1.75
2	500	10	1.62	10	31.08	11.05	20.03	19	2.35	1.25
3	1000	10	1.71	10	39.02	13.06	25.60	21	2.54	1.20
4	1500	10	1.6	10	37.01	12.08	24.30	23	2.25	1.30
5	2000	10	1.59	10	32.00	10.70	21.30	21	2.65	1.25
SD			0.101	17.889	3.346	0.987	2.238		0.158	0.226
SE			0.045	8.000	1.496	0.441	1.001		0.071	0.101
CD			0.126	22.241	4.160	1.227	2.783		0.197	0.281

As per the table no. (4) The effects of 2, 4-D on seed germination of gram .It was found to be that the % germination was decreased as per the Concentration was increased in concentration. Plant length was moderate as a result of treatment, the root length and shoot length did not show any significant difference, while biomass was not variable when compared with control. But number of leaves show variation, there was increase the number of leaves 4, 6, 8, and 6 in 500, 1000, 1500 and 2000 ppm concentration respectively. When compared to control. 2, 4-D as it shows significant decrease in the germination .It is found inhibitory. Because 2, 4-D is a herbicide it might have shown the inhibitory effect on the metabolism.

The similar results also reported by Sakdev (1996), she found poor response of red gram of IAA on in red-gram seed germination.

Conclusion

2, 4, D found effective in Sorghum to increasing Plant growth. It was also effective to increasing number of leaves in Cicer. It is inhibitory to increase in seed germination percentage as it is herbicide.

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**Study of Zooplankton Occurrence during monsoon season from Kurnur dam,
Akkalkot**

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Abstract: -

Present study on zooplankton occurrence is carried out at Kurnur dam during monsoon season 2021. The results showed occurrence of three groups of zooplanktons viz rotifers, copepods and cladocerans during investigation of four months (June to September). Changes in Physicochemical parameters exerting its impact on zooplankton distribution. Our results are discussed in light of seasonal fluctuations and their effect on occurrence of zooplankton community.

Introduction

Water quality assessment and bio monitoring involves the analysis of physico chemical parameters and biotic components of aquatic ecosystem. Water quality assessment will highlight water quality, it's status, trends in different physicochemical parameters while biomonitoring deals with biological parameters, their abundance, distribution as well as studying and analyzing changes in water quality related with them. Monitoring of water quality is very much needed for preservation and conservation of freshwater ecosystems. Kurnur dam is a freshwater resource constructed for supply of drinking water as well as for agricultural use for Akkalkot city and surrounding villages. In the recent past due to unprecedented human activities such as bathing, performing rituals along banks of dam, tourism etc. resulted in pollution and exploitation of dam's catchment area. The Kurnur dam also considered as major breeding site for various migratory birds during winter season.

The zooplankton diversity comprises of representative microscopic animals including protozoans, Rotifers, copepods and cladocerans. Freshwater zooplanktons serve as food source for economically important fishes as well as higher vertebrates like aquatic birds. Zooplanktons act as biological indicators as they quickly respond to slight changes in water quality. Dutta *et.al*, (2020) studied seasonal variation in zooplankton density and physicochemical parameters of perennial freshwater body. They noticed 8 species of rotifers, 5 species of copepod, 10 species of cladocera and 3 species of ostracoda. The total zooplankton density is lower than that is 756 ind/L-957 Ind/L than desired value required for fish culture. Manay (2004) studied impacts of eutrophication and chemical pollutants on copepods of coastal zone stated that

dominance of zooplankton groups in shallow water varies due to degree of organic pollution. Sharma *et.al*, (2013) stated that physicochemical states of aquatic body is directly related to biological productivity. Kar *et.al*, (2018) studied physico-chemical aspects and zooplankton diversity of freshwater wetland in Cachar, Assam. Evjemo *et.al*, (2003) noticed that copepods are common members of zooplankton community inhabiting brackish water and meet the nutritional requirement of fish larvae. According to Kurnur *et.al*, (2004) predominance of rotifers and copepods influenced by nutrient availability.

Materials and Methods

The Kurnur dam is constructed in recent years during 1997-2003. The dam is situated between (Lat 17. 62077931⁰ , long 76. 76.204143⁰) Altitude 386 met located 20 kms from Akkalkot city. After the survey of entire dam, three sampling sites were identified and selected, designated as site I to site III. The samples were collected bimonthly for period of 4 months during monsoon season in 2021. For zooplankton collection scientifically designed planktonic net was used. Zooplanktons are identified by using ultra modern zoom microscope. The samples are collected in collection bottles and preservative was added (4% formalin). The abundance and identification of zooplanktons was done by using taxonomic keys by Dhanapati (1975), Edmonson (1959) Kodalkar (1992). Battish (1992), APHA (2005)

Result and Discussion

In present study the detailed microscopic examination of zooplanktons revealed 3 major groups of zooplanktons species viz Rotifers, Copepods and Cladocerans. During June 2021 the zooplankton number org /L at site I of Kurnur dam revealed rotifer number was found to be 35, copepods were 25 and cladocerans number was

20. During July 2021 rotifer number was decreased by 20, copepod number was 15 and cladocera number was 16. In August 2021 both rotifers and copepod showed increase in their number 32 & 140 respectively while cladocera also showed significant increase in their Number. In September 2021 overall all three groups showed low numbers in their occurrence. At site II which is located near Lord Madhadev Temple, where rituals are performed occasionally, The rotifer number varies in between 25-140 org/L during June-September 2021. Copepods number in between 20-135 org/L while cladocera number fluctuated between 8-50 org/L. At site II highest numbers of zooplanktons are recorded. This might be due mixing of nutrient content along with human activities responsible for increase in zooplankton number. The monthly variation at site III revealed that rotifers, copepods

and cladocerans were maximum in August 2021. Their number is reduced in September 2021, while cladocerans were totally absent. Overall monsoon season is exerting negative impact on cladocera group as their number is consistently low throughout monsoon season. Zooplankton number showed gradual increase from June-August while number was decreased from September 2021. At all study sites change in environment parameters and availability of nutrients might be responsible for occurrence of zooplanktons in above said sites.

From Kurnur dam overall rotifers and copepods were representative species which were dominant and contribute zooplankton biomass. Biswas (2015) noticed high number of zooplanktons during monsoon season, during their study rotifer exhibited high species richness and diversity.

Table 1: Monthly variations in zooplankton number (org/L) at Kurnur dam, during monsoon season 2021.

	Rotifer			Copepod			Cladocera		
	S-I	S-II	S-III	S-I	S-II	S-III	S-I	S-II	S-III
June	35	28	10	25	30	14	20	15	12
July	20	18	10	15	20	12	16	18	09
August	32	36	12	140	135	50	70	75	14
September	20	40	8	20	30	08	12	20	0

Conclusion

From our study it is observed that seasonal variations influence zooplanktons abundance and occurrence. Increasing trends in rotifer and copepods underlines quicker response towards changing environmental condition and nutrition availability. Further investigations are necessary with zooplankton diversity especially from various groups for different seasons.

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Antioxidant Potential Of Different Developmental Growth Stages Of Stem Bark And Pods Of *Cassia Fistula* L.

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Abstract:

C. fistula is small, deciduous, medium sized, ornamental, sweet smelling and fragrant tree. It is scattered in different countries like Mauritius, India, Nepal, China, South Africa, East Africa, West Indies, Brazil and Mexico. It possess antitussive, antiviral, antimicrobial, anticancer, anthelmintic, hepatoprotective, insecticidal, antidiabetic, antifertility, laxative, purgative activity. Antioxidant potential of different developmental growth stages of *Cassia fistula* (Caesalpinaceae) stem bark and pod extracted with different solvent such as water, ethanol, methanol was done. Antioxidant potential was determined by DPPH. The DPPH activity in ethanolic and methanolic pulp extracts is greater than aqueous pulp extracts. Thus for the antioxidative compound ethanolic and methanolic medium was suitable for the extraction of *Cassia fistula* bark and pod.

Keywords: DPPH, *Cassia fistula*, antioxidant activity, Medicinal plant

Introduction:

Cassia fistula is sweet smelling and fragrant plant which is originated from the earlier Greek name *Kassia* or *Cassia*. *C. fistula* is small, deciduous medium sized (Edward and Watson, 1993) ornamental (Khare, 2007) tree. It is fast growing tree having height up to 30 to 40 feet and densely moderate, oval, upright, vase shape crown. Kashiwada *et al.*, (1990) showed that because of high concentration of tannins, proanthocyanidins, the DPPH radical scavenging capacity of *C. fistula* stem bark extract was raised. Siddhuraju *et al.*, (2002) investigated the antioxidant properties of 90% methanol extract of *C. fistula* stem bark. Stem bark had more antioxidant activity in terms of inhibition of peroxidation, reducing power, O₂⁻ and DPPH radical scavenging activity. Antioxidants present in the medicinal plants involved to delay oxygen process. They inhibit the polymerase chain reaction initiated by free radicals (Halliwell and Aruoma 1991). Antioxidant defence mechanism present in living organism helps for to remove or repair of damaged molecules (Sun *et al.*, 1998). Synthetic antioxidants are harmful but herbal antioxidants have no side effect (Hou *et al.*, 2003). In the present study The DPPH activity in ethanolic and methanolic pulp extracts is greater than aqueous pulp extracts. Ethanolic 1 month pod shows highest H₂O₂ scavenging potential. Ethanolic extract of different developmental growth stages of pod and stem bark is higher than methanolic and aqueous extracts.

Material and Methods Plant material-

The different developmental growth stages of pods (1 month, 4 month and pulp) and stem bark (young and old bark) of *Cassia fistula* were collected from Akulj. The pods and barks samples were cut into small pieces and oven dried at 60°C. Dried pods and bark samples were grind into powder and stored in air tight plastic container. Oven dried 5g of powdered samples of pod and stem bark were soaked in 100ml distilled water, ethanol. Methanol respectively for 48 hours on shaker then filtered through whatman No.1 filter paper. Filtrate was evaporated by using waterbath. The residue of the extract was dissolved in 50ml of distilled water ethanol and methanol.

i) DPPH (2, 2-diphenyl-1-picrylhydrazyl) radical scavenging activity

The free radical scavenging effect of 1 month old pod, 4 month old pod, pulp and young stem bark and old stem bark of *C. fistula* was assayed in vitro by 1,1-diphenyl-2-picryl-hydrazyl (DPPH) by Koleva *et al.*, (2002) method. Equal volumes of methanolic solutions of DPPH (100µM) and crude extract containing (100µg/ml) were added together. After half an hour the absorbance of the coloured complex was read at 517nm on double beam UV-spectrometer against methanol as blank. The L-ascorbic acid (100µg/ml) was used for positive control. The percentage of DPPH discoloration of sample was calculated by using the formula

$$\frac{(Ac-AE/As) \times 100}{\text{-----}}$$

% inhibition=

Where, Ac

Ac is the Absorbance of control (DPPH),

AE is the Absorbance of DPPH+ plant extract,

As is the Absorbance of standard

Result:

i. DPPH (2, 2-diphenyl-1-picrylhydrazyl) Radical scavenging activity

The DPPH radical scavenging activity of aqueous, ethanolic, methanolic extracts of 1 month old pod, 4 month old pod, pod pulp and young stem bark and old stem bark of *C. fistula* is shown in **fig.1**. The DPPH activity in ethanolic and methanolic pulp extracts is greater than aqueous pulp extracts. It is observed that 4 month old pod also shows higher activity in methanolic, ethanolic and aqueous extracts and young stem bark methanolic, ethanolic and aqueous extracts shows higher activity than old stem bark.

Discussion:

2,2-diphenyl-1-picrylhydrazyl (DPPH) is stable organic free radical proton (Yamaguchi *et al.*, 1998) in its crystalline form but in aqueous solution it becomes more reactive. It contains an odd electron which is responsible for the absorbance at 515-517nm (Brand *et al.*, 1994). Bozin *et al.*, (2008) reported that due to stability in the radical form and simplicity, DPPH radical is used to measure the antioxidant activity. Gadow *et al.*, (1997) states that when absorbance of compound decreases, antioxidant activity increases in terms of hydrogen donating ability. Tissue injury occurs due to extra production of the free radicals (Cross *et al.*, 1987). Due to oxidative injury various disorders like inflammation, viral infections, autoimmune pathologies, digestive disorders, gastrointestinal inflammation are formed (Aruoma, 2003). Antioxidants with free radical scavenging activities play important role to prevent free radical mediated diseases (Hasan *et al.*, 2009).

Plants are the important source of vitamin E, carotene, phenolic acids etc. antioxidants. These antioxidants prevent the disease (Anonymous,

2002). Kavimani *et al.*, (2014) noted that ascorbic acid, tannins, glutathione, flavonoids, cysteine, aromatic amines and tocopherols reduce and due to hydrogen ability DPPH loss its colour.

In the present investigation, different developmental growth stages of pod i.e. 1 month pod, 4 month pod and pulp as well as young stem bark and old stem bark was taken for analyse the DPPH activity. Methanolic extracts of *C. fistula* one month pod shows DPPH radical scavenging activity (40.07 to 75.09% inhibition) was increased in 0.1ml to 0.4ml. 4 month pod and pulp showed maximum DPPH activity as compared to the 1 month pod. Young stem bark showed maximum (15.33 to 79.60%) DPPH radical scavenging activity as compared to old stem bark (12.79 to 66.52%). The standard ascorbic activity showed positive correlation with 4 month pod and pulp. Ethanolic extracts of *C. fistula* one month pod showed DPPH radical scavenging activity (40.14 to 79.40% inhibition) was increased in 0.1ml to 0.4ml. 4 month pod (94.71%) and pulp (9.64%) showed maximum DPPH activity as compared to the 1 month pod as well as bark. Young stem bark showed maximum (62.58 to 88.90%) DPPH activity as compared to old bark (44.56 to 83.13%). The aqueous extract 1 month pod, 4 month pod as well as young stem bark and old stem bark showed maximum activity as compared to pulp (9.97 to 41.44 %). In the present study, methanolic, ethanolic and aqueous extract showed high radical scavenging potential. Thus the different developmental growth stages of pod and stem bark of *Cassia fistula* showed potent antioxidant effect by inhibiting free radicals which will be potent source for the cancer chemoprotective action.

The results of this study show that the methanolic, ethanolic, aqueous extracts are easily available source of natural antioxidants which are useful for pharmaceutical industry.

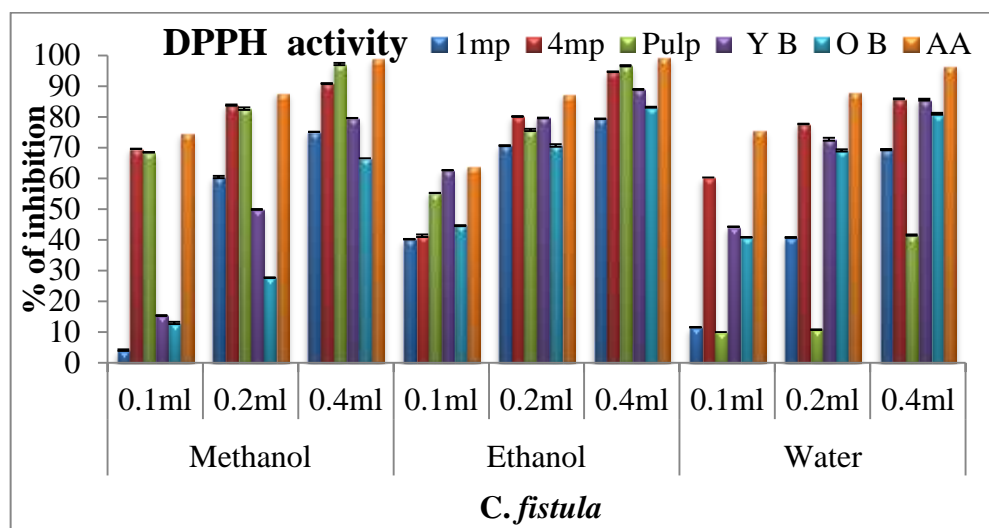


Figure 1: The DPPH radical scavenging activity indifferent developmental growth stages of pod and stem bark of *Cassia fistula*.

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Influence of Vertebrate Hormones on the Biology of Silkworm, *Bombyx mori* (L.)

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Abstract

Hormones are a type of chemical messenger that are released in tiny amounts by one type of tissue and delivered by the blood to a target tissue elsewhere in the body to support a certain biochemical or physiological activity. The presences of vertebrate hormone like compounds in insects and crustaceans have been reported by various scientists. In insects and other vertebrates, the vertebrate hormones promote growth, lipid metabolism, sugar uptake, and cellular internalisation. Previous studies revealed that the vertebrate pituitary extract prolactin and prostaglandins accelerated the growth of silkworm and advancement in the pupation with increased weights of cocoons. Pregnant mare serum gonadotropin (PMSG) and thyroxin hormone shows significant influence on the biology of silkworm. It is also evident that economic characters like cocoon weight, shell ratio, shell weight, filament length and filament weight were increased and the denier value was decreased in thyroid supplemented larvae. Glucocorticoids affect protein catabolism, free amino acids, production of larger amounts of uric acid and increase the output of free fatty acids from adipose tissue etc. The weight of the silkworm larvae significantly increased after topical treatment of cortisone and hydrocortisone, along with other improved larval, cocoon, and adult characteristics. Finally it is concluded that the functional significance of vertebrate hormones on silkworm larvae was evident by this study.

Key words: Silkworm biology, Vertebrate hormones, Economic parameters, Metabolism.

Introduction

Hormones are a type of chemical messenger that are released in tiny amounts by one type of tissue and delivered by the blood to a target tissue elsewhere in the body to support a certain biochemical or physiological activity as well as psychological health. These hormones control various biological functions like growth and development, metabolisms, and reproduction etc. of an organism. Like vertebrates, invertebrates also use various hormones to regulate the processes of growth, development, metabolism etc. Of all the organisms included in the invertebrates, insects are having the most well-studied and developed endocrine system due to their economic and ecological importance.

Prothoracotropic hormone (PTTH) and Ecdysone are the most important hormones that regulate the molting process in insects. Juvenile hormone is one another key hormone that plays a crucial role during the intermolt period of the last larval stage to achieve either the pupal or adult stage of the insect. The Lepidopteran *Bombyx mori* (L.) is a holometabolous insect, passes through four distinct stages namely egg, larva, pupa and adult during its life cycle and used for silk production (yu et al. 2011, Fu et al. 2022). The duration of each stage varies according to the inherited characters of the race, environmental conditions and climate during rearing and the quality of food. The duration of

each stage of the life cycle is longer in the Uni and Bivoltines than in the Multivoltines (Ganga and Sulochana Chetty, 1998).

Influence of Hormones

The growth, development, metamorphosis and reproduction of insects are under control of juvenile hormones (JHs) and ecdysteroids or moulting hormones, secreted by specific endocrine glands, the corpora allata (CA) and prothoracic glands (Gilbert *et al.*, 2000). Administration of juvenile hormone analogous like methoprene showed a highly significant increase in survival percentage, cocoon weight, shell weight and shell percentage (Chaudhuri *et al.*, 1990). Both juvenile hormone analog (JHA) and anti juvenile hormone (AJH) improved the size of the cocoon filament and chemical properties of the cocoon (Tsubio *et al.*, 1988). Anti juvenile hormone had effect on the quantitative characters of the silkworm (Akai *et al.*, 1987). Effects of fenoxycarb on the secretory activity of the prothoracic glands of the silkworm, *Bombyx mori* were investigated (Skarlatos *et al.*, 1996).

Influence of Vertebrate Hormones

A few investigators have made an attempt to investigate the useful effects of various vertebrate hormones on growth, metabolism and economic traits of silkworm, *Bombyx mori* (L.). The presences of vertebrate hormone like compounds in insects and crustaceans have been reported (Lafont, 1991). Hemavathi *et al.* (2002) reported the effect of

thyroxine on the activities of dehydrogenases in silkworm, *Bombyx mori*. Previous studies revealed that the vertebrate pituitary extract prolactin and prostaglandins accelerated the growth of silkworm and advancement in the pupation with increased weights of cocoons (Bharathi and Govindappa, 1987). Effect of pregnant mare serum gonadotropin (PMSG) and thyroxine hormone on the biology of silkworm was studied (Pushparani and Bharathi, 1998). The vertebrate hormones stimulate growth, lipid metabolism, sugar uptake and cellular internalization in insects and other vertebrates (Kramer, 1983). Bhaskar *et al.* (1982) reported that there was an increased trend on the body growth, cocoon crop and fecundity in the silk worm when treated with prolactin. Economic characters like cocoon weight, shell ratio, shell weight, filament length and filament weight were increased and the denier value was decreased in thyroid supplemented larvae (Pushparani and Bharathi, 1998). The dietary administration of vertebrate sex hormones ethynyl estradiol (EE) and norethindrone (NE), on the silk worm, *Bombyx mori* increased the larval weight, cocoon and shell weights, female pupal and adult weights. But the larval, pupal periods and hatchability were significantly reduced (Saha and Khan, 1997).

The effect of topical application with cortisone, hydrocortisone and corticosterone to the silkworm larvae showed significant increase in larval weight along with other enhanced larval, cocoon and adult parameters (Goudar and Kaliwal, 2000; 2001, Rao *et al.*). There are some reports on estrogen hormone effect on early moth eclosion in *Antheria mylitta* by triggering tissue metabolism in advance for pupal-adult transformation, there by controlling the diapause regulatory mechanism (Chaudhuri *et al.* 1996, Shantanu DAS, 2016). The effects of estradiol-17 β on several metabolic parameters in the silk gland of *Bombyx mori* were studied by Keshan and Ray (1998). Keshan and Ray (2001) has studied the evidence for systematic changes in the titer of estradiol 17 β in *Bombyx mori* and its specific binding sites in the posterior silk gland according to the physiological age of V instar larvae. Shen *et al.* (2015) studied the effect of vertebrate estrogen on development of female characteristics of silkworm, *Bombyx mori*.

Conclusion

Finally it is concluded that the functional significance of vertebrate hormones on silkworm larvae was evident by this review. The changes in growth pattern and metabolic modulations might have provided improvement in cocoon quality and quantity in silkworm larvae on the administration of vertebrate hormones which helps the sericulture industry.

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DNA bar-coding of *Drosophila annanase* from Khandesh Region

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Abstract

The *Drosophila* Species from natural habitat of Moolji Jaitha College Campus, Jalgaon was randomly collected with the help of Banana as bait. This species was reared and culture in laboratory conditions in BOD incubator at 23° C fixed temperature on *Drosophila* diet (Hi-media) as food. The Isolated Species was subjected to DNA bar-coding for species specific identification. The DNA bar-coding has granted percent-based identification of animal species by Cox 1 Method at molecular level. The nucleotide chains obtain in Fasta format is put in Blast search engine of NCBI for percent similarity and the species is confirmed as *Drosophila ananassae*.

Key words: Bar-coding, Identification, Nucleotide, Molecular level.

Introduction

The geological time scale, periods, epochs, eras and course of evolution are expressed in mya, which reflect the huge changes and small-scale level changes within the traits of animal species. In those days no such technology was available but still the taxonomist and researcher successfully highlighted the systematic position of each and every species on the basis of paleontological evidences, Biochemical relation and Morphological basis, but the time required was very large and some time it was very difficult for them to analyze the subspecies level. As the time changes and due to modernization and technology the DNA bar-coding came into existence which decline the time required for species identification and differentiation. Now with the help of DNA bar-coding near about 99 to 100 % gene sequence can be analyze with the already present gene sequence for getting closeness to the species and its family members. The Bioinformatics play the important role in aligning the gene sequence with the help of BLAST search engine in various computer based online tools or programmes like NCBI and Fly Base. The Tropical and subtropical regions are considered as good breeding sites for *Drosophila* species. The abundant availability of ripe bananas from Banana City attracts and acts as a food medium for *Drosophila* population. Various varieties in *Drosophila* species are avail depended on the availability of food resources. The North East Khandesh region is well famous for Banana Cultivation, Berries, Giant Brinjal, Cotton and variety of vegetables. The amount of Rain fall is

moderate along with hot summer in which temperature ranges from 40° C to 45° C. Still these species adapt themselves to survive in such geographical region and escape out the adverse climatic conditions.

Certain species of *Drosophila* found in India have been investigated for genetic diversity within the species such as *D. melanogaster*, *D. ananassae*, *D. nasuta* and *D. bipectinata* (Singh 2001, 2013b). However, in India the most extensively studied species from the genetic diversity point of view within the species in the Indian subcontinent is *D. ananassae*. *D. ananassae* was described for the first time in Ambon Island, Indonesia, by Doleschall (1858). Although *D. ananassae* is cosmopolitan in distribution, it is largely circumtropical and frequently found in domestic habitats. It is commonly distributed in the Indian subcontinent but it occurs throughout the year in south, including Andaman and Nicobar Islands and towards the sea coast where climatic conditions are tropical and humid and the occurrence differs from north in this respect. Because of this reason, it is called a circumtropical species although it occurs on all the six biogeographic zones. It belongs to the *ananassae* species complex of the *ananassae* subgroup of the *melanogaster* species group. For genetical studies, *D. ananassae* was used for the first time by Japanese researchers (Moriwaki 1936; Kikkawa 1938). It occupies unique status in the genus *Drosophila* because of certain peculiarities in its cytological and genetical behaviour (Singh 1985a,

1996, 2000, 2010). The common occurrence in the Indian subcontinent coupled with genetic peculiarities attracted the attention of Indian researchers. S. P. Ray-Chaudhuri initiated research on *D. ananassae* in 1940s in Calcutta University and continued it in the Department of Zoology, BHU, where he joined as Professor and Chairman in 1960. Since that time, population genetical work on *D. ananassae* is being continued (Singh 2010).

Varieties of *Drosophila* species are present in North East (khandesh) region of Maharashtra. Yet the biodiversity of fruitfly has to be work upon. No bar-coding analysis has been carried out uptill now at molecular level for identification. So, it has become a priority task for species specific identification by collecting, isolating, rearing, culturing and identifying for records, so that it can be used for future reference to monitor the effects of environment, toxicity substances and its impact on biological system along with genotoxicity effects.

Materials and Methods:

Drosophila adult species were collected from campus of Moolji Jaitha College near Zoology

department from their natural habitat with the help of plastic jars having ripened banana as their bait. Few *Drosophila* adult were collected upto 6-7 in number and culturing in BOD incubator. The fix temperature for their normal growth was adjusted; these flies had shown good growth at 23° C with their metamorphic changes. The isolation process of species was started by allowing the male and female to be mate in bottle with *Drosophila* Diet (Himedia). After completions of several generations, the new colony of *Drosophila* species was separately established and one pair was kept in isolation on the basis of their morphological features. Their culture was maintained and 2 to 3 Adult were sent for molecular level identification for species specificity. This species was sent to Rajiv Gandhi center of Biotechnology Thiruvananthapuram Kerala for DNA Barcoding to identify the *Drosophila* species at specific level and the following protocol was followed for Culturing and Rearing of *Drosophila* species in Laboratory conditions titled "Collection, Handling, and Maintenance: Field to Laboratory" by Pragya Topal, Divita Garg and Rajendra S. Fartyal.

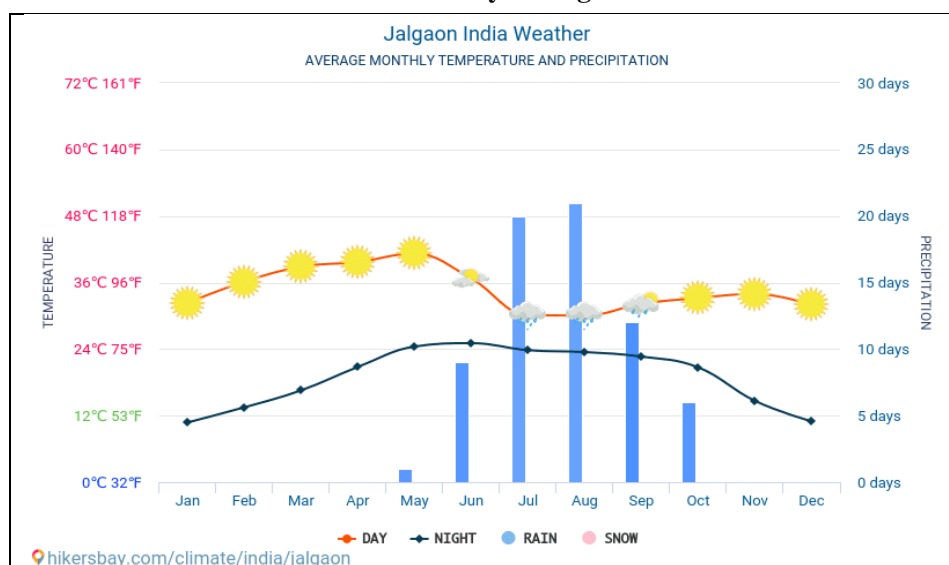
Table.1 Average Monthly temperatures from 2015 to 2021 of Jalgaon District,

	Jan	Feb	Mar	April	May	June	July	August	Sep	October	November	December
Daytime Temperature	33°C	36°C	39°C	40°C	41°C	37°C	30°C	30°C	32°C	33°C	34°C	32°C
Night-time Temperature	11°C	14°C	17°C	21°C	25°C	25°C	24°C	24°C	23°C	21°C	15°C	11°C
Rainy days	0	0	0	0	1	9	20	21	12	6	0	0
Snow days	0	0	0	0	0	0	0	0	0	0	0	0

Average monthly temperatures (day and night) in Jalgaon. Average yearly precipitation (rain and snow) and days of wet weather per month in Jalgaon.

References- <http://hikersbay.com/climate/india/jalgaon?lang=en>

Table.2 Humidity average -51 %



Protocol for DNA Bar-coding DNA Barcoding using universal primers of CO1

I Protocols

Genomic DNA Isolation

Genomic DNA was isolated from the tissues using NucleoSpin® Tissue Kit (Macherey-Nagel) following manufacturer's instructions. Tissues were placed in a 1.5 ml microcentrifuge tube. 180 µl of T1 buffer and 25 µl of proteinase K was added and incubated at 56°C in a water bath until the tissue were completely lysed. After lysis, 5 µl of RNase A (100 mg/ml) was added and incubated at room temperature for 5 minutes. 200 µl of B3 buffer was added and incubated at 70°C for 10 minutes. 210 µl of 100% ethanol was added and mixed thoroughly by vortexing. The mixture was pipetted into NucleoSpin® Tissue column placed in a 2 ml collection tube and centrifuged at 11000 x g for 1 minute. The NucleoSpin® Tissue column was transferred to a new 2 ml tube and washed with 500

µl of BW buffer. Wash step was repeated using 600 µl of B5 buffer. After washing the NucleoSpin® Tissue column was placed in a clean 1.5 ml tube and DNA was eluted out using 50 µl of BE buffer.

Agarose Gel Electrophoresis for DNA Quality check

The quality of the DNA isolated was checked using agarose gel electrophoresis. 1 µl of 6X gel-loading buffer (0.25% bromophenol blue, 30% sucrose in TE buffer pH-8.0) was added to 5 µl of DNA. The samples were loaded to 0.8% agarose gel prepared in 0.5X TBE (Tris-Borate-EDTA) buffer containing 0.5 µg/ml ethidium bromide. Electrophoresis was performed with 0.5X TBE as electrophoresis buffer at 75 V until bromophenol dye front has migrated to the bottom of the gel. The gels were visualized in a UV transilluminator (Genei) and the image was captured under UV light using Gel documentation system (Bio-Rad) (Figure 1).

PCR Analysis

2X Phire Master Mix	5µL
D/W	4µL
Forward Primer	0.25µL
Reverse Primer	0.25µL
DNA	1µL

Primers used

Target	Primer Name	Direction	Sequence (5' → 3')
COX1	LCO	Forward	GGTCAACAAATCATAAAGATATTGG
	HCO	Reverse	TAAACTTCAGGGTGACCAAAAAATCA

The PCR amplification was carried out in a PCR thermal cycler (Gene Amp PCR System 9700, Applied Biosystems).

PCR amplification profile

COX1

98 °C	-	30 sec	
98 °C	-	5 sec	}
45 °C	-	10 sec	
72 °C	-	15 sec	
98 °C	-	5 sec	}
50 °C	-	10 sec	
72 °C	-	15 sec	
72 °C	-	60 sec	
4 °C	-	∞	

Agarose Gel electrophoresis of PCR products

The PCR products were checked in 1.2% agarose gels prepared in 0.5X TBE buffer containing 0.5 µg/ml ethidium bromide. 1 µl of 6X loading dye was mixed with 4 µl of PCR products and was loaded and electrophoresis was performed at 75V power supply with 0.5X TBE as electrophoresis buffer for about 1-2 hours, until the bromophenol blue front had migrated to almost the bottom of the gel. The molecular standard used was a 2-log DNA ladder (NEB). The gels were visualized in a UV transilluminator (Genei) and the image was captured under UV light using Gel documentation system (Bio-Rad) (Figure 2).

ExoSAP-IT Treatment

ExoSAP-IT (GE Healthcare) consists of two hydrolytic enzymes, Exonuclease I and Shrimp Alkaline Phosphatase (SAP), in a specially formulated buffer for the removal of unwanted primers and dNTPs from a PCR product mixture with no interference in downstream applications.

Five micro litres of PCR product is mixed with 0.5µl of ExoSAP-IT and incubated at 37°C for 15 minutes followed by enzyme inactivation at 85°C for 5 minutes.

Sequencing using Big Dye Terminator v3.1

Sequencing reaction was done in a PCR thermal cycler (Gene Amp PCR System 9700, Applied Biosystems) using the Big Dye Terminator v3.1 Cycle sequencing Kit (Applied Biosystems, USA) following manufactures protocol. The Sequencing PCR mix consisted of the following components:

D/W	6.6µL
5X Sequencing Buffer	1.9µL
Forward Primer	0.3µL
Reverse Primer	0.3µL
Sequencing Mix	0.2µL
Exosap treated PCR product	1µL

SequencingPCR amplification profile

96°C	-	2min	} 30 cycles
96°C	-	30sec	
50°C	-	40sec	
60 °C	-	4min	
4 °C	-	∞	

Post Sequencing PCR Clean up

D/W	5 µl
3M Sodium Acetate	1 µl
EDTA	0.1 µl
100% Ethanol	44 µl

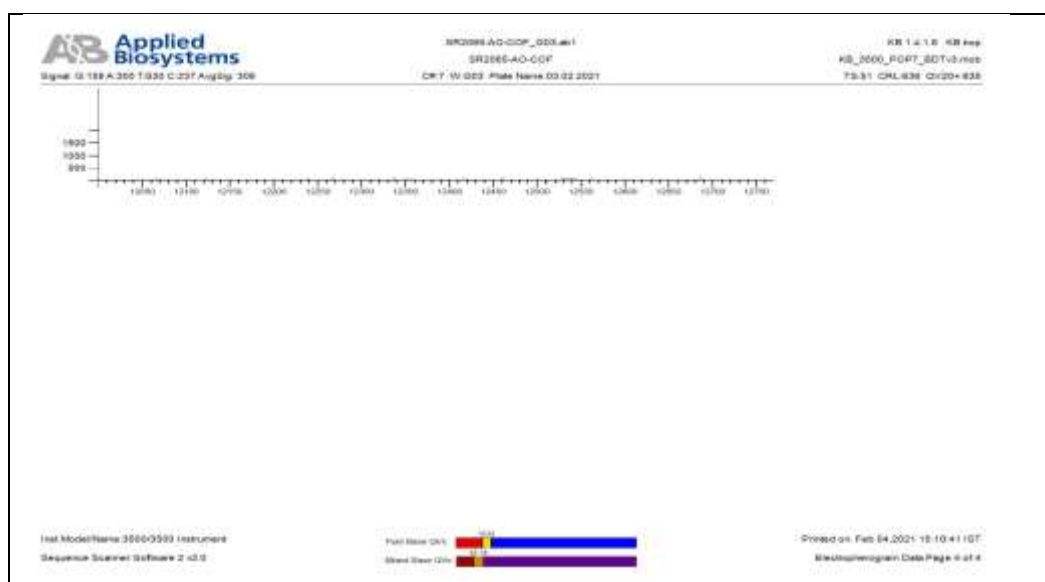
1. Mix D/W, 125mM EDTA, 3M sodium acetate pH 4.6 and ethanol were prepared and were properly mixed.
2. 50 µl of mix was added to each well in the sequencing plate containing sequencing PCR product.
3. Vortex by Mix mate vortex and incubated at room temperature for 30 minutes
4. Spun at 3700 rpm for 30 minutes
5. Decanted the supernatant and added 50 µl of 70% ethanol to each well
6. Spun at 3700 rpm for 20 minutes.

7. Decanted the supernatant and repeated 70% ethanol wash
8. Decanted the supernatant and air dried the pellet.

The cleaned-up air dried product was sequenced in ABI 3500 DNA Analyzer (Applied Bio systems).

Sequence Analysis

The sequence quality was checked using Sequence Scanner Software v1 (Applied Biosystems). Sequence alignment and required editing of the obtained sequences were carried out using Geneious Pro v5.1 (Drummond et al., 2010).



Forward sequence of Fasta Files

>SR2065-AO-COF_G03.ab1

GAAAATTTTTTATTTTTGGAGCTTGAGCTGG
 AATAGTTGGAACCTTCACTAAGTATTTTAATT
 CGAGCTGAATTAGGACACCCTGGAGCTTTA
 ATTGGAGATGATCAAATTTATAACGTTATTG
 TAACAGCACACGCTTTTATTATAATTTTTTTC
 ATGGTTATACCAATTATAATTGGAGGATTTG
 GGAATTGATTAGTTCCTTTAATATTAGGAGC
 ACCTGATATAGCATTCCACGAATAAATAAT
 ATAAGATTTTGATTACTACCCCTGCTCTTT
 CTCTATTATTAGTAAGAAGAATAGTTGAAA
 ATGGAGCTGGTACTGGGTGAACAGTTTACC
 CACCTCTTTCAGCTGGAATTGCTCATGGAGG
 GGCTTCAGTTGATCTAGCTATTTTTTTCATTAC
 ATTTAGCCGGAATTTCTTCAATTTTAGGAGC
 TGTAATTTTATTACAACAGTAATTAATATA
 CGATCAACTGGAATTACTCTAGATCGTATAC
 CTTTATTTGTTTGATCGGTAGTAATTACAGC
 TTTATTATTACTTTTATCTTTACCAGTATTGG
 CCGGAGCTATTACCATATTATTAACAGATCG
 AAATTTAAATACATCATTTTTTTGACCCAGCT
 GGAGGGGGAGATCCAATTTTATACCAACAT
 TTATTTTGATTTTTTTGAGTCACCCTGAAGTT
 AAAACA

Reverse Sequence of Fasta Files

>SR2065-AO-COR_G04.ab1

AAGGATTGGGTATAAATTGGATCTCCCCCTC
 CAGCTGGGTCAAAAAATGATGTATTTAAATT

Table 1 Distribution of *Drosophila ananassae* into their respective subfamilies and tribes on the basis of classification.

Order	Family	Insect	GenBank accession number	Barcode ID
Diptera	Drosophilidae	<i>Drosophila ananassae</i>	OK175852	GBMNE29712-21

Up till now no such record was found from North Maharashtra region related to *Drosophila* species identification by means of DNA bar-coding and taxonomic point of view. This species of fruit fly was randomly collected by means of banana as bait. And culturing was carried out in laboratory conditioned in a cooling incubator at fixed temperature of 23° Celsius. Earlier the temperature was adjusted for Rearing and Culturing, when we got good growth and development along with their survival rate then the stability in temperature was finalized. The temperature of Jalgaon region is showing fluctuation and can increase up to 47.8 C. (118.0 F.) which is the highest one. The humidity up to 50% helps for transformation of metamorphic stages and hatching of larvae from eggs plays a pivot role. The humidity and temperature relationships help and decide the hatching of larvae from eggs. Low temperature and high humidity

TCGATCTGTTAATAATATGGTAATAGCTCCG
 GCCAATACTGGTAAAGATAAAAAGTAATAAT
 AAAGCTGTAATTACTACCGATCAAACAAAT
 AAAGGTATACGATCTAGAGTAATTCCAGTT
 GATCGTATATTAATTACTGTTGTAATAAAAT
 TTACAGCTCCTAAAATTGAAGAAATTCCGGC
 TAAATGTAATGAAAAAATAGCTAGATCAAC
 TGAAGCCCCTCCATGAGCAATTCCAGCTGA
 AAGAGGTGGGTAAACTGTTCAACCAGTACC
 AGCTCCATTTTCAACTATTCTTCTTACTAATA
 ATAGAGAAAGAGCAGGGGGTAGTAATCAAA
 ATCTTATATTATTTATTCGTGGGAATGCTAT
 ATCAGGTGCTCCTAATATTAAAGGAATAAT
 CAATTCCCAAATCCTCCAATTATAATTGGTA
 TAACCATGAAAAAATTATAATAAAAGCGT
 GTGCTGTTACAATAACGTTATAAATTTGATC
 ATCTCCAATTAAAGCTCCAGGGTGTCTAAT
 TCAGCTCGAATTAAATACTTAGTGAAGTTC
 CAACTATTCCAGCTCAAGCTCCAAAAATAA
 AATATAATGTTCCAAAAAATTATAAAGA
 TTTTGTGACCCAA

Result and Discussion:

The *Drosophila ananassae* collected for DNA Barcoding showed resembling morphological characteristics with *Drosophila melanogaster*, *Drosophila pallidosa* when compare in NCBI search Engine.

favor the hatching process and if temperature increases the humidity should be low otherwise the

degradation of eggs is observed. The temperature fluctuations can lead to delay and distortion of morphometric stages. The data of average monthly temperature day/night was analyzed and mean value of temperature was drawn out, which is 34°C and humidity 51% as compared to Fixed temperature of 23°C. The difference of 11°C in between this temperature of natural habitat and incubator was observed. This constant temperature helps the flies for their good growth and development, whereas fluctuation in natural habitat temperature leads to escape out various metamorphic stages and undergo dormancy till it gets the favorable conditions for development and survival purpose. Hence *Drosophila* are rarely observed during high temperature in region like khandesh for period of 3 to 4 months till it ends.

Conclusion

The cultured and reared species were isolated and analyzed at Molecular level compared with the two closely related *Drosophila* species. Though the species are closely related to each other and belong to the same melanogaster subgroup, they have significant variation in some aspects. Since the flies live in and around human habitat, the impact of environmental change on the fly life could be a reflection of the same as on human. The bidirectional nucleotide sequence was analysed with the help of NCBI and Fly Base Software with BLAST as a search engine. The following are the result of this analysis and it was confirmed that this fly collected belongs to *ananassae* species with close resemblance of 96% matching.

Acknowledgement:

The Researcher is Thank full to Principal of Moolji Jaitha (Autonomous) College, Jalgaon and Head of Zoology Department for Providing laboratory and Experimental facilities.

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Occurrence and Quantification of Mycorrhizal fungi on Spiny Pig Weed (*Amaranthus spinosus* L.)

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Abstract

An Arbuscular mycorrhizal fungus is a prevalent mutualistic symbiosis between land plants and fungi of the phylum Glomeromycota. AM fungal association with Amaranthaceae is considered doubtful. The present studies recognized the occurrence of AM fungal colonization in *A. spinosus*, a species of the Amaranthaceae family. The root and soil samples were collected from ten different study sites in the Osmanabad district. The highest % root colonization recorded was in Naldurg (41.30 ± 11.79) and the lowest in Hungarga (9.13 ± 1.37). The highest percentage of root length colonization was also recorded in Naldurg (38.8 ± 4.63) and the lowest in Hungarga (0.59 ± 4.10). The maximum spore density recorded in the rhizosphere of the Naldurg study site (85.5 ± 1.32 / 100 g soil) and the lowest in Khudawadi (11.42 ± 4.32 /100g soil). The vesicles were frequently

recorded followed by hyphal and arbuscule types of root colonization. The three genera and 6 species were recorded, i.e. *Glomus macroaggregatum*, *Glomus clarum*, *Glomus geosporum*, *Acaulospora bireticulata*, and *Acaulospora laevis*, *Gigaspora margarita* among these *Glomus geosporum* having the highest % of relative abundance (16.66) and frequency of occurrences (60). The presence of AM fungal structure in the roots and the spore number in the soil has indicated a possible mycorrhizal association with a varied percentage of colonization in *A. spinosus*.

Key words: Rhizosphere, Study sites, AMF status, *A. spinosus*.

Introduction

Amaranthus spinosus L. belongs to the family Amaranthaceae, commonly known as spiny amaranth. It is an annual herb bred from only seed and grows cosmopolitan in warm temperate and tropical regions. The plant is erect, branched, and may grow to about 1.2 metres in height. The stems of the plants are angled in cross section, red-green in colour, fleshy, and covered with spines. Leaves have alternate phyllotaxy, are lanceolate, and are covered at the lower surface with sparse, straight spines at the base. The flower is present on the long terminal spike or clumped at leaf axils in the lower part of the plant. The male and female flowers are present on the same plant and both are green in colour and small in size. The fruits are shiny, tiny, dark red to black in colour, and have an ovoid shape (Kurokawa, 2001). It is used as a wild edible leafy vegetable and the leaves have been widely used as medicine in the ayurvedic system of medicine. The leaves comprise about 3.88% protein, 1.1% fat, 9.38% carbohydrate. They are very rich in Vitamins A & C, rich in vitamin B1. Its leaves are used in the treatment of malaria, fever, hepatic disorders, inflammation,

leprosy, eczema, leucorrhoea, and bronchitis (Vipin et. al., 2013).

Arbuscular mycorrhizal (AM) fungi are ubiquitous soil-borne microbial symbionts that develop mutualistic associations with a broad range of terrestrial plants. It belongs to the phylum Glomeromycota. It is the fungus associated with almost all plant species in terrestrial ecosystems (Wu et. al., 2016). It is a mutualistic relationship in which fungi provide minerals and water to the host plant and the plant offers photosynthetic products as food to the fungi (Smith and Read, 2008). AM fungi afford different benefits to plants and the environment. It enriches the photosynthesis rate, increases the plant's establishment and survival, increases the yield and crop quality, progresses drought tolerance, improves flowering and fruiting, reduces the use of chemical fertilizers, solubilizes phosphorus, increases tolerance to soil salinity, and reduces disease occurrence, primarily soil-borne pathogens (Rodrigues, 2015). The present study shows the importance of *A. spinosus* as a wild edible leafy vegetable and its medicinal values along with mycorrhizal association and the diversity of AM fungi.

Material and Methods

Study area

The investigation was accompanied in the Osmanabad district, which is situated in southern Marathwada between latitudes 17.35 and 18.40 degrees north, and 75.16 and 76.40 degrees east. The Study was conducted at 10 different study sites, i.e., Naldurg, Horti, Murta, Chikundra, Kesarjalwga, Nilegaon, Khudawadi, Gujnur, Hangarga, Osmanabad etc. The temperature ranges from 10.1-43.1°C and the average rain per year is 760 mm.

Collection of Rhizosphere sample

Rhizosphere soil and root samples of *A. spinosus* were collected from the 10 different study sites in the Osmanabad district. The secondary root of *A. spinosus* was washed with clean water, removing soil debris and stored in FAA solution (Formalin-Acetic Alcohol) in a separate sterilized glass bottle. The soil samples were collected from the surface of underground roots and their surroundings. A sterilized scalpel was used to transfer rhizosphere soil into sterilized zip-lock polythene bags separately.

Assessment of arbuscular mycorrhizal status

Roots were processed and stained using methods proposed by Philips and Hayman (1970). Primary and secondary fine roots were selected and washed 3–4 times to remove the FAA from the root. 20-30 root pieces were cut into 2-3 cm lengths and boiled in 10% KOH. Boiled root sample wash with sterilized distilled water until the brown color changes to colorless. The root was dipped in 5% HCL for 3–4 minutes to progress the staining ability. Acidified root was washed away with sterile distilled water for 4-5 times and stained with 0.05% trypan blue stain overnight (12 hours). The root was positioned on a clean slide after the extra stain was removed. Arbuscular, vesicular and hyphal AM fungal colonization was detected and the results were recorded and photographed with a Sony digital camera (DSC-W310/BC E37). The

percentage of root colonization was assessed by using the formula (Giovannetti and Mosse, 1980).

$$\text{Root colonization (\%)} = \frac{\text{Number of colonized segments}}{\text{Total no. of colonized segments studied}} \times 100$$

Isolation and quantification of AMF spores

AM fungal spores' separation from each soil sample was done by wet sieving and decanting method (Gerdmann and Nicolson, 1963). The 100 gm of soil sample was liquefied in 1000 ml of tap water and this suspension was passed through 355 µm, 250µm, 150µm, and 98 µm and 75µm stack of sieves. Spore was collected by using Whatman filter paper. Each filter paper was placed on a glass plate and examine under stereozoom microscope. Intact and shiny spore was counted and picked up using a wet needle and mounted in polyvinyl alcohol lactophenol (PVLG) on a glass slide and identified under a compound microscope and photographed by Sony digital camera (DSC-W310/BC E37).

Identification of spore: AM spores were identified on basis of spore morphology and subcellular characters (Schenck and Perez 1990). Identification of AM fungal spores was carried out by using the INVAM International Collection of Vesicular Arbuscular Mycorrhizal morphotaxonomic criteria and mycorrhizal manuals (Schenck et. al., 1998; and Rodrigues et. al., 2009). The voucher specimens of AM fungi were deposited at Department of Botany, Arts, Science and Commerce College Naldurg, Dist. Osmanabad and Department of Botany, Dr. Babasaheb Ambedkar Marathwada University in Aurangabad, Maharashtra, India.

Relative abundance and frequency of occurrence of AM fungi

AM fungal spore density was recorded as well as relative abundance and frequency of occurrence also intended by using following formula (Giovannetti and Mosse, 1980).

$$\text{RA (\%)} = \frac{\text{Number of AM fungal spore of a particular species}}{\text{Total no. of AM fungal spore in species}} \times 100$$

$$\text{F (\%)} = \frac{\text{Number of soil sample possessing spores of a particular AM species}}{\text{Total no. of soil sample analyzed}} \times 100$$

Statistical analysis: All records were statistically examined and the significance of variances was determined by using book (Mungikar 1997).

Root colonization: The root samples of *A. spinosus* were collected from ten different study sites in the Osmanabad district. The maximum percentage of root colonization (41.30±11.79) recorded in

Results and Discussion

The results of root colonization and root length colonization as well as spore density from the rhizosphere of *A. spinosus* were recorded.

Naldurg and the minimum were found in Hungarga (9.13±1.37). The highest percentage of root length colonisation was also recorded in Naldurg (38.8±4.63) and the lowest in Hungarga

(0.59±4.10). The vesicles were frequently recorded, followed by hyphal and arbuscule types of root colonization in the rhizosphere *A. spinosus* (Table - 1).

Spore density: The presence of AM fungal spore density is diverse from site to site. The maximum spore density recorded in the rhizosphere of the Naldurg study site (85.5±1.32 / 100 g soil) and the lowest in Khudawadi (11.42±4.32/100g soil (Table-1). The three genera and 6 species were recorded, i.e. *Glomus macroaggregatum*, *Glomus clarum*, *Glomus geosporum*,

among the other plants. Shwetha and Lakshman (2010) have previously reported the arbuscular mycorrhizal association found in most of land plants. Approximately twenty-three plant species, mostly from the amaranthaceae family, were screened, through *A. spinosus* having root colonization (17%) and spore density (21.95%). Armando et. al. (2013) earlier observed that *A. spinosus* having AM fungal association isolated from the Coastal Vegetation In Chuburna. Lakshman et al, (2010) indicate that the species composition in AM fungal populations from diverse habitats of the amaranthaceae is generally

Sr.No	study site (Locations)	(%) Root colonization	(%) RLC	Type	Spore density (%)
1.	Naldurg	41.30±11.79	38.8±4.63	HVA	85.5±1.32
2.	Murta	14.00±1.14	4.0±5.50	V	41.30±7.40
3.	Horti	11.50±4.05	4.05±1.25	HV	16.52±7.40
4.	Osmanabad	11.50±0.00	4.05±2.08	HV	16.52±5.32
5.	Nilegaon	19.00±4.63	7.00±4.13	V	21.92±9.32
6.	Kesarjawalga	14.18±1.10	8.00±7.12	HV	36.90±11.25
7.	Hangarga	9.13±1.37	0.59±4.10	H	19.42±7.40
8.	Khudawadi	10.0±4.14	0.61±0.00	VAH	11.42±4.32
9.	Gujnur	14.0±10.0	0.80±0.03	VH	24.26±10.25
10.	Chikundra	10.00±2.48	3.13±0.40	VA	17.34±4.32

Acaulospora bireticulata, and *Acaulospora laevis* *Gigaspora margarita* among these *Glomus geosporum* having the highest % of relative abundance (16.66) and frequency of occurrences (60) in the recorded rhizosphere of *A. spinosus* (Table 2).

The association of AM fungi influence the composition and structure of vascular plant communities by enhancing the growth response in plants (Moora et. al., 2004). The leafy vegetables are members of the amaranthaceae family, which contains a high concentration of micronutrients and bioactive compounds. It is used to reduce food insecurity, hunger and malnutrition in Africa. Many species of this genus are used as pseudo cereals in Europe and America (Enock et. al., 2014).

Harley and Harley (1987) previously reported that family amaranthaceae not having the AMF association. Sign et. al. (2011) specified that four genera of amaranthaceae family *Achyranthes aspera* L., *Alternanthera sessilis* L., *Amranthus spinosus* L., having the arum globular vesicular, hyphal colonization. Selvaraj (2015) earlier reported the AM fungal root colonization in *A. spinosus* ranges from 45% and spore density 95/ 100gm of soil

unknown. There are not as much of attention has been paid to factors maintaining diversity of AM fungal populations in such disputed members. Frequent field collections or establishment of successive trap cultures significantly develop the assessment of species composition in natural ecosystems.

AMF association not only yield to plant growth but also used as plant shield, especially against environmental stresses. Shortage of essential nutrients especially phosphorus resultant limit crop growth and productivity it fix this problem by providing the phosphorus to the host plant and increases yield.

Conclusion

The present study concluded that occurrence of AM fungal in *A. spinosus* from 10 different study site of Osmanabad district. The investigation was conforms vesicular, arbuscular and hyphal type of root colonization and three genera and 6 species were recorded. In previous studies, it was reported that there was not mycorrhizal association on *A. spinosus*. But our study have reported the possible infection of AMF due to black cotton soil. Hence this investigation was described.

Table 1. Showing status of percentage (%) of AMF root, root length and type of root colonization and spore density from rhizosphere of different study sit from Osmanabad district. (n*=25).

Legends: *-Number of Root segments, RC- root colonization, RLC- Root length Values are means of three replications, standard error (\pm).

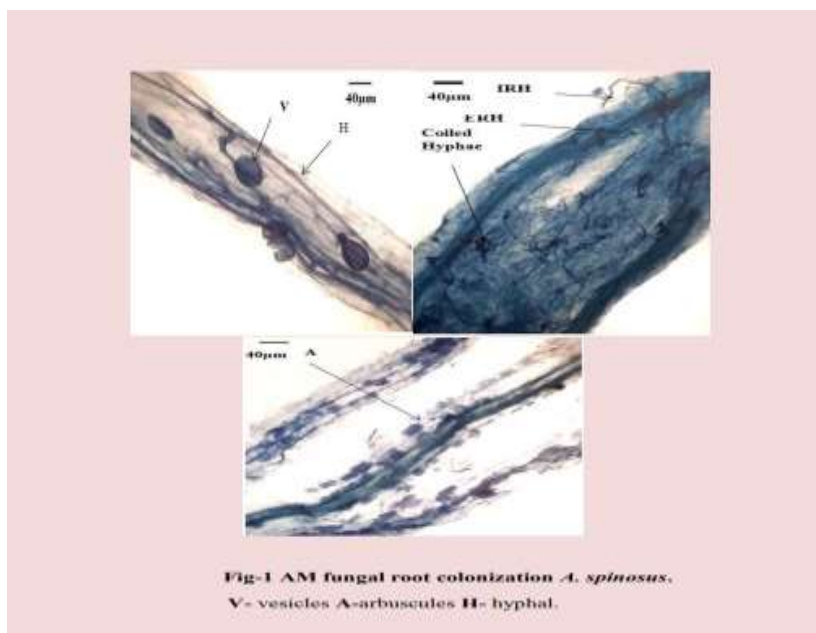


Table 2 -Showing distribution of species of AM fungal spores in different study site, (%) relative abundance and (%) frequency of Osmanabad District.

Sr.no.	Species of AM fungi	Study site										%RA	% F
		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10		
1.	<i>Acaulospora birticulata</i>	+	-	+	-	+	+	+	+	-	-	11.11	50
2.	<i>A. laevis</i> Gerdemann and Trappe	+	+	-	+	+	+	+	-	-	-	11.11	50
3.	<i>Glomus clarum</i> Nicoloson and Schenck.	+	+	+	-	-	-	-	-	-	-	5.5	25
4.	<i>G. geosporum</i> (Nicoloson and Gerdemann) Walker.	+	+	+	+	+	-	+	+	+	+	16.66	60
5.	<i>G. macroaggregatum</i> N.C.Schenck & G.S. Smith.	+	+	-	+	-	-	-	-	-	-	5.5	25
6.	<i>Gigaspora margarita</i> Becke and Hall.	+	+	-	+	-	-	-	-	-	-	5.5	25

Legends:+: present - : absent S1-Naldurg S2- Murta S3- Horti S4- Osmanabad S5- Nilegaon S6- Kesarjawalga S7- Hangarga S8- Khudawadi S9- Gujnur S10- Chikundra.%RA- relative abundance, %F- Frequency of occurrence.

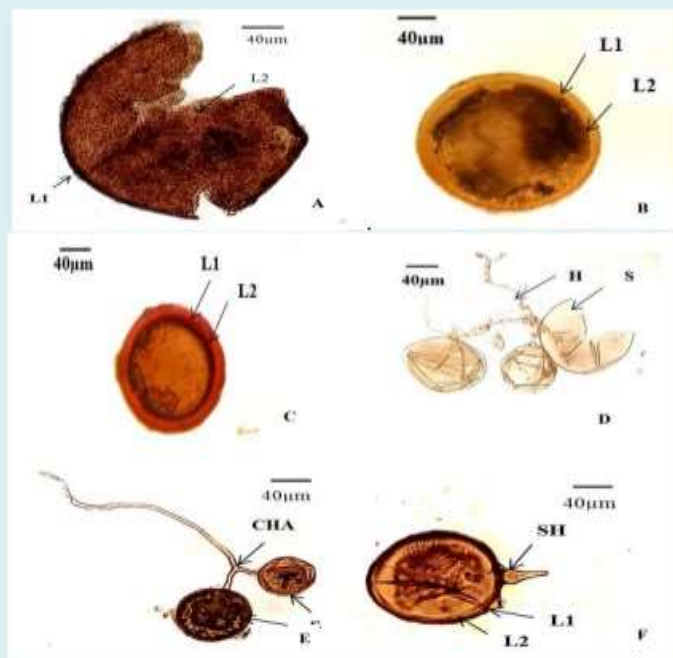


Fig- 2 AM fungal spore isolated from rhizosphere *A. spinosus* (X=400).

A- *Acaulospora birticulata*, B- *Acaulospora laevis*, C- *Glomus geosporum*, D- *Glomus macroaggricatum*, E- *Glomus clarum*, F- *Gigaspora margarita*.

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Ecosystems and the energy cycle in the environment!

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DOI- 10.5281/zenodo.7800714

Abstract:

Due to the diversity in natural structure and climate, India has many ecosystems of greater or lesser extent. India has major ecosystems like mountain, plateau, forest, desert, river, wetland, coastal etc. Every ecosystem, every living society has a limit of endurance. If there is a change in the elements of the environment and if the balance is disturbed, the consequences of this are seen on the ecosystem. Ecosystems are dynamic and may occasionally be disturbed. The more frequent or more severe the disturbances in the ecosystem, the longer it takes for the ecosystem to return to its original state. Like when a volcano erupts or a snow falls, the animals, plants and organic matter (organic matter) in the environment are destroyed. Such an ecosystem is re-established after a long period of time. On the contrary, in the event of wildfires and cyclones, the ecosystem is restored in a short period of time. In ecosystems where food supply is abundant, the number of animals increases and in those where food supply is low, the number of animals decreases. When we change ecosystems to suit our needs, we unknowingly disrupt their balance. Many of the world's ecosystems have been altered by human intervention. Environmental stress beyond certain limits can threaten not only ecosystems but the entire ecosystem and, in turn, human existence.

Keywords: food chain, interaction, interdependence, biodiversity, nutrient cycle;

Introduction:

Different components of an ecosystem are interdependent. There is a continuous interaction between these elements for the purpose of food, shelter, reproduction. Energy flow and nutrient cycling are essential processes for ecosystems and their interactions to function. The sun is the major source of energy in all ecosystems. Only one percent of the energy reaching the earth from the sun is absorbed by plants and converted into food. This energy is passed on to other organisms in the ecosystem. Every living or dead thing is food for other living things. There is a transfer of food energy from the autotrophic layers of the ecosystem to the various prey and predators. Through this process, energy in the ecosystem is transferred from one organism to another. All living things in a food chain depend on each other for food and, in turn, energy. There are many such food chains in nature. They intertwine and form a food web. Living things need nutrients for survival, growth and reproduction. In the environment, these nutrients and their compounds move to inorganic components. Nutrient cycling occurs from original sources of minerals to organisms and back again from organisms to original minerals. This is called the nutrient cycle. Nutrient cycles are regulated by solar energy and gravity. Examples of nutrient cycles are carbon cycle, oxygen cycle, nitrogen cycle, phosphorus cycle, sulphur cycle and water cycle.

Definition of Ecosystem:

The living organisms in the environment and the abiotic environment in their vicinity are related to each other and their interrelationship is called ecosystem. The famous thinker Transne first developed the concept of the ecosystem in 1935. According to him, due to the integration of both living and non- living things in the environment (Integration). An ecosystem comes into being.

1. A. G. According to Transne, "The combined structure of living organisms and their habitats is an ecosystem."
2. According to F.R. Fosberg, "A functioning interacting system composed of one or more living organisms and their effective environment, both physical and biological."
3. According to Nable, "It is the mutual interaction of different classes of organisms on earth and their environment."

Nature and Scope of Ecosystem:

Inorganic substances in the environment pass through organisms to the biotic, from the biotic to the decomposer and back to the environment. This circular system is called an ecosystem. The interaction between the abiotic and biotic components of the environment in a particular habitat is called an ecosystem.

Ever since the creation of life on Earth, living organisms have been zonally interrelated with biological and inorganic elements. In this regional

interrelation, the influence of geographical factors such as topography, water system, climate, vegetation and minerals is strongly felt. The characteristic organization of living organisms and forms of existence on earth is found in the form of ecosystem.

In an ecosystem, organisms or groups of organisms are structured by interaction with each other and with some elements of the environment. In this way ecosystems are realized due to the orderly organization and combination of interactions between biotic and abiotic components using energy.

Ecosystem Structure:

The term ecosystem is a small unit of large living organisms on Earth, derived from the prefix *pari* (environment). In an ecosystem, living organisms (plants, animals, and microorganisms) and the inorganic components of their environment (air, water, minerals, soil) live together and are interdependent. The components that makeup an ecosystem are in a state of being able to live together and have the capacity for self-development. In any ecosystem, interactions between living organisms and the living environment take place on a wide scale. So the ecosystem can be expanded to any extent. Some ecosystems are as big as natural areas and some ecosystems are of small extent like rivers, lakes, forests. Such components of the ecosystem fall into two major groups:

(1) Abiotic, (2) Biological. (1) Inorganic elements include air, water, soil, rock etc. Includes physical and chemical factors. A change in the amount of these elements has an adverse effect on the population of living organisms. Every species of living organism has a limit of tolerance to the effects of abiotic factors.

(2) Biological components include plants and animals in the ecosystem. According to the method of obtaining food, biological entities are classified into three groups namely producers, predators and decomposers. Green plants and algae produce their own food in the form of organic nutrients from inorganic matter in the environment through photosynthesis. They are called production or autotrophic. The living organisms that eat the food prepared by the producers are called carnivores. Depending on the mode of food consumption, these carnivores are classified as herbivores, carnivores and omnivores.

(a) Herbivores are producers, i.e. they make their living by eating plants. In the food chain of natural environment, they are called primary predators. The primary predators are deer, elephants, rabbits, cows, buffaloes, etc.

(b) Organisms that get their livelihood by eating herbivores are called carnivores or secondary

carnivores. This group includes tiger, lion, dog, cat, eagle etc.

(e) Animals like cockroaches, rats, pigs, humans etc. consume both grass and meat. They are called omnivores.

Living organisms, fungi, fungi, etc. convert dead organic matter into inorganic compounds. They are called decomposers.

Energy flow in the environment:

Every ecosystem consists of numerous interconnected mechanisms that affect human life. These are water cycle, carbon cycle, oxygen cycle, nitrogen cycle and energy cycle. While each ecosystem is governed by these cycles, each ecosystem has distinct abiotic and biotic characteristics. All the functions of an ecosystem are to some extent related to the growth and regeneration of its plant and animal species. These linked processes can be depicted as various cycles. These processes depend on energy from sunlight. During photosynthesis, carbon dioxide is taken in by the plant and oxygen is released. Animals depend on this oxygen for their respiration. The water cycle depends on rainfall, which is essential for the survival of plants and animals. The energy cycle recycles nutrients into the soil upon which plant life grows. Our own life is closely connected with the proper functioning of these cycles of life. Humanity cannot survive on our earth if human activity continues to change.

Water Cycle:

Water, air and food are the most important natural resources for people. Humans can survive a few minutes without oxygen, less than a week without water, and about a month without food. Water is also essential for our oxygen and food supply. Plants breakdown water and use it to produce oxygen during the process of photosynthesis. The water (or groundwater storage hydrology) cycle describes the movement of water through different reservoirs, including oceans, atmosphere, glaciers, groundwater, lakes, rivers, and the biosphere. Solar energy and gravity drive the movement of water in the water cycle. Simply put, the water cycle is the movement of water from oceans, rivers, and lakes to the atmosphere through evaporation. From clouds it falls as water and precipitation (rain and snow) on land.

An important part of the water cycle is how water changes in salinity, which is the abundance of dissolved ions in the water. Salt water in the oceans is very salty. About 35,000 milligrams of dissolved ions per litre of seawater Evaporation (where water changes from liquid to gas at ambient temperature) is a distillation process that produces nearly pure water with almost no dissolved ions. Like water vapor. It releases dissolved ions into the original liquid state. Finally, condensation (where water changes from a gas to a liquid) and sometimes forms

precipitation (rain and snow). After rainwater falls on the ground, it dissolves minerals in rocks and soil, increasing its salinity. Most lakes, rivers, and near-surface groundwater have relatively low salinity and they are called freshwater.

Carbon cycle:

The physical cycle of carbon through Earth's biosphere, geosphere, hydrosphere, and atmosphere, including processes such as photosynthesis, decomposition, respiration, and carbonization. The carbon cycle is essential for sustaining life on Earth, which describes the flow of carbon between the biosphere, geosphere and atmosphere. Atmospheric Carbon Dioxide: Carbon exists in two main forms in the Earth's atmosphere. Carbon Dioxide and Methane. Carbon dioxide is released from the atmosphere through photosynthesis, thus entering terrestrial and marine organisms. Carbon dioxide also dissolves from the atmosphere directly into the bodies of water (oceans, lakes, etc.), and dissolves into precipitation, causing raindrops to fall from the atmosphere. Over the past two centuries, human activities have significantly increased the amount of carbon in the atmosphere. Plants and animals are used to release carbon dioxide during respiration. They also return fixed carbon to the soil in the waste they expel. After the death of plants and animals, carbon will be returned to the soil. These processes complete the carbon cycle.

Oxygen Cycle:

The oxygen cycle is a cycle that helps move oxygen through the Earth's three main regions, the atmosphere, the biosphere, and the lithosphere. The atmosphere, of course, is the region of gases above the Earth's surface and is one of the largest reservoirs of free oxygen on Earth. The sum total of all ecosystems on Earth is biosphere. It also contains some free oxygen produced from photosynthesis and other life processes. Most of the oxygen is in the lithosphere. Most of this oxygen does not exist by itself or in free circulation but is part of chemical compounds such as silicates and oxides. The atmosphere is the smallest source of oxygen on Earth, accounting for only 0.35% of Earth's total oxygen.

Oxygen is released into the atmosphere through a process called photolysis. This occurs when high-energy sunlight splits oxygen-containing molecules to produce free oxygen. The most famous photolysis is the ozone cycle. An oxygen molecule breaks down into atomic oxygen due to ultraviolet radiation of sunlight. This free oxygen then recombines with existing molecules to form ozone. This cycle is important because it helps protect the earth from harmful ultra violet radiation before it reaches the earth's surface. Respiration and photosynthesis are the main cycles in the biosphere. Respiration occurs when animals and humans

breathe in to use in metabolic processes and expel carbon dioxide. Photosynthesis is the reverse of this process and is primarily carried out by plants.

Nitrogen Cycle:

Carnivores eat herbivores that live on plants. When animals defecate, this waste material is broken down by worms and insects, mainly beetles and ants. These tiny 'soil animals' breakdown the waste material into small pieces that micro-bacteria and fungi can act on. This material is thus further broken down into nutrients that plants can absorb and use for their growth.

In this way, nutrients are recycled from animals to plants. Similarly, dead animal bodies are also broken down into nutrients that plants use for their growth. Thus, the nitrogen cycle on which life depends was completed. Nitrogen-fixing bacteria and fungi in the soil provide this vital element to plants, which absorb it as nitrate. Nitrates are part of plant metabolism, helping to make new plant proteins. It is used by herbivores. Nitrogen is then transferred to carnivores when they feed on herbivores. Thus our own lives are closely connected with soil animals, fungi and even soil bacteria. When we think of food webs, we usually think of large mammals and other large life. But we must understand that the unseen tiny animals, plants and micro-organisms are life forms which are very valuable to the functioning of the ecosystem.

Energy cycle:

The energy cycle is based on atmosphere energy. The energy from sunlight is converted by the plant itself into growing new plant material including leaves, flowers, fruits, branches, stems, and plant roots. Since plants can grow by converting sunlight energy directly into tissue, they are known as eco-friendly among growers. Plants are used by herbivores as food for herbivores, which provide them with energy. A large part of this energy is used for the daily functions of these animals such as breathing, digesting food, supporting tissue growth. Maintaining blood flow and body temperature.

Energy is also used for activities such as finding food, finding shelter, breeding, and raising young. Carnivores depend on the herbivores they feed on. Thus, different plant and animal species are interconnected through food chains. Each food chain consists of three or four links. However, each plant or animal can be connected to many other plants or animals through many different connections, so these interconnected chains can be depicted as a complex food web. The food web is thus called the 'web of life' which shows that there are thousands of interconnections in nature. When plants and animals die, these materials are returned to the soil after being broken down into simpler substances by decomposers such as insects, worms, bacteria and fungi so that plants can absorb nutrients through their roots. Animals excrete waste products after

digesting food, which goes back into the soil. It links the energy cycle to the nitrogen cycle.

Integration of cycles in nature:

These cycles are a part of the global life process. Each ecosystem has specific characteristics in this biogeochemical cycle. These cycles, however, are linked to nearby ecosystems. Their characteristics are specific to the flora and fauna community of the region. It is related to the geographical features of the area. Climate and chemical composition of soil. Cycles are collectively responsible for maintaining life on Earth. If mankind disturbs these cycles beyond the limits of nature, they will eventually breakdown and lead to a degraded earth on which man cannot live.

Conclusion:

In total, there are more than eight million species of living organisms on Earth, including insects and animals. New species are still being discovered. Thousands of species are also being destroyed due to human encroachment. For three billion years till today, living organisms have evolved gradually in various ecosystems under various conditions. But today we are depleting all inorganic and biological resources. It is a tragedy that we intelligent human beings in the age of science do not realize that we are axing ourselves.

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Bioremediation of industrial waste water by using *azolla*

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Abstract:

Bioremediation is process which employs the use of living organisms such as microbes & bacteria as a remedy for solving environmental problems. It confers the decontamination of affected areas. It is used in the removal of contaminants, pollutants. The current project studies Bioremediation of petroleum industry waste water by using *Azolla*. *Azolla* is an aquatic fern commonly known as mosquito fern. In this project, the *Azolla* plant was allowed to grow in industrial waste water. The various physical & chemical parameters of waste water before & after *Azolla* treatment showed significant changes that help to conclude that *Azolla* seems to be an ecofriendly approach to treat the industrial waste water. It will be considered as the better method for bioremediation to prevent water pollution.

Introduction:

Water pollution is concerned with the altered the physical, chemical and natural characteristics of water which may beget dangerous goods on mortal and submarine life. Water pollution is nowadays considered not only in terms of public health but also in term of conservation, aesthetics and preservation of natural beauty and coffers. The main reason of water pollution seems to be the release of industrial wastes in it making it more toxic to biological agents. Thus, the waste water treatment is more important to reduce water pollution. Bioremediation helps to use biological agents to solve environmental issues (Luciene M. Coelho et. al. 2014). It can include the use of plants or microbes to reduce pollution. *Azolla* is a globally distributed aquatic fern also called as mosquito fern. It shows dichotomously branched morphology and can grows in moist soils, marshy ponds (Waseem R. et.al. 2012). It has shown many beneficial roles as biofertilizer, biofeed, green manure, mosquito repellent, as human food, for biogas production etc.(Waseem R. et.al. 2012). Water pollution is the most serious problem at moment's civilization. Wastewater treatment involves breakdown of complex organic composites in the wastewater into simpler composites that are stable or moreover physico-chemically ecofriendly. The adverse environmental impact of allowing undressed wastewater to be discharged in groundwater. Undressed wastewater (sewage) containing a large quantum of organic matter, if discharged into a sluice, will consume the dissolved oxygen for satisfying the Biochemical Oxygen Demand of

wastewater and therefore deplete the dissolved oxygen of the sluice, thereby causing fish kills and other undesirable goods. Wastewater may also contain nutrients, which can stimulate the growth of submarine shops and algal blooms, therefore leading to eutrophication of the lakes and aqueducts. Undressed wastewater generally contains multitudinous pathogenic, or complaint causing microorganisms and poisonous composites, that dwell in the mortal intestinal tract or may be present in certain artificial waste. These may pollute the land or the water body, where similar sewage is disposed. For the below- mentioned reasons the treatment and disposal of wastewater, isn't only desirable but also necessary.

Materials And Methods:

1. Collection of Industrial waste water:

Industrial waste water was collected from Indian Oil Corporation, Pakani, Solapur, in clean dry plastic bottle.

2. Collection of *Azolla*

-*Azolla* plant was collected from the *Azolla* pond in the agricultural field located in Virwade (BK), Solapur.

-*Azolla* plant was thoroughly washed with clean water to remove soil particles a

3. Treatment of waste water by using *Azolla*:

-10g *Azolla* was added in a glass beaker containing 250ml of waste water.

-Glass beaker was kept at room temperature for 7 days for treatment. (Noorjahan C.M. et al. 2015).

4. Analysis of various physical & chemical parameters of waste water:

-The untreated industrial waste water was analyzed for physical & chemical parameters by using standard methods for physical chemical estimation. (Arshad Hussain *et. al.* 2014)

-The parameters include pH, colour, odour, TS, TSS, TDS, DO, BOD, and Estimation of sulphates, nitrates and oil.

-After treatment of industrial waste water with *Azolla* for 7 days, the plant residue was removed from water.

-This water was analyzed for same parameters by using standard methods.

Observation & Results:

The standard methods for analysis of physical & chemical parameters were used. The following table shows the analysis of parameters of untreated & treated waste water.

Observation Table:

Sr. no	Parameter	Untreated water	Treated water
1	Colour	Pale yellow	Pale yellow
2	Odour	Petrol like	Odor less
3	PH	14	09
4	TS	1%	0.9%
5	TSS	35%	20%
6	TDS	65%	35%
7	OD	0.4	0.2
8	Sulphate	25%	19%
9	Nitrate	0.007%	0.003%
10	Oil	0.1%	0.01%
11	DO	33.6mg/lit	16mg/lit
12	BOD	17.6mg/lit	4mg/lit
13	COD	20mg/lit	6mg/lit

Conclusion:

It is studied that the *Azolla* plant has grown well in the waste water and has altered various parameters in waste water. It is observed that the dissolved oxygen in the waste water decreases with the growth of *Azolla*. But there is significant decrease in the sulphates, nitrates and oil content of waste water due to growth of *Azolla* in it.

Thus, It is concluded that the use of *Azolla* can be a better and eco-friendly bioremediative approach for the treatment of waste water which in turn will reduce water pollution.

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Problems and Prospects of Tourism Development in India

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Abstract

The term "tourism development" refers to the planning and execution of strategies, infrastructure, or other projects that the Council deems necessary for the expansion of the tourism industry with the goal of making a destination more appealing to tourists and bringing in more of them. Taxation, travel marketing, infrastructure issues, security, and cross-border regulations are the most significant obstacles to tourism. Too many tourist destinations lack visitor preparation. Travelers and tourists may at times consider travel marketing exaggerated. Due to global trends and important investments the country has made in technology and energy, India is on track to become the third largest economy in the world by 2030 and surpass Japan and Germany as the third largest economies. Infrastructure: India is a difficult place to travel due to its diversity and size, but the lack of good infrastructure, particularly in terms of certain hotel quality, and poor connectivity make it even more difficult. Tourism is not always merely a means of physical or mental rejuvenation, amusement, or entertainment.

Keywords: Tourism, Prospects, Problems, Locations, Excursion.

Introduction

Tourism is the practice of people going to and staying in places that aren't in their usual environment for less than a year at a time for rest, business, and other reasons that aren't related to the use of a motion waged from within the region stayed. The travel industry is venture for satisfying or outing purposes. People who "journey to and stay in locations separate from their traditional environment for not more than one repeated year for excursion, business, and other commitments no longer associated with the exercise of an activity compensated from within the location stayed" are referred to as tourists, according to the sector Tourism Corporation. Tourism has become a well-known global trend for unwinding. In addition, it is an effective tool for ending poverty, reducing unemployment, fostering cultural exchange, and providing avenues through which various traditions' streams ought to mix. This study aims to cover a variety of factors that contribute to their arrival as well as the challenges they face in the Uttar Pradesh tourism region in all its possible dimensions, particularly the numerous variables that continue to have an impact on it.

Objectives of the Study

The larger goal of the study is to thoroughly examine the issues and opportunities facing the tourism industry in Lucknow and the surrounding areas. The specific goals are as follows:

1. to talk about the place, the people, and their

habits, as well as to look at the infrastructure that the tourism industry has available;

2. to examine the state government's tourism development policy;
3. to identify the major areas of concern for the tourism industry;
4. to make appropriate recommendations for the state's sustainable tourism industry development.

explain how the service industry of tourism contributes to the growth of a region; examine how the promotion of its invisible exports, the marketing of local handicrafts, and the activities of performing folk artists have an effect on employment and income generation as a result of tourism growth; identify the potential dangers (i.e., negative effects) posed by a large influx of tourists; evaluate the policies that are suggested by the national and regional governments to promote healthy people and area-friendly tourism.

Scope of the Study

Different definitions, ideas and depictions of the travel industry emerge from the multidisciplinary idea of the point. As a relatively new field, it has developed theoretical and empirical foundations for tourism as a phenomenon by drawing on other fields. The "Industrial Policy of Lucknow & Periphery, 1995" document, which prioritizes the state's tourism industry, further illustrates the scope of the study.

Tourism in India: Opportunities and Challenges

India is a diverse nation with a rich cultural heritage.

India was invaded by a lot of foreigners, who not only left magnificent monuments but also their culture here. In today's world, every state has its own culture and has its own festivals. India's scenic beauty, which stretches from Kashmir in the north to Kanyakumari in the south, Arunachal Pradesh in the east to Gujrat in the west, and its multiculturalism draw visitors from all over the country. For instance, in addition to being the landmark in Lucknow, Imambara is also home to numerous restaurants serving excellent Nawabi cuisine and being renowned for its Chikan embroidery. The tourism industry contributes 10% of the country's income. However, the tourism industry lags behind the other major sectors, some of which are “developed” while others are only “developing,” for a variety of reasons.

Significance of Indian Tourism Sector:

One of the world's oldest civilizations, India is a melting pot of cultures. Due to its numerous attractions and rich heritage, the nation is one of the most popular tourist destinations worldwide. India covers 3,287,263 sq. miles, from the snow-capped Himalayas in the north to the tropical rain forests in the south. km. The country's diverse ecology and rich culture have contributed significantly to its tourism boom. In terms of its contribution to GDP, India's tourism industry ranks eighth. India's tourism industry generated US\$ 247.3 billion in revenue in 2018, an increase of 6.7% from the previous year and a contribution of 9.2% to the economy as a whole. Additionally, the sector was one of the largest earners of foreign currency. Numerous reforms were implemented in India to encourage tourism following the COVID-19 pandemic; The industry has benefited greatly from these policies. From January to July 2022, India's total FTAs increased by 406.6% to 2,764,975 from the previous year. The United States contributed the most to FTAs in India during this time, 25.88%, followed by Bangladesh (18.61%), the United Kingdom (10.99%), and Australia (5.16%). The United States ranked among the top 15 sources. In 2020, India's tourism industry generated \$6.96 billion in foreign exchange. After the pandemic, it is anticipated that this will rise even more.

Growth Drivers for Tourism in India:

India has seen a sharp rise in FTAs in recent months. This increase in FTAs could be ascribed to various government policies and India-based factors. A few of the major growth factors are described below.

Vaccination Drive:

India's vaccination campaign against COVID-19 began on January 16, 2021. The distribution of free vaccines to each citizen was the primary objective of the program. This mission was profoundly fruitful - just about 200 crore immunizations were disseminated in the initial year and a half. This

helped India's monetary opening and made the country a protected the travel industry objective.

Medical and Wellness Tourism:

With world-class facilities and doctors, India's healthcare system is one of the most affordable in the world. The wellness sector in the nation is well-known worldwide. Medical tourism in India has significantly increased as a result of the combination of Western medical knowledge and Eastern medical wisdom. In May 2022, the "Heal in India" and "Heal by India" campaigns were announced by the Indian government. The primary objective of these programs is to establish India as a global center for medical value and further develop the traditional medicine sector. India had 1.83 million FTAs for medical purposes in 2020.

Rise in Domestic Tourism:

India's domestic tourism has grown considerably after the pandemic. This growth could be majorly attributed to increasing dispensable income and a rise in India's working class. The country has registered higher spending on leisure tourism compared to business spending tourism. There

English to represent 'one's turn.' The suffix -ism is defined as 'an action or process; typical behavior or quality' whereas the suffix -ist denotes one that performs a given action. When the word tour and the suffixes -ism and -ist are combined, they suggest the action of movement around a circle. One can argue that a circle represents a starting point, which ultimately returns back to its beginning. Therefore, like a circle, a tour represents a journey that is a round trip, i.e., the act of leaving and then returning to the original starting point, and therefore, one who takes such a journey can be called a tourist.

Development Of Tourism In India

Early Stages Domestic tourism in India has significantly increased since the pandemic. India's expanding middle class and rising disposable income may play a significant role in this expansion. The country has reported spending more on leisure tourism than on business tourism.

present day English, this articulation currently signifies "one's turn." The suffix -ism is defined as "an action or process; typical behavior or quality," whereas the suffix -ist refers to a person who performs a specific action. Tour conjures up images of circling a circle when combined with the suffixes -ism and -ist. One possibility is that a circle is a point of origin that eventually returns to itself. A tour is a journey that is a round trip, like a circle—the act of leaving and then returning to where you started—and a person who takes one can be considered a tourist.

According to Krishna, A.G., 1993, the committee was established by the government and headed by Sir John Sargent, who was at the time the Educational Adviser to the Government of India.

After that, in 1956, in conjunction with the Second Five Year Plan, the planned expansion of tourism began. The methodology has advanced from separated arranging of single unit offices in the Second and Third Long term Plans. The 6th Arrangement denoted the start of another period when the travel industry started to be viewed as a significant instrument for social reconciliation and monetary turn of events.

However, tourism activity did not begin to gain momentum until after the 1980s. Several significant actions were taken by the government. In 1982, a National Tourism Policy was announced. The National Committee on Tourism developed a comprehensive strategy for sustaining tourism growth late in 1988. A National Action Plan was created in 1992, and a National Strategy for Tourism Promotion was created in 1996. The New Tourism Policy of 1997 acknowledges the public and private sectors, as well as the central and state governments, in the growth of tourism. The requirement for contribution of Panchayati Raj foundations, nearby bodies, non-legislative associations and the neighborhood youth in the production of the travel industry offices has additionally been perceived.

Present Situation and Features of Tourism in India

With an employment rate of 8.78 percent and a contribution of 6.23 percent to the country's GDP, tourism is today India's largest service sector. India receives 562 million domestic tourism visits and more than 5 million foreign tourists annually. At a rate of 9.4% per year, India's tourism industry is expected to generate US\$275.5 billion by 2018, up from US\$100 billion in 2008. The "Incredible India" campaign is managed by the Ministry of Tourism, which serves as India's focal point for tourism development and promotion.

India has the highest 10-year growth potential, according to the World Travel and Tourism Council, and it will be a tourism hotspot from 2009 to 2018. The World Economic Forum's 2009 Travel and Tourism Competitiveness Report places India 11th in the Asia-Pacific region and 62nd overall, moving up three spots on the list of the world's most appealing destinations. It has numerous World Heritage Sites, both natural and cultural, a diverse fauna, and thriving creative industries, making it the nation's 14th best tourist destination for its natural resources and 24th best for its cultural resources. India's air transport system also came in 37th place. By 2019, the travel and tourism industry in India is expected to be the world's second-largest employer and ranked fifth in long-term (10-year) growth. The 2010 Province Games in Delhi are supposed to essentially help the travel industry in India further.

In addition, the Country Brand Index (CBI) survey conducted by Future Brand, a leading global

brand consultancy, ranked India as the "best country brand for value-for-money." India also came in second place in the CBI's "best country brand for history," was ranked fourth for "best new country for business," and was among the top five for "authenticity" and "art & culture." India was included among the "rising stars," or nations that are likely to become major tourist destinations in the next five years, alongside China, Vietnam, and the United Arab Emirates.

India's tourist attractions include India is known for its lavish treatment of all visitors, regardless of their origin. Its welcoming customs, diverse ways of life, and rich cultural heritage, as well as its vibrant fairs and festivals, remained constant draws for tourists. Beautiful beaches, forests, wildlife, and eco-friendly landscapes are additional attractions; river, mountain peaks, and snow for adventure tourism; for science tourism, technological parks and science museums; centers of spiritual tourism pilgrimage; heritage, heritage hotels, and trains for heritage tourism. Tourists also flock to hill stations and ayurvedic and yoga resorts. Foreign tourists spend the most money on Indian handicrafts, particularly jewelry, carpets, leather goods, ivory, and brass work. According to a survey, nearly 40% of the money tourists spend on shopping is spent on such items. According to the market research report "Booming Medical Tourism in India," medical tourism is India's fastest-growing tourism sector despite the country's economic slowdown. The report also says that the medical tourism industry in India has a lot of potential. The country's low cost, scale, and variety of treatments make it a popular destination for medical tourism. Efforts to Increase Tourism: The grant of export house status to the tourism industry and incentives for promoting private investment in the form of Income Tax exemptions, interest subsidy, and reduced import duty are two recent government efforts to promote tourism. The hotel and tourism sector has been designated as a high priority for foreign investment, with automatic approval of direct investments up to 51% of foreign equity, 100% non-resident Indian investment, and simplified approval procedures for travel agents, tour operators, and tourist transportation providers.

Impact of Tourism In India

Tourism industry in India has several positive and negative impacts on the economy and society.

These impacts are highlighted below.

Positive Impacts

1. **Finding Work and Making Money:** In India, the travel industry has emerged as a means of earning money and conducting business, alleviating poverty, and sustaining human life. It contributes 6.23 percent to India's GDP and 8.78 percent to the country's total employment. India's tourism industry currently employs

nearly 20 million people.

2. **Foreign Exchange Earnings:** Tourism is India's primary foreign exchange earner. As a result, the country's balance of payments benefits. India's tourism industry is expected to generate US\$275.5 billion by 2018, up from US\$100 billion in 2008. This growth is expected to occur at a rate of 9.4% per year.
3. **Conservation of the Environment and National Heritage:** Tourism contributes to the preservation of historical landmarks by designating them as heritage sites. The Travel industry Office's endeavors to safeguard milestones like the Taj Mahal, Qutab Minar, Ajanta and Ellora sanctuaries, among others, forestalled their rot and annihilation. Additionally, tourism helps to preserve the natural habitats of numerous endangered species.
4. **Infrastructure construction:** Notwithstanding the inns and top of the line cafés that take special care of unfamiliar guests, the travel industry will in general support the improvement of various use framework that helps the host local area. Sports facilities, medical facilities, and other forms of transportation are all part of this infrastructure. As a result of the construction of infrastructure, additional directly productive activities have emerged.
5. **Promotion of Peace and Stability:** Honey and Gilpin (2009) assert that by providing employment opportunities, generating income, diversifying the economy, protecting the environment, and fostering an awareness of other cultures, the tourism industry can also contribute to peace and stability in a developing nation like India. However, significant obstacles must be overcome in order to reap the peace-enhancing benefits of this industry, such as the implementation of regulatory frameworks and mechanisms to reduce corruption and crime.

Negative Impacts

1. **Changes in social and cultural norms that aren't wanted:** Tourism occasionally tore at the social fabric of a community. The more people who visit a place, the greater the likelihood that it will lose its identity. Goa is a decent delineation. From the late 1960s to the early 1980s, when Hippie culture was at its height, Goa was a haven for such hippies. They showed up on a huge scale and modified the state's whole culture, bringing about an expansion in drug use, prostitution, and illegal exploitation. The country was impacted in different ways by this.
2. **Antagonism and Pressure to Increase:** Tourism can increase hostility, suspicion, and hostility when locals and tourists do not respect and comprehend each other's culture and way of life. Violence and other crimes against tourists may

rise as a result. This is shown by the recent crime that a Russian tourist was the victim of in Goa.

3. **Making a Hostility Demeanor:** The local community benefited little from the travel industry. On the majority of all-inclusive package tours, airlines, hotels, and other international businesses pay more than 80% of the fees, rather than local workers and business owners. As a result, local ranchers and laborers are prevented from reaping the benefits of their presence because large lodging network cafés frequently import food in order to satisfy unfamiliar guests. Additionally, these cafés rarely employ local employees for senior management positions. Consequently, there has frequently been hostility toward tourists and the government.
4. **Negative effects on the environment and ecology:** One of the most significant effects of tourism on the environment is the increased strain placed on the ecosystem's carrying capacity in each tourist destination. Expanded transportation and development activities led to widespread deforestation and the instability of common landforms, while an expanding tourist population led to an increase in strong waste unloading and the use of water and fuel resources. Due to stomping on, killing, and aggravated rearing environments, a stream of travelers to biologically fragile regions caused the extinction of interesting and endangered species. Noise from vehicles and public address systems are examples of other forms of pollution, including water contamination, vehicle emissions, untreated sewage, and others. also have a direct impact on biodiversity, the environment, and tourist destinations as a whole.

Conclusion

India's tourism industry is growing and has the potential to significantly boost the country's overall economic and social development, create jobs, and generate significant foreign exchange earnings. However, much more work is required. To ensure that India's tourism contributes to the preservation and maintenance of the country's cultural and natural diversity, ecotourism must be promoted. The tourism industry in India needs to be developed in a way that not only accommodates and entertains visitors without being overly intrusive or harmful to the environment, but also preserves and promotes the indigenous cultures of the regions in which it operates. In addition, all branches of the Central and State governments, the private sector, and non-profit organizations must work together actively to achieve sustainable growth if India is to become a global tourism player. This is because of the way that travel industry is essentially a help industry with various features.

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New trends in Biotechnology and Nanotechnology.

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Introduction:

Biotechnology one of the prominent fields of biology. It involves the use of living organisms, bioprocesses, and other significant applications in many industrial sectors such as engineering, technology, medicine and other fields requiring by-products. The applications of biotechnology are wide-ranging that eventually almost every industry is using this technology.

Nanotechnology involves innovations in drug delivery, fabric design, reactivity and strength of material and molecular manufacturing. It has extensive range of applications in various branches of science including molecular biology, Health and medicine, materials, electronics, transportation, drugs and drug delivery, chemical sensing, space exploration, energy, environment, sensors, diagnostics, micro-fabrication, organic chemistry and biomaterials. Nanotechnology applications are spread over almost all surgical specialties and have revolutionized treatment of various medical and surgical conditions. Clinically relevant applications of nanotechnology in surgical specialties include development of surgical instruments, suture materials, imaging, targeted drug therapy, visualization methods and wound healing techniques. Management of burn wounds and scar is an important application of nanotechnology. Prevention, diagnosis, and treatment of various orthopaedic conditions are crucial aspects of technology for functional recovery of patients. Throughout the years, these primary sectors played significant roles in the advancements of the world today. As the demand for biotech applications continues to expand and new innovations arise every day, the industry will continually grow as mankind seeks to surpass biological challenges with specific research-based solutions. As far as the global pandemic is concerned, it has indeed accelerated both the development and adoption of biotech, with the hope that it will lead to new solutions for major global challenges, including illness, food shortages, and damage to the environment.

Key Words: Trend, Biotechnology, Nanotechnology, printing, medicine.

Major trends in biotechnology:

Bio manufacturing:

This trend relies on naturally occurring processes and reactions to produce outputs such as chemicals, material, etc. that are normally produced through a synthetic process. The most common biological process of bio manufacturing is fermentation. The goal of this application in bio manufacturing is to search for ways to boost sustainability, reduce energy consumption, and increase innovation and productivity. This trend is truly poised to continue advancing.

Synthetic Biology:

The principle of this trend is to engineer new biological systems or re-design existing ones for useful purposes. It involves manipulation of biological compounds which are then integrated into cells which are chosen to provide suitable experimental strategy. Although there are hurdles to overcome in this trend, its potential still outweighs the challenges. It is capable of delivering new solutions to agriculture, global healthcare, manufacturing, and many more.

Bio printing:

The relatively new technology is an additive manufacturing process like 3D printing. The only difference is that bio printers print with cells or biomaterials to create organ-like structures that is beneficial to the healthcare industry. The grandiose potential of this trend benefits several industries including drug discovery, regenerative and personalized medicine. As more researchers gauge the latest bio printing technology, the developments will surely breakthrough in the coming years.

Precision medicine:

The approach to precision medicine allows researchers and doctors alike to predict more accurate treatment and preventive strategies for a particular disease, usually in groups of people.

The goal of this trend is to reduce the risk of human complications in the healthcare industry. Professionals in the field of science are holding on to the promise of precision medicine as it expands in the future.

Gene editing:

This technique in biotechnology inserts, removes, changes, or replaces specific pieces of a person's

existing DNA. To treat diseases, scientists are exploring ways to edit pieces of DNA at precise spots along the gene. The goal of gene editing is to change the existing gene and correct mutations where they occur. CRISPR is the most common type of editing. With this innovation, scientists can now modify genes or replace faulty genes with healthy ones to potentially treat, cure, or prevent a disease or medical condition.

Future of nanotechnology: Nanonuclear medicine:

Treatment of cancers are achieved by delivery of nanoparticles by therapeutic radioisotopes. NPs properties are wide and flexible and enables use of radioisotopes in newer applications. Radio-isotopes versatility and potential with a promise to develop widerange of Nano applications in the future.

Conclusion:

Advances in the fields of drug and gene delivery, biomedical imaging and diagnostic biosensors has enhanced patient care. It plays a great role in all surgical specialties especially with regard to cancer diagnosis, imaging and treatment. Complex and innovative hybrid technologies have widened their applications have potential for development in future.

High-efficiency delivery transporters for biomolecules into cell are produced using single- walled carbon nano-tubes. Nanotechnology manipulation of genetic material and discovery of new biological components are possible. Wound healing and care of burn injuries are most beneficial applications that helps heal wounds and reduce the sufferings of patients.

As the world slowly recovers and adjusts from the setbacks caused by COVID-19, it is essential to still study possible aftershocks that may happen. Biotech research on post- pandemic must spare no effort.

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Content Analysis of Types of Crop Information In Agrowon Newspaper

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Abstract

Agriculture is a back bone of Indian economy. Agriculture is more important in India than anything else because agricultural production sets the tone to all the economic progress. About 58.40 per cent population of the country depends upon agriculture. The crop husbandry information was categorized into different types, on the basis of the crop types. It consists of cereals, pulses, oilseeds, cash crops, forage crops and general information. Among the crop husbandry information cash crop information topped (37.97 per cent). Among the crop husbandry, a cereal was the second highest type (20.86 per cent) and It was followed by general information (19.78 per cent). The information which was not covered cropwise under crop husbandry included under general type of information. The general information followed by oilseeds (10.96 per cent) and very less number of articles was observed on pulses (7.22 per cent) and forage crops (3.21 per cent).

Key words: Content Analysis, Types of crop Information, Agrowon Newspaper

Introduction

Majority of farmers reading newspaper are interested to read matter related to farming. Thus newspaper can be used effectively for transfer of technology to the farmers. There is a scope to publish agricultural information in regional language newspaper (Kalantri et al, 1991). It is important to investigate the analysis on coverage of various agricultural information. Among various mass media, print media play important role in dissemination of farm information among the rural society. In print media newspaper plays unique role, majority of farmers reading newspaper are interested to read matter related to farming. The sakal group of newspaper has launched Agrowon, the first ever Marathi daily completely devoted to agriculture in 19th April 2005. Agrowon includes latest news and views about agriculture, political news affecting the socioeconomic life of farmers, National-International and State level development, success stories of farmers, research and development and new project information on processing of agriculture produce, market rates and trends, weather forecasting and audience. Apart from this various schemes of the Central and State Government, Science and technology related to Agriculture, export of agricultural produce and export procedures and facilities are also part of Agrowon.

This type of investigation is thought to prove to be a great value to editors, farm writers from State Agricultural Universities, Research Institutes, Development Departments of

Government, NGO's, Progressive farmers, while editing and supplying farm information for the benefit of farmers. The findings of the study will be useful in improving the physical makeup of the printed farm material. Government of Maharashtra and Government of India is laying down heavy emphasis on horticultural development programmes. Hence, the findings of the present investigation having more emphasis on content analysis of the agricultural information will be useful to extension agencies of Government. For giving more emphasis of the information supply on less emphasized areas and demanded areas of the farmers as per felt needs.

Materials and Methods

Agrowon is one of the renowned farms Marathi daily newspaper was considered purposefully for the study. The issues of the Agrowon newspaper published in three years during June 1st 2008 to May, 31st 2011 were considered for the study, from this selected issues making the size of sample about 122 newspaper were selected randomly for the study. Firstly each issue of newspaper was read carefully total frequency and space covered by information and advertisement (agricultural, horticultural and non agricultural) and also the space covered by the horticultural articles (fruits, vegetables, flowers, spices and aromatic and medicinal crops) were counted in square centimeters. The figures are expressed in terms of frequencies and percentage for simple comparison and for drawing meaningful conclusions.

Content analysis of the information

It is the method of communication analysis

as well as methods of observations. It is versatile research technique in man communication as well as social science research. Where data obtained from archival records can be analyzed systematically and scientifically to draw conclusion (Murthy, 1999).

Content analysis of agricultural information

It refers to the analysis of the agricultural information appeared in the newspaper in terms of identification of agricultural and non agricultural information, identification of major agricultural and allied areas, categorization of major and sub major agricultural area from the article.

Crop husbandry- This type includes information on cereals, pulses, oilseeds and cash crops with its

Table. Types of crop husbandry information appeared in the Agrowon newspaper

Sl. No	Types of crop husbandry Information	Frequency of package of practices (n =374)				
		Crop production	Farm mechanization	Postharvest technology	Marketing	Total
1.	Cereals	58 (15.51)	01 (0.27)	08 (2.14)	11 (2.94)	78 (20.86)
2.	Pulses	21 (5.61)	-	02 (0.53)	04 (1.07)	27 (7.22)
3.	Oilseeds	31 (8.29)	01 (0.27)	04 (1.07)	05 (1.34)	41 (10.96)
4.	Cash crops	82 (21.92)	08 (2.14)	09 (2.41)	43 (11.50)	142 (37.97)
5.	Forage crops	10 (2.67)	-	02 (0.53)	-	12 (3.21)
6.	General	47 (12.57)	13 (3.48)	09 (2.41)	05 (1.34)	74 (19.78)
	Total	249 (66.58)	23 (6.15)	34 (9.09)	68 (18.18)	374 (100.00)

(Figures in the parentheses indicate percentage). It was elucidated that among the crop husbandry information cash crop information topped (37.97 per cent) in the total number of crop husbandry information in Agrowon newspaper. Among the crop husbandry, a cereal was the second highest type (20.86 per cent) and It was followed by general information (19.78 per cent). The information which was not covered cropwise under crop husbandry included under general type of information. The general information followed by oilseeds (10.96 per cent) and very less number of articles were observed on pulses (7.22 per cent) and forage crops (3.21 per cent).

It was concluded that majority of the articles were observed on cash crops (37.97 per cent). Because of these crops gives more income and regular money to the rural farmers. The cash crops were followed by cereal (20.86 per cent). The cereal crops is staple food crops so this was good sign of Agrowon to give large number of articles on cereals. Less coverage was given to oilseeds, pulses and forage crops. There is scope to Agrowon to give more attention on these important crops.

Regarding package of practices crop production topped (66.58 per cent) in the total number of crop husbandry information followed by Marketing (18.18 per cent), post harvest technology

crop cultivation, farm mechanization, post harvest technology and marketing.

Results and Discussion

Types of crop husbandry information appeared in the Marathi newspaper Agrowon

The crop husbandry information was categorized into different types, on the basis of the crop types. It consists of cereals, pulses, oilseeds, cash crops, forage crops and general information. Regarding package of practices, it includes crop production, farm mechanization, post harvest technology and marketing. The frequencies of representative types were worked out which are presented in Table 1.

(9.09 per cent) and farm mechanization (6.15 per cent). This indicates that the maximum number of articles appeared on the crop production i.e. from preparatory tillage operations to the harvesting. Second importance was given to marketing and then post harvest technology. The farm mechanization was neglected area so there is scope to give more articles on farm mechanization and also on post harvest technologies for saving labour cost and value addition respectively.

Regarding crop groupwise package of practices, in cereals crop production articles topped (15.51 per cent) followed by marketing (2.94 per cent), post harvest technology (2.14 per cent) and very less number of articles were on farm mechanization (0.27 per cent). Among pulses highest articles on crop production (5.61 per cent) followed by marketing (1.07 per cent) and post harvesting technology (0.53 per cent). Not a single article was found on farm mechanization so there is scope to cover more articles on this area. Among the oilseeds crop production topped (8.29 per cent). Less number of articles were on farm mechanization (0.27 per cent), PHT (1.07 per cent) and marketing (1.34 per cent). In cash crops also crop production articles ranked first (21.92 per cent) followed by marketing (11.50 per cent), less number of articles were observed on PHT (2.41 per cent) and farm

mechanization (2.14 per cent). Among the forage crops less number of articles was on crop production (2.67 per cent) and other practices were neglected. In general information the crop cultivation articles topped (12.57 per cent) followed by farm mechanization (3.48 per cent), PHT(2.41 per cent) and marketing (1.34 per cent).

This reported that there is a scope to give more attention on farm mechanization articles and post harvest technology articles. The findings were in line with Sindhu *et al.* (1983) and Waghmare (2001). The results are partially inline with Sawant and Shinde (1999), Jagatap (2001) and Nagane (2005).

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Ethno-botanical studies of medicinal plants from Tehsil Akkalkot district Solapur, Maharashtra, India

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Abstract:

The present study is main part of traditional knowledge and medicinal uses of plants. The present survey was done in Akkalkot tehsil in the year 2020-2022. The theme of ethno-botany or folkloric botany reveals interrelation of plants and man. Traditional medicine is defined as indigenous medicine that is used to maintain health. Which help to cure various diseases in local peoples such as Cough, Jaundice, Dysentery, Acidity, Common Cold, Toothache, Asthma, Diabetes, Wounds, Rheumatism, Fever and various skin infections like fungal and bacterial etc. The preservation of traditional knowledge can be effectively documented by the pervasive participation of local herbal-healers. This survey is carried out so as to collect and document valuable information about diversity of medicinal plant species used by local people in and around Akkalkot tehsil.

Keywords: Ethno-botany, survey, medicinal plants, traditional, various diseases

Introduction:

Ethno botany has now contributions to an understanding of man-plant association as well as for the practical applications of the biological knowledge of aboriginal people in medicine, health, agriculture and industry (Pawar et al., 2008). An ethnobotanist thus strives to document the local customs involving the practical uses of local flora for many aspects of life, such as plants as medicines, foods, intoxicants and clothing (www.eplantscience.com). Ethnobotany has grown from simply acquiring ethnobotanical knowledge to that of applying it to a modern society, primarily in the form of pharmaceuticals. Recent trends indicate that today's civilization is in the favour of Ayurveda. Utilization of plants for medicinal purposes in India has been documented long back in ancient literature because they are essential for human survival. (Panghal et al 2010). The first record of medicinal plants was recorded in the Rig Veda between 4500-1600 BC and Ayurveda between 2500-600BC (Ahmad, H; 1999). According to the National Medicinal Plants Board, Govt. of India, a number of 17,000 to 18,000 species of flowering plants are estimated of which 6,000 to 7,000 species are found to have medicinal uses in folk and documented systems of medicine like Ayurveda, Unani, Siddha and Homoeopathy (Swargiary A, et al 2013). The tribal and indigenous communities of India were found to be using more than 10,000 species of wild plants for various purposes which includes about 8,000 species for medicinal

uses (Pushpangadan et al., 2010). Throughout world, plants have been in continuous use in treatment of various diseases. This practice is deep rooted in India and the herbal medicine knowledge has been acquired through long tradition and experience. In India several groups of studies reported that traditional healer use 3000-3500 plant species and 100 species serves as regular source of medicine (Ganeshan et al., 2006, Pei, 2001 and Vidhyarthi et al., 2004). Because of the fast acceleration of market demand for herbal medicines, and recent controversies related to access, benefit sharing and biopiracy, the documentation of indigenous knowledge is of urgent priority. Many ethnobotanical studies have been carried out in different parts of India and abroad. (Rahul, J; 2013; Maheshwari J.K; 1963; Parul and Vashistha 1915) Traditional medicine is a knowledge system compiled together by different generations from different societies before the age of modern medicine. It is also known as folk or indigenous medicine (Principe et al 2002). While most theories, beliefs and practices of indigenous cultures, their ethnomedicinal knowledge is valuable for health maintenance, including diagnosis, treatment and prevention of mental and physical illnesses (WHO 2019). The World Health Organization (WHO) had estimated that 70 percent of the population uses traditional and complementary medicine (WHO 2008)

Medicinal plants produce chemical substances, synthesized by plants which are also known as secondary metabolites. Medicinal plants

have served as the main source of medicine in India (Sonowal et al 2012). Medicinal plants are used for preventive, promotive and curative purposes. Medicinal plants have been preliminary selected on the basis of local traditional knowledge (Maru et. al 2013). Plants are always considered as a primary source of drugs in traditional and conventional system of medicines. About 80% people of the world, particularly in the rural areas of developing countries, continue using traditional resources in healthcare (Poonam et,al 2009).. Rural people hand over the traditional indigenous knowledge of medicinal value of plants growing around them to next generation. (Savinaya et al., 2016). It was thought of in practical use terms for culinary and medical purposes and the ethnographic element was not studied as a modern anthropologist might approach ethnobotany today. The largest part of the population resides in the rural areas, and very strong plant-people interaction can be seen (Abbas et al., 2021). According to (WHO) World Health Organization,

Study Area:

Akkalkot taluka is situated in southern part of the Maharashtra plateau. Akkalkot taluka is lies between 170 171 5411to 170 441 3 11 north latitude

about 80% of indigenous populations in developing countries use the traditional medicines for primary treatment of common diseases. (Chandanshive et. al., 2022). In the world, India ranks 6th among 12 mega diversity countries which is a treasure for endemic medicinal plants (Samudra and Shinde, 2021). Medicinal plants have an important role in the wealthy life of people. In India, Ethno-medicinal heritage is continued even today from several centuries through rural and remote areas. The current research work is an aimed to highlight ethno medicinal plants species belonging to various families with their availability and their uses.

Materials and methods:

In the present work field survey were conducted during 2020 to 2022 in several urban and rural area of Akkalkot tehsil. The present data was collected from knowledgeable Local elder peoples, Medicinal Practitioners, Viadas and Farmers through interviews, the local names and doses of administration have been documented.

& 750 531 4211to 760 251 4311 East longitude. According to area the Akkalkot tehsils as a 6Th rank with 1401Sq. Km. & contains 138 villages

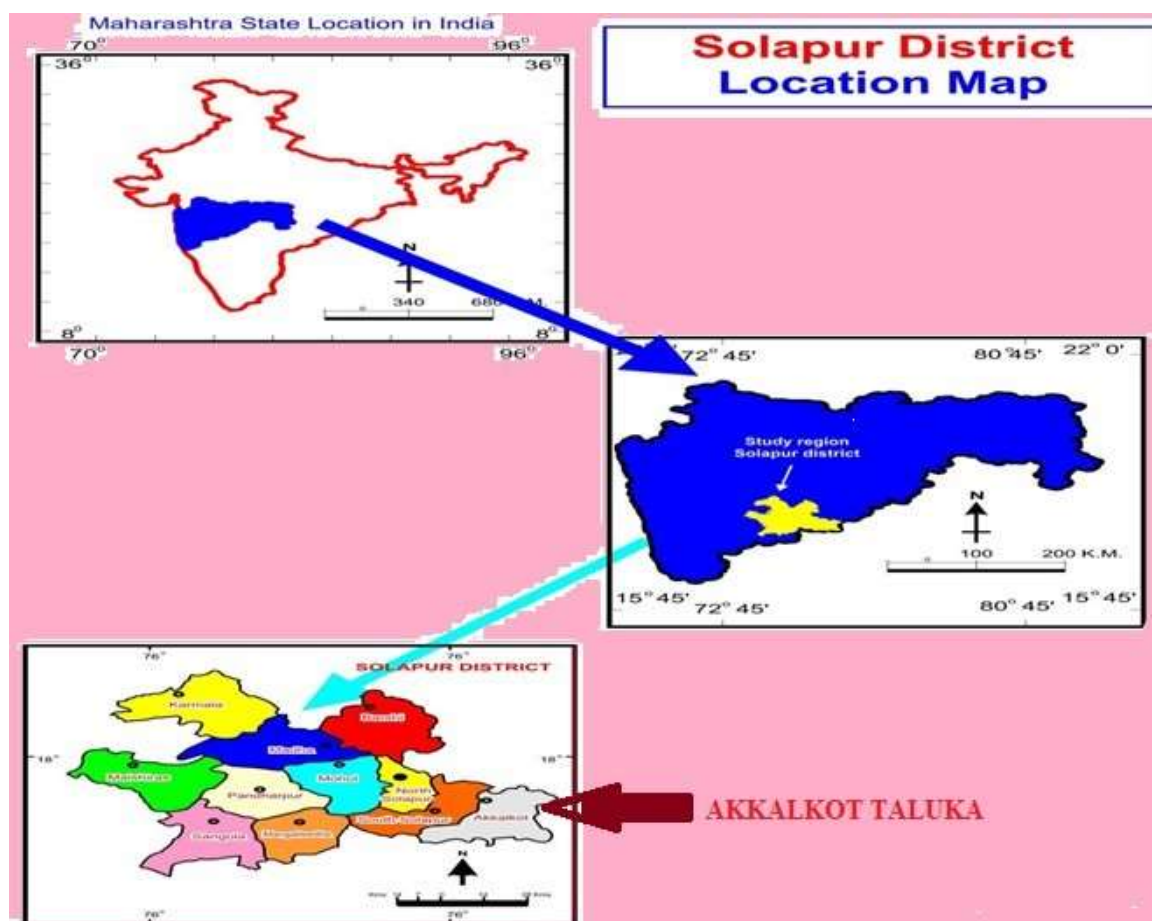


Fig 1: Location map of Akkalkot tehsil

Akkalkot tehsil occupies the southeast corner of the district and is bordered by Osmanabad District to the north, Karnataka's Gulbarga and Bijapur districts to the southeast and south respectively and South Solapur Taluka to the west. Akkalkot

tehsil is occupied by the Bori, Harana and Seena river basin. The tehsil headquarters is located at Akkalkot, which is also the largest city in the tehsil and a religious center of the area.

Table-1

Sr No	Botanical name	Family	Local name	Habit	Parts used	Use in Ethnomedicine
1	<i>Abutilon hirtum</i> (Lam.) Sweet	Malvaceae	Bankhangi	Herb	Leaves, Stem	Toothache, Hyper urea, Headache
2	<i>Adathoda vasica</i> Nees	Acanthaceae	Adulsa	Shrub	Leaves,	Bronchitis, Tuberculosis
3	<i>Acacia catechu</i> (Arn).	Fabaceae	Khair	Tree	Bark, Stem	Anti-leprosy activity, Refrigerant, Wound healing
4	<i>Achyranthes aspera</i> L.	Amaranthaceae	Aghada	Herb	Leaves, Stem	Anti-venom, to cure mineral deficiency
5	<i>Aegle marmelos</i> L. Correa	Rutaceae	Bel	Tree	Fruits, Leaves, Bark	Common cold and Cough
6	<i>Amaranthus spinosus</i> L.	Amaranthaceae	Kathemath	Herb	Leaves, Stem	Urine disease, Pain killer
7	<i>Alstonia scholaris</i> (L.) R. Br	Apocynaceae	Saptaparni	Tree	Leaves	Treat diarrhea, Dysentery
8	<i>Annona squamosa</i> L.	Annonaceae	Sitaphal	Tree	Leaves, Fruits	Cancerous tumors, bscesse
9	<i>Annona reticulata</i> L.	Annonaceae	Ramphal	Tree	Bark, Fruits	Astringent, Diarrhea
10	<i>Argemone mexicana</i> L.	Papaveraceae	Piwla dhotra	Herb	Bark, Fruits	Cough and cold, Urino-genital diseases, Ear ache,
11	<i>Asparagus racemosus</i> Willd.	Liliaceae	Shatavari	Climber	Bulb	Stomach pain, Acidity, Inflammation, Liver tonic and Urinary stringent, Leprosy, Skin diseases, Dyspepsia,
12	<i>Azadirachata indica</i> A. Juss.	Meliaceae	Kadunimb	Tree	Root, Stem, Leaves, Fruits	Ulcers, Tuberculosis
13	<i>Barleria prionitis</i> L.	Acanthaceae	Koranti	Herb	Leaf, Stem, Root, Bark	Toothache, Glandular swellings
14	<i>Bauhinia purpurea</i> L.	Fabaceae	Rakta kanchan	Tree	Bark	Antifungal, Antidiarrhea
15	<i>Boerhavia diffusa</i> L.	Nyctaginaceae	Punarnava	Herb	Roots, Pods	Boils, Healing wounds, Jaundice
16	<i>Catharanthus roseus</i> (L.) G. Don (Vinca rosea L)	Apocynaceae	Sadafuli	Herb	Leaves, Flowers	Relieve muscle pain, Depression
17	<i>Caesalpinia pulcherrima</i> (L.) Sw.	Fabaceae	Shankasur	Shrub	Leaves	Minor injuries, Relieve fever
18	<i>Calotropis procera</i> (Aiton) W.T. Aiton	Apocynaceae	Rui	Shrub	Root, Leaves	Dysentery, Boils, Stomach disorder
19	<i>Cannabis indica</i> Lam.	Cannabaceae	Ganja	Shrub	Leaves, Stem	Pain killer, Sexual stimulant
20	<i>Capparis decidua</i>	Capparaceae	Nepati	Shrub	Leaves, Stem,	Gastric trouble, Cough,

	(Forsk.) Edgew.				Seeds	Common cold,
21	<i>Senna auriculata</i> (L.) Roxb. (Synom : <i>Cassia auriculata</i> L)	Fabaceae	Tarvad	Herb	Leaves, Stem	Constipation, Jaundice, Diabetes
22	<i>Carica papaya</i> L	Caricaceae	Papaya	Herb	Leaf	Intestinal parasite infections
23	<i>Cassia fistula</i> L	Fabaceae	Bahava	Herb	Leaf, Root	Inflammatory swellings
24	<i>Capparis divaricata</i> Lam.	Capparaceae	Pachunda	Shrub	Fruits, Root, Seed	Anti-rheumatic, Tonic
25	<i>Carthamus tinctorium</i> L	Asteraceae	Kardai	Herb	Leaves, Fruit	Common cold, Jaundice, Rheumatism, Stomach pain
26	<i>Celosia argentea</i> L.	Amaranthaceae	Kurdu	Herb	Leaves, Stem	Sexual stimulant, Urino-genital diseases
27	<i>Centella asiatica</i> (L.) Urban	Apiaceae	Bramhi	Herb	Leaves, Stem	Headache, Fever, Hypertension, Enhancing memory in child
28	<i>Chrysanthemum indicum</i> L	Asteraceae	Shevanti	Herb	Leaves	Inflammation, Hypertension, and respiratory diseases
29	<i>Chenopodium album</i> L.	Amaranthaceae	Chakhvat	Herb	Leaves	Dysentery, Skin heating, Stomach pain
30	<i>Citrullus colocynthis</i> L. Schrad	Cucurbitaceae	Indravan	Climber	Leaves, Stem	Rheumatism, Chest inflammation
31	<i>Cleome viscosa</i> L.	Cleomaceae	Piwalya	Herb	Stem, Leaves, Fruit	Wound healing, Headache, Ear pain, Toothache, Fever
32	<i>Clitoria ternatea</i> L.	Fabaceae	Gokarn	Herb	Leaves	Memory disorder, Menstrual disorders, Sexual stimulant
33	<i>Coccinia grandis</i> (L.) Vigot	Cucurbitaceae	Tondali	Climber	Seeds, Leaves	Blood anti-clotting, Asthma, Urino-genital disease, To control blood sugar level
34	<i>Dalbergia sissoo</i> Roxb.	Fabaceae	Shisam	Tree	Leaves, Stem	Leprosy, Scabies
35	<i>Datura metel</i> L.	Solanaceae	Dhotra	Herb	Leaves, Bark, Roots	Relief body pain
36	<i>Datura stramonium</i> L.	Solanaceae	Kala Dhotra	Herb	Fruits, Leaves	Respiratory problem, Fever, Inflammation, Cough
37	<i>Delonix regia</i> (Boj. ex Hook.) Raf.	Fabaceae	Gulmohar	Tree	Stem, Leaves, Fruits	Constipation, Inflammation
38	<i>Ephorbia triucalli</i> L.	Euphobiaceae	Sher	Shrub	Seeds, Leaves	Skin disease, Wart, Rheumatic
39	<i>Euphorbia hirta</i> L.	Euphobiaceae	Dudhi	Herb	Leaf	Jaundice, Gonorrhea
40	<i>Eucalyptus globulus</i> Labill.	Myrtaceae	Nilgiri	Tree	Leaf	Arthritis and Skin ulcers
41	<i>Ficus benghalensis</i> L.	Moraceae	Vad	Tree	Latex, Leaves	To cure wounds, Inflammation
42	<i>Ficus religiosa</i> Linn.	Moraceae	Pimpal	Tree	Leaves	Gonorrhea, Scabies, Anti-venom.
43	<i>Ipomoea carnea</i> Jacq.	Convolvulaceae	Besharam	Shrub	Leaves, Stem, Fruits	Pile, Fever, Antiseptic

44	<i>Lawsonia inermis L</i>	Lythraceae	Henna	tree	Leaf, Seed	Skin infections, Wounds, Eczema
45	<i>Limonia acidissima L</i>	Rutaceae	Wood apple	Tree	Fruit, Root .Leaf	Diarrhea, High cough
46	<i>Lantana camara L</i>	Verbenaceae	Tantani	Tree	Leaf	Cancer, Leprosy, Chicken pox
47	<i>Mangifera indica L</i>	Anacardiaceae	Mango	Tree	Leaf, Seeds	Lower blood pressure, Regular pulse, Stabilize digestive system
48	<i>Mentha spicata L</i>	Lamiaceae	Mint	Herb	Leaf	Irritable Bowel Syndrome
49	<i>Millingtonia hortensis L.f.</i>	Bignoniaceae	Indian cork tree (buch)	Tree	Flower, Roots	Asthma, Antipyretic, Sinusitis, Chologogue and tonic
50	<i>Mimosa pudica L</i>	Fabaceae	Lajalu	Herb	Leaf	Conjunctivitis, Hemorrhoids
51	<i>Momordica charantia L</i>	Cucurbitaceae	Karla	Climber	Leaf, Fruits	Liver disease, Ulcers
52	<i>Moringa oleifera Lam</i>	Moringaceae	Shevga	Tree	Leaf	Arthritis, Constipation, Intestinal ulcers, Intestinal spasms
53	<i>Murraya koenigii (L.) Sprengel</i>	Rutaceae	Curry leaves	Tree	Leaf	Bruises, Edema, Piles, Itching
54	<i>Martynia annua L.</i>	Martyniaceae	Waghnakhy a	Herb	Leaves	Urino-genital disease, Ulcers
55	<i>Monoon longifolium</i> Sonn. B. Xue & R.M.K. Saunde	Annonaceae	Ashok	Tree	Leaves, Roots	Diabetes, Antiseptic, Skin diseases
56	<i>Nerium oleander L</i>	Apocyanaceae	Kanher	Shrub	Leaf, Seed	Heart conditions, Epilepsy, Painful menstrual eriods, Leprosy
57	<i>Nyctanthes arbor-tristis L</i>	Oleaceae	Parijatak	Tree	Leaf, Bark	Anti-helminthic, Anti-pyretic
58	<i>Ocimum sanctum</i> Linn.	Lamiaceae	Tulsi	Herb	Flower	Cough, Common cold, Antiseptic
59	<i>Pongamia pinnata (L.) Pierre</i>	Fabaceae	Karanj	Tree	Root	Tumors, Piles, Skin diseases
60	<i>Psidium guajava L</i>	Myrtaceae	Peru	Tree	Leaf	Gastroenteritis, Cough, oral ulcers
61	<i>Punica granatum L</i>	Lythraceae	Pomegranate	Tree	Fruits, Seeds	Digestive, Skin disorders, Arthritis
62	<i>Phyllanthus emblica L.</i>	Phyllanthaceae	Awala	Tree	Leaves, Stem	Sore throat, Vomiting, Chest relief, blood purifier
63	<i>Plumeria rubra (Lim.)</i>	Apocynaceae	Chapha	Tree	Fruits, Leaves	Wound healing, Rheumatism.
64	<i>Prosopis juliflora (Swarts) DC.</i>	Fabaceae	Vilayati babhul	Shrub	Bark	Boil, Fungal & Bacterial infections.
65	<i>Ricinus communis L.</i>	Euphobiaceae	Arandi	Shrub	Leaves, Stem	Jaundice, Fungal and Bacterial infection.
66	<i>Santalum album</i> Linn.	Santalaceae	Chandan	Tree	Leaves	Burns, Headache, Gonorrhea disease, Skin diseases
67	<i>Sesbania sesban (L.) Merr</i>	Fabaceae	Shevari	Tree	Leaf	Gonorrhea, Syphilis, Jaundice
68	<i>Spathodea campanulate</i>	Bignoniaceae	Pichkari	Tree	Leaf, Stem,	Urethral inflammation, Liver complaints, as a poison

	<i>P.Beauv.</i>				Root	antidote
69	<i>Senna tora</i> (L.) Roxb.	Fabaceae	Takala	Herb	Leaves, Stem	Skin diseases.
70	<i>Syzygium cumini</i> L. Skeels.	Myrtaceae	Jambhul	Tree	Leaves	Dysentery, Stomach, Cramps,
71	<i>Tamarindus indica</i> L.	Fabaceae	Chinch	Tree	Fruit	To cure eye infection, Ulcer.
72	<i>Tephrosia purpurea</i> L. Pers.	Fabaceae	Unhali	Herb	Fruits, Leaves	Fungal disease, Acidity, Anti- venom.
73	<i>Terminalia arjuna</i> (Roxb.) Wight & Arn.	Combretaceae	Arjun	Tree	Roots, Bark, Leaves	Headache, Wound healing, Burns.
74	<i>Terminalia catappa</i> L.	Combretaceae	Deshi badam	Tree	Fruits, Bark, Leaves	Acidity, Headache, Urinogenital disease
75	<i>Tinospora cordifolia</i> (Thunb.) Miers	Menispermaceae	Gulvel	Climber	Fruits, Leaves	Diabetes and Rheumatic weakness, Sore throat, Cardiac diseases
76	<i>Tribulus terrestris</i> L.	Zygophyllaceae	Sarata	Herb	Fruit, Leaves, Stem,	Urinary disorders, Wound healing
77	<i>Tridax procumbens</i> L.	Asteraceae	Dagadipala	Herb	Leaf	Wound healing, anticoagulant
78	<i>Vitex negundo</i> L.	Lamiaceae	Nirgudi	Shrub	Leaf	Muscle aches, Joint pains, Edema
79	<i>Withania somnifera</i> L. Dunal	Solanaceae	Ashwagandha	Herb	Bark	Ulcer, Fever, Cough, Leukoderma.
80	<i>Zizyphus mauritiana</i> Lamk.	Rhamnaceae	Chitter bor	Shrub	Roots, Leaves, Fruits	Cold and Cough, Chest relief.

Discussion:

As per the survey, we can conclude that there are so many medicinal plants available in our surrounding which are too much beneficial for health purpose (Table -1). The Indigenous healers and traditional healthcare practitioners throughout the world have developed rich stores of knowledge about these medicinal plants when providing services to a specific community. Various ethnobotanist has curiosity towards the uses of the plants and they perform survey through questionnaires and interview of the local people to collect the indigenous knowledge. As the traditional knowledge is transferred verbally from one generation to others, so to conserve these medicinally important species, the documentation, identification and collection of data related to these beneficial plants must be listed out in proper format. It also shows that the great diversity of medicinal plants with different medicinal properties. The traditional knowledge of tribal communities in has high ethno botanical importance. They utilize numerous plants and their various parts viz, roots, leaves, stems, flowers and fruits in various ways for the medicinal purposes because medicinal plants and their extracts have immense potential for the management and treatment of various diseases as well as the phyto-medicines that are used by the local people for various diseases are cheap and

easily affordable.

Conclusion:

There is an urgent need, in this new millennium, for the conservation of traditional medicinal knowledge and medicinal plant resources in developing countries. The future of ancient traditional medicine in the new millennium is uncertain, and depends on the innovations of science and technology, the interests of large industry groups, and the policies that govern cultural traditions in developing countries. There is also the undeniable truth that, at present, no single medical system is perfect and complete in its ability to treat all forms of illness and disease. Whether it is Western, Eastern, allopathic, or homeopathic. Therefore, it is important for health care providers worldwide to understand and examine the medical traditions that are being practiced in all countries. In this regard, traditional medicinal plants have a very important role to play.

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a. Abutilon hirtum (Lam.) *b. Argemone mexicana* L *c. Catharanthus roseus* (L.) *d. Cassia auriculata* L) *e. Calotropis procera* (Aiton) *f. Carthamus tinctorius* L *g. Datura metel* L. W.T.Aiton *h. Moringa oleifera* Lam *i. Nerium oleander* L. *j. Phyllanthus emblica* L *k. Tridax procumbens* L *l. Tribulus terrestris* L



Effect of Water hyacinth vermicompost on growth attributes of Cow pea plant.

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Abstract:

Solid waste management is the major problem. Because the waste generated from various sources should be properly disposed in order to maintain the healthy environment. Present study was conducted to recycle the aquatic weed, water hyacinth with suitable method of vermicomposting by using earthworm, *Eudrilus eugeniae*. The water hyacinth vermicompost was applied on Cow pea (*Vigna unguiculata*) plant and measured the growth parameters. The result indicated that vermicompost treated plants showed maximum enhancement in the plant growth attributes over control. Therefore, it can be concluded that vermicompost is very effective in improving soil quality and crop yield. And it can be best alternative fertilizer to replace the chemical fertilizer.

Key words: Water hyacinth, *Eudrilus eugeniae*, Vermicompost, Cow pea.

Introduction:

The science and technology has a greater contribution in recycling the waste generated from various biological resources. Therefore, the solid waste management is a major challenge in front of developing countries. Inadequate collection, treatment, recycling, uncontrolled and unspecified dumping leading to the health hazards (Singh *et al.*, 2018) ^[14]. Sambhaji tank is a famous water body, situated in the centre of Solapur city. The tank water remains covered with the dense mat of aquatic plant, Water hyacinth (Ankaram *et al.*, 2012) ^[2]. Water hyacinth (*Eichhornia crassipes*) is free floating, perennial hydrophyte which belongs to the family Pontederaceae. Water hyacinth is fast developing and it spreads over the surface of the water and create problem in water bodies. This plant considered as nuisance aquatic weed commonly grow in highly polluted aquatic bodies. Weeding out of water hyacinth causing lots of difficulties in the Sambhaji tank, Solapur. Therefore, this weed is not allowed to propagate in water. Plants are removed from lake and dumped on the roadside without proper care. This causes accumulation of huge masses of water hyacinth plant.

A careful disposal of water hyacinth is very essential for the environment. Therefore, it is very necessary to recycle this aquatic weed with appropriate technique to minimize the loss to the aquatic bodies (Violand and Addam, 2006 ^[15]; Ankaram, *et al.*, 2012 ^[2]). Water hyacinth is rich source of organic waste. It is easily available source as it continuously and rapidly spreads in uncontrolled manner. Therefore, the only feasible

alternative for disposal of water hyacinth weed waste is vermibiotechnology. Because it is eco-friendly method of solid waste management (Sharda Vidya and Lakshmi Girish, 2014 ^[12]; Gajalakshmi *et al.*, 2002 ^[5]). Vermicomposting is a process of conversion of organic waste into nutrient rich vermicompost by means of earthworms as bioengineers. Vermicompost is rich source of macro and micro nutrients like Nitrogen, Phosphorous, Potassium, Calcium, Magnesium, Sodium and Chloride, growth hormones and microbes which are crucial for plant growth and development (Gajalakshmi and Abbasi, 2004 ^[4]).

Cowpea is annual herbaceous leguminous plant which belongs to the genus *Vigna*. It is an important crop as it can grow in semiarid region with low rainfall. Cow pea has very good nutritive value. The raw seed are consisting of carbohydrates, fat, proteins, vitamins like A, C, K, Thiamin, Riboflavin, Niacin, B₆ and Folate. It also consists of important minerals like calcium, iron, magnesium phosphorous, potassium, sodium and zinc (Okonya and Mass, 2014 ^[9]). Osoro Newton *et al.*, (2014 ^[10]) studied the water hyacinth compost on the growth and yield of Maize (*Zea mays*). Shridevi *et al.*, (2016 ^[13]) studied the bioconversion of water hyacinth into vermicompost after mixing with cow dung with the help of earthworm, *Eisenia foetida*. Alvarez Bernal *et al.*, (2016 ^[1]) have studied the vermicomposting of water hyacinth, *Eichhornia crassipes* and stated that vermicompost is a nutrient rich manure and it can be useful for enhancement of soil potency. Latha Sadanandan (2018^[8]) has studied a detail account of comparison between the aquatic

weeds *Eichhornia crassipes* and *Pistia stratiotes* by producing vermicompost with the help of *Eisenia foetida*.

Materials and methods:

a) Study area: Sambhaji tank is located in the centre of the Solapur city. The water hyacinth plant spreads and covers the entire water body. These plants were collected from Sambhaji tank and chopped into small pieces by using mechanical choppers. Then they were allowed to sundry for about 15 days. After that these dried plants were further ground in to fine powder by using mechanical pulveriser. The production of water hyacinth vermicompost and application of vermicompost were carried out at Akkalkot during 2017-2018.

Following are the various treatments for production of vermicompost.

Set A- Organic raw material (ORM-Dried organic raw material of water hyacinth).

Set B- Water hyacinth powder subjected to decomposition (Composting)

Set C- 50% water hyacinth powder + 50 % cow dung + *Eudrilus euginae* by pot method (Vermicomposting).

b) Pot method vermicomposting: For the pot method of vermicomposting, pots of 5 kg capacity

were used. Small holes were made at the sides of the pots. These pots were filled with mixture of 50% water hyacinth powder (ORM) and 50% cow dung. The earthworms, *E. euginae* were introduced in all the pots after initial partial decomposition (45 days). The pots were kept for further decomposition by maintaining the 70-80% moisture. The decomposition of water hyacinth and cow dung mixture was carried out for about 90 days (3 Months).

c) Application of Vermicompost on Cow pea (*Vigna unguiculata*) plant:

After harvesting of the vermicompost, it was applied on Cow pea plant to observe its effect on growth attributes such as Height of plant, number of leaves, number of flowers and number of pods. Plants were observed regularly and measurement of growth parameters was carried out at interval of month. The treatments of this experiments are as follows,

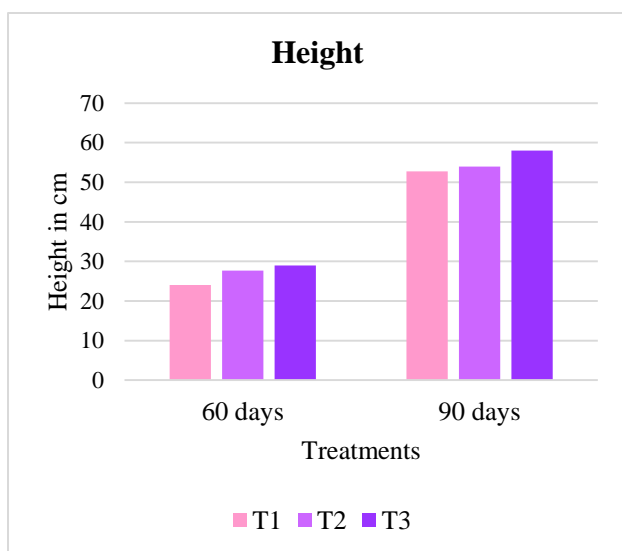
T1- Control (100% soil)

T2- Compost 50%+ Soil 50%

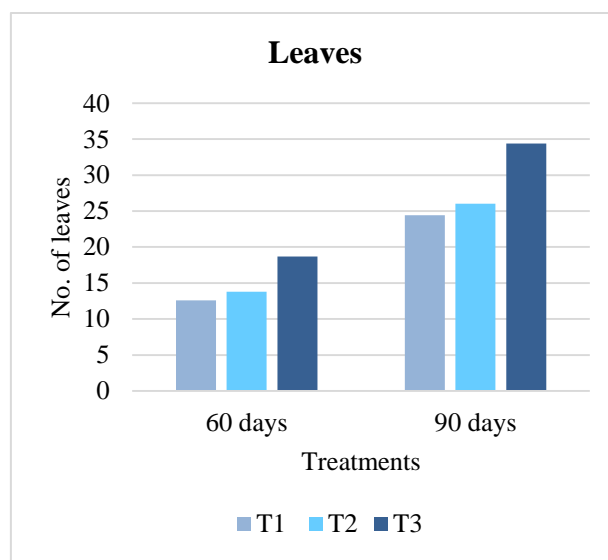
T3-Vermicompost 50% + Soil 50%.

Result and Discussion:

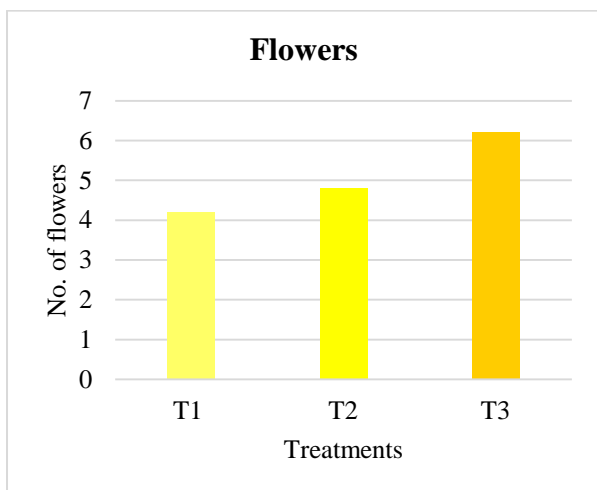
The result of the application of water hyacinth compost and vermicompost on Cow pea plant are shown in graph 1-4.



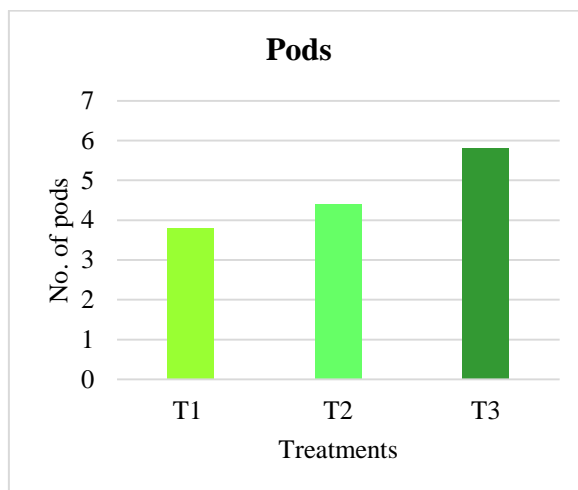
Graph 1: Effect of vermicompost on Height of Cow pea plant after 60 and 90 days.



Graph 2: Effect of vermicompost on No. of leaves of Cow pea plant after 60 and 90 days.



Graph 3: Effect of vermicompost on No. of flowers of Cow pea plant after 90 days.



Graph 4: Effect of vermicompost on No. of pod of Cow pea plant after 90 days.



Figure 1: Cow pea plants grown in pots.



Figure2: Pods of Cow pea plant.

The Cow pea plants were grown in pots with treatments T1, T2 and T3 as stated above. From our results can be observed that, the plants in T3 (Vermicompost application) group showed significant enhancement in the growth parameters as compare to T2 and T1. This indicates that water hyacinth vermicompost might have played role in increasing the plant height, number of leaves, number of flowers and number of pods of Cow pea plant. Vermicompost contains the essential nutrients in plant available form. Therefore, the plants uptake these nutrients and results in enhancement of plant parameters (Gajalakshmi and Abbasi, 2004^[4]; Hemlatha, 2012)^[6]. Enrichment of nutrients in the vermicompost occurs because of the mutual efforts of microorganism and earthworms that cause degradation of complex organic matter and release of nutrients (Atiyeh *et al.*, 2000^[3]).

Many workers have observed the effect of vermicompost on vegetable plants. Paul Sreyashi and Bhattacharya (2012^[11]) used water hyacinth vermicompost on African Marigold (*Tagetes erecta*) plant to see its effect on plant growth. They finally

suggested that vermicomposting is effective method for conversion of nuisance weed water hyacinth into nutrient rich vermicompost. Sharda Vidya and Lakshmi Girish (2014^[12]) have studied a detail account of *Eichhornia crassipes* and recommended that the water hyacinth can be used as a green manure. Ishtiyag Ahmed *et al.*, (2015^[7]) studied effect of macrophyte vermicompost on growth and productivity of Brinjal plant. Yadav Anil Kumar *et al.*, (2019^[16]) studied effect of organic manure and biofertiliser on growth and yield of cow pea plant. They studied various plant growth parameters like plant height, number of branches, leaf area and leaf area index.

Conclusion:

In the vermin composting process earthworm change garbage into gold. The water hyacinth was converted in to nutrient rich vermicompost by pot method. Therefore, it is concluded that the eco-friendly disposal of water hyacinth weed by vermicomposting is the best method of solid waste management. Application of vermicompost on cow pea (*Vigna unguiculata*)

plants resulted in enhancement of various growth parameters of the plants which indicates that the water hyacinth vermicompost played significant role in these parameters. Therefore, it is clear that this vermicompost can also be applied to other commercial an agricultural crop to get maximum yield of crops. Vermicomposting is cost effective and environmental friendly method of solid waste management. Another important aspect involved in vermitechology is that it is considered as a green technology since it does not involve in the production of pollution into the nature.

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Physicochemical, biological and antimicrobial properties *Plagiochasma* Lehm. & Lindenb. from Western Ghats, Maharashtra

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Abstract

Crude organic solvents and aqueous extracts of three different species of genus *Plagiochasma* viz. *P. articulatum* Kash. *P. appendiculatum* L. et L. and *P. simulensis* Kash. from Purandar, Kas-Satara and Panhala Western Ghats, Maharashtra. They were screened for antimicrobial activities against the bacterial strains viz. *Bacillus subtilis* (NCIM 2697), *Escherichia coli* (NCIM 2067), *Pseudomonas aeruginosa* (NCIM 2200), *Staphylococcus aureus* (NCIM 2492) and fungal strains viz. *Aspergillus niger* (NCIM 507), *Fusarium moniliformae* (NCIM 1276), *Fusarium oxysporum* (NCIM 1072), *Rhizopus stolonifer* (NCIM 1139). The disc diffusion assay method was followed, visible antimicrobial activity for ethanolic extracts of *P. articulatum* Kash. and *P. appendiculatum* L. et L. against *S. aureus*. The zone of inhibitions indicates, the more frequent occurrence of bioactive substances in these species. The antibiotic ampicillin (10 mcg^{-disc}) used as control, exhibits sensitivity and more antimicrobial activities against *S. aureus*. In addition, the rhizosphere soil were also analyzed for available nutrient elements and biological characteristics.

Key words : *Plagiochasma*, organic solvent extractions, antimicrobial activity, rhizosphere characteristics, Western Ghats, Maharashtra.

Introduction

Liverworts are group of non-vascular plants consisting of 6000 species. Generally, bryophytes are not damaged by microorganisms, insects, snails, slugs and small mammals. Several hundreds of new compounds have been isolated from bryophytes and their structure elucidated (Asakawa, Y. 1995, 1999, 2001). The World Health Organization (WHO) estimated that, 80% of the population of developing countries relies on traditional medicines, mostly plant drugs, for their primary health care needs (Heinrich and Gibbons, 2001). Bryophytes closely linked with civilization, culture, beliefs and ethics of humankind (Pant and Tewari, 1990). These are used in the ethnomedicinal field from times immemorial in many parts of the World (Subramonian and Subhisha, 2005). A literature search revealed no studies on the antifungal activity of Indian bryophytes. Studies done in other countries indicate that bryophytes are a rich source of antifungal agents. The Chinese, Europeans, and North Americans have used bryophytes as medicine for hundreds of years. Veljic, M. et al. (2009) reported the antimicrobial activity of methanol extracts of mosses from Serbia whereas, antimicrobial activity of some Indian mosses studied (Rawat and Govindarajan, 2007). Recently, in India, exploration yielded about 250 species of bryophytes in Kerala state (Manju and Madhusoodanan, 2002). The bryophytes form an important component of the

forest ecosystem in India (Shrinivasan, C. 1998). The secondary metabolites from mosses identified so far are: terpenoids, flavonoids and bibenzyls and derivatives of fatty acids (Borel et al. 1993); acetophenols (Lorimers et al. 1993); aryl benzofurans (Von Reusz and Konig, 2004). Basile et al. (1999) showed that 7-o-flavonoids (apigenin, apigenin-7-o-triglycoides, leteolin-7-o-neohesperidoside, lucenin-2, saponarin and vitexin) possess antimicrobial activity. It has been shown that, mosses rich in flavonoid possess strong antimicrobial activity.

About 40 mosses species are used are used in Chinese traditional medicine because of their medicinal properties. Some species are still in use for treatment of hepatitis and inflammatory processes (Hu, 1987). The active compounds isolated from these species are biflavones, flavone glycosides and diglycosides (Cambie, 1996). Antimicrobial activity of methanol extract of *Hypnum cupressiformae* was also analyzed (Dulger et al.; 2005). Studies on the volatile compositions of mosses have been started, because of the abundance of aldehydes and terpenoids (Asakawa, Y. 1995; Saritas, Y. et al. 2001; Li and Zhao, 2009; Cansu, T. et al. 2010). The chemical composition and antimicrobial activity of the essential oils from mosses (*Tortula muralis* Hedw., *Homalothecium letescens* (Hedw.), *Hypnum cupressiformae* Hedw.

and *Pohlia nutans* (Hedw.) from Turkey, reported by Ucuncu et al. 2010.

Our very recent investigation also showed that, organic solvent extracts of different species of genus *Plagiochasma* were screened for physicochemical, biological and antimicrobial properties.

Material And Methods

Different species viz. *P. articulatum* Kash., *P. appendiculatum* L. et L. and *P. simulensis* Kash. of genus *Plagiochasma*, from Western Ghats of Maharashtra used for further antimicrobial screening. The liverworts material were collected during October to December, 2010 from Lonawala, Kas-Satara and Panhala localities of W. Ghats, Maharashtra in India.

Extracts Preparation: The liverworts plant material carefully washed with running tap water until, adhering soil particles removed. After proper washing and cleaning, with help of mortar and pastel, (10 g) plant material of each species homogenized with organic solvents like acetone, ethanol, petroleum ether and distilled water, separately. These extracts shaken on rotary shaker (200-300 r.p.m.) for 24 h., then volumes was adjusted to 2 ml/g fresh weight of plant material and filtered it. Filtrates were used for screening test.

Effect of different *Plagiochasma* extracts against target organisms: Microbial cultures were obtained from National Collection of Industrial Microorganisms (NICM), Biochemical Sciences Division, National Chemical Laboratory, Pune (MH). The bacterial strains included *Bacillus subtilis* (NCIM 2697), *Escherichia coli* (NCIM 2067), *Pseudomonas aeruginosa* (NCIM 2200), *Staphylococcus aureus* (NCIM 2492) and fungal strains viz. *Aspergillus niger* (NCIM 507), *Fusarium moniliformae* (NCIM 1276), *Fusarium oxysporum* (NCIM 1072), *Rhizopus stolonifer* (NCIM 1139).

Screening of extracts for antimicrobial activity: Extracts of each species viz. *P. articulatum* Kash., *P. appendiculatum* L. et L. and *P. simulensis* Kash. were screened for antibacterial and antifungal activity by employing disc diffusion assay method (NCCLS 2000; Santra S C et al. 1999), using 100 µl of suspension of the tested microorganisms. This suspension contained 2×10^8 CFU/ml for bacteria and 2×10^6 CFU/ml spores for fungal strains. Muller-Hinton agar (MHA, Fluka) and Sabouraud's dextrose agar (SDA), sterilized in a flask and cooled to 45-50 °C, were distributed in sterilized petri dishes with a diameter (9 mm). Filter paper discs (6 mm, Schelcher and Schuell) were individually impregnated with 10 µl of the extract solutions then, placed on agar media plates, which had been previously inoculated with tested organisms, incubated at 37 °C for 24 h and at 30 °C for 48 h for bacterial and fungal strains, respectively. The antibiotics ampicillin and

nystatin served as a positive control. The zone of inhibitions were measured in millimeter and accounted for results.

Results and Discussion

Antimicrobial activity of different extracts of three different species of genus *Plagiochasma* viz. *P. articulatum* Kash., *P. appendiculatum* L. et L. and *P. simulensis* Kash. against the target organisms were summarized in Table 1 and 2. In the present investigation, three different species of *Plagiochasma* have been selected for antimicrobial potential. In vitro, antibacterial and antifungal efficacy of the crude extracts of all species was quantitatively assessed on the basis of inhibition zone and exhibited varying level of inhibitory effect. The inhibition zones were in the range of 7 to 26 mm for most of the tested organisms. Over all, the more antibacterial activity showed by acetone extract of *P. articulatum* Kash. against the *S. aureus* (26 mm) while, low activity against *B. subtilis* (7 mm). The *P. articulatum* Kash. acetone extract showed greater antifungal activity against *A. niger* (15 mm) whereas, minimum activity against *F. moniliformae* (7 mm) and *F. oxysporum* (7 mm). A strong fungicidal effect was exerted by extracts of *Plagiochasma* against *A. niger* and *F. oxysporum* and bactericidal effect against *S. aureus*. Although, remaining all the extracts of three species showed varying levels of moderate activity against all the test organisms. But, no antifungal activity against *R. stolonifer*. In addition, the results of *A. angusta* St. by rhizosphere analysis including available nitrogen (N), phosphorus (P), potassium (K), organic carbon (C%); Na, CaCO₃ ion salts; electric conductivity and pH etc. physicochemical characteristics, summarized in Table 3. These element concentrations are sufficient for vigorous growth of such plants. The biological characteristics with fungal genera viz. *Penicillium*, *Aspergillus*, *Fusarium*, *Trichoderma*, *Glomus* sp. from Purandar, *Dematium*, *Aspergillus*, *Mucor* sp. from Kas-Satara and, *Trichoderma*, *Dematium*, *Penicillium*, *Aspergillus* sp. reported from Panhala soils

This study reports for the first time potent antimicrobial activity of genus *Plagichasma*. The active extractions were obtained from such plants, showed varying level of activity against all tested organisms. The biologically active substance is one that has demonstrated significant experimental results to inhabiting the tested organisms. The antibiotic activity may indicate that chemical constituents of these plants are more sensitive to variation in the season, soil type etc. The *Plagichasma appendiculatum* possesses significance antibacterial and antifungal activities (Singh et al., 2006). Several liverworts (*Bazzania*, *Frullania*, *Marchantia*, *Plagiochilla*, *Porella* and *Radula* sp.) extracts have been used in antimicrobial, antifungal and antiviral activity. In vitro antimicrobial activity

of *Brachythecium compestre* and *Eurhynchium pulchellum* extract (Yayintas and Yapici, 2009). Antifungal compounds were isolated from the New Zealand liverwort *Plagiochila faciculata* (Lorimer and Perry, 1994). Cinnamolide from *Porella* and *Makinoa* showed activity against a few species of fungal dermatophytes (Subramonian and Subhisha, 2005). Here, the studied thalloid liverworts from Western Ghats exhibits more antimicrobial activity.

In our study, the acetone and ethanol extracts of *Plagichasma* possessed strongest antimicrobial activity while, the P. ether and aqueous extract showed low activity. The results showed that plants evaluated for screening of antibacterial and antifungal activity are potentially rich source of antimicrobial agents.

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***Trichoderma*: - Effective fungus in waste management and Plant Disease control agent.**

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Abstract :-

In the present investigation attempts have been made to study the quality rate of *Trichoderma* spp in compost preparation and antagonistic activity of *Trichoderma* spp against other plant pathogenic fungi like *aspergillus niger*, *A. flavus*, *fusarium* spp., *altaria* spp. etc. It is clear from the results *Trichoderma* spp. produces various hydrolytic enzymes and maceration of Agricultural wastes and *Trichoderma* spp. effective against plant pathogenic fungi and proved to be superior for management of crop plant diseases.

Key words :- Agricultural wastes, Antagonism, Biocontrol, *Trichoderma*, plant pathogen.

Introduction :-

Microorganisms are tiny units of life that are too small to be seen with the naked eye and the exists everywhere in nature. Microorganisms are crucial for maintaining to ecological balance mainly they are fungi & Bacteria among the fungus *Trichoderma* spp, are very important in many fields as decomposer and bioccontrol agents. *Trichoderma* is known as king of fungal bio- control agents, which are worldwide in occurrence and easily isolated from soil, decaying wood and from of plant organic matter. Important property of this genus is rapid growth rate in the culture & production of numerous spores. The genus *Trichoderma* was introduced by person in 1974 but its importance as bio-control agent of plant pathogens was recognized in the early days. Plant diseases caused by a variety of fungi may cause significant losses on agricultural crops. All plants are attacked by some kinds of fungi, and each of parasitic fungi can attack one or many kinds of plants. More than 10,000 spp. of fungi cause disease in plants. *Trichoderma*, a filamentous soil borne mycoparasitic fungus, has been shown to be effective against many soil borne plant pathogens as they have more than one mechanism of action [2]. Characterisation for the antagonistic potential of *Trichoderma* species is the first step in utilising the full potential of *Trichoderma* spp. for specific applications [3]. *Trichoderma* spp. has the potential to control *Macrophomina phaseolina*, *Pythium* sp, *Fusarium oxysporum* in vitro. [4] Therefore, the present study was conducted to evaluate the antagonistic potential of different *Trichoderma* spp. in inhibiting the growth of pathogenic fungi To determine the antagonistic property of *Trichoderma* spp. against

other pathogenic fungi were compared on a medium. And The present study was undertaken, to find out the biocontrol efficacy of *Trichoderma* spp. inoculated compost in pot culture experiment for management of collar rot of groundnut, seedling disease of Bhendi and wilt of red gram.

Material and Methods:-

Isolation of Mycoflora from Composts

The compost samples collected from the field as well as from various sources were used for isolation of fungi by using same dilution plate method given by Waksman, (1922).The dilution plate method consist of 1 gram compost sample dissolved in 100 ml distilled water, then series of dilutions were made. From the dilution flasks, one ml sample was placed in petridishes and dispersed on potato dextrose agar medium (Peeled potato, 200 gm, Dextrose 20 gm, Agar 20 gm, Water 100 ml, pH 6.0 to 6.5) by shaking and rotating the plate before agar solidifies. Then plates were incubated at room temperature for six days and then slide were prepared from the colonies of fungal growth appeared on agar plate and were count and identified with the help of manuals.

Growth Of Compost Fungi On Different Agricultural Wastes

Four different categories of substrates viz., Agrowastes (Jowar straw, maize straw, Bajra straw, soyabean straw, sugarcane bagase, tur husk, greengram straw, black gram straw), fruit rinds (*Musa paradisica*, *Mangifera indica*, *Citrus sinensis*, *Nanilkara sapota*, *Carica papaya*, *Punica granatum*), leaves (*Azadirachta indica*, *Ziziphus mauritiana*, *Peltocarpum pterocarpum*, *Hibiscus rosa sinensis*, *Acacia nilotica*) and flowers (*Tagetes*

erecta, *Cassia fistula*, *Rosa indica*, *Spathodea campanulata*) were evaluated for the growth responses of compost fungi through solid state fermentation technique. For determination of conidiospore production of the bioagent on different substrates, 200 gm of each substrate adjusted with 70 percent moisture content, was filled into (21 x 16 inch) polythene bags fitted with staples. The bags were then sterilized by autoclaving at 15 lb psi pressure for 1 hour. One ml spore suspension of compost fungi in sterilized distilled was used to inoculate each bag with the help of disposable syringe inoculated bags were incubated at $25 \pm 2^\circ\text{C}$ for 12 days for comparing the ability of growth and sporulation on these substrates. Colony forming units (CFU g^{-1}) were determined by dilution plate technique on selective medium.

Methods Of Compost Preparation Pocket compost method: Pocket composting technology involves inoculating the plants substrates used for composting with cultures of cellulose decomposers fungus. The pocket compost attempts have been made to evaluate the potential of agricultural wastes of crop plants. These substrates were used for the preparation of compost. The methods developed and described by Das and Ghatnekar (1979). Joshi *et al.*, (1989) and Joshi and Thakre (1991) was adopted to active the aerobic biodegradation to the substrates under study. These substrates were collected from fields after harvest. These were chopped of the size 5–6 cm and placed in polythene bags of the size 12 x 16 inch of 150 gauze. The bags were regularly monitored to maintain required moisture and

aeration, pH and temperature of the biodegrading substrates were noted at regular intervals. Associated mesophilic, thermotolerant and thermophilic fungi were isolated and identified to note the role of fungi in composting. Final product was analyzed for the total NPK value, C:N ratio and organic carbon percentage by different methods.

Antagonistic Activity Of Compost Fungi

Antagonistic potential of compost fungi against plant pathogenic and other decomposing fungi was studied by dual culture method (Sudhamoy Mandal *et al.*, 1999). In this method an agar disc (15 mm) containing mycelial growth of plant pathogenic and decomposing fungi was inoculated at the four corners of PDA poured petriplates and culture discs of Antagonist species were placed at center leaving 1 cm distance. Petriplates were incubated for a week at $25 \pm 1^\circ\text{C}$. Plates without antagonist served as control. Two replicated were kept for each treatments and observation of colony diameter (mm) over growth, lysis and formation of inhibition zone were recorded to select highly effective nature of tested antagonist species. Test were also carried out to evaluate the efficacy of compost fungi against the plant pathogens. Pot experiments also conducted two week old cultures of pathogenic fungi and *Trichoderma* inoculated compost were mixed in sterilized soil separately in different plots cultures of pathogens were added at the rate of 5 percent of compost and inoculated were mixed in the upper 3 to 5 layer of compost. Pots inoculation of pathogen were kept as control and observation were noted.

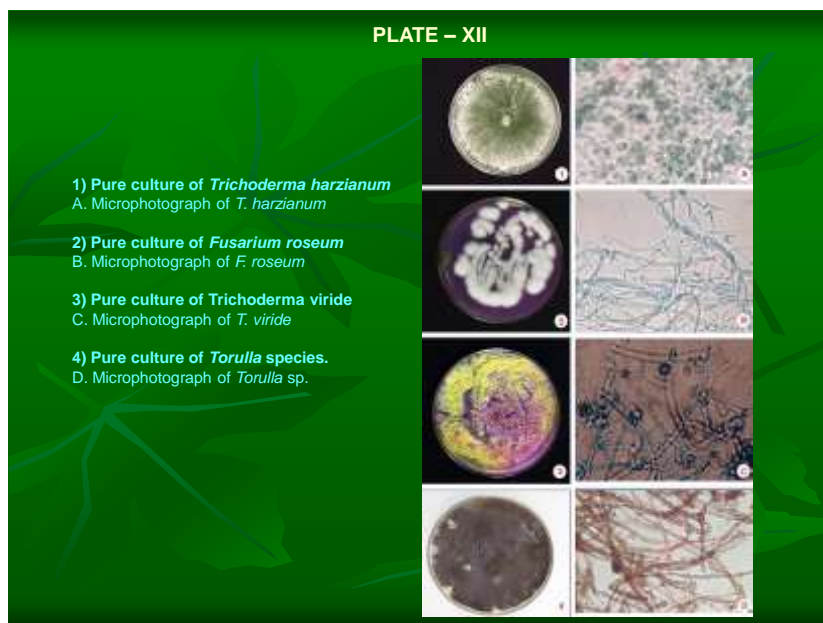


Table 5: Growth of artificially inoculated compost fungi on different leaves

Leaves	Growth of fungi				
	TRH	ASN	ASF	FUS	RHS
<i>Glyricidia maculate</i>	Profuse	Profuse	Poor	Profuse	Profuse
<i>Ziziphus mauritiana</i>	Profuse	Profuse	Poor	Moderate	Moderate
<i>Syzium cumini</i> L.	Profuse	Profuse	Poor	Moderate	Profuse
<i>Azadirachta indica</i>	Profuse	Profuse	Poor	Moderate	Moderate
<i>Annona squamosa</i> .	Profuse	Profuse	Moderate	Moderate	Profuse
<i>Manilkara zapota</i> .	Poor	Moderate	Poor	Profuse	Profuse
<i>Peltocarpum pterocarpum</i>	Poor	Poor	Poor	Poor	Poor
<i>Hibiscus rosa sinensis</i>	Poor	Moderate	Poor	Moderate	Moderate
<i>Bougainvillea spectabilis</i> .	Profuse	Moderate	Poor	Profuse	Moderate
<i>Cassia simeia</i>	Moderate	Moderate	Poor	Profuse	Moderate
<i>Ficus religiosa</i>	--	Moderate	Poor	Profuse	Moderate
<i>Carica papaya</i>	--	Poor	Poor	Moderate	Profuse
<i>Dendrocalamus strictus</i>	--	Poor	Poor	Poor	Poor
<i>Acacia nilotica</i>	--	Poor	Poor	Poor	Poor

TRH – *Trichoderma harzianum*
 ASF – *Aspergillus flavus*
 RHS – *Rhizopus* sp.

ASN – *Aspergillus niger*
 FUS – *Fusarium roseum*
 -- No growth

PLATE – VIII GROWTH OF ARTIFICIALLY INOCULATED COMPOST FUNGI ON DIFFERENT AGRICULTURAL STRAW

- 1) *Penicillium* sp. on Soyabean straw
- 2) *Penicillium* sp. on gram straw
- 3) *Fusarium roseum* on Black gram straw
- 4) *Penicillium* sp. on Bajra straw
- 5) *Fusarium* sp. on Wheat straw
- 6) *Trichoderma viride* on red gram pod straw
- 7) *Trichoderma viride* on weed



PLATE – XX EFFICACY OF *TRICHODERMA* INOCULATED COMPOST IN POT CULTURE EXPERIMENTS

- A) Effect of *Trichoderma* sp. inoculated compost and *F. oxysporum* on red gram.
- 1) *Fusarium oxysporum* + soil
 - 2) *Fusarium oxysporum* + leaves compost
 - 3) *Fusarium oxysporum* + agricultural waste compost



- B) Effect of *Trichoderma* sp. inoculated compost and *P. aphididermatum* on bhindi.
- 1) *P. aphididermatum* + soil
 - 2) *P. aphididermatum* + leaves compost
 - 3) *P. aphididermatum* + agricultural waste compost



- C) Effect of *Trichoderma* sp. inoculated compost and *F. oxysporum* on gram.
- 1) *Fusarium oxysporum* + soil
 - 2) *Fusarium oxysporum* + leaves compost
 - 3) *Fusarium oxysporum* + agricultural waste compost



Result and Discussion :

Among these fungi some of the selected fungi like *Trichoderma viride*, *Trichoderma harzianum*, *Penicillium sp.*, *Aspergillus niger*, *Aspergillus flavus*, *Fusarium roseum*, *Torula sp.*, *Verticillium lecani* were further studied for their individual and collective role in the process of decomposition of agricultural waste and it was interesting to note that the fungi like *T. virie*, *T. harzianum*, *Penicillium sp.*, *Torula sp.*, *Aspergillus niger* play very important role in degradation of organic waste. The chemical composition of agricultural waste is mainly cellulose, hemicellulose, lignin and pectic substances. Degradation of these compounds is carried out with the help of in vitro production of various enzymes produced by microorganisms. Among the total fungi used for compost preparation the species of *Trichoderma* grew fast and overlapped on the other fungi.

Antagonistic activity of compost fungi
Antagonistic nature of *Trichoderma harzianum* against other compost fungi

T. harzianum the another important compost fungus was tested against pathogenic fungi.

It is clear from the results that *T. harzianum* showed its significant overlapping growth on all the tested fungi. Similarly *T. harzianum* was found to be totally antagonist against *Mucor sp.* and *Rhizopus stolonifer*, *Torulla sp.* and *Verticillium lecani*. It has also inhibited growth of *Fusarium oxysporum*, *F. roseum*, *Phytophthora sp.*, and *Alternaria solani*.

Antagonistic nature of *Trichoderma viride* against other compost fungi

Antagonistic nature of *T. viride* was tested against pathogenic and compost fungi by dual culture method. It is clear from the results that all the compost and pathogenic fungi were found to be significantly inhibited for the growth in the presence of *T. viride*. It was highly antagonist against *Helminthosporium sp.*, *Alternaria solani*, *Curvularia lunata*, *Rhizopus stolonifer*, *Verticillium lecani*, *Rhizoctonia solani*, *Fusarium oxysporum*, *F. roseum*, *Aspergillus niger* and *Phytophthora sp.*

Efficacy of *Trichoderma sp.* Inoculated compost in the management of wilt in red gram and horse gram.

Trichoderma inoculated leaves and agricultural waste compost were separately tested in the soil containing *Fusarium oxysporum* (the wilt pathogen) in separate pots. The pots were used for sowing the seeds of red gram and horse gram separately, the pots without *Trichoderma* supplemented compost served the control. It is clear from the results that in case of both the crops all the species of *Trichoderma* inoculated compost showed significant control of wilting disease in both the crops.

Efficacy of *Trichoderma* inoculated compost in the management of seedling disease of bhindi

The *Trichoderma* inoculated leaves and agricultural wastes composts were mixed in sterile soil in pot containing spore loads of *Pyuthium sp.* damping off pathogen and used for germination of Bhindi seeds, disease incidence of Bhindi seeds and seedling was recorded the compost with *Pyuthium sp.* but without compost served the control.

It is clear from the results that percentage germination of Bhindi seed in the presence of *Trichoderma* inoculated compost was found to be improved. Similarly there was significant control of damping off disease in presence of *Trichoderma* inoculated compost.

Efficacy of *Trichoderma* inoculated compost in the management of color rot of groundnut

Trichoderma inoculated leaves and agricultural waste compost were mixed in the sterile soil separately in pots containing spore load of *Aspergillus niger* (Collar rot pathogen) and used for germination of groundnut seeds, disease incidence and seedling stand were recorded. The compost with *A. niger* and without *Trichoderma* served the control. It is clear from the results that percentage germination of groundnut seeds due to *Trichoderma* of compost was found to be improved. Similarly there was significant control of seedling rot in the presence of compost.

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Innovative Trends in Life Sciences

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Abstract

The life sciences sector is also seeing an increase in the use of smart medical devices by patients, the continual development of new ways to enhance the delivery of health care to patients, an increase in the utilization of big data, and an increase in the utilization of cloud technology in its operations. In 2022, robotic process automation, artificial intelligence, augmented reality, the internet of things block chain technology, and increasing application of digital tools and platforms will change the game. The term "life sciences industry" encompasses all businesses and organizations whose work revolves around research and development centered on living things. Companies are able to face the future thanks to innovation and trends, which form the foundation of either an innovation strategy or a digital strategy. They give businesses the ability to plan for the long term. In contrast to rivals who only promote incremental innovation, customer-driven innovation, or process enhancements. Artificial intelligence, self-charging gadgets, and zero- emission vehicles are helping to remake and update some of the most significant technologies of the last few centuries.

Keywords : Innovative , Trends, Life Sciences , multinational , development

Introduction

Notwithstanding, having worked for a really long time in worldwide innovative work of new medications, I believe that the fate of India will go past generics and biosimilars. The existing Indian ecosystem has a lot to offer the life sciences industry, and I believe India will eventually play a significant role in the development of novel medicines. Upgrades in genome sequencing have prompted a superior comprehension of what causes and drives the movement of sickness. Translational strategies-based therapies rationally target the disease's underlying mechanisms. By delivering the appropriate medication to the appropriate patient at the appropriate time, precision medicine combines these two ideals. I see opportunities here for Indian pharmaceutical companies with global operations to address worldwide unmet medical needs. One of the fields in which there are always new developments in the life sciences. Since its inception, the life sciences have been an industry devoted to the preservation and enhancement of natural, animal, and human life. Let us first define what it is before delving into the most recent discoveries in the life sciences. Indian companies with significant US operations are excellent examples of such innovators. Such organizations are finding new, state of the art accuracy drugs utilizing best in class advancements, and hurrying exploratory clinical examinations as a team with significant clinical focuses in India that give remarkable admittance to treatment-gullible patients. Indian biomedical

research and development's potential is being further unlocked by partnerships between the public and private sectors

Top Trends in the Life Sciences Industry

Advancements in genetics allowing for personalized medicine. Numerous experts have discovered that some conditions are inherited through genetic coding as the life sciences industry's research body expands. This suggests that DNA information or other genomic characteristics can be used to tailor healthcare more precisely. This ushers in a new era of personalized medical treatments and medications. Innovative collaboration among various companies in the life sciences The collaborative nature of the life sciences industry contributes to its ongoing development. In order to push the boundaries of development, we can anticipate that biotech companies will collaborate with other organizations related to the health sciences in 2023. Arzeda, Twist Bioscience, Labcyte, and TeselaGen collaborated in May 2019 to develop a cutting-edge DNA assembly platform as an illustration of this. The production of food items like sweeteners and other industrial necessities is the goal here. Additionally, since DNA will be created in laboratories, it is hoped that this will make it less necessary to harvest or mine resources.

The advancement of drug research is another trend that is on the rise. Improved medication-based patient assessment and treatment are made possible by cutting-edge technology. Integrating assessment tools like MRI scans,

laboratory equipment, and in-patient monitors and management tools are some mechanisms that will improve. Consequently, doctors are able to combine the necessary data to prescribe the patient with the appropriate medication. Instead of subjective reports, this provides accuracy and adherence to the objective information provided by the assessment tools. Neuroscience is yet another important aspect of the life sciences industry. Neurological conditions account for 10% of all deaths worldwide, so developments like brain mapping will help improve treatment outcomes.

5 Innovative Trends in Life Sciences Trend 1 – The Effects of COVID

The pandemic has necessitated a paradigm shift in the life sciences sector, as it has in every other industry that has had to adapt, overcome, and reevaluate its outlook. Supply chains have been scrutinized as a result of COVID-19, which has had a major impact on the life sciences. With the increase in supply chains coming from China, the life science industry had to adjust to a structure that was more localized.

Trend 2 – The Rise of Personalised Medicine

Personalized medicine is currently one of the most significant developments in the life sciences. Based on each patient's unique genetic makeup, this method of medicine tailors treatments to their specific requirements. Traditional medicine's one-size-fits-all approach is becoming less and less effective. With new turn of events and execution into training, a new upsetting treatment could change how we treat illnesses for eternity.

Trend 3 – Lab Automation

Our health and safety at work are now a top priority for every profession and industry as a result of COVID-19. With automation, you can make sure that as few people as possible are in a place. The humans who program and control these machines can better use their innovation to create newer and better ways to produce life sciences materials thanks to automation, which allows for faster production and results that are more accurate.

Trend 4 – Lab Trial Progression

After COVID-19, lab trials did not begin to accelerate. The Ebola pandemic in West Africa from 2014 to 2016 marked the beginning of lab trial progression. The highly contagious and fatal disease known as Ebola required a vaccine immediately. The implementation and success of the COVID-19 trials were largely due to the creation of an Ebola vaccine. Production was accelerated by faster lab trials. As a result, the life sciences have had to adjust to meet the demands of speed and precision.

Trend 5 – Increased Investment in Life Science Research

The government realized that the pandemic-related tragedies and death tolls could be reduced in the future with more funding and support.

As previously stated, life sciences thrive on innovation and the desire to address the most pressing healthcare issues. These objectives, as well as our species' overall health, become a little easier to achieve with increased funding. With our forefront cleanrooms and our ear to the ground in regards to industry patterns, iST Logical is focused on giving the most creative lab gear and consumables.

The global pandemic has compelled the life sciences sector to rapidly innovate. There is both excitement and anxiety associated with the unknowable future. Scientists, regulators, and commercial business teams can now work together to solve everyday problems thanks to the paradigm shift. In all phases of work, from early R&D to post-market monitoring, a data-centric approach has been put into place by deploying new tools based on AI, Machine Learning, and cloud computing. In addition, in an effort to become self-sufficient and lessen risks brought on by global geopolitical issues, these new challenges have prompted increased investments in research and development.

Innovative Trends in Life Sciences

There has been a significant shift in the environment for biomedical research that is both innovative and cost-effective. Preclinical and early clinical research, in particular, are particularly subject to increased time and cost constraints in today's world. In this regard, big Western pharmaceuticals face difficulties. In the increasingly competitive field of life sciences discovery, despite the industry's capacity to develop and commercialize drugs and the economies of scale necessary to do so profitably, these organizations frequently lack the agility and flexibility necessary to continuously innovate.

To manage the inherent risk of drug innovation, many of the world's largest pharmaceutical companies are relying on early collaboration with established academic labs and start-up biotech companies. Early innovations of this kind will always be risky, but more importantly, they will have to learn to quickly manage that risk. Finding strategies and procedures that aid unsuccessful projects in "failing faster" is, in essence, the goal. Innovation hypotheses based on translational medicine, patient stratification, and value propositions that persuade investors, payers, and regulators of the potential improvement and superiority in care standards will be the key to nimble risk management.

There were less than 50,000 physicians in India sixty years ago; Today, there are nearly 800,000 registered medical practitioners, a 16-fold increase. The country's public health centers, which are the backbone of rural healthcare, have grown from less than 100 to more than 23,000. This dangerous development is fruitful ground for

figured pioneers, financial backers, controllers and clinical focuses to team up on fostering the abilities to support the kind of start-up climate that will zero in on advancement and better methods of medical services conveyance, with an eye on lengthy run as opposed to transient productivity. I believe India can take a number of steps to take advantage of these opportunities. For instance, trust in the Indian life sciences sector is bolstered by commitment to stringent global compliance standards and incentives for biotech start-ups. These trends are happening all over the world, but experts with roots in India have yet to start them in some ways. Figured pioneers should embrace an outlook that celebrates risk-taking and shows relentless obligation to long haul targets. The global life sciences landscape will change as India transforms itself into a center of excellence by investing in risky but highly valuable emerging science. In recent years, there has been a lot of progress made in science and technology, especially in immuno-oncology, which treats some of the hardest-to-treat cancers. These innovations were born out of collaborative networks rather than independently. Today, innovation takes place worldwide rather than in a single nation. India is poised to become a dominant player in the life sciences because it has so much to offer. This groundswell has the potential to become a reality right now. Being a part of it excites.

The emerging trends in life sciences?

The life sciences sector is also seeing an increase in the use of big data, the use of cloud technology in their operations, and an increase in patient use of smart medical devices. Continuous innovations to improve the way patients receive health care (such as personalized, smart medication) are also taking place. Health Catalyst's General Manager and Senior Vice President of Life Sciences Business, Sadiqa Mahmood, claims that the unanticipated pandemic had a significant impact on the life sciences sector. The life sciences are going through never-before-seen transformations as a result of an increase in digital solutions, modifications to pharmaceutical processes, and increased innovation. According to Mahmood, these changes brought on by the pandemic sparked seven positive trends in the life sciences that will have an effect on the healthcare industry, pharmaceutical companies, providers of medical technology, and health systems:

Life sciences sector in India:

India currently ranks third among the top 12 biotech destinations worldwide and has a rapidly expanding pharmaceutical industry. The sector has made significant progress over the past two decades, despite the fact that it was once regarded as a separate facility and operated under the umbrella of "other industries" or manufacturing. The COVID-19 outbreak increased awareness of the significance of

the country's pharmaceutical and healthcare sectors. The research and development (R&D) and manufacturing (M&M) of drugs and medicines saw accelerated momentum as a result of the crisis's requirement for a vaccine drive. Due to its inherent strength in the production of vaccines and generic drugs, India was placed precisely at the right time to meet nearly 62% of global demand for vaccines. As a result, India became an essential component of the global ecosystem that addresses the urgent requirement for vaccines and treatments, which is not surprising. India's life sciences industry is at a pivotal moment right now. Its expansion has been aided by a variety of factors, ranging from the conceptualization of India's first organized life sciences cluster to the development of the first state-level biotech policies.

Driving factors of the life science sector:

India's domestic pharmaceutical market is expected to expand dramatically over the next ten years. It is anticipated to reach USD 65 billion by 2024, according to the Economic Survey 2021, while another study projects its medium-term growth to USD 120-130 billion by 2030. The life sciences industry in the nation will benefit greatly from this significant growth that is anticipated in the coming years. A strong workforce: India has the second-largest proportion of the world's workforce working in the pharmaceutical and biotech industries, which is one of the primary reasons why many businesses choose to establish R&D and manufacturing facilities here. According to industry analysis, manufacturing costs in India are approximately 33% lower than those in the United States. The country has a large pool of skilled workers and relatively low labor costs, making it extremely attractive to businesses looking to establish R&D facilities there.

Increasing venture capital funding: India currently ranks fourth in terms of attracting venture capital funding for the technology and health industries, with USD 4.4 billion invested from 2016 to 2021, of which 43% was invested in 2021 alone. This is because investors have realized that investing in the industry now will give them advantages as early adopters due to the anticipated growth prospects in the coming years. Actis, a global investor in sustainable infrastructure, deserves to be mentioned. Under its platform, which focuses on providing real estate to tenants in the life sciences and related industries in India, Actis plans to invest USD 700 million to build and develop assets. In the meantime, Bharat Serums and Vaccine Limited has announced a USD 25.7 million investment in the production of cutting-edge injectables and vaccines. Ferring Pharma, another player, plans to invest USD 64.4 million in the next two to three years to construct a manufacturing facility for Pentasa.

Initiatives by the government: Consistent investment efforts demonstrate that the pandemic has been a major factor in the expansion of government funding for the health and life sciences sector. In addition, the government will announce incentive plans in 2020 for at least USD 4.9 million spread out over five years to encourage and boost investments in medical device manufacturing. In fact, the pharmaceutical and healthcare industries received USD n from the Union Budget for 2022-23. Additionally, USD 343.56 million was allocated to the Department of Biotechnology for the development of fundamental infrastructure, genetic engineering, technologies and bioinformatics, agriculture biotechnology, and professional development. A financial investment of was also announced to support the Pharmaceutical Industry (SPI) Scheme These drives are supposed to fortify the existence sciences area significantly in the following ten years.

The world changes constantly every day. There are a lot of things to look forward to in the future, whether they are developments in technology, culture, the arts, or the sciences. One of the life sciences industries that is constantly experiencing breakthroughs. Since its inception, the life sciences have been an industry devoted to the preservation and enhancement of natural, animal, and human life. Let us first define what it is before delving into the most recent discoveries in the life sciences.

While productivity continues to decline, manufacturing costs have significantly increased across all industries. To address this worry, outstanding changes, for example, authoritative rebuilding and functional redesigns are being made. Adapting the process improvement, like digitizing the inventory process, can help plan experiments, increase lab efficiency, and obtain real-time updates about stock levels and locations. In addition, data traceability, regulatory compliance, and audit readiness would all benefit from such revolutionary solutions. As businesses seek to implement innovative and cross-functional transformations to achieve sustainable productivity enhancements, it is reasonable to anticipate that a greater number of businesses will adopt this strategy in the upcoming years.

The Life Sciences sector will become increasingly digital and data-driven in the future. Patients' and consumers' confidence in emerging technologies and treatment approaches will grow as more people and businesses contribute resources to make manufacturing more personalized and automated. We can unleash the life sciences' full potential by increasing government, industry, and academic collaboration and focusing on industry convergence. We can pave the way for revolutionary advancements in human health and

make a lasting impact on humanity through operational restructuring and increased deployment of digital solutions for diagnosing and treating diseases. Success will not be measured solely by profits.

Conclusion:

Whether it be advancements in technology, culture, the arts, or the sciences, there are many things to anticipate in the future. The current ecosystem in India has a lot to offer the life sciences industry, and I think India will eventually play a big part in the creation of new medicines. one of the fields in the life sciences where there are always new developments. Since its beginning, the existence sciences have been an industry dedicated to the safeguarding and improvement of regular, creature, and human existence. Despite the industry's capacity to develop and commercialize drugs and the economies of scale required to do so profitably, these organizations frequently lack the agility and flexibility required to continuously innovate in the increasingly competitive field of life sciences discovery.

In addition, the life sciences industry is seeing an increase in the utilization of big data, the incorporation of cloud technology into its operations, and the utilization of smart medical devices by patients. Government initiatives: The pandemic has been a major factor in the expansion of government funding for the health and life sciences sector, as evidenced by consistent investment efforts. Whether it be advancements in technology, culture, the arts, or the sciences, there are many things to anticipate in the future. A group of businesses, research institutes, and companies dedicated to enhancing organism life is referred to as the "life sciences industry." Understanding the nature of diseases in terms of human health depends on this industry.

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Advances in animal sciences.

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Introduction:

Advances and upgrading is a must trend to follow worldwide. There is no doubt animal sciences is an exception to this. In recent times multiple concepts has emerged as revolutionary things in animal sciences such as aquaculture, animal behavior, animal welfare, animal safety, animal genetics, animal breeding, animal cruelty, animal husbandry, cross breeding animals, dairy farming, farmed livestock, factory farming, livestock systems, livestock farming, poultry, pasture farming, production physiology, functional biology of farmed, wild game animals, ruminant nutrition, sheep farming and wild life species. Top trends such as crossbreeding involves the mating of animals from two breeds. In this process breeds are chosen that have complementary traits that will enhance the offspring's economic value. Livestock farming is the best source of employment and a source of livelihood for families to support their needs. Animals that provide milk can be raised and managed with a good income to support a family. Animals that help in labor such as draught animals are used in agricultural work. The waste generated from these animals can be used as natural manure to maintain soil fertility.

Key Words: Poultry, dairy, aquaculture, farming, employment, nutrition.

Poultry farming:

In this process one use to do the breeding of domesticated birds for their meat and eggs, the examples involved chickens, geese, ducks, turkeys, and some species of pigeons, it is known as poultry. From small to huge scales, anything is possible.

The process of poultry farming involves raising birds either domestically or commercially for their meat, eggs, and feathers. Important birds including chicken, turkey, geese, and ducks are frequently raised as poultry. Other birds, such as guinea fowl and squabs, are not as frequently raised for food.

Aquaculture farming:

Aquaculture farming basically involves the practices like breeding, growing and harvesting fish for the need of food and get monetary benefit from it. Aquaculture can improve food security and nutrition by increasing the amount of seafood available for people to eat. If done correctly, aquaculture increases food production, boosts economic growth in coastal and rural areas, and can help keep waterways clean. The products in aquaculture are the best sources of high quality protein. It also creates an employment opportunity for the people living in coastal areas. China, India, Vietnam and Indonesia are among the top producers of this product.

Animal husbandry:

Animal husbandry basically associated with the production of animals. It is a branch of agriculture related to the raising of animals for the

need of meat, fibre, milk and other products. Cows, buffaloes, goats, and sheep are some of the types of livestock that can be used for milk production or agricultural tasks like ploughing and irrigation. 'Poultry' refers to the farming of domesticated birds for food. This branch of farming helps in the proper management of animals by providing specific food, shelter and protection against diseases to domestic animals. It also helps to provides employment to a large number of farmer and thereby increases their living standards. It helps in developing high yielding breeds of animals by cross breeding.

Animal welfare:

Recently India's documentary on animal welfare that is elephant welfare has received the best documentary Oscar award for 'The elephant whisper'. Animal welfare is important because there are so many animals around the world suffering from being used for entertainment, food, medicine, fashion, scientific advancement, and as exotic pets. Every animal deserves to have a good life where they enjoy the benefits of the Five Domains. The norms or measures of animal welfare should be strictly followed such as the size of an enclosure, the depth of a pool, the nutritional content of the food and the healthcare provided. The most important area of concerns in the area of animal welfare include animal testing, living conditions in zoos, wildlife conservation, and treatment of animals in the food industry. Wildlife conservation is the protection of animals in the wild from human

impacts, including breeding programs to repair the damage done.

Dairy farming:

This form of farming is a form of agriculture that is dedicated to the production of milk and dairy products from the care and feeding of cattle, mainly dairy cows. In this type of farming the farmer focus on managing the health, welfare, and milk production of animals to obtain the highest quantity and quality of milk possible. Talking about the benefits of dairy farming it provides many non-marketed economic benefits, including manure for use on-farm as fuel or organic fertilizer. The ways that dairy farming sector contributes to sustainable agrifood sector are achieving food security and nutrition, offering livelihood and spurring economic growth, promoting health, contributing to the conservation of biodiversity and most importantly it helps in reducing greenhouse emission. It is also known as one of the country's major agri-businesses and also a leading contributor to the nation's GDP is dairy farming in India. With a 4% economic share, it is the biggest agricultural commodity. With over 180 million MT output in 2020, India is the world's leading milk producer.

Conclusion:

With the advances in animal sciences the branch of this kind of farming gets progressed. In India or in other developing and developed nations as well we found that sectors come under animal sciences has created an opportunity of employment and addressed the need of food all over the world such as the sectors of aquaculture, animal behavior, animal welfare, animal safety, animal genetics, animal breeding, animal cruelty, animal husbandry, cross breeding animals, dairy farming, farmed livestock, factory farming, livestock systems, livestock farming, poultry, pasture farming, production physiology, functional biology of farmed, wild game animals, ruminant nutrition, sheepfarming and wild life species. It is required to focus both on advantages and disadvantages of the outcomes that come with the progress of this sector with new advances in animal sciences.

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शाश्वत विकासात दुग्ध व्यवसायाची भूमिका: अक्कलकोट तालुका एक भौगोलिक अभ्यास

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सारांश: महाराष्ट्र हे पशुधन अनुवंशिक सामग्रीचे समृद्ध स्रोत आहे. 2022 मध्ये भारतात 254.6 दशलक्ष टन दुधाचे उत्पादन होते. या लेखामध्ये दुग्ध व्यवसायाचा शाश्वत विकासावर होणारा परिणाम व घटकांचा समावेश आहे. आर्थिक परिस्थिती, सामाजिक स्थिती, आर्थिक स्थलांतरण, जनावरांचे वर्गीकरण, जनावरांच्या प्रकारानुसार वर्गीकरण, व्यवसाय हेतू, आरोग्य स्थिती, व्यवसाय पद्धती, दुधाची विक्री करण्याच्या पद्धती, महिलांचा सहभाग, विघटनशील घटकांच्या उत्पादनानुसार वर्गीकरण, पशुखाद्याची निर्मिती, इत्यादी घटकांचा समावेश यात केला आहे. अर्थव्यवस्थेत पशुधन महत्वाची भूमिका बजावते. दुग्धव्यवसायाने देशातील पूर्ण विकसित उद्योगाची रूपरेषा देखील आत्मसात केली आहे आणि या व्यवसायात गुंतलेल्या लोकांचे जीवन सकारात्मकरित्या सुधारले आहे. संतुलित आहाराचा भाग म्हणून, दूध आणि दुग्धजन्य पदार्थ हे आहारातील उर्जा, प्रथिने आणि चरबीचे महत्वपूर्ण स्रोत असू शकतात. भारतीय शेती ही पीक आणि गुरेदोरे यांचे आर्थिक सहजीवन आहे. लाखो ग्रामीण छोटे दूध उत्पादक भारताच्या डेअरी उद्योगावर वर्चस्व गाजवतात. पशुपालन हा ग्रामीण भागातील सर्वात महत्वाचा आर्थिक क्रियाकलाप आहे. दुग्धव्यवसाय क्षेत्र आज 80 दशलक्ष शेतकरी कुटुंबांना पौष्टिक अन्न, पूरक उत्पन्न आणि कौटुंबिक श्रमासाठी उत्पादक रोजगार असे तिहेरी फायदे प्रदान करते. मुख्यत्वे महिलांसाठी संकरित गुरे आणि उच्च उत्पन्न देणाऱ्या म्हशींसह दुग्धव्यवसाय हा एक फायदेशीर व्यवसाय बनला आहे. पशुपालन घटकांनी सहज उपलब्ध करून दिलेल्या रोख रकमेमुळे, लहान शेतकरी पीक उत्पादनास प्राधान्य देतात. कृषी अर्थव्यवस्थेत आणि संसाधन गरीब शेतकरी/ग्रामीण लोकसंख्येच्या उपजीविकेत भरीव योगदानामध्ये दुग्धव्यवसायाचे महत्त्व ओळखून, दुग्ध विपणन पायाभूत सुविधा, पशुवैद्यकीय सेवा आणि आरोग्य सेवा, विस्तार समर्थन बळकट करण्यासाठी अनेक ठिकाणी उच्च प्राधान्य दिले जाते.

मुख्य शब्द : पशुसंवर्धन, पशुधन लोकसंख्या आणि उत्पादन, शाश्वत विकास

प्रस्तावना : दुग्धव्यवसाय हा दुर्बल, लहान जमीनधारक, ग्रामीण लोकांचा मजूर वर्ग आणि महिलांमध्ये प्रत्यक्ष किंवा अप्रत्यक्षपणे आणि त्यांच्या उपजीविकेला आधार देण्यासाठी आणि उपजीविका टिकवून ठेवण्यासाठी अत्यंत महत्त्वपूर्ण भूमिका बजावत आहे. दुग्धव्यवसाय अन्न पुरवठा, कौटुंबिक पोषण, कौटुंबिक उत्पन्न, मालमत्तेची बचत, मातीची उत्पादकता, उपजीविका, वाहतूक आणि सामुदायिक रोजगार, कृषी कर्षण, कृषी वैविध्य आणि शाश्वत कृषी उत्पादनात महत्त्वपूर्ण ठरते. भारतातील अंदाजे 27.6 दशलक्ष लोकांसाठी दुग्धव्यवसाय हा प्रमुख उत्पन्नाचा स्रोत आहे. अल्पभूमि आणि लहान शेतकरी यांच्या उत्पन्नापैकी 60-65 टक्के उत्पन्न आता दुग्धव्यवसायातून येते. दुग्धव्यवसाय दूध उत्पादकांना त्यांच्या कृषी-आर्थिक व्यवस्थेला अडथळा न आणता एक आधार प्रणाली प्रदान करते.

जागतिक स्तरावर सुमारे 23 टक्के अर्थव्यवस्था ही दुग्ध व्यवसायावर अवलंबित आहे. भारताची सुमारे पाच टक्के अर्थव्यवस्था ही दुग्ध व्यवसायावर अवलंबून आहे. भारतीय दुग्धव्यवसायाचा संदर्भ संपूर्ण जगात दुधाचा प्रमुख उत्पादक आणि ग्राहक म्हणून आहे. भारतीय दुग्धव्यवसाय संघटित आणि बहुतांश असंघटित (75%) मध्ये विभागलेला आहे. भारतात 80 दशलक्ष लोकसंख्येचे दुग्धव्यवसायात समाविष्ट आहेत. महाराष्ट्र राज्य दुग्ध उत्पादनात दुसऱ्या स्थानावर आहे. सोलापूर जिल्ह्यातील अक्कलकोट तालुका ही दुग्ध व्यवसायामध्ये अग्रेसर असून दुग्ध व्यवसायामुळे तालुक्यातील दुग्ध व्यवसायिकांचे राहणीमान उंचावले आहे.

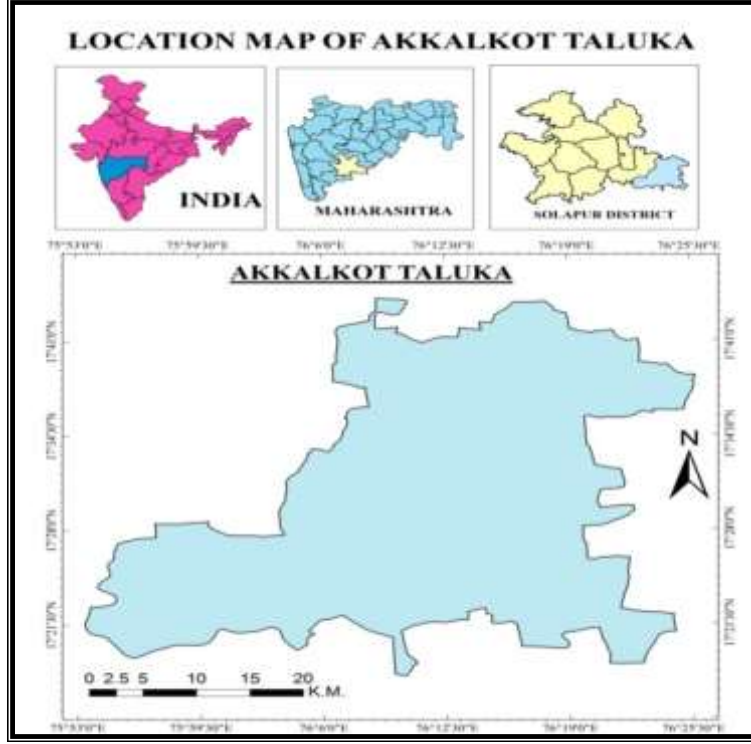
अभ्यास क्षेत्र :-

अक्कलकोट तालुका हा महाराष्ट्राच्या पठाराच्या दक्षिण भागात सोलापूर जिल्ह्यात दक्षिणेला वसलेला आहे. अक्कलकोट तालुका 17°17'54" ते 17°44'3" उत्तर अक्षांश

आणि 75°53'42" ते 76°25'43" पूर्व रेखांश दरम्यान आहे. क्षेत्रफळानुसार अक्कलकोट तहसील 1401 चौ. किमी. आणि 138 गावांचा समावेश आहे. अक्कलकोट तालुका जिल्ह्याचा आग्नेय भागने व्यापलेला आहे आणि अक्कलकोट तालुक्याच्या उत्तरेला उस्मानाबाद जिल्हा, आग्नेय आणि दक्षिणेला अनुक्रमे कर्नाटकातील गुलबर्गा आणि विजापूर जिल्हा आणि पश्चिमेला जिल्ह्यातीलच दक्षिण सोलापूर तालुका आहे.

अक्कलकोट तालुका बोरी, हरणा आणि सीना नदीच्या खोऱ्याने व्यापलेले आहे. तालुक्याचे मुख्यालय अक्कलकोट येथे आहे, जे तालुक्यामधील सर्वात मोठे शहर आणि परिसरातील धार्मिक केंद्र आहे. अक्कलकोटची लोकसंख्या शेती आणि पशुपालनाशी संबंधित प्राथमिक कार्यात अधिक गुंतलेली आहे.

क्षेत्र नकाशा



साहित्य समीक्षा:

डॉ. संतोष कुमार व प्रियंका कुमारी (२०१४) यांच्या अध्ययनात ग्रामीण भागातील विकास, दुग्ध व्यवसाय, शेतीचे महत्व सांगितले आहे. या अध्ययनात दुग्ध व्यवसायामुळे सामाजिक व आर्थिक परिणाम काय आहेत, तसेच पायाभूत सुविधावरील परिणाम, त्याचबरोबर आहारामध्ये झालेला बदल याचाही अभ्यास त्यांच्या लेखनात केला आहे. अली जे. (2007) यांच्या अभ्यासात पशुधन विभागातील विकास व ग्रामीण भारतातील दारिद्र्य निर्मूलन या शीर्षकाखाली पशुधनाची संख्या व सध्याची स्थिती, उत्पादन व मूल्य, व्यापार, आयात व निर्यात, रोजगार निर्मिती, पशुधन व ग्रामीण दारिद्र्य इ. घटकांचा अभ्यास त्यांच्या लेखात झाला आहे.

मधु मदनराव (2017) यांनी दुग्ध व्यवसाय क्षेत्रात, उद्योग आणि कृषी या अर्थव्यवस्थेच्या दोन घटकांमधील महत्त्वपूर्ण संबंध आहे, 70 दशलक्ष ग्रामीण

कुटुंबासह भारतीय लोकसंख्येचा मोठा भाग प्रामुख्याने लहान आणि अल्पभूधारक शेतकरी आणि देशातील कमी मजूर प्रत्यक्ष आणि अप्रत्यक्ष दुग्ध क्षेत्राशी जोडलेली आहेत, असे मत त्यांच्या लेखात मांडले आहे. सारा रोबीनसन & मारडिन पेटीक (2021) यांनी शाश्वत विकासातील उद्दिष्टे आणि मध्य आशियातील पशुधन क्षेत्र या विषयाखाली पशुधन क्षेत्रात व्यापार, मध्य आशिया मधील पशुधन, उत्पादक, व्यापक पशुधन आणि पर्यावरण, मानवी पोषण व पशुधन खोत, इ. घटकांचा अभ्यास त्यांच्या लेखात झाला आहे.

उद्दिष्टे: या विषयावर अभ्यास करण्याचे उद्देश अत्यंत विशाल असून यात केवळ अक्कलकोट तालुक्याचा नसून संपूर्ण विश्वातील दुग्ध व्यवसायामुळे मानवी जीवनावर होणारा परिणाम अभ्यासणे आहे.

यासाठी खालील उद्दिष्टे ठरवण्यात आली आहेत.

1. दुग्धजन्य प्राण्यांचा मानवी जीवनावर होणारा परिणाम अभ्यासणे.

2. दुग्ध व्यवसायावर अवलंबून असणाऱ्यांची सामाजिक, आर्थिक परिस्थितीचे अध्ययन करणे.
3. दुग्ध व्यवसायात येणाऱ्या अडचणी व उपाययोजना शोधणे.

अभ्यास पद्धती : प्रस्तुत शोधनिबंध प्राथमिक व दुय्यम आकडेवारी वर आधारलेली आहे.

1. प्राथमिक माहिती ही अक्कलकोट तालुक्यातील दुग्ध व्यवसाय करणाऱ्या व्यवसायिकाकडून मिळवण्यात आली आहे.
2. प्रश्नावली द्वारे आर्थिक, शैक्षणिक, सामाजिक, आरोग्य, स्थिती व समस्या माहिती मिळवण्यात आली आहे.
3. काही माहिती दुय्यम आकडेवारीच्या साह्याने म्हणजेच इंटरनेट, पुस्तके, वृत्तपत्रे इत्यादीच्या साह्याने माहितीचे संकलन करण्यात आले.

माहितीचे संकलन व विश्लेषण दुग्ध व्यवसायिकांचे वर्गीकरण:

तक्ता क्र. 1

अ.क्र.	मुख्य घटक	वर्गीकरण	दुग्ध व्यवसायिकांचे एकूण संख्या	टक्केवारी
	जनावरांच्या प्रकारानुसार	स्थानिक	72	76.59
		मुरा	14	14.89
		जर्सी	08	08.50
	हेतू नुसार	पारंपारिक	26	27.65
		जोड व्यवसाय	32	34.04
		उदरनिर्वाह	20	21.27
	रेशन कार्ड नुसार	पिवळा	48	51.06
		केशरी	44	46.80
		पांढरा	02	2.12
	आरोग्य व पोषण यानुसार	उत्तम	44	46.80
		चांगला	16	17.02
		समाधानकारक	32	34.04
	व्यवसाय पद्धतीनुसार	पारंपारिक पद्धती	62	65.95
		आधुनिक पद्धती	32	34.04
	महिलांच्या सहभागानुसार	होय	88	93.61
		नाही	06	06.38
	विघटनशील घटकांच्या उत्पादनानुसार	इंधन / बायोगॅस	06	06.38
		स्वतःच्या शेतीसाठी खत	72	76.60
	आर्थिक सामाजिक परिस्थिती सुधारणा	होय	86	91.48
		नाही	08	8.51

स्रोत: क्षेत्र अभ्यास (2023)

अक्कलकोट तालुक्यातील दुग्ध व्यवसाय हा शेतीपूरक व जोडधंदा म्हणून जास्त प्रमाणात केला जातो. अक्कलकोट तालुक्यातील दुग्ध व्यवसायात असणाऱ्या

4. प्राप्त झालेली माहिती संख्याशास्त्रीय तंत्राच्या साह्याने विश्लेषण करण्यात आले आहे.

गृहीतके:

1. दुग्ध व्यवसायामुळे शैक्षणिक स्तर व राहणीमान उंचावण्याची शक्यता असते.
2. दुग्ध व्यवसायातून सेंद्रिय खताची उपलब्धता होत असल्याने इंधन निर्मिती करून पर्यावरणीय संतुलन केले जाऊ शकते.
3. दुग्ध व्यवसायातून रोजगाराच्या संधी उपलब्ध होतात, दुग्ध व्यवसायामुळे कुटुंबातील आरोग्य स्थिती सुधारले जाते.

शेतकऱ्यांकडे किमान पाच जनावरे आहेत व त्याचे प्रमाण 67% आहे व या व्यवसायात स्थानिक व जर्सी जनावरांचे प्रमाण जास्त आढळून येते. दुग्ध व्यवसाय करणाऱ्या

व्यावसायिकांमध्ये 51% व्यावसायिक हे दारिद्र्य रेषेखालील तर 46.8% व्यावसायिक हे दारिद्र्यरेषेवरील दूध उत्पादक आहेत. दुग्ध व्यवसायामुळे ग्रामीण भागातील लोकांच्या आरोग्य स्थितीत सुधारणा झाली आहे . शैक्षणिक स्थिती सुधारण्याचे प्रमाण हे 83% आहे. दुग्ध व्यवसायामुळे 95 टक्के लोकांना रोजगार उपलब्ध झाली आहे. तालुक्यातील बहुतांश 76% दुग्ध व्यावसायिक हे पारंपारिक पद्धतीने नुसार व्यवसाय करतात व संकलित दुधाची विक्री ही गवळी व वैयक्तिक पद्धतीने जास्त प्रमाणात करण्याचे दिसून येते. दररोजच्या संकलित दुधाचा दर हा 30 ते 65 रुपये प्रति लिटर असून कमाल दर 45 रुपये प्रति लिटर आहे. या व्यवसायामुळे समाजातील स्त्रियांना रोजगार मिळू लागले आहे. या व्यवसायात स्त्रियांचा सहभाग 93.61% आहे. या व्यवसायासाठी लागणाऱ्या पशुखाद्याची निर्मिती ही स्वतःच्या शेतीतून केली जाते व ती कमी खर्चिक ठरते. अक्कलकोट तालुक्यातील बहुतांश दुग्ध व्यावसायिक हे इंधन निर्मिती करत नाहीत. या व्यवसायातून निर्माण होणाऱ्या विघटनशील उत्पादकांचे वापर शेतीपूरक व्यवसाय करणारे शेतकरी स्वतःच्या शेतात खत म्हणून करतात. दुग्ध व्यवसायामुळे आर्थिक व सामाजिक परिस्थितीत सुधारणा झाल्याचे दिसून येते. दुग्ध व्यवसाय करणाऱ्या व्यावसायिकांचे समाजातील सामाजिक दर्जा उंचावला आहे. त्याचे प्रमाण 87.2 टक्के आहे. व्यावसायिकांचे आर्थिक, सामाजिक स्थिरता प्राप्त झालेली आढळून येते.

निष्कर्ष: अक्कलकोट तालुक्यातील दुग्ध व्यावसायिक मूलतः पारंपारिक व्यवसाय पद्धतीवर अवलंबून आहेत. अक्कलकोट तालुक्यातील पशुधनांची संख्या ही जास्त आहे व अनेक शेतकरी कुटुंब दुग्ध व्यवसायावर अवलंबून आहेत. दुग्धव्यवसाय ग्रामीण शेतकरी कुटुंबांच्या उत्पन्नात आणि रोजगारामध्ये सकारात्मक आणि लक्षणीय योगदान देते, विशेषतः अल्पभूधारक आणि गरीब शेतकरी, ज्यामुळे त्यांचा उपजीविका आणि उदरनिर्वाह होतो. दुग्धव्यवसायामुळे ग्रामीण शेतकरी कुटुंबांमध्ये उत्पन्न आणि रोजगाराचे समान वितरण होण्यास मदत होते, ज्यामुळे ग्रामीण समुदायांतील संसाधनांची असमानता कमी होते. दुग्धव्यवसायामुळे पौष्टिक पातळी वाढण्यास मदत होते आणि त्यामुळे ग्रामीण भागातील शेतकरी कुटुंबांची, विशेषतः ग्रामीण समाजातील अल्पभूधारक आणि वंचित घटकांची अन्न सुरक्षा होत आहे. दुग्ध व्यवसायामुळे शेतकरी कुटुंब व अनेक बेरोजगार व्यक्तींच्या आर्थिक, सामाजिक, शैक्षणिक स्थितीत सुधारणा झाली आहे. दुग्ध व्यवसाय हा 95 टक्के लोकांना समाधानकारक वाटतो व व्यवसाय सोडून न देता या व्यवसायात विकास करावा असे मत असणारे लोकांची संख्या ही जास्त आहे.

उपाय योजना:

1. पशुधनाच्या आरोग्याची माहिती देण्यासाठी गावोगावी पशु दवाखाने उपलब्ध व्हावे.
2. दुग्ध व्यवसाय करत असताना दुग्धजन्य जनावरांच्या इन्शुरन्सची सोय असावी.
3. ग्रामीण भागात एक व्यवहारी उपक्रम म्हणून दुग्ध व्यवसायाला प्रोत्साहन दिल्यास ग्रामीण उत्पन्न व रोजगार मोठ्या प्रमाणात वाढू शकते.
4. दुग्ध व्यवसाय प्रोत्साहन योजनांचे लक्ष प्रामुख्याने अल्पभूधारक आणि गरज शेतकरी असायला हवेत जे सामान्यतः या व्यवसायात अधिक गहनपणे गुंतलेले व अवलंबून असतात.
5. पशुपालनासाठी आर्थिक मदत मिळावी व इंधन निर्मितीसाठी प्रोत्साहन देणे.
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7. दुग्धजन्य पशुसाठी व संख्या वाढण्यासाठी सरकारकडून उपाययोजना राबविल्या पाहिजेत.

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