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JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

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Physicochemical Analysis of Drinking Water and Agricultural Water in village Deulgaon mahi, Tahasil: Deulgaon raja, district: Buldana.

Dr. A. D. Deshpande, Dr. P. B. Wagh, Dr. G. B. Andhale*

Jijamata Mahavidyalaya Buldana

Email: aanand.deshpande25@gmail.com

Water covers about three fourth area of the earth's surface with volume of about one billion cubic kilometers of total surface water reserves, ocean constitutes 97%, permanent glaciers and ice-caps 2.1%, and remaining only 0.9% water is available as fresh water in the form of rivers, lakes, ponds, streams (Dugan, 1972 and Behura, 1981)[2]. Water and life are intricately linked, and water is the main constituent of the human body making up about 80% of total body weight and is the medium for all metabolic activities. More than half of the world's species of plants and animals live in water, and even our terrestrial-derived food is totally dependent on water and often largely composed of water. Water is needed not only for drinking purpose, but also for production of food. Water is also used to generate electricity (hydropower and cooling for thermal power), for navigation, and also for leisure. For this reason, most ancient civilizations grew near the bank of rivers and other perennial sources of water.

Key words: Water analysis, parameters for the analysis water sample

Introduction

Water plays an essential role in human life. Approximately, 71 per cent of the earth's surface is covered with it but fresh water constitutes only about 3 per cent of the total water. There are four major sources of surface water. These are rivers, lakes, ponds, and tanks. In the country, there are about 10,360 rivers and their tributaries longer than 1.6 km each. The mean annual flow in all the river basins in India is estimated to be 1,869 cubic km[3]. inadequate water supply is still one of the major challenges in developing countries. The joint monitoring programme (jmp) for water supply and sanitation, implemented by the world health organization (who) and unicef, reports that 783 million people in the world (11% of the total population) have no access to safe water,

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84% of whom live in rural areas. The WHO reports that approximately 36% of urban and 65% of rural Indian were without access to safe drinking water[4].

COLLECTION & SELECTION OF SAMPLE

Sample Collection

Total 5 water sample were collected, in Deulgaon mahi, from 5 different locations. Water samples were collected in pre- cleaned, sterilized, polyethylene bottles of one liter capacity. **Materials and Methods:-**

i) Color[5]: - Procedure: -

1. Label the test tubes; Control, and Local community sample.
2. Pour the 50ml of Limit Sample into the test tube.
3. Fill the Control test tube with the deionized water to the same level as the test tube.
4. Fill the Sample test tube with Local community water to the same level as the test tube.
5. Hold the Local community test tube side by side with the Control and test tubes over a white piece of paper
6. View the test tubes from above: Is the color of the Sample lighter or darker than the color of the test tube[5].

ii) Taste and odor [5]: - The taste is carried out by inhaling through two tubes of an osmoscope. One is kept in a flask containing diluted water and the other one to be tested. The taste and odor of water may also be tested by threshold number. In this method, the water to be tested is diluted with odor-free and the mixture at which odor becomes detectable is determined. It indicates threshold number and other intensities of odor are then worked out. The result of test is greatly affected by the sensitiveness of the observer. For the public water supply, the threshold number should not more than 3. If the taste and odor are suspected to be due to growth of any kind, the cause may be found out by conducting microscopically and biological examinations.

iii) Turbidity[5]: - The measurement of turbidity can be done with the help of Nepholometric turbidimeter[5].

iv) Temperature[5]:- The desirable temperature of portable water is 25 ^{0}C The measurement of temperature is done with the help of ordinary thermometers. Chemical Analysis

iii) pH[5]: pH may bc measured accurately using a pH meter. The pH meter must be calibrated before making pH measurements. For calibration standard buffers of pH 4.00, 7.00 and 10.00 are used. pH of water indicates the hydrogen ion concentration in water.

iv) **Electrical conductivity[5]**: thoroughly rinse cell with one or more portions of sample. Adjust temperature of a final portion to about 25°C. Measure sample resistance of conductivity and note temperature to ±0.1°C.

iv) Alkalinity [5]:-

1) Mix 100 ml of the sample with two or three drops of phenolphthalein indicator in the porcelain basin.

2). Add a few drops of methyl orange indicator. If the sample is orange without the addition of acid, the total alkalinity is zero. If the sample turns yellow, titrate with standard acid until the first perceptible color change towards orange is observed.

3). The determination by means of mixed indicator is done in the same way as with methyl orange.

Formula-

$$\text{Total alkalinity} = \frac{Vol.of\ tittrant \times N \times 50 \times 1000}{ml.of\ sample}$$

Where, N = Normality of H_2SO_4

v) Determination ORP (Oxidation-Reduction Product):-

The ORP of the water sample was measured with the help of Water analysis kit according to standard protocol.

vi) Biochemical Oxygen Demand [5]:-

Procedure:-

1. Pretreatment of dilution water by seeding is sometimes necessary. Pretreatment of sample is needed if the sample is supersaturated with oxygen or if the sample contains residual chlorine. If the pH of the sample is not between 6.5 and 8.5, it should be brought within this range.

2. In some wastes, suspended matter may cause difficulty because the distribution of the solids may be uneven when the sample is made up into dilutions. This may cause discrepancies in the results from different dilutions or duplicate dilutions. In such cases, shake the sample vigorously immediately before the dilutions are made. Artificial homogenizing procedures may cause an increased oxygen demand, and cannot be recommended.

3. Sometimes, the BOD determination in settled or filtered samples is needed. In such cases a settling time of 30 minutes is usually applied. For the BOD test of filterable substances, membrane filter, glass-fiber filter or paper filter may be used. The type of filter should be indicated in reporting the result. If determinations other than the BOD test are carried out on the filtered sample, it is recommended that filters of the same type and porosity be used for all of those procedures.

vii) Dissolved Oxygen [5]: - Procedure

- Collect sample in BOD bottle
- Add 2 ml $MnSO_4$ with 2 ml Alkali iodide-azide and close the stopper
- Mix well and allow the ppt. to settle
- Add 2 ml concentrated H_2SO_4 and mix well till ppt. dissolves
- Take 203 ml (Correspond to 200 ml) sample in a conical flask, titrate it against Sodium thiosulphate (0.025 N) till pale yellow color add starch indicator titrate till blue to colorless

viii) Chemical oxygen demand [5]:-

Procedure

1. Place in an Erlenmeyer flask 20 ml of the sample or an aliquot diluted to 20 ml with distilled water.

2. Add 10 ml of standard potassium dichromate solution, 0.0417mole, and a few antidumping granules. Mix well.

3. Add slowly, with caution, 30 ml of concentrated H_2SO_4 containing silver sulphate, mixing thoroughly by swirling while adding the acid. If H_2SO_4 containing silver sulphate is not used, add 0.15 g of dry silver sulphate and then, slowly, 30 ml of concentrated H_2SO_4

4. Attach the condenser to the flask and reflux the mixture for 2 hours. Allow to cool and then wash the condenser with distilled water.

5. Dilute the mixture to about 150 ml with distilled water, cool to room temperature, and titrate the excess dichromate with standard ammonium ferrous sulphate using 2-3 drops of ferroin indicator.

6. Reflux in the same manner a blank consisting of 20 ml of distilled water together with the reagents and titrate as in step 5, above.

ix) Test for Hardness:-Pipette 10 ml hard water sample into a 250 ml conical flask. Add 2 ml of buffer solution add 3 drops of EBT indicator. Titrate the solution with standard EDTA solution from the burette until the color changes from wine red to clear blue at the end point. Repeat the titration at least two times for the confirm titration value. Note the titration value which corresponds to the total hardness.

Chloride Methodology: An Argentometric Method

i) Chloride is determined in a natural or slightly alkaline solution by titration with standard silver nitrate, using potassium chromate as an indicator. Silver chloride is quantitatively precipitated before red silver chromate is formed.

Chloride mg/L = (A-B) x N x 35.45 x 1000ml sample

Where

A = ml $AgNO_3$ required for sample

B = ml $AgNO_3$ required for blank

N = Normality of $AgNO_3$

ii) Sulphate (Titrimetric method)

Procedure

1. Place 50 ml of sample in a porcelain dish. Add 1 to 2 ml of buffer solution. The pH should be 10.0 ± 0.1. Adjust as necessary.

2. Add 2 drops of indicator solution .

3. Titrate slowly with EDTA standard titrant, stirring continuously, until the last reddish tinge disappears and the sample becomes blue. The titration should be completed within 5 minutes of the addition of buffer. Record the amount of EDTA titrant used.

4. If more than 15 ml of titrant are used, repeat steps 1 to 3 using 25 ml of sample diluted to 50 ml with distilled water. If less than 1 ml is used, repeat using 100 ml of sample, or more if necessary.

5. Calculate hardness as $CaCO_3$ mg

6. Measure 100 ml of sample and pour into a beaker. Neutralize the alkalinity to pH 4.5 with 1 mol. HCl or HNO_3 Add 1 ml more of the acid.

7. Bring the sample to the boil to expel carbon dioxide. Add 10 ml of barium chloride standard solution to the boiling sample. After the volume has been reduced to less than 100 ml, remove from heat and allow cooling.

8. Transfer with rinsing to a 100-ml graduated cylinder and make up to the 100-ml mark with distilled water. Allow any precipitate to settle.

9. Pour 50 ml of the clear supernatant into a porcelain dish. Add 2 ml of buffer solution; the pH should be 10.0 ± 0.1. Adjust as necessary.

10. Add 2 drops of the indicator solution (or a small portion of the dry powder indicator mixture).

11. Titrate slowly with EDTA standard titrant, stirring continuously, until the last reddish tinge disappears and the sample becomes blue. The titration should be completed within 5 minutes of the addition of buffer. Record the amount of EDTA titrant used.

12. If more than 15 ml of titrant are used, repeat steps 9 to 11 using 25 ml of sample diluted to 50 ml with distilled water. If less than 1 ml is used, repeat using 100 ml of sample, or more if necessary.

Calculation: SO_4^- mg\lit = [A + B + C] = X x 0.98 x 4

Where, A = Titrate value in hardness estimation

B = Value equivalent to volume

C = Titrate value in Sulphate determine

Result and Discussion: - Readings of Water Quality parameters of Different samples of Deulgaon mahi, Tahasil: Deulgaon raja, district: Buldana

Parameters	S1	S2	S3	S4	S5
Temperature	25^0C	25^0C	25^0C	25^0C	25^0C
Color	Colorless	Colorless	Colorless	Colorless	Colorless
Taste	Sweetish	Sweetish	Sweetish	Sweetish	Sweetish
Odor	Odorless	Odorless	Odorless	Odorless	Odorless
P^H	7.88	7.89	7.88	7.89	7.89
Chlorides	152	157	154	150	157
Conductivity	0.402	0.407	0.410	0.409	0.408
Alkalinity	285	293	250	290	278
Hardness	322	341	334	349	329
Sulphate	160	172	150	197	169
ORP	280	246	268	279	290
TDS	449	429	394	387	429

Dissolved Oxygen	9.1	9.5	9.3	9.5	9.5
BOD	32	34	34	33	37
COD	141	137	138	139	134

Discussion: - Monitoring of Dam water samples from five different samples were analyzed by following parameter.

Color, Taste, Odor and temperature are found to be unobjectionable. .

P^H : - The p^H serves as an index to denote the extent of pollution by alkaline waste. These values are in between 7. 88 to7. 89

Chlorides: - The amount of chlorides ions present in water samples are found to be in between 152 to 157 gm/lit

Alkalinity: - The Alkalinity of water samples are found to be in between 285 to 293 ppm.

Dissolved Oxygen: - All the samples are analyzed for D.O. and the values are found to be in the range 9.1 to 9.5 mg/lit

Hardness :-Hardness of water is due to calcium, magnesium, silicates, carbonate, bicarbonate and sulphates. Total hardness of water samples found to be in between 322 to 349 mg/lit.

TDS: - The TDS of water samples are found to be in between 387 to 449 ppm

Conductivity: - The Conductivity of water samples are found to be in between 0.402 to 0.410 ms/cm

BOD: - The BOD of water samples are found to be in between 32 to 37 ppm.

COD: - The COD of water samples are found to be in between 134 to 141 ppm.

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Assessment of Agricultural Soil Quality of village Sav Tehsil & District Buldana

Dr. Pradip Wagh, Dr. Ganesh Andhale, Dr. Anand Deshpande,*
Jijamata Mahavidyalaya Buldana
Email: waghpradip1984@gmail.com

Soil is the mixture of minerals, organic matter, gases and countless Organisms that together support plant life. Two general classes are topsoil and subsoil. Soil is a natural body that exists as part of the pedosphere and which performs four important functions: it is a medium for plant growth; it is a means of water storage, supply and purification; it is a modifier of the atmosphere of Earth; and it is a habitat for organisms all of which modify the soil. Soil is the end product of the influence of the climate, relief (elevation, orientation, and slope of terrain), organisms, and parent materials (original minerals) interacting over time.6 Soil continually undergoes development by way of numerous physical, chemical and biological processes, which include weathering with associated erosion. Most soils have a density between 1 and 2 gram per cubic centimeter. Soil is a major component of the Earth's ecosystem. The world's ecosystems are impacted in far-reaching ways by the processes carried out in the soil, from ozone depletion and global warming, to rain forest destruction and water pollution. Soil is the largest surficial global carbon reservoir on Earth, and it is potentially one of the most reactive to human disturbance and climate change. As the planet warms, soils will add carbon dioxide to the atmosphere due to its increased biological activity at higher temperatures. Thus, soil carbon losses likely have a large positive feedback response to global warming.

Key words: Soil sample collection, soil analysis and its parameter

Introduction:

Soil is a complex collection of Organic and Inorganic matter. Soil is called the *Skin of the Earth*[1] and interfaces with the lithosphere, the hydrosphere, the atmosphere, and the biosphere.[2] The term *pedolith*, used commonly to refer to the soil, literally translates *ground stone*. Soil consists of a solid phase of minerals (the soil matrix) and organic matter, as well as a porous phase that holds gases (the soil atmosphere) and water (the soil solution).[3][4][5] Accordingly, soils are often treated as a three-state system of solids, liquids, and gases.[6]

Physically, soils are composed of mineral and organic particles of varying size. The particles are arranged in a matrix that results in about 50 per-cent pore space, which is occupied by water and air. This produces a three-phase system of solids, liquids, and gases. Essentially, all uses of soils are greatly affected by certain physical properties. [7]

Plants need certain *essential nutrient elements* to complete their life cycle. No other element can completely substitute for these elements. At least16 elements are currently considered essential for the growth of most vascular plants. Carbon, hydrogen, and oxygen are combined in photosynthetic reactions and are obtained

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from air and water. These three elements compose 90 percent or more of the dry matter of plants. The remaining 13 elements are obtained largely from the soil. Nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and sulfur (S) are required in relatively large amounts and are referred to as the *macronutrients.* Elements required in considerably smaller amount are called the *micronutrients.* They include boron (B), chlorine (Cl), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo), and zinc (Zn). Cobalt (Co).

Sample collection

Area of study:- Sav village is situated on the Buldana road. It is about 8 km. away from Buldana. Dist. Buldana. Buldana is one of the five Districts of Amravati divisions of Vidharbha region of Maharashtra. Mostly Agriculture crop is found in Sav village is as follows Jawar, chili, wheat, soybean, cotton, but cotton is one of the most important crops in Sav village.

Various type of soil is present in Sav

1) Lime soil
2) Black cotton soil
3) Red soil…..etc.

4) Ten soil samples are collected from the farms of following farmers at Sav village.

Sr. No.	*Name of farmer*	*Source*
1	*Prakash Pundlik Lahane*	*Farm*
2	*Jayant Anurag Jadhav*	*Farm*
3	*Rajaram gajanan Gawai*	*Farm*
4	*Devidas Totaram Jatol*	*Farm*
5	*Sanjay Vitthal Patil*	*Farm*
6	*Sk. Ganim sk. Alim*	*Farm*
7	*Sunil Ganesh Gadekar*	*Farm*
8	*Haridas Punjaji Sole*	*Farm*
9	*Vilasrao Sheshrao Bahekar*	*Farm*
10	*Damodar Arjun Patil*	*Farm*

Materials and Methods

pH

Procedure:

Extraction:

1- Add 25 ml distilled water to 10 g air-dried sample in a beaker 50 ml. Read the suspension temperature by thermometer.

2- Stir at regular intervals for 20-30 minutes.

3- Wash the pH meter electrode with distilled water.

4- Open the contact switch, wait 5 minutes, adjust temperature knob to room temperature.

Measurement:

5- Rinse the electrode with distilled water, then with the soil suspension after stirring.

6- Read the pH value of the soil suspension.

ELECTRICAL CONDUCTIVITY (EC)

Procedures:

Extraction:

1- Put 10 g air-dry soil in 100 ml beaker, add 25 ml distilled water.

2- Stir for 10 minutes, repeat stirring 4 times on 30 minutes intervals.

3- Measure the suspension temperature by thermometer.

Operation:

Before measuring, rise and fill the cell with reagent.

1- Set the temperature compensation dial.

2- Open the contact switch, wait for 5 minutes.

3- Balance the bridge with the main dial.

TOTAL NITROGEN

Procedure:

Digestion:

1- Weigh 5 g soil into digestion flask.

2- Add 5 g digestion mixture and 20 ml H_2SO_4 conc.

3- Put the flask on digestion board with electric heaters. Heat gradually; low at 10-30 minutes, then raise heating degree.

4- After the end of fuming, the digestion is continued for 1 hour after the solution had cleared with white color of digestion mixture.

5- Transfer the sample to 250 ml volumetric flask, complete the volume with dist. Water.

Distillation:

6- Put 20 ml H_3BO_3 in Erlenmeyer flask and 4 drops of the indicator.

Put the flask so that the lower tip of the glass receiver tube is below the boric acid surface.

7- Start running the cooling water in condenser

8- Start boiling the water in the boilers.

9- Put 25 ml of the sample in the funnel with dist. Water. Released ammonia is trapped in boric acid.

Titration:

10- Ammonia is titrated with HCl or H_2SO_4. At end point the green color just disappears.

Calculation

$$\text{N \% in soil} = \frac{(sample\ titration - blank) \times normality \times 14 \times dilution}{sample\ weight}$$

SOIL ORGANIC MATTER: WALKLEY-BLACK METHOD

Procedure:

1 Weigh out 01.0 to 2.00 dried soil (< 60 mesh) and transfer to a 500 ml Erlenmeyer flask. The sample should contain 10 to 25 mg of organic C (17 to 43 mg organic matter). For a 1 g sample, this would be 1.2 to 4.3% organic matter. Use up to 2.0 g of sample for light colored soils and 0.1 g for organic soils.

2 Add 10 ml of 1 N $K_2Cr_2O_7$ by means of a pipette.

3- Add 200 ml of concentrated H_2SO_4 by means of dispenser and swirl gently to mix. Avoid excessive swirling that would result in organic particles adhering to the sides of the flask out of the solution.

4- Allow to stand 30 minutes. The flasks should be placed on an asbestos sheet during this time to avoid rapid loss of heat.

5- Dilute the suspension with about 200 ml of water to provide a clearer suspension for viewing the endpoint.

6- Add 10 ml of 85% H_3PO_4, using a suitable dispenser, and 0.2 g of NaF, using the "calibrated spatula" technique. The H_3PO_4 and NaF are added to complex Fe^{3+}, which would interfere with the titration endpoint.

7- Add 10 drops of ferroin indicator. The indicator should be added just prior to titration to avoid deactivation of adsorption onto clay surfaces.

8- Titrate with 0.5 N Fe^{++} to a burgundy endpoint. The color of the solution at the beginning is yellow-orange to dark green, depending on the amount of the unreacted Cr^{++}remaining, which shifts to a turbid gray before the endpoint and then changes sharply to a wine red at the endpoint. Use of a magnetic stirrer with an incandescent light makes the end point easier to see in the turbid system. (Fluorescent lighting gives a different endpoint color). If less than 5 ml of Fe^{++} solution was required to back titrate the excess Cr^{++} , there was

insufficient Cr^{++} present, and the analysis should be repeated either by using a smaller sample size or doubling the amount of $K_2Cr_2O_7$ and H_2SO_4. Alternatively use a Pt electrode to determine the endpoint after step 5 above. This will eliminate uncertainty in determining the endpoint by color change.

9- Run a reagent blank following the above procedure without soil. The reagent blank is used to standardize the Fe^{++} solution daily.

10- Calculate % C and % organic matter:

a. % easily oxidizable organic C

$$C = \frac{(B-s)\times n \times Fe++}{gm\ of\ soil} \times \frac{12}{4000} \times 100$$

Where:

B = ml of Fe^{++} solution used to titrate blank,

S = ml of Fe^{++} solution used to titrate sample,

And 12/ 4000 = m equivalent

Result

The physical, chemical properties and all parameters of the collected soil sample from the various farms are discuss below: (F = soil sample in farm)

Farm / P.m.	*F1*	*F2*	*F3*	*F4*	*F5*	*F6*	*F7*	*F8*	*F9*	*F10*
water Holding Capacity	*8.9*	*0.6*	*10.15*	*2.11*	*10*	*10.1*	*5.5*	*11.2*	*10.5*	*9.1*
pH	*7.2 (26^0 C)*	*6.76 (24^0 C)*	*6.90 (25^0 C)*	*7.2 (26^0 C)*	*6.73 (23^0C)*	*7.3 (22^0 C)*	*6.82 (26^0 C)*	*6.92 (25^0 C)*	*6.43 (24^0C)*	*7.23 (25^0)c*
Nitrogen (%)	*3.23*	*3.44*	*3.2*	*4.30*	*3.54*	*3.24*	*2.46*	*3.50*	*3.1*	*3*
Chloride (%)	*0.07*	*0.05 7*	*0.07*	*0.50*	*0.13*	*0.31*	*0.07 2*	*0.08*	*0.074*	*0.05*
Magnesium (%)	*3.3*	*3.23*	*3.23*	*3.24*	*3.30*	*2.50*	*1.49*	*2.23*	*3.21*	*2.3*
Electrical conductivity ms^{-1}	*0.51 7*	*0.41 9*	*0.519*	*0.21 5*	*0.275*	*0.52 9*	*0.12 9*	*0.32 0*	*0.512*	*0.215*

Discussion

Reference Tables:

Based on the pH value of the following ratings may be adopted.

S.N.	Rating	pH range	Characteristics
1	Extremely alkaline	>9.0	Characteristic of highly alkaline soils requiring reclamation measures.
2	Strongly alkaline	8.4-9.0	
3	Moderate alkaline	7.6-8.3	Suitable for many crops. pH beyond 8 to 8.3 can be tolerated by crops like rice, Lucerne.
4	Slightly alkaline	7.1-7.5	
5	Nearly alkaline	6.5-7.0	
6	Slightly acidic	6.0-6.5	Characteristic of much red and lateritic soil indicating deficiency of calcium and low in base saturation.
7	Moderate acidic	5.3-6.0	
8	Strongly acidic	4.5-5.2	Characteristic of soil of the humid regions where annual rainfall exceeds 18 inches.
9	Extremely acidic	>4.5	

Categorization of soil on the basis of Electrical conductivity:

Electrical conductivity (ds/m)	Rating
<1	Good soil
1.00-2.00	Poor seed germination
2.00-3.00	Harmful for some crop like pulses
>3	Harmful for most of the crops

Rating of soil in 6 tier system on the basis of organic carbon.

Sr.No.	Rating	Organic carbon content %
1	Very low	Less than 0.20
2	Low	0.21 to 0.40
3	Moderate	0.41 to 0.60
4	Moderately high	0.61 to 0.80
5	High	0.81 to 1.00
6	Very high	Greater than 1.00

Soil categorization on the basis of Nitrogen, Phosphorus and Potassium content [18]

Sr. No.	Element	Required range
1	Nitrogen	3-5%
2	Magnesium	5-10%
3	Chloride	12-15%

Conclusion

After collecting the soil sample from Sav village, Buldana District in observed all the parameters i.e. N, P, & Cl water holding properties, pH, organic carbon , as composition it is concluded that all the parameter are in the good health but pH holder show the slightly acidic in nature .Electrically conductivity indicates good soil.

From the study of calcium carbonate, it is indicated that the soil is slightly calcareous and from the percentage of calcium carbonate it is concluded that the $CaC0_3$ is present is less amount which is good for the soil. If it is present in excess it may affect the crop.

Organic carbon determination shows the carbon content is high. It is beneficial for supplying water to plants and also by providing the good physical condition to the soil. Farmers are requested to not use the large quantity of organic carbon containing fertilizer because which is present in sufficient amount.

From N, P, K studies it is observed that all the parameter is in the required range which indicates that the soil is good for the Soybean, Harbhara, Tur crop and also for oranges and lemon crops.

Farmers are suggested that to do not use much fertilizer because the farm is rich with all the nutrient and excess of fertilizer may decrease the crop yield.

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Infructescences, fruits and seeds of the distinctive fossil palm, *Tricoccites trigonum* K.P. Rode from Mohgaonkalan in Chhindwara District, Madhya Pradesh, India: three-dimensional morphology, and anatomy

Steven R. Manchester[1*], Dashrath K. Kapgate[2], Rahul W. Ukey[3] and Mangesh H. Wanjari[4]

[1*]Florida Museum of Natural History, University of Florida, Gainesville FL., U.S.A.
E-mail: steven@flmnh.ufl.edu
[2]Department of Botany, Jashbhai Maganbhai Patel College, Bhandara–441902, India.
E-mail: dkapgate@gmail.com
[3]Department of Botany, Jijamata Mahavidyalaya, Buldhana–443001, India.
E-mail: rahulukey256@gmail.com
[4]Department of Botany, Om Sataysai Arts and Science College, Parsodi–441806, Bhandara District, India. E-mail: mangeshwanjari998@gmail.com
*Corresponding author

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ABSTRACT

Manchester S.R., Kapgate D.K., Ukey R.W. & Wanjari M. 2022. Infructescences, fruits and seeds of the distinctive fossil palm, *Tricoccites trigonum* K.P. Rode from Mohgaonkalan in Chhindwara District, Madhya Pradesh, India: three-dimensional morphology, and anatomy. Geophytology 50(1&2): 49–60.

Infructescences and fruits of the extinct genus *Tricoccites* from the latest Cretaceous of central India were previously studied by optical analysis of fractured surfaces and thin sections. The application of micro-CT scanning now allows for improved documentation of the 3-dimensional morphology. We reconfirm most of the morphological and anatomical features reported previously, including trilocular fruits with one seed per locule and a single cotyledon in each seed, but we also call attention to the presence of a prominent subapical germination pore on the dorsal side of each of the three pyrenes. These characters support assignment of *Tricoccites trigonum* to the *Arecaceae*. The infructescence is composed of closely packed sessile fruits and is unusual in the lack of an obvious central axis or rachis. Spongy tissue arising apically above each locule is interpreted to be stigmatic. The fruit was likely adapted for aquatic dispersal, due to the buoyancy that would have been provided by the longitudinal pericarp cavities.

Keywords: Palm fruits, micro-CT scanning, Maastrichtian, chert, permineralized

INTRODUCTION

The unusual monocot genus *Tricoccites* has been known since the 1930s based on well preserved silicified fruits from the village of Mohgaonkalan in Chhindwara District, Madhya Pradesh, India. The trilocular fruits were named *Tricoccites trigonum* by Rode (1933) who considered them likely to represent *Euphorbiaceae*, but Sahni (1937) reinterpreted them as palm fruits. Chitaley (1956) elaborated on the fruit anatomy and suggested affinities with *Pandanaceae*

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or *Arecaceae*. Additional contributions were made by Bonde (1985), who described new material including many expertly ground thin sections of exceptionally well-preserved specimens revealing more details of the fruit and its seed. Some authors noted close association with anatomically preserved pseudostems of the genus *Cyclanthodendron* (Trivedi & Verma 1972, 1978, Biradar & Bonde 1990), but physical connection was not proven. The precise affinities of *Tricoccites* have remained uncertain.

Here we summarize and augment the morphology and anatomy of *Tricoccites trigonum* based on newly recovered infructescences and using new methods of X-ray analysis to revisit the question of its systematic affinities with additional evidence that it belongs to the *Arecaceae*.

MATERIAL AND METHODS

Although angiosperm fruits and seeds have been found at more than 20 different chert sites across central India (Smith et al. 2015), fruits of *Tricoccites* have been recovered only at sites near the villages of Mohgaonkalan and Keria in Chhindwara, Madhya Pradesh, India, where they are locally abundant (Figure 1). We examined specimens at Birbal Sahni Institute of Palaeosciences (BSIP), Agharkar Research Institute, Pune (ARI), and the Cleveland Museum of Natural History, Cleveland, Ohio (CMNH). Newly collected material (Figure 2) was cataloged in the paleobotanical collection of the Florida Museum of Natural History at University of Florida (UF).

Specimens were photographed by reflected light with a Canon Rebel XSI digital SLR camera with an EFS 60 macro lens, or for higher magnification of peel slides, with the same camera mounted on a Nikon Labophot microscope using a fiber optic light source and a white paper background for an optimal combination of reflected and transmitted light. X-ray imagery was obtained with a GE Phoenix V/tome/xm240 CT scanner, located at the University of Florida College of Engineering Nanoscale Research Facility. Depending on size of the chert specimen, scans were set at 200–220 kV and 120-300 mA, obtaining voxel resolutions of 47-61 µm. 2200 images were taken

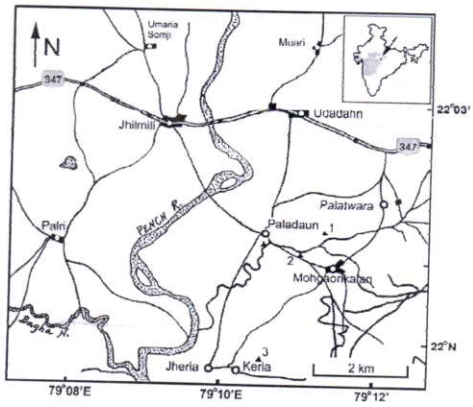


Figure 1. Map updated from Sahni and Rode (1937) showing the location of sites where *Tricoccites* is known including the type locality of Mohgaonkalan. Inset map shows location in relation to the Deccan Traps, shaded gray. Numbered sites include Mohgaonkalan (1 = UF 18311, 2 = UF 19348) and Keria (3 = UF 19329).

through a rotation of 360 degrees with exposure times of 333 or 500 ms. Resulting image stacks were processed with VG Studio Max version 3.1 and Avizo Lite version 9.1 to produce volume renderings, surface renderings, and digital sections. The best example data sets are accessible as TIFF stacks and as 3-D surface renderings at https://morphosource.org under the project "Deccan Plant Reproductive Structures," at Morphosource.org. We studied the following specimens: ARI SDB-5276, CMNH P-3163, 3166, 3776, 3782, 3792, 3795, UF 68964, 69705, 69707, 69708, 71118, 71124, 71125 from Mohgaonkalan and UF 56231, 56232, 56236, 85612 from Keria.

DESCRIPTION

Chitaley (1956) recorded infructescences up to 14 cm long. Newly collected infructescences are up to at least 35 cm long (the longest specimen recovered, Figure 2), but all specimens so far recovered are broken at both ends. Up to 14 closely packed fruits are visible in the 35 cm length. As noted by Chitaley (1956, p. 56) the fruits are crowded, "closely packed in such a way that sides of two adjoining ones fit together." The specimens discussed and illustrated by Chitaley, and those we have studied (e.g. Figure 2.2–13), show the

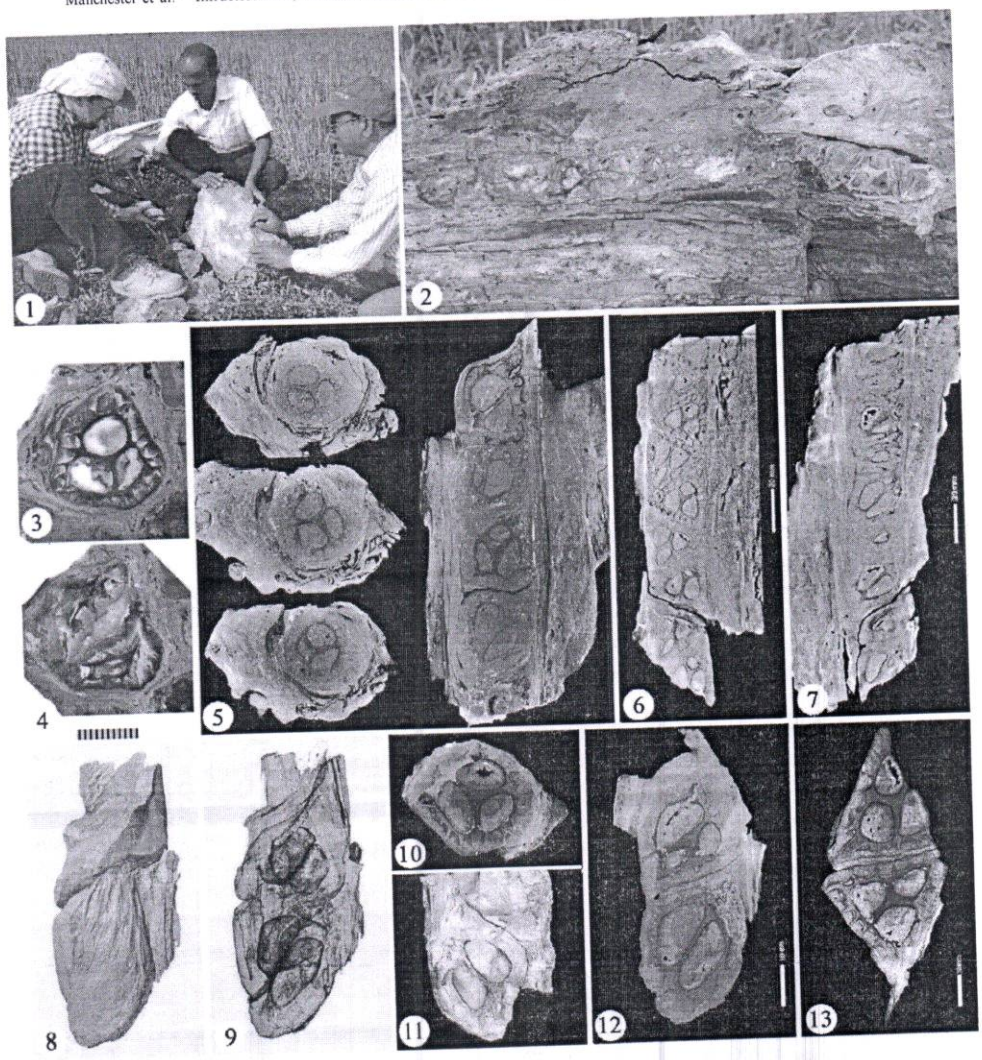


Figure 2. *Tricoccites trigonum* K.P. Rode.
1, 2. Chert boulder in the field near Mohgaonkalan containing infructescences. **3–13.** Specimens obtained from the same boulder by reflected light (3, 4) and micro-CT scanning (5–13). **3.** Physical transverse section of infructescence revealing one of the trilocular fruits, UF 19348-69708. **4.** Another transverse section of same infructescence intercepting two adjacent overlapping fruits. **5.** Successive transverse sections and a longitudinal section, UF19438-69707. **6. 7.** Virtual longitudinal sections of UF19438-68964, with the specimen in two planes rotated about 90 degrees from each other, one plane intercepting the fruits in mostly transverse orientation (6), the other plane intercepting fruits in lateral orientations (7). **8–13.** Two-fruited fragment of the specimen in 6 and 7. **8.** Surface rendering showing rhomboid outline of the fruits. **9.** Translucent rendering showing the positions of pyrenes within the fruits. **10.** Virtual transverse section of fruit. **11.** Surface rendering of naturally fractured specimen with two seeds exposed. **12, 13.** Virtual longitudinal sections in two planes of rotation. Scale bars 1 cm in 4 (applies also to 3), 12, 13, 2 cm in 6, 7.

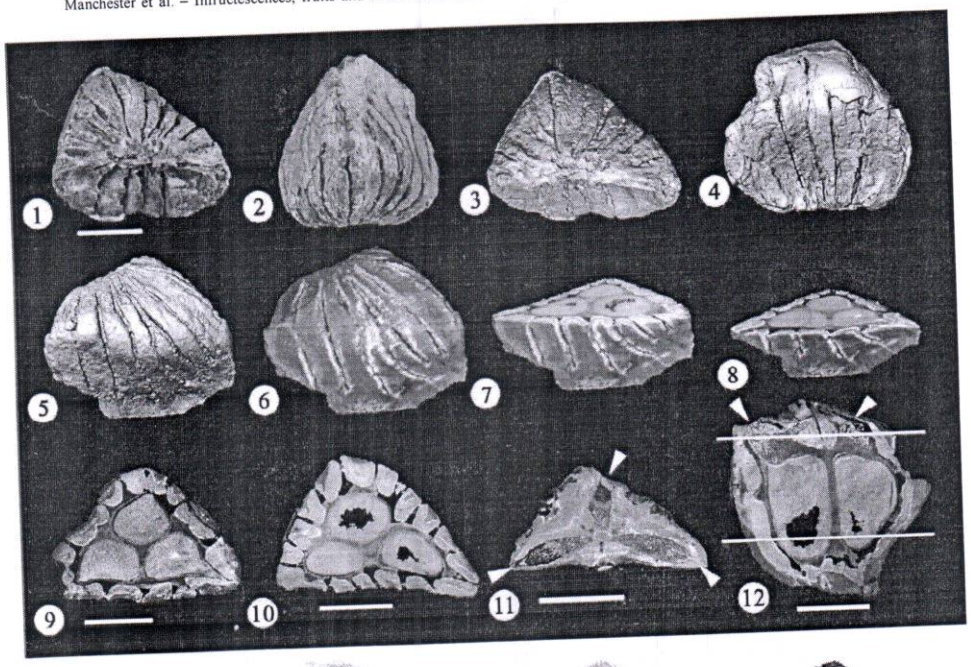
fruits packed in a single file within a tubular infructescence. Shukla (1950) mentioned a specimen bearing twenty fruits. In longitudinal section, the fruits in that specimen appear to be in two rows (Figure 4.7). However, we infer that this appearance was due to distortion as the infructescence was compressed and starting to disaggregate, because all other infructescences, like those in Figure 2, show the fruits tightly arranged in a single file (see also Chitaley 1956, Plate 1).

Physical sections and successive micro-CT virtual sections show that the fruits not only are sessile but lack obvious vascular attachment to a common rachis. This makes the mode of attachment and indeed determination of "which way is up" on each fruit somewhat mysterious. Chitaley (1956 p. 59) stated "Both ends are truncate and are so similar that I could hardly tell them apart in isolated fruits. However, I conclude that the end which shows more vascular tissue in sections is the base." We found enrolled leafy tissue surrounding our infructescences as noted by previous authors, e.g. Chitaley (1956), but could not establish a physical connection and the preservation of the laminar tissue was poor compared to that studied by Biradar and Bonde (1990).

The emended diagnosis of Chitaley (1956) readily applies to the newly collected material as well: "Elongated fructification composed of closely packed sessile fruits, enclosed in several ensheathing leaves. Fruits 3-locular, 3-seeded drupe; shape triangular in transverse section, rounded in longitudinal section but with more or less flattened ends. Fruit wall with three main regions: outer region thin, fibrous; middle region broad, divided by radial plates of fibrous tissue alternating with soft tissue or spaces; inner region richly fibrous and thick. Loculi rounded in cross section occupying the angles of the fruit..." Chitaley's emended diagnosis included the statement, "embryo not preserved". Subsequently, Bonde (1985) sectioned fruits with well preserved seeds showing clearly a monocotyledonous embryo of medium size, surrounded by cellular endosperm tissue (refigured here, Figure 4.1, 4–6). It is also worth noting that the seed coat is smooth, not intruded as in those genera of palms with ruminate endosperm.

The prominent lacunae within the pericarp outside of the locules were interpreted by Bonde (1985) as abortive pyrenes, but this hypothesis can be discarded because the structures he interpreted as abortive embryos can be seen to be the somewhat shrunken parenchymatous mesocarp (Figure 4.4; Figure 6.2, 3). The fruits are distinctive in having longitudinal parenchyma-filled lacunae within the pericarp extending from base to apex. There are 16 to 22 of these mesocarp lacunae in the fruits we studied (e.g. Figure 2.3; Figure 3.10; Figure 4.1; Figure 5.2, 12). Each cavity is bounded by exocarp tissue at the surface and fibrous mesocarp tissue that forms longitudinal septations (Figure 6.2, 3). The septations extend from base to apex of the fruit and can be seen as surface grooves in eroded specimens (Figure 3.1–5), because the exocarp can be mostly stripped away so that the

Figure 3. *Tricoccites trigonum* K.P. Rode.
1–12. A single fruit from Mohgaonkalan showing typical shape, S.D. Chitaley collection, CMNH 3776, viewed by reflected light (1, 2) and micro-CT scanning (3–12). **1.** Basal view showing radiating grooves representing the eroded septations delimiting longitudinal cavities of the pericarp. **2.** Lateral view, with most of exocarp flaked away except left and upper right. **3.** Basal view rotated slightly from 1. **4.** Lateral view showing eroded septations delimiting longitudinal silica-filled lacunae of the pericarp. Exocarp flaked away except at upper right. **5.** Lateral view by surface rendering. 6–9. The same orientation, volume rendering, with virtual transverse sections at the levels of 9, 10. 9. **10.** Virtual transverse sections at, and below the equator showing the 3 locules, and lacunae of the fruit wall. **11.** Virtual transverse section at apex showing vascular bundles of septum and three radiating arms of spongy tissue that arise above each locule (arrows). **12.** Longitudinal section traversing two of the stigmatic envelopes (arrows). 13–15. Fruit digitally extracted from chert, rendered translucent to show outlines of the locules, UF 19438-71125A, same specimen as in Figure 5.2–7. **16.** Virtual transverse section, intercepting the germination pore within pyrene (arrow), UF 19438-71118. **17.** The same specimen, virtual longitudinal section intercepting the germination pore (arrow). **18.** The same pyrene, digitally extracted, dorsal view showing germination pore in face view, UF 19438-71118. 19–23. Pyrene digitally extracted from the fruit in 13-15, UF 19438-71125A, in lateral, dorsal, ventral, apical and basal views. Note germination pore at arrow. Scale bars 1 cm. (bar at 1 applies also to 2-8; bar at 13 applies also to 14, 15; bar at 19 applies also to 20-23).



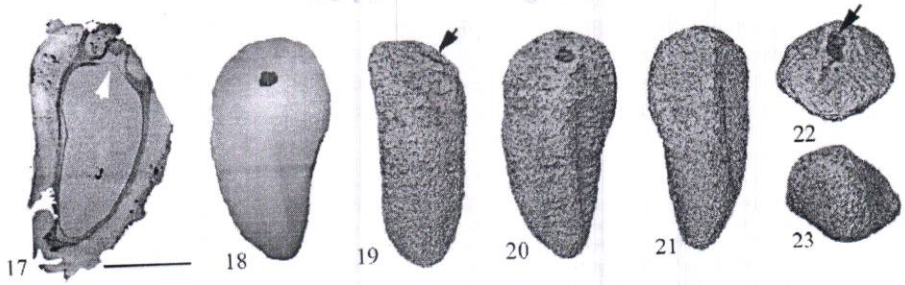


Figure 3

septations erode preferentially more than the adjacent silica-filled lacunae giving the appearance of surface grooves. The inner mesocarp is formed of interwoven fibers through which sinuous fibrovascular bundles and/or canals are prolific (Figure 6.2, 5–7). The fibers are arranged in sinuous tracts accompanied by crystalliferous strands (Figure 6.10).

Although placentation was reported as basal, we have not observed obvious attachment between the seed and the locule. Chitaley (1956, p. 59) stated: "The attachment of the seed appears basal (though there is doubt if I have recognized the base correctly), and the placenta extends up the side along the angle of the fruit." She considered the placenta to be richly vascular…" but the figures she cited seem to show the vasculature of the mesocarp (as we depict in Figure 6.2, 5–7), rather than of specialized placental tissue. Using sections, both physical and by X-ray methodology, we have not been able to confirm the placentation type.

The layers interpreted as seed coat by Chitaley (1956) are here considered to represent the endocarp or pyrene as is consistent with the morphology of palm fruits (Murray 1973, Romanov et al. 2011, Matsunaga & Smith 2021). Chitaley noted that in transverse section the thickness of this layer is about 0.25 mm and composed of three regions: a uniseriate outermost layer of radially elongated prismatic cells interpreted as epidermis, a middle zone of about 5–7 cells thick of parenchyma with rather thick walls and dense contents, and an innermost layer made up of several layers of thin-walled parenchymatous cells. In addition to these layers, we noticed a faintly preserved inner uniseriate layer of thin-walled cuboidal cells (Figure 6.9). Digital extraction of pyrenes from micro-CT scanned fruits show the external morphology, including a prominent circular germination pore (Figure 3.18-23).

A peculiar feature of the morphology and anatomy of *Tricoccites* that has not received prior attention are the pockets of spongy tissue peripheral to the apex of each locule (see arrows in Figure 4.3, Figure 5.4-6, 15). Under higher magnification (Figure 6.4), this zone is seen to arise within the mesocarp, and is composed of a spongy tissue of thin-walled cells traversed by sinuous tubular strands (Figure 6.8). Transverse sections above the locules intercept three or six vascular bundles situated on the radii between the radiating spongy zones (Figure 3.11; Figure 5.5, 17). We refer to the apical spongy zones as stigmatic pockets, but they are in need of further study. They may represent pollen-tube transmitting tracts (e.g. Castaño et al. 2016; Stauffer et al. 2002) and it is possible that the tubular structures (Figure 6.8) may be pollen tubes. The exocarp separates along the periphery of each of these pockets (Figure 5.4, 13, 24, 6.4), suggesting that these functioned also as germination openings in the pericarp. The germination pore in each pyrene is situated immediately below the stigmatic pocket (Figure 3.16, 17).

DISCUSSION

Affinities

The monocotyledonous affinities of *Tricoccites* are affirmed by the combination of tricarpellate fruits, scattered vascular bundles of the pericarp (Figure 5.5–7), and single cotyledon per seed Figure 3.4–6). Sahni (1937) considered these fruits to represent an extinct kind of palm, but other possibilities have been presented subsequently, including *Pandanaceae* (Chitaley 1956, Bonde 1985), and *Zingiberales* (Biradar & Bonde 1990).

Trivedi and Verma (1972, 1978) published what they considered to be a peduncle bearing fruits of

Figure 4. 1-6. *Tricoccites trigonum* fruit from Mohgaonkalan in ground thin sections. S.D. Bonde collection, AGI, Pune.
1. Transverse section near equator of fruit showing three locules with each of the three seeds containing endosperm, SDB5276, slide 26. **2.** Specimen sectioned closer to the apex showing stigmatic pockets (arrows). **3.** Oblique-transverse section near apex of fruit intercepting pericarp lacunae (bottom of figure), and three stigmatic pockets (arrows). **4.** Enlargement from 1, showing receded parenchymatous tissue within each of the pericarp lacunae, and a single seed with a central linear cotyledon within the shrunken mass of endosperm tissue. **5, 6.** Longitudinal slice of a seed showing the single cotyledon (C) and endocarp (E), SDB5276 slide 33. **7.** Longitudinally sectioned infructescence of Shukla 1950 from Mohgaonkalan. BSIP coll. Scale bars 1 cm in 1–5, 7, 2 mm in 6.

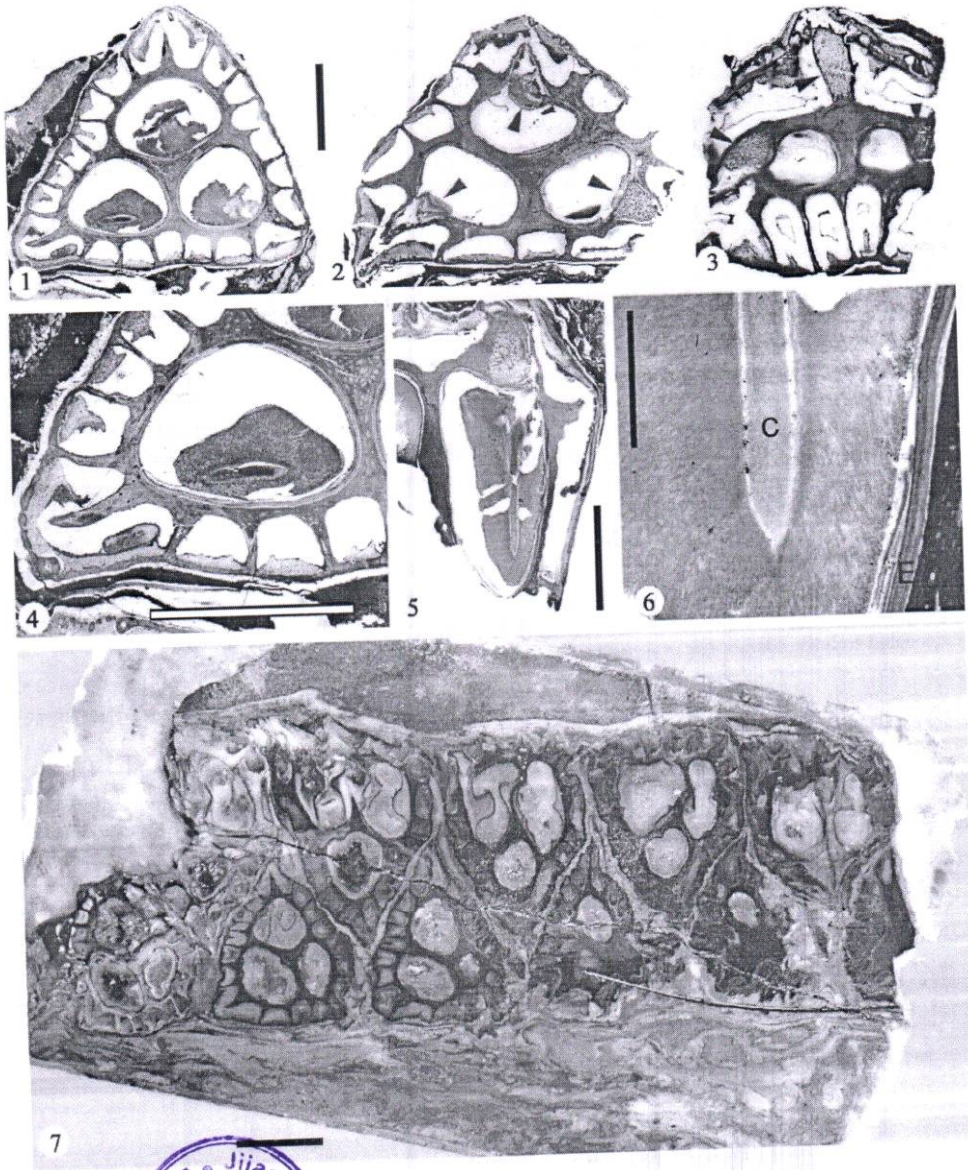


Figure 4

Tricoccites trigonum enclosed by leaf sheaths and showed the anatomical similarities between the peduncle and the pseudostem of *Cyclanthodendron sahnii* Sahni & Surange (Rode 1933; Sahni 1937; Shukla 1950; Sahni & Surange 1953). However, the specimen figured as evidence of attachment does not show physical continuity of tissue and seems instead to be a monocot axis lying adjacent to a fruit. Bonde (1985, p. 65) also mentioned organic connection but did not illustrate specimens with such a connection. The evidence that *Cyclanthodendron* stems and *Tricoccites* represent the same plant thus remains circumstantial, based on close association in the chert. We must remember that there are various other monocot fruits abundant at the same locality including at least four palms and the extinct genera *Momordiocarpon* (see Smith et al. 2021), *Viracarpon* (reviewed, Matsunaga et al. 2018), and *Sahnipushpam* (reviewed, Kapgate et al. 2011) so it is difficult to be certain of the connection between the vegetative and reproductive organs. Among the monocot seeds common at Mohgaonkalan, *Momordiocarpon cardiospermum* (R.K. Jain) Manchester, Kapgate & S.Y. Sm. clearly represents *Zingiberaceae* (Smith et al. 2021), and might be expected to have been borne on a pseudostem like that of *Cyclanthodendron*. The inference that *Tricoccites* is zingiberalean (scitaminean of older literature) (Biradar & Bonde 1990) was based mainly on the assumption that the fruits were borne by *Cyclantodendron* stems, but that remains to be demonstrated.

We reaffirm the affinities of *Tricoccites trigonum* with *Arecaceae*, as recognized early by Sahni (1940). This placement is consistent with the great diversity of fruit morphology known in the family today (Dransfield et al. 2008). Our recognition of a circular germination pore in the pyrene (Figure 3.16-23) reinforces the assignment to *Arecaceae*. Not all palms possess germination pores, but their presence is characteristic of some clades within the family, being particularly useful in recognizing members of the subfamilies *Nypoideae Arecoideae* (Matsunaga & Smith 2021). The position of these apertures, whether basal, lateral or more apical is also informative. In the case of *Tricoccites*, they are dorsal, near the apex.

Although no extant palm shows the same combination of characters, most of its features are not foreign to the family. *Brassiophoenix schumannii, Ptychococcus paradoxus* and *Satranala decussilvae* have similar longitudinal cavities in the pericarp, but differ greatly in other features, e.g. having only a single seed per fruit. *B. schumannii*, and *S. decussilvae* seeds are radially lobed rather than smooth and ellipsoidal. Seeds of *S. decussilvae* have ruminate endosperm. The inflorescence structure of *Tricoccites* resembles the row of sessile flowers, termed acervulus, as seen in the chamaeodorid genus *Synechanthus* (Dransfield et al. 2008). However, a central rachis axis is not observed in otherwise well preserved *Tricoccites* infructescences, so that the mode of attachment of the fruits remains unclear. Also, the structures we call

Figure 5. *Tricoccites trigonum* fruits in chert from Mohgaonkalan, by micro-CT scanning.
1. Virtual section intercepting two fruits with prominent lacunae in the pericarp, UF 19438-71125. **2–7.** Virtual sections of the left side fruit from 1, UF 19438-71125A. **2.** Nearly equatorial section, showing three equally developed locules; lines indicate the longitudinal planes of section in panels 6 and 7. **3.** Section near the top of the locules. **4.** Section skimming the apex of the locules with three stigmatic pockets (arrows). **5.** Apical section intercepting three-armed stigmatic complex (arrows). **6.** Longitudinal section at orientation indicated in 2, intercepting two of the locules and their adjoining apical stigmatic pockets (arrows). **7.** Tangential section through pericarp showing longitudinal lacunae. **8–17.** Virtual sections of the right side fruit from 1, UF 19438-71125B. **8.** Longitudinal section intercepting two of the locules (each with a central black, empty pocket lined with quartz crystals). Horizontal lines indicate the levels of the transverse sections in 9–17. **9.** Section near base of fruit below the locules. **10.** Section skimming the basal part of the endocarp. **11.** Section in basal 1/5 of fruit intercepting three locules and showing the radiating mesocarp partitions defining lacunae within the pericarp. Note stray seed of *Momordiocarpon cardiospermum* (arrow). **12.** Equatorial section. Note stray seed of *Indovitis chitaleyae* (arrow). **13.** Section approaching the apices of the locules. **14.** Section skimming the apices of the locules. **15.** Section above the locules showing three radiating stigmatic pockets (arrows). **16.** Section at higher level of the stigmatic pockets. **17.** Enlargement from 16. Note three vascular bundles alternating in position with the stigmatic pockets. **18–26.** Virtual sections of a fruit partially exposed at surface of chert, UF 19438-71118. **18.** Longitudinal section intercepting two locules and their apical stigmatic pockets. Horizontal lines indicate the levels of the transverse sections in 19–26. **19–26.** Successive transverse sections from base to apex. Arrows indicate stigmatic complex. Scale bars 1 cm.

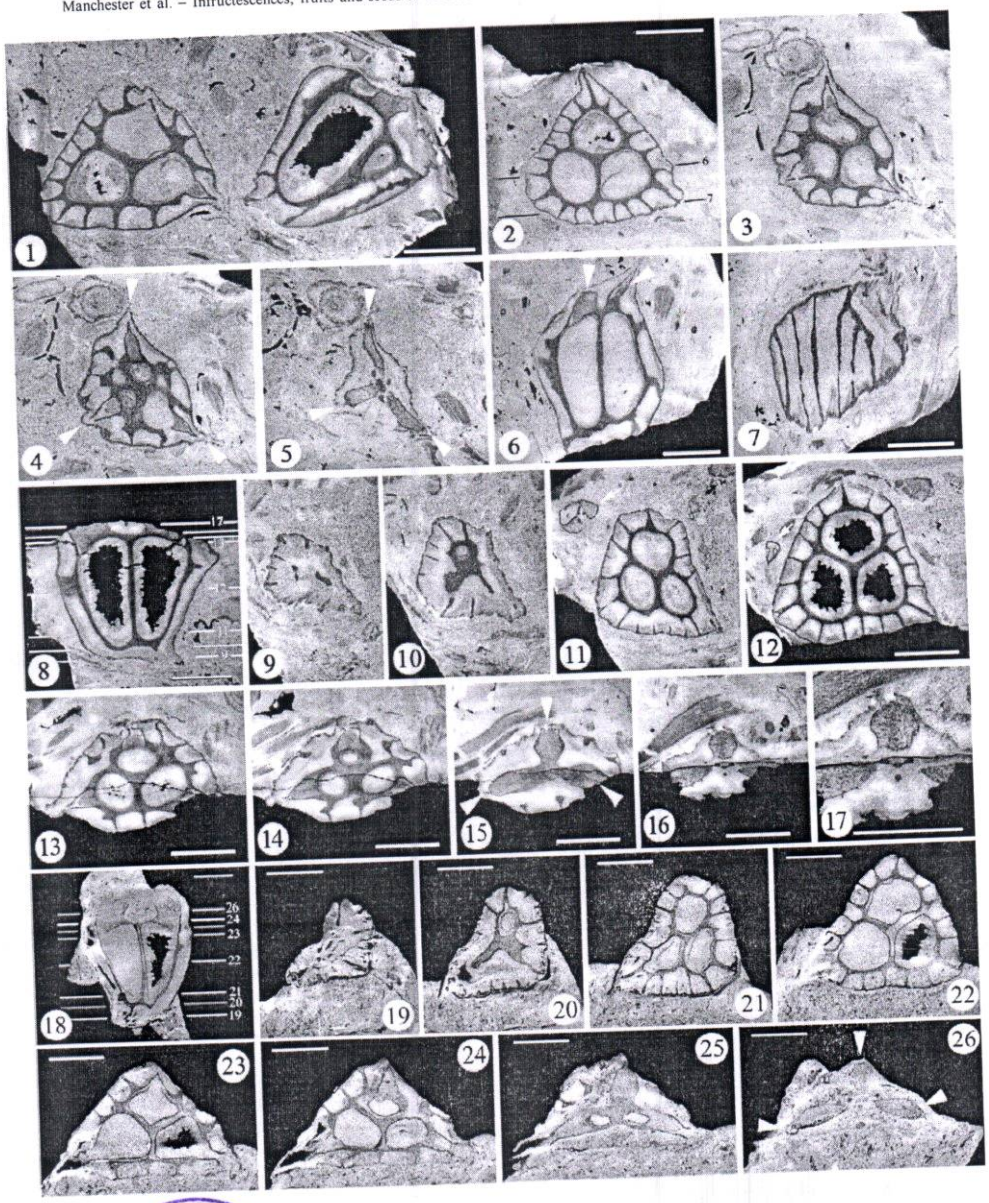


Figure 5

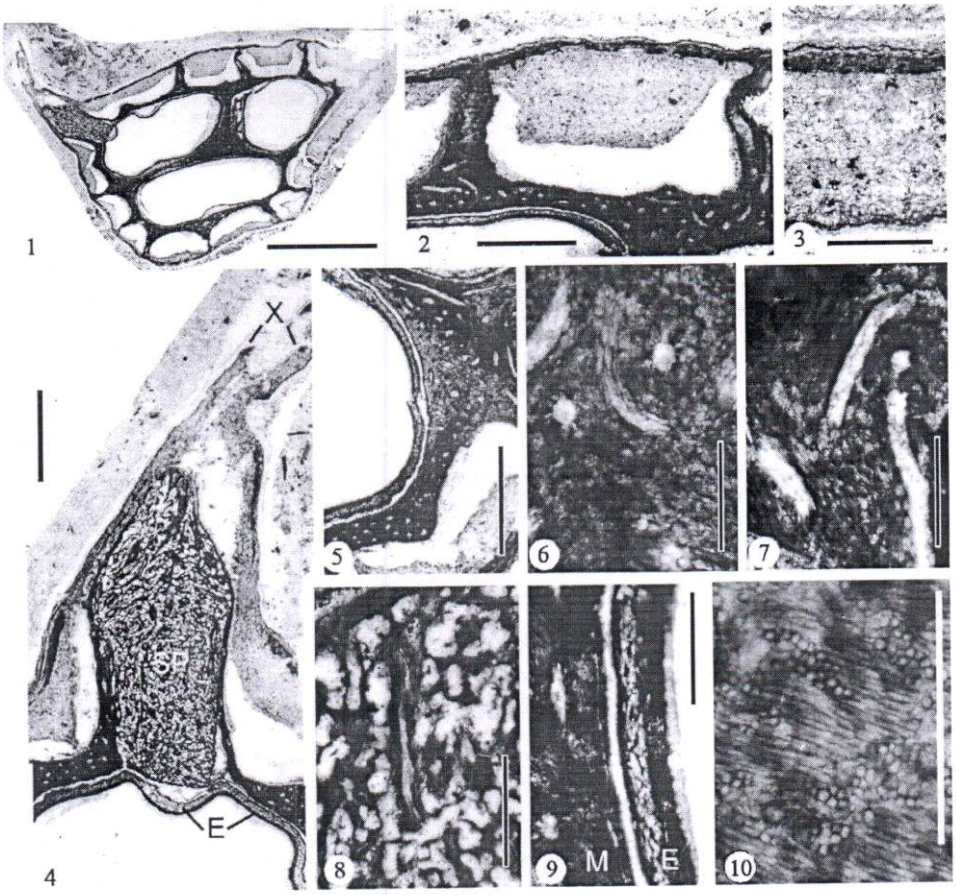


Figure 6. 1–7. *Tricoccites trigonum* fruit sectioned by the acetate peel method for details of anatomy. UF 19329-85612 from Keria. **1.** Somewhat oblique transverse view with plane of section intercepting apical stigmatic pocket upper left. **2.** Detail of pericarp lacuna with parenchymatous tissue adhering to exocarp but receded away from sclerenchymatous layers. Note scattered bundles of the inner mesocarp. **3.** Detail of mesocarp and exocarp. **4.** Detail from 1, showing endocarp (E), exocarp (X), and stigmatic pocket. **5.** Mesocarp with scattered bundles in septa, and endocarp lining the locule. **6–7.** Detail of fibrous mesocarp with sinuous vascular bundle tubes. **8.** Enlargement of tissue from stigmatic pocket. **9.** Histology of mesocarp (M) and endocarp (E). **10.** Detail of mesocarp showing fibers and crystalliferous strands. Scale bars 1 cm in 1; 2 mm in 2, 4; 1 mm in 3, 5–10.

stigmatic pockets may correspond to the pollen tube transmission tract recognized in palms (Castaño et al. 2006; Stauffer et al. 2002). It will be interesting to include *Tricoccites* in a broader phylogenetic analysis of palms taking advantage of the framework presented by Matsunaga and Smith (2021).

Palms were an important component of the Deccan Intertrappean vegetation, represented by vegetative organs such as stems and leaves, and by reproductive structures including fruits, seeds and pollen (Bonde

2006). Co-occurring at the Mohgaonkalan site were at least four other kinds of palm fruits and seeds: 1. *Nypa* (e.g. Chitaley & Nambudiri 1995); 2. *Palmocarpon mohgaoense* U. Prakash (1955) and similar or perhaps conspecific fruits of *P. indicum* U. Prakash (1960), and *Cocos intertrappeansis* G.V. Patil & Upadhye (1984); 3. *Hyphaeneocarpon indicum* Bande, U. Prakash & Ambw. emend. Matsunaga, Manchester, R. Srivast., Kapgate & S.Y. Sm. 2019 (Matsunaga et al. 2019); and 4. *Graminocarpon* Chitaley & Sheikh (Chitaley & Sheikh 1971), the seeds of which have recently been observed to possess germination pores diagnostic of palms (Manchester pers. obs.). We consider *Tricoccites* to be yet another example.

Ecology

We agree with Sahni (1940, p. 15), who concluded that the fruit was adapted for dispersal by water, as evidenced by the longitudinal chambers in the pericarp. A convergent morphology with similar wall cavities occurs in fruits of the North American cornalean species *Nyssa ogechi*. The marsileaceous sporocarps of *Rodeites*, common at Mohgaonkalan (Sahni 1943, Kapgate & Ukey 2014), also indicate a pond or stream environment that would be suitable for aquatic dispersal as is also suggested by the fruits of other palms at the site including *Nypa* (Chitaley 1960, Chitaley & Nambudiri 1995) and *Hyphaeneocarpon* (Bande et al. 1982, Matsunaga et al. 2019).

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REPORT OF DICOT ROOT FROM THE DECCAN INTERTRAPPEAN BEDS OF BETUL DISTRICT OF MADHYA PRADESH, INDIA

R. W. Ukey

Department of Botany, Jijamata Mahavidyalaya, Buldana (M.S.) 443001, India

ABSTRACT

The present paper gives an anatomical description of a petrified dicotyledonous root. The fossiliferous cherts had been collected from the Deccan Intertrappean beds of Amabagholi, of Betul district of Madhya Pradesh, India. Serial peel sections were taken through its exposed plane with Cellulose Acetate peel Technique. So far, few dicot roots are reported from the Deccan Intertrappean Beds of Madhya Pradesh such as *Dicotylirhizos sahnii* Rao (1957), Chitaley, Sheikh & Rao (1970), *Aerorhizos harissii* Chitaley (1962-63), *Sonneratiorhizos raoi* Chitaley (1968), *Acanthus* Trivedi, Verma & Bajpai (1982), *Jusiaeoidiorhozos deccani* Trivedi, Chandra & Agrawal (1975), *Restirhizos chitaleyi* Ainapore (1994), *Dicotylirhizos herbatiales* Kapgate (2005), *Dicotylirhizos nautalii* Saxena et al. (2003). It is with diameter of 7 mm, well preserved 1-2 mm thick phellogen produce cork and phelloderm towards outer and inner side; epidermis uniseriate, cuticle and stomata absent; cortex multilayered, parenchymatous with intercellular space, sclerenchyma or collenchyma are seen in patches; endodermis uniseriate, drum or barel shaped cells; centrally placed, five, exarch primary xylem group, pentarch stele, diffused and porous; xylem parenchyma paratracheal vasicentric; primary phloem crushed outside the secondary phloem; secondary tissue collateral, cambium strip present below the phloem; medullary rays primary and secondary type, secondary uniseriate, homocellular, primary multiseriate; vessels multiples of 2 - 4, small sized between 4 µm to 8 µm in diameter, inter-vessel pits absent; pith very small of parenchymatous cells.

On comparing with above reported species, it greatly resembles with *Dicotylirhizos sahnii* Rao (1957). Hence it is created a new species named *Dicotylirhizos betuli* sp. nov. The specific name is after district of the fossiliferous locality Betul.

Keywords: *Fossil, Dicot, Root, Deccan Intertrappean, Maastrichtian*

INTRODUCTION:

The present paper gives an anatomical description of a petrified dicotyledonous root from Maastrichtian, fossiliferous locality, Amabagholi (N 21° 52'.738"; E 78° 11' .693") which is 6 km away towards east from Jaulkheda in Multai tehsil of Betul District of Madhya Pradesh India. The specimen is collected from the field near road side of the village. From this locality few monocot and dicot woods, *Sahnipushpum* flower, Seeds of *Indovitis* dicot fruits and *Graminocarpon* grains are reported.

So far, few dicot roots are reported from the Deccan Intertrappean Beds of Madhya pradesh such as *Dicotylirhizos sahnii* Rao (1957), Chitaley, Sheikh & Rao (1970), *Aerorhizos harissii* Chitaley (1962-63), *Sonneratiorhizos raoi* Chitaley (1968), *Acanthus* Trivedi, Verma & Bajpai (1982), *Jusiaeoidiorhozos deccani* Trivedi, Chandra & Agrawal (1975), *Restirhizos chitaleyi* Ainapore (1994), *Dicotylirhizos herbatiales* Kapgate (2005), *Dicotylirhizos nautalii* Saxena et al. (2003) and all these are from same locality Mohgaonkalan of Chindwara district. Therefore this report adds more to the diversity of Deccan flora of Betul district.

MATERIAL AND METHOD:

The fossiliferous cherts had been collected from the Deccan Intertrappean beds of Amabagholi, of Betul district. After breaking the chert and itching with hydrofluoric acid (HF), a fairly well-preserved root was exposed in transvers plane. Serial peel sections were taken through its exposed plane with Cellulose Acetate peel Technique (Darrah, 1936; Joy et. Al, 1956; Stewart and Taylor, 1965; Holmes and Lopez, 1986). After that peels are pressed in pressing machine then mounted on slide in DPX mountant and drying in sun light. Then slides are observed under microscope and photographed for detail study.

DESCRIPTION:

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The root is well preserved completely embedded in black chert. It is circular in outline which cut in transverse plane measuring 7 mm in diameter (Plt. Fig. 1) with secondary growth reveals the following anatomical structure in transverse section.

Phellogen: It is originated in the outer cells of pericycle, produce phellem or cork and phelloderm towards its outer and inner side respectively.

The pressure caused by the secondary tissue ruptures cortex with the endodermis which is sloughed away and it is 1- 2 mm thick (Plt. Fig. 2).

Epiblema / Epidermis: The outer layer consists of thin walled tightly jointed cells, known as epidermis, epiblema or piliferous layer. It is uniseriate and made up of single layered parenchymatous cells. Cuticle and stomata are absent.

Cortex: The epiblema is followed by the cortex. The cortex is multilayered and consists of thin walled rounded to polygonal parenchyma cells containing well developed intercellular space. In this region some sclerenchyma or collenchyma are seen in patches (Plt. Fig. 4). Innermost layer of the cortex consists of specialized uniseriate, drum or barrel shaped cells known as endodermis.

Pericycle: Next to the endodermis there is a narrow zone of thin walled parenchyma cells termed as pericycle. The cells are usually transversely elongated. It is the limiting layer of the stele, and contains sclerenchyma or elements of protoxylem.

Vascular tissue: It shows presence of exarch primary xylem strand situated in the center i.e. secondary vascular tissue form a continuous cylinder and primary xylem is embedded in it. Primary xylem is in five group forming pentarch stele (Plt. Fig. 6). Xylem is diffuse and porous type.

Xylem Parenchyma: Parenchyma well preserved, paratracheal vasicentric forming a single layered sheath around the vessel. Cells of parenchyma uniform and rectangular in shape (Plt. Fig. 5).

Primary Phloem: Primary phloem strands are seen to be crushed outside the secondary phloem element.

Secondary tissues are collateral i.e. xylem situated towards the center and the phloem towards the periphery (Plt. Fig. 3). Below the phloem there is presence of cambium strip.

Vascular ray or medullary rays: These are running with xylem and phloem through the cambium (Plt. Fig. 5). These are primary and secondary type. Secondary medullary rays are uniseriate, homocellular of erect cells. Primary medullary rays are multiseriate.

Vessel: They are mostly in multiples of two to four (Plt. Fig. 5). These are small in size with the diameter varying between 4 µm to 8 µm. Vessel frequency is 10 To 13 per sq. mm. Vessels are thick walled and filled with dark colour deposition. Intervessel pits are bordered, alteernate, contagious, perforation plate simple with oblique pore (Plt Fig.: 7).

Pith: Pith is ill preserved, very small parenchymatous present in the center of section (Plt. Fig. 1).

DISCUSSION AND CONCLUSION:

From the above description following important features are confirmed:

- Present well preserved petrified root is cut in transverse plane having secondary growth.
- It consists from outside phellogen, epiblema / epidermis, cortex, pericycle, primary and secondary vascular tissue and pith.
- Phellogen produces phellem or cork and phelloderm towards its outer and inner side respectively.
- Epiblema / Epidermis consist of thin walled tightly jointed cells. Cuticle and stomata are absent. It is uniseriate.
- Cortex is multilayered and consists of thin walled rounded to polygonal parenchyma cells containing well developed intercellular. In this region some sclerenchyma or collenchyma are seen in patches.
- Pericycle is the limiting layer of the stele, and contains sclerenchyma, elements of protoxylem. The cells are usually transversely elongated.
- Vascular tissue shows presence of exarch primary xylem strand situated in the center i.e. secondary vascular tissue form a continuous cylinder and primary xylem is embedded in it.
- Primary xylem is in five group forming pentarch stele.
- Xylem is diffuse and porous type.
- Xylem Parenchyma: paratracheal vasicentric forming a single layered sheath around the vessel.
- Primary phloem strands are seen to be crushed outside the secondary phloem element.
- Secondary tissues are collateral i.e. xylem situated towards the center and the phloem towards the periphery.
- Below the phloem there is presence of cambium strip.
- Vascular ray or medullary rays are primary and secondary type. Secondary medullary rays are uniseriate, homocellular of erect cells. Primary medullary rays are multiseriate.
- Vessel are mostly in multiples of two to three, vessels are thick walled and filled with dark colour deposition. Inter vessel pits are not seen.
- Small parenchymatous pith present in the center of section.

It is evident from the above discussion that the present specimen is dicot root showing primary as well as secondary growth.

IDENTIFICATION:

For identification it is compared with the root of modern taxa and reported fossil specimens.

Comparison with modern species:

Above described fossil root is compared with modern families Ampelidaceae, Nepenthaceae, and Compositae because of presence of xylem with six exarch arcs, but widely differs in their generic level.

Comparison with reported species:

This root fossil specimen is also compared with reported fossil roots from Deccan Intertrappean Beds (Table), such as *Dicotylirhizos sahnii* Rao (1957), Chitaley, et al (1970), *Aerorhizos harissii* Chitaley (1962-63), *Sonneratiorhizos raoi* Chitaley (1968), *Acanthus* Trivedi, Verma & Bajpai (1982), *Jusiaeoidiorhozos deccani* Trivedi, Chandra & Agrawal (1975), *Restirhizos chitaleyi* Ainapore (1994), *Dicotylirhizos nautalii* Saxena et al. (2003), *Dicotylirhizos herbatiales* Kapgate (2005).

On comparing with above reported species (Table), it greatly resembles with *Dicotylirhizos sahnii* Rao (1957). Hence it is created a new species named *Dicotylirhizos betuli* sp. nov. The specific name is after district of the fossiliferous locality Betul.

DIAGNOSIS:

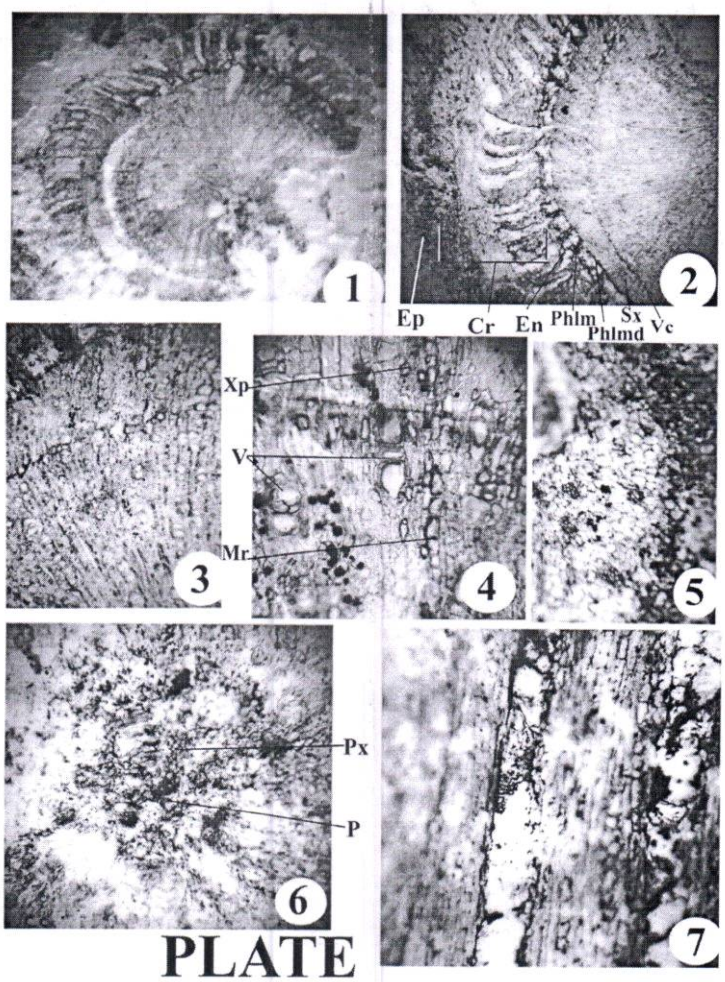
Dicotylirhizos betuli sp. nov.

Petrified dicotyledonous root with diameter of 7 mm, well preserved 1-2 mm thick phellogen produce cork and phelloderm towards outer and inner side; epidermis uniseriate, cuticle and stomata absent; cortex multilayered, parenchymatous with intercellular space, sclerenchyma or collenchyma are seen in patches; endodermis uniseriate, drum or barel shaped cells; centrally placed, five, exarch primary xylem group, pentarch stele, diffused and porous; xylem parenchyma paratracheal vasicentric; primary phloem crushed outside the secondary phloem; secondary tissue collateral, cambium strip present below the phloem; medullary rays primary and secondary type, secondary uniseriate, homocellular, primary multiseriate; vessels multiples of 2 - 4, small sized between 4 µm to 8 µm in diameter, inter-vessel pits absent; pith very small of parenchymatous cells.

Holotype:- RWU/Rt./12/Deposited at Dept. of Botany, J. M. Patel College, Bhandara.
Horizone:- Deccan Intertrappean Series of Madhya Pradesh.
Locality:- Amabagholi of Betul district.
Age:- Late Cretaceous (Maastritchian).

Table: Showing Comparison with reported dicot roots.

Sr. No.	*Dicotylirhizos sahnii* (Rao, 1957)	*Dicotylirhizos sahni* (Chitaley, Sheikh and Rao1970)	*Dicotylirhizos herbatiales* (Kapgate, 2005)	Present Specimen *Dicotylirhizos betuli* sp. nov.
1.	Thin cortex with epiblema.		Cortex with epiblema not preserved.	Thin cortex with epiblema and phellogen. Cuticle and stomata absent.
2.	Pericycle of parenchyma and sclerenchyma forming ring.		Pericycle absent.	Pericycle of parenchyma and sclerenchyma
3.	Cambium differentiation is seen.		Cambium differentiation is not seen.	Cambium differentiation is seen.
4.	Xylem diffuse, porous.	Xylem diffuse, porous.	----------	Xylem diffuse and porous.
5.	Vessels in radial multiples of 2-4.	Vessels in radial multiples of 2-4	Only few vessels in 12/sq. mm.	Vessels in radial multiples of 2-4 and 10-13 sq./mm in distribution.
6.	Vessels 70-75 µm in tangential diameter.	Vessels 40-80 µm in tangential diameter.	Vessels 5-8 µm in tangential diameter.	Vessels 4µm to 8µm in diameter.
7.	Intervessel pits are not mentioned.	Intervessel pits are bordered, alteernate, contagious, perforation plate simple with oblique pore.	Intervessel pits are bordered, alteernate, contagious, perforation plate with simple transversely or obliquely placed.	Intervessel pits are bordered, alteernate, contagious, perforation plate simple with oblique pore.
8.	Medulary rays are primary and secondary type.			
9.	Secondary medullary rays are uniseriate homocellular of erect cells.			Secondary medullary rays are uniseriate, homocellular of erect cells.
10.	Primary medullary rays are multiseriate.		Six wide rays of homogeneous parenchyma, radially banded and 5-7 celled thick.	Primary cells are multiseriate.
11.	Parenchyma diffuse.	Parenchyma paratracheal and metatracheal.	Parenchyma apotracheal and diffuse type.	Xylem parenchyma paratracheal vasicentric.
12.	Fibres sparse.	Fibres non-septate.		
13.	Primary xylem in 5 group forming pentarch stele.			
14.	Nature of xylem is exarch.			
15.	Pith very small parenchymatous.			Pith is ill preserved and very small.



PLATE

EXPLANATION OF PLATE

1-Specimen of root exposed on fossiliferous chert in T.S. (30X), 2-General organization of a root (transverse section) showing tissue differentiation. (45 X) Ep = Epidermis, Cr = Cortex, En = Endodermis, Phlm = Phoem tissue, Phldm = Phelloderm SX = Secondary xylem, Vc = Vascular cambium, 3-Enlarge Portion of vascular tissue (90X), 4- Magnifying view of xylem with xylem parenchyma (405X) V = Vessels, Xp = Xylem parenchyma, Mr = Medullary ray, 5-Enlarged view of cortex (90X), 6-Photography showing primary xylem in five group forming pentarch stele (45X) Px = Primary xylem, P = Pith, 7-Root in TLS showing vessels pitting (405X)

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An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Hydro biological Studies of Yelgaon Dam of Buldana (M.S.)

Authors- Kakde V. R[1].; Yewale R. M[2]

[1&2]Department of Zoology

Jijamata Mahavidyalaya, Buldana(M.S.)

Email-vrkakde@gmail.com; yewalerajshree@gmail.com

Introduction

Water quality deals with physical, chemical, biological characteristics in relation to other hydrological properties. Present work on Hydro biological Studies of Yelgaon Dam of Buldana (M.S.) is undertaken during July 2019 to June 2021. Water is probably the only natural resource to touch all aspects of human civilization from agricultural and industrial development of the cultural and religious values. Water is essential at all levels of life, cellular to ecosystem. Industrialization of the world affects the faunal diversity of the water, as the waste water from these industries is directly dumped into the water bodies without any treatment.

The problem of water pollution in India is very critical. Several states in the country are facing problems due to over exploitation of ground water resources and pollution of surface water. Its manifestations are declining per capita water availability, falling water tables and deterioration of water quality. These increasing imbalances and anomalies shed doubt on the long availability of water resources. Accurate information on the condition and trends of water resources quantity and quality is required as a basis for economic and social development and for the development and maintains of environmental quality. Water quality becomes an important parameter for the assessment and management of surface water. The natural aquatic resources are causing heavy and varied pollution in aquatic environment leading to pollute water quality and depletion of aquatic biota.

Number of workers carried out hydrobiological investigations on the manmade water bodies in Maharashtra (Goel et. al. 1988, Hujare 2008). Population dynamics of rotifers in Ranjeet sagar reservoir was studied by Mediha Shafiq et.al. (2006).

As compared with developed countries in country like India mini aquatic Ecosystem still remained to be fully investigated (Kodarkar, 1998). A survey of literature to the hydrobiology studies has revealed that virtually no research work have been generate scientific information on the hydrobiological studies of Kalapani reservoir and hence the present studies.

Methodology-The water samples were analyzed by standards recommended by WHO (2006) and APHA (1998, 2005) methods-

1 .Water sample

The selected sampling sites were visited monthly for the study of the various physicochemical and biological parameters. The study was complete in two years from February 2014 to January2016. Surface water sample of four sites were collected during the day time to analyze the physical chemical and biological parameters. The water samples were collected in the plastic cans. Before collecting, the can was rinsed thoroughly by sampling water and the can was sealed after collecting the sample.

2. Physico-chemical Parameters.

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The physicochemical parameters and biological parameters were studied during the two years periods. Some of the parameters were studied on-the-spot at sampling sites, whereas some parameters were studied in the laboratory by carried the water samples from the study area.

2.1. Physical Parameters.

The air temperature and water temperature were recorded at the fixed sites of the dam by using a mercury thermometer. The pH of water was determined by pH meter (Hanna Model Champ). The electric conductivity was measured with the electro conduct meter in laboratory

2.2 .Chemical parameters

The chemical parameters of water such as dissolved oxygen, total Alkalinity, free carbon dioxide, total hardness, calcium hardness, magnesium hardness, total dissolved solids, total suspended solids, total solids, calcium, and chlorides were determined by standard methods described by American Public Health Association (APHA 2005) and Kodarkar, et, al (1998).

3. Biological Parameters

i) Zooplankton sampling

The study of zooplankton is carried out by the monthly collection of water sample of three sampling sites for the period of two years. Water sampling done once in each month between 7:00 am to 11:00 am. The water samples for zooplankton were collected by filtering 100 liters of surface water through net of bolting silk No. 25. The Lugol's iodine solution was added in each bottle and was kept in dark for 24 hours to settle down the zoo plankton. After 24 hours the supernatant was removed with the help of pipette and zooplankton (sediment) was collected. The sediment zooplankton was diluted by adding few ml of diluted water. The zooplankton sample was again preserved in Lugol's iodine solution for further investigation.

ii) Concentration of sample

The concentration of sample was done by sedimentation technique. The sample was concentrated in series of steps by quantitatively transferring the sediment from the initial container to sequentially smaller one. The setting chamber was filled without forming vortex and kept over a vibration free surface. The supernatant was siphoned out.

iii) Mounting and preparation of slides.

0.1ml of each sample was taken on separate glass slides and cover slip was kept over the sample by rinsing the cover slip with an adhesive (clear nail polish) to prevent evaporation. For semi-permanent slides glycerin was mixed with sample, as the sample age evaporates, leaving the organisms embedded in glycerin.

v) Identification and counting

The zooplanktons were identified using methodology by APHA (1992) and Kodarkar (1998). The counting was done by using Sedgwick- Rafter counting cell. 4. Most Provable number of Coli forms Organisms (M.P.N.) - It was estimated by multiple tube fermentation technique described by APHA (1989). Using standard methods in subscribed bottles did the sampling. The samples were brought to the laboratory immediately after collection and were preceded immediately. The samples were inoculated in Mac- Conkey's broth.

Observations

In the present study emphasis is given on physico-chemical characteristics, zooplankton study, and Primary nature of fresh water of Yelgaon Dam. Observations were mainly concerned with pollution measuring indicators and parameters. The water samples from four different sites were collected and analyzed for various physico -chemical parameters were done. Observation and results were following-

Temperature:

In present investigation the monthly variation in temp of air ranged between 15.6and 42^{0}C in the year 2019-20 and similarly 15.10 to 42.10 ^{0}C in the year 2020-21. The minimum air temp was recorded in the month of January at all sites and maximum in the month of May at all sites.

The air temp exhibited high degree positive correlation with water temperature. It also exhibited low degree positive correlation with the changes according to the seasons. The water temperature ranged between 12.10^{0}C to 39.10 ^{0}C in year 2019-2020 and 12.40^{0}C to 39.20^{0}C in year 2020-21.

pH:

pH actually shows the hydrogen ion concentration in that particular sample. The pH of water ranged between 7.15 and 8.38 in 2019-20. The pH of the Kanapani reservoir water was less alkaline throughout the year (Kodarkar 1998). Similarly, in 2020-21 minimum pH was 7.28 in the month of October and it was highest 8.48 in the month of April.

Transparency:
The transparency of water ranged between 26 cm to 96.75 cm in year 2019-20 and 26.25 cm to 96.75 cm in year 2020-21.Seasonal variations in transparency were also recorded. The light penetration in water also play important role in the transparency.

Turbidity:
The Turbidity of water was ranged between 6.25 to 23 NTU in Year 2019-20 and 5.25 to 22.50 NTU in year 2020-21 the water was more turbid in rainy season because of rain water along with other waste material makes the water more turbid

Total Dissolved solids (TDS):
Total dissolved solid fluctuated between 74.44 mg/L in the month of November and 200.50 mg/L in the month of March in 2019-2020.The TDS was 67.25 mg/lit in the month of November and 201.50 mg/lit in the month of March in 2020-21. The seasonal variations in TDS were also observed.

Conductivity:
In present investigation Electric Conductivity ranging between 135(umho/cm) and 279 (u mho/cm) in the year 2019-20.Similary the conductivity was ranging from 136 (u mho/cm) to 279 (u mho/cm) in year 2020-21. Similar trend was found at all four sites. It was observed that the conductivity goes on decreasing from June to December but constant rise in conductivity was observed from January to May in both years.

Dissolved oxygen: (DO)
In present investigation, the values of Dissolved Oxygen ranging between 3.88 mg/lit and 7.25 mg/lit in the year 20__-20.Similary it was ranging from 3.25 mg/lit to 7.10 mg/lit in year 2020-21. The seasonal variations in the values of dissolved oxygen were also observed.

Free CO2:
In present investigation, the values of free CO2 ranging between 4.58mg/lit and 6.88 mg/lit in the year 2014-15.Similary it was ranging from 4.15mg/lit to 7.02 mg/lit in year 2015-16. Similar trend was found at all four sites. The seasonal variations in the values of free CO2 were also observed.

Alkalinity:
The lake water was moderately alkaline throughout the year. Total alkalinity was ranged between 80.25 mg/L to 173.75 mg/L in year 2019-20 and 81.25 mg/L to 175.50 mg/L in year 2020-21.There were two peaks one was in summer and other was in rainy season.

Chloride:
During the period of investigation chlorides in the reservoir water was ranged between 44.50 mg/L to 143.25mg/L in year 2019-20 and it was ranged between 42.75 mg/L to 144 mg/L in year 2020-21. During rainy season higher values were recorded where as in winter and summer season less chloride content were detected.

Total hardness:
The lake water was moderately hard throughout the period of investigation. The total hardness ranged between 57__g/L to 112 mg/L in year 2019-20 and 57 mg/L to 11.50 mg/L in year 2020-21. The total hardness showed maximum values during May and minimum value during July.

Sulphates:
During the period of investigation Sulphates in the reservoir water was ranged between 1..55 mg/L to 15.55 mg/L in year 2019-20 and it was ranged between 1.52 mg/L to 15.70 mg/L in year 2020-21.During rainy season higher values were recorded where as in winter and summer season fewer sulphates content were detected.

Biochemical oxygen Demand (BOD):
In present investigation BOD of reservoir water was ranged between 2.02 mg/L to 30.70-mg/L years 2019-20 and 2.05 mg/L to 30.65 mg/L in year 2020-.21The value of BOD was higher during summer and rainy months while lower during winter months.

MPN of Coli form
In present investigation MPN of Coli form was detected. It was ranged between 19 to 56.75 and 20 to 57.25 per 100 ml of sample in 2019-20 and 2020-21 years respectively. It was detected maximum during month of May and minimum during month of February

Zooplankton:
Monthly water samples from reservoir were collected to study quantitative and qualitative data of various zooplanktons. Rotifers are represented by 10 species, Cladocerans by 3 species and Copepods by 3 species.

Among the total zooplankatonic organisms rotifer come first in order of abundance. Throughout the summer month rotifer population were found to maximum during winter season.
Cladocerans were abundance in summer and early monsoon. The density of copepods population was more during summer and least during late rainy and early winter season.

Results and Discussion

The obtained results of physico-chemical parameters of water collected from Yelgaon Dam at Buldana District. It was shown that all the physico-chemical parameters were in normal ranges according to WHO which indicates that water of Yelgaon Dam is convenient for aquatic life. And also domestic life physicochemical parameters recorded for sediments were also within the normal ranges.

Present study was conducted in order to analyze physicochemical parameters of water collected from Yelgaon Dam. The water sample which is collected from Yelgaon dam is having different parameters like pH, temperature, alkalinity, salinity, hardness. Sulphates, conductivity, turbidity, BOD etc. The water sample has small creatures i.e. zooplanktons more in number. Direct and in indirect way, these parameters affects the decreasing and increasing zooplanktons fauna. In our study water temp found in the range between 15.6 and 42^{0}C in the year 2019-20 and similarly 15.10 to 42.10 ^{0}C in the year 2020-21.The fluctuation in water temp usually depends on the season sampling time and temp of effluents entering the stream. High temp of water recorded because of low water level and high atmospheric temperature (Zubia Masood et.al.2015) Correlation studies between the variables of the physico-chemical parameters indicate that during rainy season, DO was found to be highly significant with chlorine, free CO_2, with total alkalinity, Ca hardness and conductivity, total alkalinity with Ca hardness and total hardness with Mg hardness. In summer, pH was found to be highly significant with Cl, BOD, with free CO_2. In winter, temperature was found to be highly significant Ca hardness, total alkalinity with Mg hardness and total hardness with Ca hardness. These relationships show that DO and free CO_2 are the most important parameters of water quality parameters which indicate the pollution status of water quality. (Maqbul Hussain et.al.2021) The pH values of the samples ranged from 7.15 to 8.38 were most of the samples. All variables except pH do showed significant spatial variations due to the effect of anthropogenic activities (Varol, M.Spatio 2020). Total hardness was recorded at 57 mg/L to 112 mg/L similar findings are also found (Arivoli Appavu 2016) In present investigation Electric Conductivity ranging between 135(umho/cm) and 279 (u mho/cm) through the year. The Conductivity of water is affected by the suspended impurities and also depend upon the concentration of ions in the water. Our present investigation the value of chlorides is maximum in summer season and minimum in season mansoon. The maximum value of chlorides is in summer indicating body related diseases. (Rohit Sharma et. al. 2020) The maximum value of the biochemical oxygen demand (BOD) in jan which indicates more polluted water and the minimum value is in the April which is indicates that less polluted water (Rohit Sharma et. al. 2020)

Conclusion

The data presented are discussed on the basis of three seasons. The temperature of water varied between 21 .6ºC and 23.7ºC at the sampling site Aji Reservoir. At the sampling site Nyari it ranged between 21 .65ºC and23.55ºC and at sampling site Lalpari ranged between 21 .85ºC and 23.80ºC. In all the three sampling locations high temperature was recorded during summer season and lower temperature recorded during winter season, which is a normal feature in freshwater reservoirs. Poonam Bhadja, Ashokkumar Vaghela(2013). The calcium and magnesium hardness also suggest the comparatively hard quality of the lake waters. The total dissolved salt content was also high in the entire lake leading to rise in its hardness. The Total Alkalinity (TA) values clearly indicate that currently the lake water is moderately hard to hard. The calcium concentration shows that the good portion of calcium has been deposited from the soil erosion. Sumedh Humane et. al.(2018)

Zooplankton of fresh water body Gangapur dam consisting of Rotifers, Copipods, Cladocerans and protozoan. An attempt has been made to analyze the percentage variation among all zooplankton counted weekly during the said period. Salve et. al. (2013). In this present study by and large the status of dissolved gases like dissolved oxygen, free carbon dioxide and chloride remained within the optimum ranges required. Dissolved oxygen value was ranged from 3.77 to 10.9 mg/l with an average of 7.19 mg/l for entire year; minimum dissolved

oxygen is recorded during monsoon and maximum during winter season. The biological oxygen demand (BOD) and chemical oxygen demand (COD) for the water samples were estimated to qualify the water qualities suitability for fisheries purpose. The data indicates that the reservoir is not having either organic or inorganic pollution threats, therefore is suitable for fish stocking Goswami and Mankodi(2012)

The present investigations suggest that there is an urgent need to study the physico-chemical status of water of Yelgaon Dam for the assessment of quality in future. Though the water bodies under investigation are not severely polluted requires careful monitoring in the future to maintain quality of water by proper means. Supervision of experts and remedial measures are essential for rehabilitation and conservation of for long duration. In order to reduce the incidence of heavy pollution following suggestions have been recommended. Bathing, washing of clothes, vehicles, domestic animals etc. should be avoided. Continues disposal practices of the agricultural and domestic effluents should be strictly avoided. Adequate water supply schemes must be implemented for the residents to avoid unlimited misuse of water. Preliminary treatments should be performed before using the water for drinking. Recycling of waste waters through proper methods of purifications should be applied for saving water. Formation of reservoir Management Authority to protect, preserve and revive the water bodies. Government agencies, organizations, citizens, groups and NGO should collectively work to achieve common goal of protecting, preserving and reviving water bodies. Take measures to minimize generation of waste and its discharge to (the) aquatic environment. This could be achieved by reducing the consumptive use of water and goods.

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DIVERSITY OF MILLIPEDES AT AND AROUND MEHKAR CITY OF BULDANA DISTRICT, MAHARASHTRA, INDIA.

[a]Thakare Pavan R, [b]KakdeVandana R

[a&b] Department of Zoology, JijamataMahavidylaya, Buldana (M.S.)

Corresponding g-mail: pavanthakare70@gmail.com, vrkakde@gmail.com

INTRODUCTION

Millipedes are small invertebrates which placed under the Phylum Arthropoda. These are small invertebrate's species which is having two pairs of jointed legs on entire most body segments. This all are placed in class Diplopoda, Subphylum Myriapoda of Phylum Arthropoda, which is the largest and highly diverse group of invertebrate animals. Few species of millipedes are having elongated cylindrical or flattened bodies with more than 20 segments, while pill millipedes are showing shorter and can roll into a ball. There are about 1000 legs observed in millipedes in the universe. Majority of the species are slow moving detritivores which eating decayed leaves and other dead plant matter. The name "millipede" derives from the Latin root which means "thousand feet". They are soil loving animals living on the ground, in shallow habitats, among the leaf-litters or in the soil. Millipede ranges from 2 to 280 mm in length, and can have about 11 to over 100 segments. Generally they are black or brown in colour, but few are brightly coloured species. Millipedes move slowly due to presence of short legs, which are helping them push their way through the soil and vegetative litter. They are seasonal animals, generally seen is monsoon season and rarely in summer and winter season, as they are commonly affected by environmental conditions specially change in temperature **(Ashwini and Sridhar, 2006),** and so are predominantly abundant in the tropical and sub-tropical regions of the world.

The characteristics features of the group is the presence of diplosomites, double trunk segments formed from the fusion of two segments. They have as many as 200 pairs of legs-two pairs on each diplosomite except for the first (head) segment, which is legless, and the next three segments, which each contain one pair of legs. They are good biological indicators of environment change in ecosystem and improve the structure content organic matter and nutrient elements of soil. Most millipedes are detritivorous animals; feed on decaying plant matter, functioning as decomposers in the ecosystem. A few species of millipedes are omnivorous or occasionally carnivorous, feeding on small invertebrates like earthworms, insects, snails etc.**(LorangerMerciris et al., 2007, Seeber et al., 2008).**Millipedes are functionally important in facilitating nutrient cycling through decomposition of plant debris, and also play a vital role in soil formation process useful to the plant or crops. Globally there are 12,642 species of millipedes belonging to 2,001 genera of 163 families in 16 orders. There are over 270 species occur in India belonging to 90 genera, 25 families and 11 orders **(Golovatch and Wesener, 2016).**Study on Indian millipedes begins with Linnaeus (1758). Major studies on Indian millipedes made by Pocock (1899a, 1899b) and Carl (1932) works on South Indian millipedes and published his results on the Indian species of Ploydesmoidea in which he described 41 new species and 23 new genera from India.

The research work on millipede diversity is so much limited in the Maharashtra state. Its need to do

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Western Ghat of Maharashtra. Recently Mane et al., (2020) added one more species Anoplodesmussaussurii to the millipede's fauna of Maharashtra.**Dash and Priyadarsini (2013)** recorded three species of millipedes from Gujarat. Similar work was done by **Alagesab and Ramanathan, (2013)** and **Chezhian and Prabakaran,(2016)** in Tamil Nadu. History of this study was not exploring the ideas about diversity of millipede species and importance of millipedes' decomposers in the natural environment from this study area. Hence, main objective of this study is to provide the information regarding with the distribution and diversity ofmillipedes species in Mehkar city of Buldana district, Maharashtra, India.

MATERIALS AND METHODS

The present study area of Mehkar is taluka place and municipal council located in Buldana district of Maharashtra state, India.Mehkar is situated near to PaingangaRiver and falls in Vidarbha region. It was previously known as "MeghankarNagari". Its latitude is $20^0$9'0''North and longitude is $76^0$34'30''East. It has pleasant climate atmosphere with temperature ranges between 22^0C to 45^0in winter and summer season.

The study was carried out during the monsoon season in year 2021 for six months. There were five different sites selected for the study purpose. In the biodiversity area, millipedes species selected by used hand-picking method. Samples can be taken from rotten woods, under stone, uppermost soil strata and all other kinds of plant debris. The photographs were taken to collected millipedes and then released them in their natural habitat. Species of collected millipedes were identified with the help of field guider and standard literature. They all helped me to identify the millipede species.

RESULT AND DISCUSSION

In the present study total 05 different species of millipedes belongs to 05 genera of 04 families were recorded from Mehkar tehsil of Buldana district, Maharashtra.The following species of millipedes were identified from the study area.

Harpaphehaydeniana: It is commonly known as yellow-spotted millipede. It belongs to order Polydesmida and family Xystodesmidae. The body is black in colour and both the sides with patches of yellow spots. It consists of approximately 15-20 segments, bearing a total of 30 (in case of males) or 31 (in case of females) pairs of legs. It reaches a length of 4-5 cm, width of 0.1 to 0.3 cm, and weight of 0.8 to 1.5 g.

Orthomorphacoarctata: It belongs to order Polydesmida and family Paradoxosomatidae. The male are 14.5 to 20.5mm in length and female are 16.5 to 2.5 mm. The middle body portion is segmented, with longer gonopods. Narceusamericanus (Palisot de Beauvois, 1817): It is commonly known as American giant millipede. It belongs to order Spirobolida and family Spirobolidae. It was found in Painganga river shore near the Mehkar city. It was about 3 inches long, cylindrical and blackish brown in colour.

Trigoniuluscorallines: It is commonly known as rusty millipede. It belongs to order Spirobolida and family Trigoniulidae. It is medium to large-sized millipede with brick red colour body. It grows up to 5cm in length and can often be found in bunch. During this survey it is noted that *Harpaphehaydeniana* and *Orthomorphacoarctata*were found to be most abundant species at all, seen on dry leaf, around the crop roots, wet landscape and on other plant debris. On the other hand *Narceusamericanus* was single time recorded in farm area near the city. It is due to the geographical location and habitat differences. *Trigoniuluscorallinus* was found to be on dry landscape in bunch. *Harpaphehaydeniana* is generally found in agricultural area, breaking down leaf litter and freeing its nutrients for other organisms. *Orthomorphacoarctata* and *Trigoniuluscorallinus* are capable of composting waste. Recently in Brazil, studies with the species *Trigoniuluscorallinus* have shown that mill compost obtained from agricultural residues has physico-chemical characteristics similar to vermicomposting (Antunes*et al*., 2016). The present study on millipedes was the first report of the distribution of millipede fauna in the Mehkar city, Amravati district, Maharashtra, India.

Table1. Photographs of Millipedes species recorded from study area.

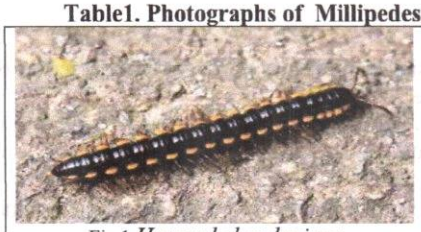

Fig.1.*Harpaphehaydeniana*

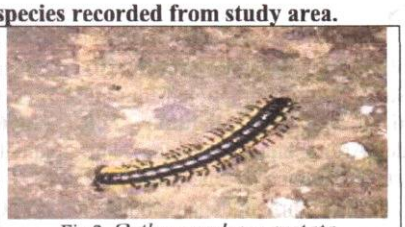

Fig.2. *Orthomorphacoarctata*

Fig.3. *Oxidusgracilis*

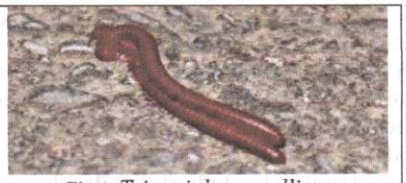

Fig.4. *Trigoniulus corallines*

Fig.4. *Narceusamericanus*

Table 2. List of Millipedes species recorded from at and around Mehkar tehsil

Sr. No.	Species Name	Order	Family	Genus
1.	*Harpaphehaydeniana*	Polydesmida	Xystodesmidae	*Harpaphe*
2.	*Orthomorphacoarctata*	Polydesmida	Paradoxosomatidae	*Orthomorpha*
3.	*Oxidusgracilis*	Polydesmida	Paradoxosomatidae	*Oxidus*
4.	*Trigoniulus corallines*	Spirobolida	Trigoniulidae	*Trigoniulus*
5.	*Narceusamericanus*	Spirobolida	Spirobolidae	*Narceus*

CONCLUSION

India has great and rich biodiversity. Western Ghats is one of the major bio-geographic zones in India and Western Ghats of Maharashtra state occupied about 12.5% of total bio diversified area of it.. It has great rich source of major faunas and small invertebrates including millipedes, centipedes and small creatures, molluscs, annelids, echinoderms etc. Due to less available of literature about these small millipedes' invertebrates, this group is most likely to be neglected such as soil fauna, deforestation, soil erosion, lack of rains and other artificial practices pose risk to the survival of millipedes. There is need to have study over this millipedes species every day. This current study reveals the study of biodiversity and distribution of millipede's species.

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TITLE-AVIFAUNAL DIVERSITY AT AND AROUND NALGANGANGA DAM OF BULDANA DISTRICT, MAHARASHTRA, INDIA

AUTHORS- KAKDE VANDANA R[1]; KASTURE SAMTA N[2].

[1&2] DEPARTMENT OF ZOOLOGY
JIJAMATA MAHAVIDYALAYA, BULDANA (M S)
Email ID –vrkakde@gmail.com; samta358@gmail.com

INTRODUCTION

Birds are excellent model organisms for understanding key issues in ecology, animal behavior, evolutionary biology and conservation Unni K S, (2002).Birds, nearly everyone enjoys the beauty of their forms and coloring, the vivacity of their movement, the buoyancy of their flight and sweetness of their songs. Diversity of avifauna is one of the most important ecological indicators to evaluate the quality of habitats. Now a day, avifaunal diversity has been decreasing due to the destruction of natural habitats and human disturbances. Random destruction of natural habitats by cutting nesting trees and foraging plants for commercial use of woods and lands are the main factor responsible for narrow down in avian foraging habitat and their nesting sites. Thus, many species of birds may be forced to inhabit in the urban areas and constrain them to breed there. Birds are among the nature's most beautiful animal and undoubtedly, bird habitat particularly within the lake areas seems to be strongly influenced by climatic changes and immediate human impact. Freshwater lakes one of the important types of wetlands, play a vital role in the economics of their respective regions, especially with reference to agriculture, fishing, livestock maintenance and drinking water facilities of the adjacent areas.

Avifaunal diversity forms an importantcomponent of natural ecosystem (Manjunath and Joshi, 2012). Birds are good bio-indicatorsin terms of potential pollinators andscavengers. Population of birds is a sensitiveindicator of pollution in both terrestrial andaquatic ecosystems. In Maharashtra state, Kasambe and Wadatkar (2003) recorded 78species from Pohara- Malkhed forest reservoir of Amravati district. Bhandarkar and Paliwal (2014) recorded 52 species from Shrungarbandh lake in Gondia district. The Nalganga Dam is the principal local freshwater bodies situated east side and the area of this dam is spread over 1500 Km^3 and 21 kmaway from the Malkapur city, located in the Buldana district of Maharashtra state, India. It is situated at 20°43′34″Nlongitudeand 76°10′49″Elatitude.Total capacity of Nalganga Dam is 70540 km^3.The water of this dam is primary used for agriculture, water supply and fishing activities.

MATERIALS AND METHODS

The present work was carried out from Oct. 2019 to Sep. 2021. The observation was carried out by using a field binocular (7x25x magnification) during the morning (6 to 10 AM) and in the evening (4 to 7

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PM) and Internet Birds database and other relevant literature (Ali 2002; Grimmett et. al. 2011) were used for identification of birds. Identification of species was done with the help of standard literature of Woodcock (1980), Ali & Ripley, (1995); Grimmet et al., (1999). Regular field visits were made throughout this period. Bird specimens were not collected, and the study was based on only photographs, video and audio recordings.

Diversity and density of Birds were recorded by weekly visit for two year to Nalganga dam and an average of 4 weeks was accounted for a month. This dam was demarcated into 2 sites, one is in east and other is in west for getting proper light for observation in morning and evening hours. Water fowl population was enumerated by point count and direct counting methods [Inac S]. Binoculars and cameras were used for bird watching and to photograph them. Waterfowl population was observed and documented every week in the morning and evening hours. The relative abundance of birds was estimated and their monthly fluctuation was recorded and is classified on the basis of "**The Book of Indian birds**" [Colin J].

OBSERVATION

The Habitat or occurrences of the bird is categorized as residential (R), Migrant (M) and Residential Migrant (RM) Abundance of birds i. e. status of birds was categorized as Least Concern (LC), Near Threaten (NT) and Non assessment (NA).

Table 1: Check list of Birds in Nalganga Dam

Sr No	Order	Family	Scientific name	Common name	Habitat	Status
1	Accipitriformes	Accipitridae	*Accipiter badius*	Shikara	R	LC
2	Accipetriformes	Accipitridae	*Buteo buteo*	Common buzzard	R	LC
3	Accipetriformes	Accipitridae	*Butasturteesa*	White eyed buzzard	R	NT
4	Ansariformes	Anatidae	*Nettapus coromandelianus*	Cotton Teal	R	LC
5	Ansariformes	Anatidae	*Anas poecilorhyncha*	Spot Bill Duck	R	LC
6	Ansariformes	Anatidae	*Anas pundulata*	Yellow billed Duck	R	LC
7	Ansariformes	Anatidae	*Anser indicus*	Bar headed Goose	RM	LC
8	Apodiformes	Apodiae	*Apus affinis*	House swift	R	LC
9	Bucerotiformes	Bucerotidae	*Ocyceros birostris*	Indian grey hornbill	R	LC
10	Bucerotiformes	Bucerotidae	*Ocyceros griseus*	Malbar Grey Hornbill	M	LC
11	Bucerotiformes	Upupidae	*Upupa epops*	Common Hoopoe	R	LC
12	Caprimulgiformes	Podargidae	*Batrachostomus moniliger*	Frog mouth Owl	M	LC
13	Charadriiformes	Jacanidae	*Metopidius indicus*	Bronze-winged Jacana	R	LC
14	Charadriformes	Scolopacidae	*Actitishypoleucos*	Common Sandpiper	RM	LC
15	Charadriformes	Recurvirostridae	*Himantopus himantopus*	Black Winged Stilt	R	LC
16	Charadriformes	Charadridae	Vanellus indicus	Red wattled Lapwing	R	LC
17	Charadriformes	Glareolidae	*Glareola lacteal*	Small pratincole (Grey wadars)	R	LC
18	Ciconiformes	Ardeidae	*Aredeola grayii*	Indian Pond Heron	R	LC
19	Ciconiformes	Ardeidae	*Ardea cinerea*	Grey Heron	R	LC
20	Ciconiformes	Ardeidae	*Casmero diusalbus*	Egret	R	LC
21	Ciconiformes	Ardeidae	*Ardea alba*	Great Egret	M	LC
22	Columbiformes	Columbidae	*Treronphoenicoptera*	Yellow-footed green pigeon	R	LC
23	Columbiformes	Columbidae	Columba livia	Rock Pigeon	R	LC
24	Columbiformes	Columbidae	*Streptopelia chinensis*	Spotted Dove	R	LC

ecological condition of our environment, as birds are important ecological indicators responsive to changes in the environment.

Open billed Stork and Black-tailed Godwit were seen during May 2000 when most of the wetlands shrink excessively due to loss water and expose snails. These birds preferred molluscs for food and were found particularly on the Sawanga Reservoir of this region. Thus the availability of ample food of choice might have made passage migrants like Black-tailed Godwit and Whiskered Tern to stay for some time on this reservoir while migrating from north to south or back, Kasambe and Wadatkar (2007). Kurhade(2010) reported 208 species of Birds in Jaikwadi reservoirs near Ahmadnagar(M S), Narwade and Farkade(2011) recorded 165 species of Birds of Osmanabad District(M S), Rasal and Chavan (2011) reported 61 species of birds in local ecosystem of Aurangabad (M S), Kukade et al.(2011) recorded 68 birds species of Chhatri Lake of Amravati district(M S),Harney, et al,(2013) recorded 37 species of birds from Kanhala pond of Bhadrawati, District Chandrapur(M S), Joshi and Shrivastava (2012) reported 64 species of Birds in Tawa reservoir of Hoshangabad district (M P).During the investigation 55 Birds species belonging to 13 different orders and 37 families were recorded from Ghotnimbhalake by Harney N V (2014).Avifaunal diversity of the Khairbandhalake confirm that the site is suitable habitat for the residential and migratory birds Puri S D and Virani (2016).Shelke A D (2019a, 2019b) studied Bird Diversity in and around the Hatale Dam, TalukaChalisgaon, District of Jalgaon, as well as, local and peripheral ecosystems of Chalisgaon in Jalgaon Maharashtra, He reported total 45 and 73 bird species respectively from these two localities. Total 75 species, including water and land bird species, belonging to 11 orders and 31 families were recorded during November 2018 to February 2019, Shelke A D (2020).Rohankar and Kothare (2020) reported 17 species of birds of 16 families and observed that out of those 17species 16 are least concern and 1 is near threatenedbelongs to the family threskiornithidae i.e. *Threskiornis melanocephalus* (White Ibis).

CONCLUSION

There were 55 Species including aquatic and terrestrial birds belonging to 18 orders & 34 families.Among the recorded species of birds,8 species belongs to order Passeriformes, 5 species belongs to Charadriformes & Coraciformes 4 species belongs to Ciconiformes, Psittaciformes, Columbiformes & Ansariformes 3 species belongs to Acipitriformes, Pelecaniformes, Gruiformes and Galliformes, 2 species belongs to Cuculiformes & Buceriformes and one species belongs to Podicipediformes, Apodiformes, Falconiformes, Capriformes and Trogoniformes each. Out of 55 Birds investigated in the present study 51 are Least Concern, 02 are Near Threaten and 02 are Non assessment Birds.

The birds present at and around the Nalganga Dam are affected by many factors such as organicpollution, distribution by human activities and lack of maintenance of dam, yet the avifauna of Nalganga Dam is diverse. Keeping in view the varied avifauna recorded, steps should be taken to do proper maintenance and beautification of the Dam. In this field work attempt has been made to record avian diversity at and around Nalganga Dam during Oct 2019 to Sep 2021.

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25	Coraciformis	Alcedinidae	*Alcido bengalensis*	Common Kingfisher	R	LC
26	Coraciformis	Halcyonidae	*Halcyon smyrnensis*	White kingfisher	R	LC
27	Coraciformes	Coraciidae	*Coracias bengalensis*	Indian Roller	R	LC
28	Coraciformes	Meropidae	*Meropusapiaster*	Bee Eater	R	LC
29	Coraciformes	Halcyonidae	*Halcyon smyrnensis*	White kingfisher	R	LC
30	Cuculiformes	Cuculidae	*Cacomantis flabelliformis*	Fan tailed Cuckoo	RM	LC
31	Cuculiformes	Cuculidae	*Cuculus canorus*	Common Cuckoo	R	LC
32	Falconiformis	Falconidae	*Falco amurensis*	Amur Falcon	M	LC
33	Galliformes	Phasianidae	*Ortygornis pandiceiranus*	Gray Francolin	R	LC
34	Galliformes	Phasianidae	*Francolinus pictus*	Painted Francolin	R	LC
35	Galliformes	Phasianidae	*Francolinus francolinus*	Black Flancolin	R	LC
36	Gruiformes	Rallidae	*Amaurornis phoenicurus*	White-breasted water hen	R	LC
37	Gruiformes	Rallidae	*Gallinula chloropus*	Common Moor Hen	R	LC
38	Gruiformes	Rallidae	*Fulica atra*	Common Coot	R	LC
39	Passeriformes	Monarchidae	*Terpsiphone paradise*	Indian Paradise Fly catcher	R	NT
40	Passeriformes	Pycnonotidae	*Pycnonotus cafer*	Red Vented Bulbul	R	LC
41	Passeriformes	Corvidae	*Corvus splendens*	Corvus-Crow	R	NA
42	Passeriformes	Corvidae	*Corvus culminates*	Large billed Jungle Crow	R	NA
43	Passeriformes	Dicrudidae	*Dicrurus macrocercus*	Black Drango	R	LC
44	Passeriformes	Passeridae	*Passer domesticus*	House Sparrow	R	LC
45	Passeriformes	Motacillidae	*Motacilla alba*	Wagtail	R	LC
46	Passeriformes	Leiothrichidae	*Argya strita*	Jungle Babbler	R	LC
47	Pelecaniformes	Phalcrocoracidae	*Phalacrocorax fusicollis*	Indian Cormorant	M	LC
48	Pelecaniformes	Phalcrocoracidae	*Microcarbo niger*	Little cormorant	RM	LC
49	Pelecaniformes	Threskiornithidae	*Pseudibis papillosa*	Red napped Ibis	R	LC
50	Psittaciformes	Psittaculidae	*Psittacula krameri*	Rose Ringed Parakeet	R	LC
51	Psittaciformes	Psittaculidae	*Psittacula cyanocephala*	Plum headed Parakeet	R	LC
52	Psittaciformes	Psittaculidae	*Psittacula eupatria*	Alexandrine Parakeet	R	LC
53	Psittaciformes	Psittaculidae	*Psittacula roseate*	Blossom headed Parakeet	R	LC
54	Podicipediformes	Podicipedidae	*Tachybaptus ruficollius*	Little Grebe	M	LC
55	Trogoniformes	Trogonidae	*Harpactes fasciatus*	Malabar Trogon	M	NT

RESULT & DISCUSSION

In Present study gives information about 55 Birds belonging to 18 different orders. Out of 55 birds 45 birds are residential birds and 10 birds are migratory visited this Dam during winter season and from these migratory birds 04 birds becomes residential due to abundant availability of food, shelter and other environment such as *Anser indicus*(Bar headed Goose), *Actitis hypoleucos* (Common Sandpiper), *Cacomantisfla belliformis* (Fan tailed Cockoo) and *Microcarbo niger, (Cormorant)*. Results of this study are valuable, as they serve as baseline information in the development of measures and strategies that will safeguard the wetland from destruction. Likewise, results of this study will also enable us to be aware of the

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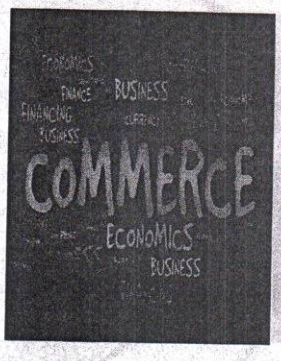

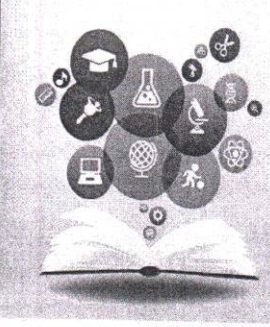

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Sources Of Knowledge In Faculty Of Humanities

Milind Damodhar Jadhao

Associate Professor JijamataMahavidyalaya, Buldana.

Humanities are academic disciplines that study aspects of human society and culture. In the Renaissance, the term contrasted with divinity and referred to what is now called classics, the main area of secular study in universities at the time. Today, the humanities are more frequently defined as any fields of study outside of professional training, mathematics, and the natural and social sciences.

The humanities use methods that are primarily critical, or speculative, and have a significant historical element—as distinguished from the mainly empirical approaches of the natural sciences,yet, unlike the sciences, it has no central discipline.The humanities include the study of ancient and modern languages, literature, philosophy, history, archaeology, anthropology, human geography, law, religion,and art.

Scholars in the humanities are "humanities scholars" or humanists. The term "humanist" also describes the philosophical position of humanism, which some "anti-humanist" scholars in the humanities reject. The Renaissance scholars and artists are also known as humanists. Some secondary schools offer humanities classes usually consisting of literature, global studies and art.

Human disciplines like history, folkloristics, and cultural anthropology mainly use the comparative method and comparative research. Other methods used in the humanities include hermeneutics and source criticism.

The word "humanities" is derived from the Renaissance Latin expression studiahumanitatis, or "study of humanitas" (a classical Latin word meaning—in addition to "humanity"—"culture, refinement, education" and, specifically, an "education befitting a cultivated man"). In its usage in the early 15th century, the studiahumanitatis was a course of studies that consisted of grammar, poetry, rhetoric, history, and moral philosophy, primarily derived from the study of Latin and Greek classics.

Humanities, those branches of knowledge that concern themselves with human beings and their culture or with analytic and critical methods of inquiry derived from an appreciation of human values and of the unique ability of the human spirit to express itself. As a group of educational disciplines, the humanities are distinguished in content and method from the physical and biological sciences and, somewhat less decisively, from the social sciences. The humanities include the study of all languages and literatures, the arts, history, and philosophy. The humanities are sometimes organized as a school or administrative division in many colleges and universities in the United States.

The modern conception of the humanities has its origin in the Classical Greek paideia, a course of general education dating from the Sophists in the mid-5th century BCE, which prepared young men for active citizenship in the polis, or city-state; and in Cicero's humanitas (literally, "human nature"), a program of training proper for orators, first set forth in De oratore (Of the Orator) in 55 BCE. In the early middle-ages, the Church Fathers, including St. Augustine, himself a rhetorician, adapted paideia and humanitas—or the bonae ("good"), or liberales ("liberal"), arts, as they were also called—to a program of basic Christian education; mathematics, linguistic and philological studies, and some history, philosophy, and science were included.

The word humanitas, although not the substance of its component disciplines, dropped out of common use in the later Middle Ages but underwent a flowering and a transformation in the Renaissance. The term studiahumanitatis ("studies of humanity") was used by 15th-century Italian humanists to denote secular literary and scholarly activities (in grammar, rhetoric, poetry, history, moral philosophy, and ancient Greek and Latin studies) that the humanists thought to be essentially humane and Classical studies rather than divine ones. In the 18th century, Denis Diderot and the French Encyclopédistes censured studiahumanitatis for what they claimed had by then become its dry, exclusive concentration on Latin and Greek texts and language. By the 19th century, when the purview of the humanities expanded, the humanities had begun to take their identity not so much from their separation from the realm of the divine as from their exclusion of the material and methods of the maturing physical sciences, which tended to examine the world and its phenomena objectively, without reference to human meaning and purpose.

Contemporary conceptions of the humanities resemble earlier conceptions in that they propose a complete educational program based on the propagation of a self-sufficient system of human values. But they differ in that they also propose to distinguish the humanities from the social sciences as well as from the physical sciences, and in that they dispute among themselves as to whether an emphasis on the subject matter or on the methods of the humanities is most effectual in accomplishing this distinction. In the late 19th century the German philosopher Wilhelm Dilthey called the humanities "the spiritual sciences" and "the human sciences" and described them, simply, as those areas of knowledge that lay outside of, and beyond, the subject matter of the physical sciences. On the other hand, Heinrich Rickert, an early 20th-century Neo-Kantian, argued that it is not subject matter but method of investigation that best characterizes the humanities; Rickert contended that whereas the physical sciences aim to move from particular instances to general laws, the human sciences are "idiographic"—they are devoted to the unique value of the particular within its cultural and human contexts and do not seek general laws. In the late 20th and early 21st centuries the American philosopher Martha Nussbaum emphasized the crucial importance of education in the humanities for maintaining a healthy democracy, for fostering a deeper understanding of human concerns and values, and for enabling students to rise above parochial perspectives and "the bondage of habit and custom" to become genuine citizens of the world.

WHAT SKILLS CAN YOU GAIN BY STUDYING HUMANITIES?

Humanities expand our knowledge of human cultures and help us understand what binds us together and what differentiates us from one another. In addition to these high-level insights, however, they also provide practical applications that can enhance your professional skillset and give you a competitive edge. By studying humanities in a formal university-level program, you can acquire transferrable, marketable skills and qualities that will be an asset to you in your professional pursuits. What will you learn in a humanities program? Examples include:

- Critical Thinking—The ability to receive and analyze knowledge and to use your creativity to develop innovative solutions to problems.
- Communication—The ability to form unique viewpoints and to express yourself clearly and persuasively in both written and spoken forms.
- Empirical and Quantitative Reasoning—The ability to comprehend and use numerical data to formulate and deliver educated decisions.
- Teamwork—The ability to understand and accept the viewpoints of others and to work collaboratively with them to achieve common goals.
- Personal Responsibility—The ability to see the consequences for your actions and take responsibility for and justify the choices you make.
- Social Responsibility—The ability to see what's best for society and the world as a whole and to act accordingly.

Employers want professionals who can come up with fresh approaches to solving problems, express themselves clearly, collaborate with others, and act in a responsible, ethical manner. These abilities are the foundation for nearly every career path, as well as many graduate-level programs. Equipped with these skills, you'll be prepared to take on a diverse range of career paths, including:

- Teacher
- Writer
- Public relations manager
- Advertising sales agent
- Travel agent
- Counselor
- Event organizer
- Artist
- Lawyer
- Minister
- Military service member

Humanistic theories and practices

There are three major branches of knowledge: natural sciences, social sciences, and the humanities. Technology is the practical extension of the natural sciences, as politics is the extension of the social sciences. Similarly, the humanities have their own practical extension, sometimes called "transformative humanities" (trans-humanities) or "culturonics" (Mikhail Epstein's term):

- Nature – natural sciences – technology – transformation of nature
- Society – social sciences – politics – transformation of society
- Culture – human sciences – cultural – transformation of culture

Technology, politics and cultural are designed to transform what their respective disciplines study[dubious – discuss]: nature, society, and culture. The field of transformative humanities includes various practices and technologies, for example, language planning, the construction of new languages, like Esperanto, and invention of new artistic and literary genres and movements in the genre of manifesto, like Romanticism, Symbolism, or Surrealism. Humanistic invention in the sphere of culture, as a practice complementary to scholarship, is an important aspect of the humanities.

Education and employment

For many decades, there has been a growing public perception that a humanities education inadequately prepares graduates for employment.The common belief is that graduates from such programs face underemployment and incomes too low for a humanities education to be worth the investment.

In fact, humanities graduates find employment in a wide variety of management and professional occupations. In Britain, for example, over 11,000 humanities majors found employment in the following occupations:

- Education (25.8%)
- Management (19.8%)
- Media/Literature/Arts (11.4%)
- Law (11.3%)
- Finance (10.4%)
- Civil service (5.8%)
- Not-for-profit (5.2%)
- Marketing (2.3%)
- Medicine (1.7%)
- Other (6.4%)

Many humanities graduate finish university with no career goals in mind.Consequently, many spend the first few years after graduation deciding what to do next, resulting in lower incomes at the start of their career; meanwhile, graduates from career-oriented programs experience more rapid entry into the labor market. However, usually within five years of graduation, humanities graduates find an occupation or career path that appeals to them.

There is empirical evidence that graduates from humanities programs earn less than graduates from other university programs. However, the empirical evidence also shows that humanities graduate still earn notably higher incomes than workers with no postsecondary education, and have job satisfaction levels comparable to their peers from other fields.Humanities graduates also earn more as their careers progress; ten years after graduation, the income difference between humanities graduates and graduates from other university programs is no longer statistically significant.Humanities graduates can boost their incomes if they obtain advanced or professional degrees.

The benefits of studying the humanities

An analysis of several sources of information, such as surveys, studies and websites, has made it possible to understand the pointof view of different social actors who believe there are advantagesto graduating in the humanities. Students, graduates, andresearchers in the humanities share theiropinion on what the main advantages are, and their takes coin-side with the way humanities courses are promoted on thewebsites of the universities that were taken into account in theanalysis. As it would

turn out, these advantages match the profileof the ideal employee as outlined by a group of employers as acondition to achieve success at their companies, according to aseparate study that is unrelated to the humanities in particular. In other words, even neoliberalstandards and concerns are adequately addressed. At its core, this acknowledgement of the value of the humanities can be looked at in three independent, mutually reinforcinglevels: the comprehensive knowledge, skills and mindset thatcome with studying the field, and which are not easily outdated. These assets represent the genuine and specific character ofstudying these disciplines, and substantially differ from thepriorities set by the political guidelines mentioned earlier. Thefollowing picture clarifies the scope of each of these levels.The attraction of studying the humanities lies precisely in thatwhich one sets out to know and experiment with when one optsto study them. History, philosophy, languages and literature, tomention a few, are nuclear subjects that give us direct access
to knowledge on that which is fundamentally and irreduciblyhuman. The challenge that this knowledge presents us with, and theeffort of interpreting and attributing meaning to ourselves andthat which surrounds us, are enhancers of the skills and mindsethighlighted in the above graphic and their value is undeniable.Critical thought, acknowledgement of others, the ability to adjustto different realities and so forth are indispensable traits in anysituation—in any institution, organization, government or company. It would thus follow that the humanities should be asexplicitly and directly promoted by public policy as is specializedknowledge that directly serves firms and markets.Inspite of the value that can be recognized in studying thehumanities, it stands that in the last few decades education in thefield has been reduced to an almost insignificant dimensionrelative to other areas. It should be noted that demand in highereducation is representative not just of the expectations of thestudents, or even of their educational and social backgrounds. It isalso conditioned by the choices of a large group of social actors,interdependent amongst themselves8, such as decision makers –be it national or international, political or institutional –employers and parents. But this depreciation has not beenexclusive to higher education only. It has led to generalized deficits in knowledge, sensitivity and imagination, cognitiveresources which are necessary to the acknowledgement of realproblems within society and likewise to the development ofpossible solutions. The ability for citizens to possess anddemonstrate a mindset of critical thinking has in this way beenundermined.

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Studying humanistic disciplines permits us to engage with far-flung communities—across time, across space, between cultures and languages. The humanities teach us who we have been and who we are, but also who we can be—demanding more of our imagination, our aspirations. In an increasingly divided world, the humanities are a site in which real dialogue between people of different beliefs is possible, because studying the humanities draws us away from the simple truths of ideologies and toward the slender knowledge of the highest things.

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JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

MACROPHYTE DIVERSITY OF MANDWA LAKE NEARDHARNI (MELGHAT) TAHSIL, DISTRICT AMRAVATI (M.S.), INDIA

Shelekar, AL[1], Yewale, RM[2] and Bhagat, VB[3]

[1] Department of Zoology, Shri. Shivaji Art's, Commerce and Science College, Akot, Dist. Akola (M.S.), India

[2] Department of Zoology, Jijamata Mahavidyalaya, Buldana Dist. Buldana (M.S.), India

[3] Associate Professor and Head Department of Zoology, Shri Shivaji Science College, Akot Dist. Akola (M.S.), India

Zoology

E-mail : amarshelekar123@gmail.com

ABSTRACT

The Mandwa Lake is principal fresh water body located in Mandwa village of Dharni tahsil in Amravati district of Maharashtra state. Dharni is a tahsil place and it is 148 km north west side of Amravati and 80 km east side from Burhanpur, Madhyapradesh It is situated at about 500 m above the mean sea level. The Macrophyte were studied from Nov-2020 to Oct-2021 during this period total 17 species of macrophytes were found in sample of water three sites A, B, and C of mandwa lake.

In the present study total 17 macrophytes species of 5 different types were recorded in this lake.

Keywords: Macrophyte diversity, Mandwa lake, Dharni Maharashtra.

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Table No. 1.1 : Macrophytes forms of site A , Sibe B, Site C

Sr.No.	Types / Life Forms	Name of the Macrophytes
1	Submerged floating weeds	*Ceratophyllum echinatum*
2	Submerged floating weeds	*Nymphaea odorata*
3	Submerged floating weeds	*Myriophyllum exalbescens*
4	Submerged floating weeds	*Eutricularia*
5	Submerged floating weeds	*Vallisneria americana*
6	Rooted floating leaves weeds	*Marsilea quadrifolia*
7	Rooted floating leaves weeds	*Nymphaea tuberosa*
8	Rooted floating leaves weeds	*Trapa natans*
9	Rooted emergent with heterophile weeds	*Sagittaria sp.*
10	Free floating suspended submerged	*Lemna minor*
11	Free floating suspended submerged	*Azolla carolimana*
12	Free floating suspended submerged	*Salvinia rotundifolia*
13	Free floating suspended submerged	*Pistia stratiates*
14	Free floating suspended submerged	*Wolfia*
15	Free floating suspended submerged	*Nymphidis*
16	Rooted submerged hydrophytes	*Hydrilla*
17	Rooted submerged hydrophytes	*Ipomoea aquatica*

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JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Librarian's awareness and user's satisfaction with ICT in selected colleges in SGBAU Amravati University.

Sachin D. Sakarkar

Librarian, Jijamata Mahavidyalaya,

Buldana. (Maha.)

Sachin_sakarkar@yahoo.com

Abstract:

Every Library's success depends clearly on the principles and efficiency of Librarian. If Library is well equipped with ICT amenities and Librarian is efficient and keen on catering best services to all readers and researchers to match their satisfaction and expectations. Present data being compiled through questionnaire issued to various colleges which are ICT oriented. And also the viability, accessibility and efficiency were judged to verify standard and quality Services. The survey findings mainly cover various aspects that directly or indirectly affect the progress of library automation such as information technology infrastructure, in-house activities, information services and their usage, the problems encountered in this process are identified and possible suggestions are stated.

Keywords: *Librarians awareness, Users satisfaction, Information Communication Technology,*

Prologue:

The latest information and communication technology (ICT) developments, including social media such as Face book and Twitter, e-books and mobile technology offer wonderful new opportunities in the delivery of information services and the way libraries are managed.

Librarianship forms the basis of specialization and diverse career opportunities including document management, knowledge management, children's librarianship, research librarianship and electronic resources management. It is a dynamic and interesting career, which focuses on information and the management thereof. It includes the collection, organization and distribution of information, according to International principles and standards, in different formats for education, general use, research, and recreation. It is also the facilitation of access to information so that people find and use information effectively for personal and professional purposes.

What Do Librarians Do?

The primary functions of a librarian are to:

- Collect information
- Acquire information

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• Organize information
• Retrieve information
• Disseminate information based on the needs of the populations we serve

What Else Do Librarians Do?

In the process of acquiring, collecting, organizing, retrieving, and disseminating information, librarians also:
• Assist and instruct
• Provide services and programs
• Utilize technology
• Preserve and conserve library materials

The Role/Duty of the Information Professional

• Getting the right information
• From the right source
• To the right client
• At the right time
• In the right form
• For the right use
• With the right cost **(Mason, 1990)**

What is the Future Role of Librarians/Information Professionals?

• Librarian/information professional as "Information intermediary" with three functions
– Diagnosis
– Prescription
– Evaluation
• Learn and use new techniques/skills to meet the changing demands of users
• Design and use information systems to help people solve their information problems
• Consult, teach and advice patrons in their search for information
• Exploit and use new information technologies for information storage and retrieval
• Survive in a new social context that changes the meaning and significance of libraries and librarians

The aims and objectives of Librarian, the changing scenario of era of information and the challenges of future are making task of Librarian more appealing as well as challenging. In order to make position of Librarian more clear, Librarian needs to be always vigilant about various demands about the books, periodicals and other resources as well as gadgets to provide state of art amenities for quenching the thirst of knowledge and acquire readers and researchers satisfaction. For verifying so many aspects of ICT oriented libraries catering their services to colleges in SGBAU, Amravati the topic of this research paper was chosen.

Sant Gadge Baba Amravati University:

S.G.B. Amravati university was established on 1st May,1983 on the auspicious occasion of Maharashtra Day & Worker's Day. Sant Gadge Baba Amravati University geographically covers the western Vidarbha belt i.e. five districts viz. Amravati, Akola, Yavatmal, Buldhana and Washim of Maharashtra State. The University, in its small span of two decades, has contributed in many ways for economic, social and cultural upliftment of the society by offering best quality education. Amravati University is recognized under Section 12(B) of the University Grants Commission (UGC) Act of the Ministry of Education, Government of India. The University received NAAC accreditation in 2002. 127 colleges are affiliated with Amravati University, with an enrolment of over 90,000 students for the undergraduate and graduate courses, together, in different faculties. The motto of this University is 'Education for salvation of soul'

OBJECTIVES OF THE STUDY:

The main objectives as following:

1. To study the information needs of the users.
2. To study the various kinds of needs where ICT is involved for satisfying the information needs.
3. To study the awareness of librarians towards the use of information Communication Technology.
4. To study various kinds of resources that are available for satisfying the information needs.
5. To study the role and responsibility of a librarian.

Population and Sample:

The study targeted libraries and students in colleges affiliated in SGB Amravati University, Amravati. A short structured questionnaire was filed up by the researcher through librarians and students in various institutions in SGB Amravati University, Amravati.

Methodology:

Assuming the nature of the research and to know the facts about the awareness of librarians towards implication of ICT in their business environment and students satisfaction the researcher has selected a descriptive survey method. As a data collection tool, the questionnaires are distributed to the respondents.

Table 1. Which of the following services you avail from your library? (N = 95)

Sr. No.	Use of Library Services	Yes	%
1	Lending services	81	85
2	Book Bank	35	36
3	Internet Services	23	23
4	Reading Room Services	85	89
5	Xerox	68	71
6	Reference /information	41	43
7	Book reservation services	12	12
8	Display of new arrivals	72	75

From the above table it was observed that 85 % students preferred lending service, 36 % students preferred Book Bank service, 23 % students preferred Internet Service, 89 % students preferred Reading Room Service, 71 % Students preferred Xerox service while, 43 % Students preferred References/ Information & 12% Students preferred Book reservation, 75 % Students mentioned that they used display of new arrivals services from the library.

Table 2. How satisfied are you with the following services offered by the Library? (N = 95)

Success of Library is depicted from the evaluation of services catered by Library to users. Obviously study of such end users' satisfaction as per their expectations from the college libraries of colleges affiliated to SGBAU, Amravati. Almost all available resources are equipping these ICT libraries could be ranked best in its own kind. But all such amenities need to be availed for readers, students and researchers through media.

Sr. No	Resources	Very often	Often	Not often
1	Circulation	52 (55%)	13 (14 %)	30 (31 %)
2	Display board services	54 (56%)	8 (9 %)	33 (34%)

3	Library catalogue or OPC search browsing	52(55%)	14 (14 %)	29 (31%)
4	Library instruction classes.	17(18%)	7 (7%)	71(75%)
5	Handouts, research guides, bibliographies (available both in print and electronically)	21(23 %)	7 (7 %)	67 (70%)
6	Xerox / microfilm machine	47(50%)	13 (13%)	35 (37%)
7	Computers	31 (32%)	18 (19%)	46 (49%)
8	The open hours of the library are generally convenient for me.	58(61%)	8 (8%)	29 (31%)
9	I usually find most of the books I need on the shelves.	50 (52 %)	15 (16%)	30 (32 %)
10	I usually find most of the journals, magazines, newspapers, and microfilm I need on the shelves	66 (69%)	19 (20%)	10 (11 %)
11	Requests to retrieve library materials from storage are handled quickly and accurately	52(54%)	13 (14%)	30 (32%)
12	The Interlibrary Loan (ILL) service provides timely access the resources I need from other libraries	11 (12 %)	5 (5%)	79 (83%)
13	The amount of time that I am able to keep books checked out is adequate for my needs.	52 (55%)	6 (6%)	37 (39%)
14	The Library obtains and makes available my library book purchase requests in a timely manner	52(55%)	9 (9 %)	34 (36%)
15	The Newspaper Clipping Services in convenient for me	49 (51%)	10 (11%)	36 (38%)
16	All manual services in the library	50 (52 %)	11 (12%)	34 (36%)
17	Drinking water and Toilet facility	28 (29%)	14 (15%)	53 (56%)

The table 2 shows that, 69 % users are satisfied, very satisfied while 31 are dissatisfied with circulation services. 66 % users fairly satisfied and satisfied, while 9% dissatisfied with Display board services. 70% users satisfied with library cataloged or OPAC search browsing 30% dissatisfied with services. 69 % users satisfied with library instruction classes 31 % fairly satisfied, dissatisfied with the services.

30 % users satisfied with handouts, research guides, bibliographies available both in print and electronically, 70% users fairly satisfied, dissatisfied. 63% users are satisfied with Xerox / microfilm machine. 37 % are fairly satisfied, dissatisfied. 51 users are satisfied with computers facilities in the library while 49 are fairly satisfied, dissatisfied with the services. 69 % users expressed that the open hours of the library are generally convenient for them, 31 % are fairly satisfied, 68 % student are satisfied with the statement "I usually find most of the books I need on the shelves" 32 % are fairly satisfied, dissatisfied. 89 % users are satisfied with the statement "I usually find most of the journals, magazines, newspapers, and microfilm I need on the shelves" 11 % are fairly satisfied, dissatisfied with the statement. 68 % users are satisfied with the statement "Requests to retrieve library materials from storage are handled quickly and accurately" 32 are fairly satisfied, dissatisfied. 17 % users are satisfied with the statement "The Interlibrary Loan (ILL) service provides timely access the resources I need from other library" 83 are fairly satisfied, dissatisfied with the statement. 61 % users are satisfied with the statement "The amount of time that I am able to keep books checked out is adequate for my needs" 39 % are fairly satisfied, dissatisfied. 64 % users are satisfied and very satisfied with the statement "The Library obtains and makes available my library book purchase requests in a timely manner" 36 % are fairly satisfied, dissatisfied with the statement. 62 % users

found satisfied with the statement "The Newspaper Clipping Services in convenient for me". 38 % are fairly satisfied, dissatisfied. 64 % users found satisfied with the statement "All manual services in the library", 36 % are fairly satisfied, dissatisfied with the statement. 44 % users are satisfied with "Drinking water and Toilet facility", 56 % are fairly satisfied, dissatisfied.

Table 2. Librarian's awareness:

This part of the survey contains ten items measuring librarians' awareness toward the use of ICT in libraries. They relate to both positive and negative effects of ICT in automated libraries. Respondents were asked to rate their belief about ICT applications to library practices.

Analytical results of the study are as follows

Sr.No.	Statements	Agree	Undecided	Disagree	Total
1	Library is important for learning	55 (90.16%)	06 (9.83%))	00	61
2	Library is important for teaching	41 (67.21%)	08 (13.11%)	12 (19.67%)	61
3	ICT provide to overcome challenges of information explosion	45 (73.77%)	02 (3.27%)	14 (22.95%)	61
4	Online databases provide more up-to-date Information	47 (77.04%)	01 (1.63%)	13 (21.31%)	61
5	ICT helps in making specific information available	49 (80.32%)	04 (6.55%)	08 (13.11%)	61
6	ICT enables most effective ways of resource sharing	43 (70.49%)	03 (4.91%)	15 (24.59%)	61
7	The utility of ICT in my institution is good	33 (54.09%)	08 (13.11%)	20 (32.78%)	61
8	Computers brought more works stress on librarian	20 (32.78%)	07 (11.47%)	34 (55.73%)	61
9	Computers has made librarians work difficult	17 (27.86%)	02 (3.27%)	42 (68.85%)	61
10	Computers has made librarians work easy	44 (72.13%)	06 (9.83%)	11 (18.03%	61
11	ICT save the valuable time of user	51 (83.60%)	00	10 (16.39%)	61
12	ICT save the valuable time of librarian	48 (78.68%)	02 (3.27%)	11 (18.03%)	61
13	ICT improve the quality of library service	52 (85.24 %)	05 (8.19%)	04 (6.55%)	61
14	ICT influence librarians role in information dissemination support	46 (75.40 %)	05 (8.19%)	10 (16.39%)	61
15	ICT offers faster access to information in learning	49 (80.32%)	01 (1.63%)	11 (18.03%)	61
16	ICT makes both study and teaching more efficient	50 (81.96)	06 (9.83%)	05 (8.19%)	61
17	Though all the information in study and teaching are available online, I think that the existence of library is necessary	59 (96.72%))	02 (3.27%)	00	61
18	In ICT era also libraries play important role in learning and teaching	53 (86.88%))	00	08 (13.11%)	61

19	Computer creates health and environmental Problems	37 (60.65%))	11 (18.03%))	13 (21.31%)	61

The above table shows that the approach of the Librarians under consideration as regards the ICT is positive, for which experience, expectation and demands of society had provoked the Librarian have to change their approaches as well as awareness towards ICT compatibilities of Library. Simultaneously it is noteworthy to seek co-operation of Librarian and providing ICT amenities to Library on top priority is very much essential, which could make the Library better oriented to fetch the demands of the readers.

It was observed that, 90.16 % respondents were agreed that Library is important for learning. 78.68 % were agreed that Information Communication Technology save the valuable time of librarian, while 86.88 % of the librarians agreed that, In ICT era also libraries play important role in learning and teaching it means Librarians are agreed to play their role efficiently. But on the other side, 55.73% respondents mentioned that, Computers brought more works stress on librarian. While 68.85% of respondents mentioned that, Computers has made librarians work difficult.

Findings

All users of library are benefitted with single window catering for all topics, subjects required by users of library. This needs to be supported with partially or open access system for all students of vicinity to make such library open for public. For librarians Regional Training Centers play a crucial role in creating an ideal atmosphere for ICT orientation of Librarians to evolve their attitudes favoring ICT amenities to readers to revolutionize them into researchers, to fetch sufficient knowledge to calm down the crave for the same.

It is noticed that ICT facility users do not have sufficient time to make use of such high- tech amenities, but simultaneously they are dissatisfied with the conventional resources to procure information. About 40-45% users are quite satisfied with the electronic services catered by libraries, but especially about manual services offered by Libraries does not seem to be efficient and competent enough though physical set up of libraries found satisfactory. The situation may be due to insufficient training and inappropriate culture to suit the ICT environment.

Suggestions:

In view above findings and conclusions some suggestions were made for the further improvement in the libraries:

1. Equipments:

There should be a regular check up of facilities, equipment and furniture of the library to ensure that they were functioning so as not to disrupt or to delay library services and activities. The library should provide appropriate equipment in adequate quantities and in good working order for the convenient, efficient consultation of local and remote information resources by staff and the public. This includes communications of hardware and software to receive and answer queries for information from users.

When a specific Library claims to be ICT deployed and developed library, that time it should be aware about its responsibility. Users say the libraries being automated but short of supportive equipments to provide hard copies as well as soft copies in presentable way. ICT must be accompanied with OPAC Terminals, Internal Service facility, Printing (Photocopying) devices on sufficiently large scale.

2. Collection Development Program :

Every Library should have highly demanded publications in ample quantity to maintain its collection to deserved level. Libraries should concentrate in tune with its readers, students and other users and try to be in resonance with the social requirements. More books and journals are needed to better meet the course requirements of library users

3. Group Study Facilities:

New trend of students was to adopt group study culture. Students come up together in groups, discuss, design their own ways of study. Under such circumstances, Libraries if equipped sufficiently should recognize such study groups and entertain the groups for studying by providing suitable environment and offering services of all available equipments and resources of information technology.

4. Display board services

According to the users, informing/Display board services at libraries were found insufficient. Information on topical issues, for example on new services or exceptional opening hours was given on display boards and email delivery to staff and students. Paper notices are attached to library doors, notice boards and when required on desks. Information on new materials was provided on self-service basis on the library based list. The list provided novelties in all the collections or by branches of operation.

5. Reference service

A reference librarian is needed to manage the reference section, to create reference service programs to develop and implement dynamic library marketing and promotion program.

6. Staff training and evaluation

The library staff should be given regular trainings on user service and for them to have the common goal of giving equal users services and satisfaction. There should be a regular evaluation or assessment of library services and facilities so as to ensure that they were meeting users' needs. An in-depth study should be conducted on what were the expectations, role of the librarian/staff in user training in relation to OPAC use, internet searching and other library skills.

7. New Programs

Development of library programs should be done only after a user needs survey had been implemented in order to know what users really needs/desires.

8. Resource sharing

The library should participate in consortia and networks to obtain access to information sources and services which it cannot provide on its own. The library should collect or provide access to information resources relevant to its mission and reflecting the interests of the full spectrum of the population it serves. These information resources should satisfy, through content, currency, format, organization, and quantity a diversity of user needs.

As necessary, information services personnel should reach beyond reference collections to tap the resources of the library as a whole. To provide the information that users need, they should also reach beyond in-house collections and in-house expertise by drawing on the resources of the organizations that collect and provide information, by consulting individual experts, and tapping external information sources regardless of their medium.

9. Use of internet

Internet is an important tool for libraries. However, to utilize the maximum resources from internet it is necessary to make the users well versed in the surfing and browsing on the net. Internet use cannot be increased unless and until short-term courses or workshops and training programmes are conducted. This will help users to know various developments and searching techniques for accessing the desired information.

10. Information literacy (IL) program

In the world today information is constantly changing in terms of its volume, the technical aspects of its storage and retrieval, and in the way it is communicated. This situation has not only increased the amount of information available to users but it has also created an environment that is complex for them in terms of finding, accessing, selecting, evaluating and handling information. In recognition of this challenge, librarians and other academics in the education institutions of various countries have introduced IL

programmes that are intended to impart the knowledge and skills that would enable users to become effective and efficient information users. The librarian can play effective role as intermediary in bridging the gap between the users and the resources of the library and it should be introduced in all libraries.

Conclusion:

Today's Library can hardly be a competent Information Centre without deployment of ICT, because every reader, while seeking aid of Library, wishes to acquire proper and perfect information immediately without any time lapse. Impact of ICT technology is equally observed on Library as well as the readers. If new technologies enter then staff as well as users be equally made aware about and trained to make maximum use of the same, to integrate library facets for students, readers, researchers and other beneficiaries. This would certainly reduce the fear of Digital Divide amongst society and Librarian could become an ideal guide to all expectant readers to avail broad spectrum of knowledge available at very much affordable charges. So three pillars for present age libraries are ICT, Users and librarians.

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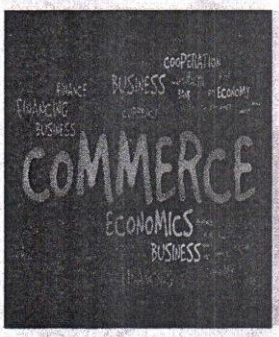

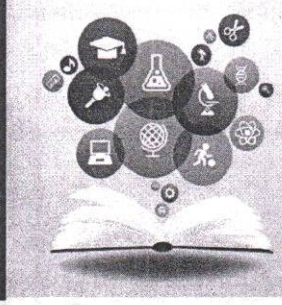

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पर्यावरणीय

मिलिंद दामोधर जाधव
सहयोगी प्राध्यापक जिजामाता महाविद्यालय बुलडाणा

सजीवांना अपायकारक किंवा विषारी असे पदार्थ पर्यावरणात मिसळण्याची प्रक्रिया म्हणजे पर्यावरणीय प्रदूषण. पर्यावरणातील हवा, जल व मृदा अशा घटकांमध्ये अपायकारक पदार्थ मिसळल्याने पर्यावरण दूषित बनते. प्रदूषणाची तीव्रता वाढल्यास अशी पर्यावरण स्थिती सजीवांना अपायकारक बनते. प्रदूषण बहुतकरून मानवी कृतींमुळे घडून येते.

ऐतिहासिक काळापासून हवेतील प्रदूषण आणि मानवी संस्कृती यांचा परस्परांशी संबंध आहे. इतिहासपूर्व काळात मानवाला अग्नीचा शोध लागल्यानंतर त्याने अग्नीचा वापर सुरू केला आणि तेव्हापासून प्रदूषणाला सुरुवात झाली असे म्हणता येईल. प्राचीन गुहांच्या छतांवर आढळलेले काजळीचे थर याची साक्ष देतात. त्यानंतर मानवाने धातू वितळविण्यास सुरुवात केली आणि त्यामुळे बाहेरील हवेच्या प्रदूषणात लक्षणीय वाढ झाली. तेव्हापासून प्रदूषणात निरंतरपणे वाढ होत राहिली आहे. जगातील मोठमोठ्या शहरांमध्ये लोकसंख्या वाढल्याने लाकूड व दगडी कोळसा यांचा इंधन म्हणून वापर वाढला. तसेच वाहतुकीसाठी घोड्यांचा होत असलेला वापर यांमुळे शहरे प्रदूषणमय व ओंगळ झाली. औद्योगिक वाढीमुळे असंस्कारित रसायने व अपघटके स्थानिक जलप्रवाहात सोडली जाऊ लागली. अणुविज्ञानाच्या विकासानंतर अणुतंत्रज्ञानावर आधारित संयंत्रे विकसित झाली आणि त्याबरोबर किरणोत्सारी प्रदूषके वातावरणात मिसळण्यास सुरुवात झाली. दुसऱ्या महायुद्धानंतर अणुचाचण्या आणि अण्वस्त्रांच्या परिणामांचे अहवाल ज्ञात झाल्यानंतर प्रदूषणाची तीव्रता लोकांना लक्षात येऊ लागली. मागील काही दशकांत आंतरराष्ट्रीय आपत्ती ठरणाऱ्या तेलगळतीच्या व वायुगळतीच्या घटना घडल्यामुळे लोक सजग झाले आहेत.

जल प्रदूषण (मुंबई)

प्रदूषण हे मुख्यत: रासायनिक पदार्थांच्या रूपात असते. वातावरणात रसायने आणि धूलिकण मिसळल्यामुळे हवा प्रदूषित होते. या रसायनांमध्ये उद्योग आणि मोटारी यांद्वारे निर्माण झालेले कार्बन डायऑक्साइड, सल्फर डायऑक्साइड, क्लोरोफ्ल्युओरोकार्बन संयुगे, नायट्रोजनाची ऑक्साइडे इ. वायूंचा समावेश होतो. मृदेमध्ये सोडलेली रसायने किंवा सांडपाणी वाहून नेणाऱ्या वाहिन्यांतून झालेली गळती यांमुळे मृदा प्रदूषित होते. तसेच हायड्रोकार्बने, जड धातू, कीडनाशके, तणनाशके, क्लोरीनयुक्त हायड्रोकार्बने इत्यादींमुळे मृदा प्रदूषित होते. औद्योगिक क्षेत्रातून सोडलेले सांडपाणी, कोणतीही प्रक्रिया न करता मोकळ्यावर सोडलेले सांडपाणी, प्रक्रिया केल्यानंतर सोडलेले

क्लोरीनयुक्त पाणी इ. जलस्रोतात मिसळल्याने जल प्रदूषण होते (पहा कु.वि. भाग २: जल प्रदूषण). तसेच पर्यावरणात प्लॅस्टिक साचून राहिल्यास त्याचा वाईट परिणाम तेथील सजीव, त्यांचा अधिवास आणि मानवी जीवन यांवर होत असतो. मोकळ्या जागेवर फेकलेले अन्न, मलमूत्र, रसायने, तुटलेल्या वस्तूंचे ढिगारे, इलेक्ट्रॉनिक कचरा इ. जैविक आणि अजैविक अपशिष्टांमुळे प्रदूषणाच्या जागतिक समस्या निर्माण झाल्या आहेत. अणुऊर्जानिर्मिती व अण्वस्त्रनिर्मिती यांकरिता केले जाणारे संशोधन यांमुळे पर्यावरणात किरणोत्साराचे प्रमाण वाढले आहे.

प्रदूषण हे केवळ रासायनिक पदार्थांच्या रूपात नसून ध्वनी, उष्णता किंवा प्रकाश अशा ऊर्जेच्या रूपात देखील असते. या ऊर्जांच्या बाबतीत, त्यांच्या सामान्य पातळीपेक्षा अतिरिक्त वाढ झाली तर प्रदूषण होते. रस्त्यांवरील वाहने, आकाशात भरारी घेणारी विमाने, औद्योगिक क्षेत्र, बांधकाम इत्यादींमुळे ध्वनी प्रदूषण होते (पहा कु.वि. भाग २: ध्वनी प्रदूषण). ध्वनी प्रदूषणाला मुख्यत: मोटारी कारणीभूत असून सु. ९०% अनावश्यक आवाज निर्माण होत असतो. औष्णिक विद्युत् केंद्रासाठी जलस्रोतांचे पाणी वापरल्यामुळे पाण्याच्या तापमानात बदल होऊन औष्णिक प्रदूषण होते. अतिप्रकाश आणि खगोलीय व्यतिकरणामुळे प्रकाशाचे प्रदूषण होते. एखाद्या परिसरात मोठ्या प्रमाणात असलेल्या विजेच्या टांगत्या तारा, जाहिरातींचे मोठे फलक, ओबडधोबड जमीन इ. बाबी नजरेला खटकतात व परिसराचे सौंदर्यमूल्य घटते. याला दृक् प्रदूषण म्हणता येईल. तसेच प्रदूषण केवळ पर्यावरणात नाही तर घरात देखील असू शकते.

ज्या पदार्थामुळे किंवा अतिरिक्त ऊर्जेमुळे पर्यावरण दूषित होते अशा कारकाला 'प्रदूषक' म्हणतात. प्रदूषके पर्यावरणातील प्रक्रियांतून निर्माण झालेली असतात आणि ती स्थायू, वायू किंवा द्रव अवस्थेत असतात. अशा प्रदूषकांची तीव्रता तीन बाबींनुसार निश्चित होते : (१) प्रदूषकांचे रासायनिक स्वरूप, (२) प्रदूषकांची संहती म्हणजे परिसरात असलेले प्रदूषकांचे प्रमाण, (३) प्रदूषकांचे सातत्य म्हणजे परिसरात प्रदूषके किती काळ निर्माण होतात आणि टिकून असतात याचा कालावधी.

पर्यावरणात प्रदूषके किती प्रमाणात शोषली जाऊ शकतात यावरून त्यांचे दोन प्रकार केले जातात : (१) काही प्रदूषकांच्या बाबतीत पर्यावरणाची शोषणक्षमता खूप कमी असते किंवा मुळीच नसते. उदा., कृत्रिम रसायने, जड धातू, अजैविक अवनत-अक्षम प्रदूषके. अशी प्रदूषके पर्यावरणात खूप काळ साचून राहतात आणि त्यांच्यापासून जादा प्रदूषके निर्माण होत राहतात. त्यांमुळे पर्यावरणाची हानी वाढतच राहते. या प्रदूषकांना 'साठा प्रदूषके' म्हणतात. (२) काही प्रदूषके पर्यावरणामध्ये शोषली जातात. अशा प्रदूषकांना 'निधी प्रदूषके' म्हणतात. मात्र पर्यावरणाच्या शोषणक्षमतेपलीकडे अशा प्रदूषकांचे प्रमाण वाढले तर पर्यावरणाला बाधा पोहोचते. उदा., पर्यावरणात तयार झालेला कार्बन डायऑक्साइड वायू प्रकाशसंश्लेषण क्रियेत वनस्पतींकडून शोषला जातो. तसेच महासागरांमार्फत जैविक आणि रासायनिक प्रक्रियांद्वारे तयार झालेला कार्बन डायऑक्साइड पाण्यात विरघळला जातो. त्यामुळे त्याची पातळी स्थिर राहते. ज्या प्रदेशांत वनस्पती कमी प्रमाणात असतात तेथे कार्बन डायऑक्साइड वाढून तेथील पर्यावरणास घातक ठरू शकतो. काही निधी प्रदूषकांचे रूपांतर कमी घातक असलेल्या पदार्थांमध्ये होत राहते.

प्रदूषण समाजाच्या दृष्टीने खर्चिक असते, हे आता मान्य झाले आहे. उदा., एखाद्या कारखान्यात निघणाऱ्या उत्पादनांमुळे त्या परिसरातील नदी दूषित होऊ शकते. नदीमुळे शेतीसाठी सुपीक जमीन उपलब्ध होते. तसेच हॉटेल, वाहतूक, बोटिंग, इत्यादींद्वारा रोजगार उपलब्ध होतात. नदी प्रदूषित झाल्यास शेतीचे नुकसान होते व स्थानिक नगरपालिकांचा महसूल घटतो. याखेरीज नदी स्वच्छ करून परिसर सुशोभित करण्यासाठी खर्च करावा लागतो. अशा खर्चाला 'बाह्य परिव्यय' म्हणतात, कारण कारखान्याने वस्तुनिर्मिती करताना प्रदूषणाचा खर्च विचारात घेतलेला नसतो. कारखाने सामान्यपणे यंत्रे, उपकरणे, कामगार व कच्चा माल यांवरील खर्च म्हणजे फक्त 'खाजगी परिव्यय' विचारात घेतात. समाजाला पडतो तो खर्च खाजगी परिव्यय आणि बाह्य परिव्यय यांनी मिळून होणारा

सामाजिक परिव्यय असतो. जागतिक अर्थशास्त्रामध्ये सामाजिक परिव्यय ही महत्त्वाची कल्पना गेल्या काही वर्षांत पुढे आली आहे आणि त्यामुळे प्रदूषणाचे आर्थिक उपद्रव मूल्यही स्पष्ट झाले आहे.

प्रदूषणाचे स्रोत : हवा प्रदूषणाचे स्रोत नैसर्गिक तसेच मानवी असतात. मात्र ज्वलन, बांधकाम, खाणकाम, कृषी उद्योग आणि युद्धसाहित्य निर्मिती इ. मानवी कृतींमुळे हवेच्या प्रदूषणात भर पडत आहे. चीन, अमेरिकेची संयुक्त संस्थाने, रशिया, भारत, मेक्सिको आणि जपान हे देश हवा प्रदूषणाच्या उत्सर्जनात आघाडीवर आहेत. याखेरीज रासायनिक कारखाने, कोळशावर चालणारे विद्युत् केंद्र, तेल शुद्धीकरण केंद्र, अणुकेंद्रकीय अपशिष्ट निर्मूलन प्रक्रिया, दुग्धव्यवसाय व कुक्कुटपालन इ. मोठे व्यवसाय, प्लॅस्टिक उद्योग, धातुनिर्मिती केंद्र व अन्य जड उद्योग हवा प्रदूषणाचे स्थायी स्रोत आहेत. मागील ५० वर्षांत झालेल्या जागतिक तापनवाढीला मानवी कृती कारणीभूत असल्याचे लक्षात आले आहे.

मृदेचे प्रदूषण तिच्यात मिसळलेले धातू (विजेरीत असलेले क्रोमियम व कॅडमियम धातू, रंग आणि हवाई इंधनात मिसळलेले शिसे, जस्त, आर्सेनिक इ. धातू), ईथर गटातील संयुगे आणि बेंझीन यांमुळे होत असते. औद्योगिक क्षेत्रातील जोडउत्पादितांचे पुनर्चक्रीकरण करून खते तयार केल्याने या प्रदूषणात वाढ होते, असे दिसून आले आहे.

नैसर्गिक आपत्तीच्या परिणामांमुळे प्रदूषण होत असते. उदा., चक्री वादळामुळे सांडपाणी पिण्याच्या पाण्यात मिसळल्याने पिण्याचे स्रोत दूषित होतात किंवा तेलवाहू जहाजे व मोटारी यांतून सांडलेल्या तेलामुळे पाणी दूषित होते. अणुऊर्जानिर्मिती केंद्र किंवा तेलवाहू वाघिणी यांचे अपघात झाल्यास घातक पदार्थ पर्यावरणात सोडले जातात. याशिवाय नैसर्गिक घटनांमुळे प्रदूषणात थेट वाढ होते. उदा., वणवा, ज्वालामुखीचा उद्रेक, वाऱ्याने होणारी धूप, हवेत पसरलेले परागकण, नैसर्गिक किरणोत्सारिता इत्यादी. मात्र या घटना वारंवार घडत नाहीत.

पर्यावरणीय ऱ्हास : जल, हवा व मृदा यांच्या प्रदूषणामुळे पर्यावरणाची गुणवत्ता घटते. वातावरणातील कार्बन डायऑक्साइडच्या अतिरिक्त वाढीमुळे धूर व धूके एकत्रित होऊन धुरके निर्माण होते. त्यामुळे पृथ्वीवर सूर्यप्रकाश पोहोचण्यात व प्रकाशसंश्लेषण प्रक्रियेत अडथळा येतो. लंडन शहरात धुरक्यामुळे सु. ४,००० लोक १९५२ मध्ये मृत्युमुखी पडले होते. हवेत मिसळलेले सल्फर डायऑक्साइड, नायट्रोजन ऑक्साइड इ. वायूंमुळे आम्लवर्षा होते. हवेची गुणवत्ता घटल्यास मनुष्याला श्वसनाचे वेगवेगळे विकार होतात. छातीत वेदना होणे, छाती भरून येणे, घसादाह होणे, हृदयविकार इ. विकार हवा प्रदूषणामुळे होतात. जल प्रदूषण व तेलगळती या कारणांमुळे अनेक सजीव मृत्युमुखी पडतात. जल प्रदूषणामुळे त्वचारोग, तसेच मृत्यूस कारणीभूत ठरणारे अनेक आजार उद्भवतात. ध्वनी प्रदूषणामुळे बहिरेपणा येतो, ताण वाढतो आणि निद्रानाश जडतो.

हरितगृह वायूंच्या उत्सर्जनामुळे खासकरून कार्बन डायऑक्साइडमुळे जागतिक तापन होते. उद्योग व वाहने यांची वाढ, प्रचंड प्रमाणात केली जाणारी वृक्षतोड यांचा प्रत्यक्ष-अप्रत्यक्ष परिणाम होऊन कार्बन डायऑक्साइड वायूची भर पडत आहे. त्यामुळे ध्रुवीय हिमनग वितळत आहेत. सागरजल पातळीत वाढ होऊन काही किनारी प्रदेशांतील लोक आणि परिसंस्था यांना धोका निर्माण झाला आहे. वातावरणात मिसळलेली विविध रसायने विशेषेकरून क्लोरोफ्ल्युओरोकार्बन वायूंच्या वापरामुळे ओझोन स्तराचा अवक्षय होत आहे. त्याचा परिणाम पृथ्वीवरील सजीवांवर होतो. कीटकनाशके व कीडनाशके यांचा वापर वाढल्यामुळे वनस्पतींची वाढ अपुरी होते किंवा योग्य होत नाही. औद्योगिक क्षेत्रातून सोडलेल्या अपशिष्टांमुळे मृदेची गुणवत्ता कमी होत आहे.

प्रदूषण नियंत्रण : प्रदूषण कमी करण्यासाठी अपशिष्टांचे केलेले व्यवस्थापन म्हणजे प्रदूषण नियंत्रण. मानवी आरोग्य आणि पर्यावरण यांची गुणवत्ता प्रदूषण नियंत्रणावर अवलंबून असते. प्रदूषण नियंत्रण सामान्यपणे पुढील प्रकारांनी करता येते : प्रदूषण करणारे उद्योग कमी करणे, औद्योगिक क्षेत्रांतून प्रदूषके कमीत कमी बाहेर पडतील अशा आधुनिक पद्धती वापरणे, प्रदूषकांची संहती कमी करण्यासाठी ती मोठ्या क्षेत्रात पसरविणे, अपशिष्टे पर्यावरणात

सोडण्यापूर्वी त्यांवर प्रक्रिया करून ती सौम्य करणे. यांखेरीज वापरलेल्या वस्तूंचे पुनर्चक्रीकरण, टाकाऊ पदार्थांचा पुनर्वापर, अपशिष्टांची किमान निर्मिती, प्रदूषण रोखणे अशा कृतींद्वारा प्रदूषण कमी करता येते. जगातील अनेक देशांमध्ये प्रदूषण कमी करण्यासाठी निरनिराळे प्रयत्न केले जात आहेत. हवा व जल यांचे प्रदूषण आणि क्लोरोफ्ल्युओरोकार्बन वायूंचा वापर कसा कमी करता येईल यांसंबंधी वैज्ञानिक संशोधन करीत आहेत. इंधन बचत करण्यासाठी विजेवर चालणारी वाहने तयार केली जात आहेत. औद्योगिक अपशिष्टांची विल्हेवाट लावण्यासाठी नवीन पद्धती शोधल्या गेल्या आहेत. कृषिक्षेत्रात कमी खते व कीटकनाशके वापरून अधिक उत्पादन देणाऱ्या जैवतंत्रज्ञानाद्वारे वनस्पतींच्या जाती शोधून काढण्यात आल्या आहेत. याचाच एक भाग म्हणून चक्रीय पीकपद्धतीचा स्वीकार केला जात आहे.

भारतातील प्रदूषण-उपशमन : प्रदूषणाची तीव्रता कमी करणे व त्याचा पर्यावरणातील प्रभाव मर्यादित राखून प्रदूषकांची विल्हेवाट लावणे याला 'प्रदूषण-उपशमन' म्हणतात. पर्यावरणातील हवा, जल, मृदा इत्यादींचे प्रदूषण कमी करण्यासाठी भारत सरकारने १९९२ मध्ये प्रदूषण-उपशमन धोरण स्वीकारले आहे. या धोरणांतर्गत प्रदूषण नियंत्रणाचे उपाय आणि धोरण प्रभावी करण्याचे प्रयत्न केले जात आहेत. वाहनांतून उत्सर्जित होणाऱ्या वायूंवर नियंत्रण, वायू प्रदूषण व जल प्रदूषण यांवर नियंत्रण, ध्वनी प्रदूषकांचे उपशमन व निवारण इत्यादींबाबत निरनिराळे उपाय सुचविण्यात येत आहेत. स्थानिक पातळीवर प्रदूषित क्षेत्रांची यादी करणे, पर्यावरण सुधारण्यासाठी योजना आखणे इ. बाबी या धोरणामध्ये समाविष्ट आहेत. २००६ मध्ये राष्ट्रीय पर्यावरण धोरण ठरविण्यात आले असून त्याअंतर्गत राष्ट्रीय प्रदूषण नियंत्रण मंडळ स्थापन करण्यात आले आहे. प्रदूषणविरहित पर्यावरणासाठी कार्यक्रम राबविण्यासाठी केंद्रीय प्रदूषण मंडळ मार्गदर्शन करते. हे मंडळ हवा प्रदूषण व जल प्रदूषण उपशमनाबाबत सरकारला सल्ला देते. सर्व राज्यांनी राज्य प्रदूषण मंडळांची स्थापना केली आहे. विज्ञान व तंत्रज्ञानाच्या उपयोजनाद्वारे प्रदूषण-उपशमन करण्यासाठी विविध योजना आखल्या जातात. प्रदूषणाला प्रतिबंध कसा करावा आणि व्यवस्थापन कसे करावे यांसंबंधी काही संस्था व संघटना अभ्यास करीत आहेत. प्रत्येक नागरिकांनी देखील वैयक्तिक पातळीवर प्रदूषणमुक्त पर्यावरणासाठी प्रयत्नशील असणे महत्त्वाचे आहे.

आज पर्यावरण प्रदूषणाची समस्या केवळ भारतापुरती मर्यादित नसून ही समस्या संपूर्ण विश्वाला भेडसावते आहे. आज प्रत्येक आई-वडिलांनी आपल्या मुलांना प्रदूषणाचे विविध प्रकार, प्रदूषणाची कारण, त्यावरचे उपाय याविषयी अवगत करायला हवे.

आज आपण रहातो त्या जगाची सर्वात मोठी समस्या प्रदूषण ही झाली आहे. आपल्या आसपास जे घाणीचे साम्राज्य पसरले आहे त्यातून हे प्रदूषण जन्मास येते. या प्रदूषणाच्या विळख्यात केवळ मनुष्य प्राणी अडकलाय असे नव्हे तर समस्त जीवजंतू आणि अवघी जीवसृष्टी याच्या दुष्परिणामांचा सामना करते आहे.

गेल्या काही दशकांमध्ये प्रदूषणाचे प्रमाण इतके वाढले आहे की मानवी जीवनच संकटात सापडले आहे. या समस्येवर गांभीर्याने विचार केला गेला नाही तर तो दिवस दूर नाही जेंव्हा दररोज प्रदूषणामुळे कुणा न कुणाचा मृत्यू होईल आणि एक दिवस या जगाचे अस्तित्वच नामशेष होईल.

जेंव्हा दुषित तत्व प्रकृतीच्या परिघात प्रवेश करतात आणि पर्यावरणाला हानी पोहोचवतात, त्यामुळे नैसर्गिक संतुलन पूर्णतः बिघडून मनुष्याला शुद्ध वायू, शुद्ध पाणी आणि शांत वातावरण मिळत नाही तेंव्हा त्याला प्रदूषण असं म्हंटलं जातं.

या प्रदुषणामुळे अनेक गंभीर समस्या जन्म घेतात. याचा दुष्परिणाम केवळ आपल्या दैनंदिन जीवनावरच होतो असे नव्हे तर अनेक गंभीर आजार प्रदुषणामुळे निर्माण होतात. ग्लोबल वार्मिंग सारखी समस्या यातूनच निर्माण झाली

आहे. आज मनुष्य आपल्या सुखासीन जीवना करता अनेक आरामदायक, सुखसुविधा देणाऱ्या उपकरणांचा वापर करतो आहे, परंतु त्यामुळे निसर्गाचे संतुलन ढासळते आहे आणि प्रदूषण आपल्या चरमसिमे पर्यंत पोहोचले आहे. आजच्या विज्ञान तंत्रज्ञानाच्या विकासामुळे मानवी क्षमतेत मोठ्या प्रमाणात वाढ झाली असून मनुष्य या उपकरणांच्या सुखसुविधेत गुरफटला गेला आहे. त्याला या क्षणिक सुख देणाऱ्या उपकरणांची इतकी सवय झाली आहे की याच्याशिवाय तो आपल्या आयुष्याची कल्पना देखील करू शकत नाही.

परंतु या मानव निर्मित उपकरणांमुळे निसर्गाची अपरिमित हानी होत असून प्रदूषणाची समस्या निरंतर वाढते आहे. त्यामुळे आज या प्रदूषणाच्या समस्येवर अंकुश निर्माण करण्याची आणि समाजाचे लक्ष याकडे केंद्रित करण्याची नितांत आवश्यकता आहे.

स्वच्छ शुद्ध वातावरणात राहिल्याने केवळ मनुष्याचा विकास होतो असे नव्हे तर स्वस्थ समाजाची देखील निर्मिती होते. शुद्ध वातावरण म्हणजे-प्रदूषण रहित वातावरण होय!

आपण सर्वजण मिळून जोवर वातावरण स्वच्छ ठेवण्याचा प्रयत्न करणार नाही, तोपर्यंत केवळ अस्वच्छता आणि प्रदूषण पसरत राहील. वाढत्या प्रदूषणावर नियंत्रण मिळविण्यासाठी याचे दुष्परिणाम आणि त्यापासून वाचण्याचे उपाय याविषयी समजून घेणे अत्यंत आवश्यक आहे. तेंव्हाच या प्रदूषणाच्या समस्येवर आळा बसू शकेल.

खरंतर आपण काहीही विचार न करता आपल्या प्राकृतिक साधन संपत्तीचे हनन करत असतो, त्यामुळे प्रदूषणाच्या गंभीर समस्येवर नियंत्रण मिळविण्यासाठी आपल्याला आपले ज्ञान वाढवावयास हवे आणि विचारांची व्याप्ती वाढवायला हवी. विविध प्रकारचे प्रदूषण, त्याची कारणं आणि मानवी जीवनावर आणि निसर्गावर त्याचे होणारे दुष्परिणाम याविषयी जाणून घेणं अत्यंत आवश्यक आहे.

प्रदूषणाचे प्रमुख प्रकार –

- वायू प्रदूषण – Air Pollution
- जल प्रदूषण – Water Pollution
- ध्वनी प्रदूषण – Sound Pollution (Noise pollution)
- रेडीयोधर्मी प्रदूषण – Radioactive Pollution
- रासायनिक प्रदूषण – Chemical Pollution
- प्रकाश प्रदूषण – Light Pollution
- दृश्य प्रदूषण – Visual pollution
- थर्मल प्रदूषण – Thermal Pollution

काही प्रमुख प्रदुषणाबद्दल आपण विस्तृत माहिती घेऊया –

- वायू प्रदूषण – Air pollution

आज पूर्ण पृथ्वीवर वायू प्रदूषणाची गंभीर समस्या निर्माण झाली आहे. वायू प्रदुषणामुळे मानवाला शुद्ध हवा मिळत नाही आणि परिणामी दमा, अस्थमा, सारख्या श्वसना संबंधित अनेक आजारांचा त्याला सामना करावा लागतो. वास्तविक जेंव्हा आपल्या वायुमंडलात जैविक, रासायनिक, सूक्ष्म असे अनेक तऱ्हेचे विषारी पदार्थ प्रवेश करतात तेंव्हा त्याला वायू प्रदूषण असं म्हंटल्या जातं.

या दुषित तत्वांमुळे वायू दुषित होतो, आपल्या वायुमंडलात एका निश्चित मात्रेत अनेक गैस असतात पण जेंव्हा दुषित तत्व या वायुमंडलात प्रवेश करतात तेंव्हा या गैसचे संतुलन बिघडते, आणि त्यामुळे वायूप्रदूषण होण्यास सुरुवात होते. वाढते औद्योगिकीकरण, अनियंत्रित लोकसंख्या, कमी होत जाणारे जंगल आणि वाहनांचा अत्याधिक वापर यामुळे वायुप्रदूषणाची समस्या सतत वाढते आहे.

- जल प्रदूषण – Water pollution

जल प्रदुषणामुळे केवळ मानवी जीवनच नव्हे तर सागरी जीव-जंतू आणि असंख्य वनस्पती देखील प्रभावित झाल्या आहेत. ज्यावेळी नैसर्गिक जल-स्त्रोतांमध्ये विविध प्रकारचे दुषित पदार्थ मिसळले जातात तेंव्हा जल प्रदुषणाची समस्या उग्र रूप धारण करते.

मोठमोठ्या उद्योगक्षेत्रांमधून निघणारा कचरा, रसायन जलस्त्रोतांमध्ये फेकण्यात येतो तेंव्हा पूर्ण पाणी विषारी होऊन जाते. अनेक सागरी जीवजंतू त्यामुळे मृत्युमुखी पडतात. या दुषित पाण्याच्या सेवनाने मनुष्याला अनेक गंभीर आजारांचा सामना करावा लागतो. जल प्रदूषणाची समस्या दिवसेंदिवस वाढते आहे. या समस्येवर गंभीर प्रयत्नांची खूप आवश्यकता आहे.

- ध्वनी प्रदूषण – Sound Pollution (Noise pollution)

मोठ्या आवाजाने होणाऱ्या प्रदूषणाला ध्वनी प्रदूषण म्हंटल्या जातं. वाहने, यंत्र, रेडियो, डीजे, लाउडस्पीकर, टेलीविजन सारख्या असंख्य उपकरणांमधून ध्वनी प्रदूषण होते.या ध्वनी प्रदूषणामुळे माणसाची ऐकण्याची क्षमता कमी होते.

कित्येकदा या ध्वनी प्रदूषणामुळे बहिरेपणा, हार्ट अटैक, तणाव, यांसारख्या गंभीर समस्या निर्माण होत असतात. याविषयी अधिकाधिक जागरूकता निर्माण करण्याची गरज आहे. तेंव्हाच या समस्येचे निराकरण होऊ शकते.

निष्कर्ष –कोणत्याही प्रकारचे प्रदूषण असो, ते हानिकारकच असते. त्यामुळे प्रदूषणाच्या समस्येवर चिंतन करण्याची आवश्यकता आहे आणि हे तेंव्हाच संभव होईल जेंव्हा संपूर्ण समाज एकजुटीने पर्यावरण स्वच्छ ठेवण्याचा संकल्प करेल आणि जास्तीत जास्त वृक्ष लागवड करून आपल्या पृथ्वीला हिरवीगार करेल.

- वाहनांचा वापर शक्य तितक्या कमी प्रमाणात करणे देखील आवश्यक आहे.
- मोठमोठे उद्योग कारखाने शहराच्या जवळ सुरु न करता शहरा बाहेर उभारले जावे जेणे करून नगर वासियांना प्रदूषणाच्या समस्येला कमी प्रमाणात तोंड द्यावे लागेल.
- आपल्या परिसरात जास्तीत जास्त वृक्ष लागवड करून ते वृक्ष मोठे होईपर्यंत त्याची काळजी घ्या.
- कचऱ्याची विल्हेवाट योग्य तऱ्हेने लावणे देखील फार गरजेचे आहे.
- कीटकनाशकांचा वापर कमीत कमी करून सेंद्रिय शेतीकडे वळण्यास शेतकरी बांधवाना प्रोत्साहीत करा.
- पर्यावरणाला स्वच्छ आणि निर्जंतुक ठेवा.
- मोठमोठ्या उद्योगांकरता कठोर नियम (पर्यावरणाला अनुसरून) बनवावे.

प्रदूषण ही आजच्या युगाची सर्वात मोठी समस्या झाली आहे. त्याचा विपरीत परिणाम मनुष्याच्या आरोग्यावर होऊ लागला आहे. पिण्याचे जलस्त्रोत प्रदूषित होत आहेत. प्रदूषणाच्या समस्येवर वेळीच नियंत्रण मिळवता आले नाही तर येणाऱ्या काळात फार मोठी किंमत आपल्याला चुकवावी लागेल.

त्यामुळे वेळ असता सजग सावध होऊन लोकांमध्ये जागरूकता निर्माण करण्याची आवश्यकता आहे. ठिकठिकाणी शिबिराचे आयोजन करून लोकांना एकत्र करून जास्तीत जास्त झाडे लावण्यासाठी प्रोत्साहीत करा. वातावरण स्वच्छ ठेवा, आपल्या पृथ्वीला निरामय करा!

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Analysis of Water Used for Drinking and Irrigation Purposes of Village Pokhari, Tehsil & District Buldana"

Dr. G. B. Andhale, Dr. A. D. Deshpande, Dr. P. B. Wagh & P. P. Ware*

Jijamata Mahavidyalaya Buldana (M.S.)

Email: ganeshandhale005@gmail.com

Abstract:

Water is the driver of life", said Leonardo da Vinci. Water is one of the most abundant substances on our planet. Our planet is a complex system of land, air and water. It is the only substances on the earth that exists in all the three states (solid, liquid and gas) of matter. Nobel laureate A.Szent- Gyogri has called "The Matrix of life" Water which maintains biologically active structure and it is now universally agreed that all life will perish without water. A few years prior, a specialist Thomson King exemplified the Water issue in the accompanying statements: "of all the aggravates that are needed indispensible to life as we know it on earth, water is unquestionably the most paramount, the most well known, and the most glorious, yet generally individuals know next to know about it ". Water is a basic human need and limited natural resource and precious national asset. In recent decades human demand and misuse of water resource have continued to grow. Therefore, water securing for human life, has become a matter of principal concern for sustainable development in the 21st century. Out of total 13,575 million cubic kilometers (km) of water on earth, only 3 per cent, i.e. 37.5 million cubic kilometers is fresh water. As population increases and water use per person increases, so demand of fresh water has also been increasing. Hence fresh water is emerging as one of the most critical natural resource issue for humanity. India has 2.4 per cent area of the earth and has 2.45 per cent of world's fresh water resources with 16.93 per cent of global population to support within its limited resources. Out of total fresh water, more than 50 per cent is consumed for industrial activity and only small portion is used for drinking purpose.

Key words: Water quality, TDS, Hardness, COD, BOD etc.

Introduction:

Water, a substance composed of the chemical elements hydrogen and oxygen and existing in gaseous, liquid, and solid states. It is one of the most plentiful and essential of compounds. A tasteless and odorless liquid at room temperature, it has the important ability to dissolve many other substances. Indeed, the versatility of water as a solvent is essential to living organisms. Life is believed to have originated in the aqueous solutions of the world's oceans, and living organisms depend on aqueous solutions, such as blood and digestive juices, for biological processes. Water also exists on other planets and moons both within and beyond the solar

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system. In small quantities water appears colorless, but water actually has an intrinsic blue color caused by slight absorption of light at red wavelengths.

Physicochemical parameter study is very important to get exact idea about the quality of water and we can compare results of different physico chemical parameter values with standard values .Some past work carried out by researchers are briefly summarized here. According to Tripathi et al. [1] pulp and paper industry effluents are highly polluted industries in India. Small and large scale pulp and paper mills which have different production capacity as well as different raw materials, adopt different processes that lead to radical differences in the physico-chemical properties of effluents. Such polluted effluents must be treated properly before being discharged into the drainage channel, to minimize the effect of various pollutants on the environment. On the basis of results reported herein it can be concluded that the effluent discharged from both the paper industries is highly polluted and has exceeding values as prescribed by the standards of regulatory agency of India. It is further stated that the pollutants generated during different stages from paper industries can be minimized either by replacing some existing pulping and bleaching techniques like bio-pulping, biobleaching, TCF (Total Chlorine Free bleaching), ECF (Elemental Chlorine Free bleaching) and ozone bleaching or by treatment of the effluent by physico-chemical or biological methods. The data bank generated herein by this monitoring study of pulp and paper mill effluent are collected from Agro-based and one from wood based could successfully be used in prediction of their toxicity and effective management. Agarwal et al., [2] studied to provide an informative data and helps to understand water characteristics and indicate that the water of Bihar River can serve as a good habitat. The pH value indicates the alkaline water of in the month of May might be due to high temperature that indicates the solubility of CO2. The analysis of the quality parameters of water from Baba Ghat of Bihar River shows that pH, alkalinity, chloride ion, total hardness, BOD and COD etc. are well within the permissible limit. Hence proper strategies should be designed to counter. Vyas et al. [3] studied that the most of the fresh water bodies all over the world are getting polluted due to domestic waste, sewage, and industrial waste, agricultural and religious activities like idol immersion. Central Pollution Control Board [4] has formulated a comprehensive set of guidelines on the practice of idol immersion in lakes, rivers and seas (CPCB, Guidelines for Idol Immersion, 2006). These guidelines delineate and specify the role of the state pollution control boards in conducting water quality assessments of water bodies and classifying them on the basis of certain physiochemical parameters. These guidelines if followed and acted upon can help in bringing tremendous International Journal of Engineering Science Invention Research & Development; Vol. I Issue IX March 2015 www.ijesird.com e-ISSN: 2349-6185 Dr.Seema Tiwari ijesird, Vol. I (IX) March 2015/ 323 change in the water quality of river post idol immersion. According to Tamot et al.,[5] DO is the most important parameter to study the quality of water and is required for the metabolism of all aquatic organisms was found to be Nil at seven sites. Ganai and Parveen [6] concluded that the most important factors affecting the phytoplankton distribution are water temperature, CO2, chloride, transparency, TDS, alkalinity and dissolved oxygen.

Selection and collection of sample

The objective of sampling is to collect representative sample. Representative sample by means a sample in which relative proportions or concentration of all pertinent components will be the same as in the material being sampled. Moreover, the same sample will be handled in such a way that no significant changes in composition occur before the tests are made. The sample volume shall optimal small enough that it can be transported and large enough for analytical purposes.

The water sample is collected from different field areas well & bore sample, lakes, damp, local hand pump, water dank, open well collected separately from area. Which color or past management the water sample which are collected and denoted by 1, 2, 3, 4, 5 and 10. Total 10 samples are collected for different area around the Pokhari, Tehsil & District Buldana.

Name of farmers in Pokhari, Tehsil & District Buldana

Sr. No.	Name of farmer	Type of source
1.	Mr. Ramdas Rajput	Well Water
2.	Mr. Dayram Brahmne	Bore well
3.	Mr. Ramesh kulkarni	Well Water
4.	Mr. Prakash Shelke	R.O. water
5.	Mr. Ramdas Wayal	Bore well
6.	Mr. Dadarav Ambekar	Bore well
7.	Mr. Sureshrav Deshmukh	Well Water
8.	Mr. Aasaram More	R.O.Water
9.	Mr. Rajesh Lahane	Bore well
10.	Mr. Nitin Pawar	Well Water

Materials and methods of analysis

1) Color: - Principle

The method is useful in the field by comparing the color of sample with a comparator. When viewed by transmitted light through a depth of several feet, pure water exhibits a light blue color which may be altered by the presence of organic matter to greenish blue, green, greenish yellow, yellow or brown.

2) Temperature: - Temperature was measured at the time of sample collection with a good mercury filled Celsius thermometer, having a scale marked for every 0.1°C.

3) pH: The pH of a solution is measured as negative logarithm of hydrogen ion concentration. At a given temperature, the intensity of the acidic or basic character of a solution is indicated by pH or hydrogen ion concentration. pH values from 0 to 7 are diminishing acidic, 7 to 14 increasingly alkaline and 7 is neutral.

4) Chloride:- Chloride was determined by argentometric method. 1.0ml of 5% potassium chromate solution was added to 20.0ml of the sample and titrated with standard 0.014N $AgNO_3$ solution till the color changed to reddish brown. mg Cl/l = (A-B) x N x 35450/vol. of sample Where A = vol. of $AgNO_3$ consumed for sample B = vol. of $AgNO_3$consumed for blank N = normality of $AgNO_3$.

5) Alkalinity: - Procedure

a. Take 25 ml sample in a conical flask and add 2-3 drops of phenolphthalein indicator.

b. If pink color develops titrate with 0.02N H_2SO_4 till disappears or pH is 8.3. Note the volume of H_2SO_4 required.

c. Add 2-3 drops of methyl orange to the same flask, and continue titration till yellow color changes to orange. Note the volumes of H_2SO_4 required.

d. Alternatively, perform potentiometric titration to preselected pH using appropriate volume of sample and titration assembly. Titrate to the end point pH without recording intermediate pH.

Alkalinity was determined by acid – base titration method. 20.0 ml of the sample was taken in a 250.0 ml conical flask and titrated with standard 0.1N sulphuric acid by using phenolphthalein and methyl orange 10 indicators. Phenolphthalein alkalinity registered total hydroxide and one half of the carbonate present in the sample. Methyl orange was used to determine total alkalinity.

Total alkalinity, mg C_aCO_3/ l = AxBx50,000 /vol. of sample

Where A = Volume of acid consumed (ml) with methyl orange as indicator B = Normality of standard acid solution Carbonate as

CO_3 -(mg /l) = Phenolphthalein alkalinity(as mg CaCO3) x 1.2

Bicarbonate as HCO_3^- (mg/l) = (Total alkalinity - 2 x phenolp. alk.) x 1.22

6) Hardness In the total hardness determination, the water samples were first buffered to a pH of 10.0 with ammonia buffer and 2 or 3 drops EBT indicator was added. The indicator reacts with calcium and magnesium ions to yield a wine red colored complex. As EDTA is added, it combines with free calcium and magnesium ions in the sample to produce EDTA – calcium and EDTA – magnesium complexes.

Hardness as mg $CaCO_3$ = A x B x mol. wt. of $CaCO_3$ x 1000/vol. of sample where A = Volume of EDTA consumed (ml); mol. wt. of $CaCO_3$=100;

B = concentration of EDTA

7) Dissolved Oxygen

1. Collection of samples- The samples were collected using special BOD bottles (glass bottles with a hurtle neck and a ground glass stopper). The bottles were directly filled by dipping them in the wells or by filling them up to the brim without any air bubbles. The sample bottle was submerged and allowed to fill without

allowing air to mix with the sample. The bottle was completely filled and kept submerged until the cap was firmly in place Measurement of DO- To the sample collected in 300ml bottle, 1.0ml of 0.414M $MnSO_4$ solution was added followed by 1.0ml alkali-iodide-azide (NaOH, NaI, NaN3) reagent. The solution was mixed by inverting the bottle a few times. When precipitate had settled sufficiently 1.0ml conc.H_2SO_4 was added to clear supernatant liquid above the manganese hydroxide flock. The bottle was restoppered and the contents were mixed by inverting several times until dissolution was complete. 200.0ml mixture solution was titrated with 0.025M hypo solution to pale straw color. A few drops of starch solution were added and titration was continued up to first disappearance of blue color.

8) Electrical conductivity (EC):- Conductivity is the capacity of water to carry an electrical current and varies both with number and types of ions in the solutions, which in turn is related to the concentration of ionized substances in the water. Most dissolved inorganic substances in water are in the ionized form and hence contribute to conductance.

Result and discussion: -

Drinking and agriculture water from different source were analyzed by following parameter.

1) Color: Color of water sample found to be colorless.

2) **Taste:** Taste of different water sample has sweetest and salty test.

3) **Temperature:-** Temperature of water sample was found to be 24.5 to 28.4^{0}c.

4) pH: The amount of pH present in the water sample was found to be in between range of 7.2 to 7.4 The normal pH is 6.5 to 8.5 .

5) Chloride: The amount of chloride ion present in the water sample was found to be in between 42.76 to 20.16 mg/lit.

6) Alkalinity: The amount of total Alkalinity present in the water sample was found to be in between range of 489 to 546 ppm.

7) Hardness: Hardness in water is mainly caused by Ca and Mg although Fe and Mg also contribute to actual hardness. The value are found to be the ranges is 281 to 320.

8) **DO:** All sample are analyzed for DO and the value are found to be the range of 9.4 to 9.2 ppm

9) CND: The conductivity of a given 10 sample the range 375 to 327 s/m

10) SAL: The amount of SAL present in the water sample was found to be in between range of 000.1 to 000.9 ppm.

11) TDS: The amount of TDS present in the water sample was found to be in between range of 281 to 318 ppm

Table: water quantity of physical parameters chemical parameters of water sample of Pokhari, Tehsil & District Buldana

Parameter	Water sample (Include the farmer of sample)				
	Bore well	Well water	RO water	Well water	Bore well
1) Color	Colorless	Colorless	Colorless	Colorless	Colorless
2) Test	Salty	Sweetish	Sweetish	Sweetish	Salty
3) Temperature	24.5^{0}c	25.1^{0}c	26.8^{0}c	27.5^{0}c	25.5^{0}c
4) pH	7.2	7.5	7.2	7.6	6.4
5) Chloride	42.76	34.13	27.31	33.21	83.16
6) Alkalinity	489	653	710	562	754
7) Hardness	281	395	431	276	318
8) DO	9.4	7.8	5.4	3.2	2.6
9) CND	375	475	432	529	348
10) SAL	000.1	000.3	000.2	000.5	000.8
11) TDS	281	395	431	276	318

Discussion:

1. Temperature varies in the range of 24.5^{0}C to 29.5^{0}C .Maximum temperature is found in Pokhari due to presence of Effluents.

2. The pH Values varies from 6.4 TO 7.8 the Desirable limit of Indian Standard is 6.5 to 8.5.It is observed that the values of PH is in the Desirable limit.

3. Dissolved Oxygen ranges from 2.6 to 9.4 mg/lit, D.O. indicating the pure symptoms.

4. The values of Total Dissolved Solid ranges in between 270 to 433 mg/lit, and all the values are in Desirable limit of Indian Standard, Because of high Dissolved Salts of Ca and mg and it requires cation and anion analysis.

5. Alkalinity ranges from 264 to 432 mg/lit. All the values of Alkalinity are in the Permissible limit of I.S. Alkalinity is the cause of Carbonate and Bi –carbonate.

6. The value of Chloride ranges from 17.5 to 222 mg/lit. It is observed that the all values of Chloride are below the Desirable limit I.S.

7. Total Hardness ranges between 230 to 740 mg/lit, maximum values of Total Hardness are below Permissible limit of I.S.

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संसदीय लोकशाहीची वाटचाल : महाराष्ट्राचा विशेष संदर्भ

श्री. पी. एन कपले
संशोधक
जी. व्ही. एम. ज्यु. कॉलेज, मलकापुर

श्री. डॉ. श्रीराम येरणकर
मार्गदर्शक
जिजामाता महाविद्यालय, बुलढाणा

सारांश –
भारताच्या संसदीय लोकशाहीच्या यशस्वी वाटचालीतील महाराष्ट्र राज्याच्या संसदीय लोकशाहीचा अभ्यास करणे आवश्यक आहे. महाराष्ट्र राज्याची १९६६० पासूनची राजकीय प्रकिया, राजकारण,विधिमंडळाचे कामकाज,अध्यक्षांची भूमिका व कार्य अभ्यासणे विशेषत: संसदीय लोकशाहीचा संदर्भात चिकित्सक विश्लेषण करणे क्रमप्राप्त ठरते.

प्रस्तावना –
आपण सर्व भारतीय स्वातंत्र्याची ७५ वर्ष पूर्ण झाल्याने स्वातंत्र्याचा अमृत महोत्सव साजरा करत आहोत. भारतात आज एकूण २८ घटकराज्ये आहेत. संसदीय लोकशाही नुसार संपूर्ण भारतीय संघराज्यात शासनकारभार सुरू आहे. संविधनात्मक तरतूदीनुसार महाराष्ट्र या राज्यात देखील अशा प्रकारे संसदीय लोकशाहीनुसार शासनकारभार व राज्यव्यवस्थाआहे. महाराष्ट्र हे भारतातील एक प्रगत, संपन्न व पुरोगामी राज्य म्हणून ओळखलेजाते. १ मे १९६० रोजी नव्या महाराष्ट्र राज्याचा उदय झाला. मराठी भाषिक समाज एक आहे. तो एका विस्तीर्ण प्रदेशात राहतो.भारताचा तो एक अविभाज्य घटक असला तरी त्याचे स्वत:चे वेगळे व्यक्तिमत्व आहे. या व्यक्तिमत्वाला राजकीय स्वायत्ततेची जोड मिळावी अशी इथल्या लोकांची इछा होती. त्यानुसार१ मे १९६० रोजी स्वायत्त राज्यव्यवस्थेचे स्वप्न पूर्ण झाले. म्हणजेच महाराष्ट्र राज्य अस्तित्वात आले. विदर्भ, मराठवाडा, खान्देश, कोकण, मुंबई या कुठल्याही भागातल्या माणसाला हे राज्य आपले आहे., त्यावर आपला अधिकार आहे. अशी कमी अधिक जाणीव झाली आहे. मराठी भाषा, वारकरी सांप्रदाय आणि इतिहासकालीन परंपरा या वौशिष्ट्यांमुळे महाराष्ट्राला स्वत:चे वेगळे व्यक्तिमत्व प्राप्त झाले आहे. राजकीय व सामाजिक चळवळी तसेच विविध राष्ट्रीय स्वरुपाचे नेते, समाजसुधारक, संत परंपरा हे महाराष्ट्राच्या भूमीने भारताला दिलेले योगदान आहे.

अशा या वैशिष्ट्यपूर्ण महाराष्ट्र राज्याची भारतीय राजकीय व्यवस्थेच्या, संघराज्याच्या, संसदीय लोकशाहीच्या पार्श्वभूमीवर वाटचाल अभ्यासणे. महाराष्ट्रातील विधिमंडळ, निवडणुका, राजकीय पक्ष, विधानसभा, विधानसभा अध्यक्षांची पक्षातीत न्याय्य व समतोल भूमिका, आघाडीचे राजकारण ई. संपूर्ण आढावा व अभ्यास करण्याचा प्रयत्न प्रस्तुत शोधनिबंधातूनकेला आहे.

शोधनिबंधाची उद्दिष्ट्ये – प्रस्तुत संशोधनाची पुढील उद्दिष्ट्ये आहेत.

१) संसदीय लोकशाहीचा अभ्यास करणे.
२) १९६० पासून महाराष्ट्राची राजकीय स्थिति अभ्यासणे.
३) महाराष्ट्र विधिमंडळच्या संविधानिक तरतूदिंची चर्चा करणे.
४) महाराष्ट्र विधानसभा अध्यक्षांची पक्षातीत न्याय्य व समतोल भूमिका अभ्यासणे.
५) महाराष्ट्र विधानसभा अध्यक्षांची परंपरा अभ्यासणे.
६) महाराष्ट्रातील राजकीय पक्षांच्या बदलत्या वैचारिक भूमिकेचे अध्ययन करणे.

गृहीतके –

१) महाराष्ट्रात संसदीय लोकशाही यशस्वी झाली आहे.
२) १९६० ते २०२१ महाराष्ट्रात पक्षपद्धतीत परिवर्तन होत गेले.
३) संविधानिक तरतुदिनुसार महाराष्ट्रात विधिमंडळाचे कामकाज चालत आहे.
४) महाराष्ट्र विधानसभा अध्यक्ष हे संसदीय परंपरा व तत्वानुसार पक्षातीत, न्याय्य व समतोल भूमिका नुसार कार्य करतात.
५) महाराष्ट्राला विधानसभेला अध्यक्षांची आदर्श परंपरा आहे.
६) आघाडीच्या राजकरणात राजकीय पक्षांच्या तडजोडी महत्वाच्या झाल्या पक्षांची धोरणे व विचारप्रणलीचेमहत्व कमी झाले.

तथ्यसंकलन – प्रस्तुत शोधनिबंधाच्या लेखनासाठी दुय्यम तथ्य संकलन पद्धतिचा उपयोग केला आहे. भारतीय संविधान, भारतीय शासन व राजकारण, महाराष्ट्राचे शासन व राजकारणावरील संदर्भग्रंथ महाराष्ट्राची संसदीय लोकशाही, निवडणुकावरील विश्लेषकांचे लेख, मराठी विश्वकोष, इंटरनेट, वेबसाईड आदि तथ्यांचा उपयोग केला आहे.

संशोधन पद्धती – प्रस्तुत शोध निबंध हा संसदीय लोकशाहीची वाटचाल महाराष्ट्राचा विशेष संदर्भ या शीर्षकाच्या अनुषंगाने सादर करण्यात आला आहे. सामाजिक संशोधन पद्धतीतील विश्लेषणात्मक, वर्णनात्मक व ऐतिहासिक शोध पद्धतीचा उपयोग या शोध निबंधातात केला आहे.

शोधनिबंधाची व्याप्ती – प्रस्तुत शोधनिबंधात महाराष्ट्रातील प्रमुख राजकीय पक्ष, त्यांची सत्तास्पर्धा, निवडणुका, विधिमंडळ तरतुदी, विधानसभेचे अधिकारी एकंदर महाराष्ट्रातील संसदीय लोकशाहीच्या वाटचालीची मांडणी करण्याचा प्रयत्न केला आहे.

संसदीय लोकशाही – लोकशाही ही जगातील बहुतांश ठिकाणी स्विकारलेली प्रभावशाली विचारप्रणालीआहे. एकविसाव्या शतकात या प्रभुत्वाचा अविष्कार वेगवेगळ्या रूपांनी होत आहे. जगभरातले लोकशाही शासनपासून दूर राहिलेले प्रदेश लोकशाहीच्या प्रभाव कक्षेतयायला लागली आहे. शासन व्यवहारांच्या लोकशाही करणांचे नवे प्रयोग करण्याविषयीप्रयत्न सुरू आहे. लोकशाही म्हणजे, प्रौढ मतधिकाराच्या आधारे, खुल्या व निःपक्षपाती निवडणुकांद्वारा लोकांनी निवडून दिलेल्या प्रतिनिधींद्वारे चालणारे राज्य. लोकशाही हा 'डेमॉक्रसी' या इंग्रजी संज्ञेचा मराठी प्रतिशब्द. डिमॉस म्हणजे सामान्य लोक आणि क्रसी म्हणजे सत्ता. अथेन्समध्ये लोकशाही राज्यपद्धतीचं बीज आढळतात ग्रीकांप्रमाणे प्राचीन रोमनांनी प्रजासत्ताकाद्वारे रोममध्ये लोकशाहीचा प्रयोग केला. लोकशाहीचे प्रत्यक्ष आणि अप्रत्यक्ष लोकशाही असे दोन प्रमुख प्रकार सामान्यतः मानले जातात. आधुनिक काळात 'लोकशाहीचे' हा शब्दप्रयोग सामान्यपणे अप्रत्यक्ष लोकशाही या अर्थानेच केला जातो. पण स्विट्झर्लंड आणि ऑस्ट्रेलिया या दोन देशातून मात्र प्रत्यक्षलोकशाही अस्तित्वात आहे.

India is a Parliamentary Democratic Republic in which the President of Indiais the head of state and the Prime Minister of India is the head of government. It isbased on the federal structure of government, although the word is not used in theConstitution itself. अशी संसदीयलोकशाही भारतात आढळते.

ऐतिहासिक पार्श्वभूमी – महाराष्ट्र राज्याची निर्मिती १९६० मध्ये झाली. पण त्यापुर्वीच्या काळातील अनेक विचारप्रवाह, घडामोडी यांचा प्रभाव साठ नंतरच्या राजकारणावर आढळतो. एकोणिसाव्या शतकातील सुधारणा चळवळ आणि महात्मा फुले यांच्यापासून सुरु झालेली जातीविरोधी चळवळ यांचा महाराष्ट्रातील राजकीय जीवनावर खोलवर परिणाम झाला. जातीविरोधी चळवळ, ब्राम्हण व ब्राम्हणेत्तरांची राजकीय आघाडी आणि संयुक्त महाराष्ट्र समितीची राज्यनिर्मितीची चळवळ हे १९६० पूर्वीच्या महाराष्ट्राच्या राजकारणातले प्रमुख टप्पे होते. १९६० नंतरच्या महाराष्ट्राच्या राजकीय वाटचालीला जी पार्श्वभूमी लाभली, ती याप्रमाणे व्यक्त होते.

महाराष्ट्र विधानसभेची रचनासंवैधानिक तरतुदी – राज्य विधानमंडळ हेराज्यपाल व प्रत्येक राज्याकरता क) आंध्रप्रदेश, बिहार,तेलंगना, महाराष्ट्र, कर्नाटक आणि उत्तरप्रदेश या राज्यामध्ये दोन, ख) अन्य राज्यामध्ये एक सभागृह मिळून ते बनलेले असेल. जेथे राज्याच्या विधानमंडळास दोन सभागृहे असतील तेथे एक विधानपरिषद म्हणून आणि दुसरे विधानसभा म्हणून ओळखले जाईल आणि जेथे केवळ एक सभागृह असेल तेथे ते विधानसभा म्हणून ओळखले जाईल. राज्यांमधील विधान परिषदा नाहीशा करणे किंवा निर्माण करणे. १६९(१) अनुच्छेद १६८ मध्ये काहीही असले तरी विधानपरिषद असलेल्या राज्यात अशी विधानपरिषद नाहीशी करण्याकरीता आपण अशी विधानपरिषद नसलेल्या राज्यात अशी विधानपरिषद निर्माण करण्याकरीता त्या राज्याच्या विधानसभेने सभागृहाच्या एकूण सदस्य संख्येच्या बहुमताने आणि सभागृहातील उपस्थित असलेल्या व मतदान करणाऱ्या सदस्यांच्या दोन तृतीयांशाहून कमी नाही इतक्या बहुमताने तशा आशयाचा ठराव पारित केल्यास संसदेस कायदयाद्वारे उपबंध करता येईल. (३) कलम ३६८ च्या प्रयोजनाकरीता पूर्वोक्त असा कोणताही कायदा हा या संविधानाचे विशोधन असल्याचे मानले जाणार नाही. विधानसभांची रचना कलम १७०. (१) अनुच्छेद ३३३ च्या उपबंधाच्या अधिनतेने प्रत्येक राज्याची विधानसभा राज्यामधील क्षेत्रीय मतदार संघामधून प्रत्यक्ष निवडणूकीद्वारे निवडलेले जास्तीत जास्त पाचशे व कमीत कमी साठ इतके सदस्य मिळून बनलेली असेल, (२) खंड (१) च्या प्रयोजनार्थ प्रत्येक राज्य अशा रितीने क्षेत्रीय मतदार संघामध्ये विभागण्यात येईल की, प्रत्येक मतदारसंघाचा लोकसंख्या व त्यास वाटून दिलेल्या जागांची संख्या यांचे गुणोत्तर,व्यवहार्य असेल तेथवर राज्यात सर्वत्र सारखेच असेल. महाराष्ट्र राज्य विधिमंडळात वरील तरतुदीनुसार राज्यपाल, विधानसभा व विधानपरिषद यांचा समावेश होतो.

महाराष्ट्र विधानसभा अध्यक्ष भूमिका वे कार्य – संविधानाच्या १७८ कलमातील तरतुदीप्रमाणे प्रत्येक राज्याची विधानसभा निवडणुकीनंतर लवकरच दोन सदस्य अनुक्रमे अध्यक्ष व उपाध्यक्ष म्हणून निवड करेल.संविधानिक तरतुदी व संसदीय लोकशाहीच्या तत्त्वाप्रमाणे तसेच भारतीय संसदेतील आदर्श परंपरा नुसार महाराष्ट्र विधानसभेत देखील अध्यक्षांनी पक्षातीतपणे, समतोल व न्याय्य भूमिकेतून कार्य करावे अशी रास्त अपेक्षा संविधान निर्माण करताना होती. महाराष्ट्र राज्यामध्ये आजपर्यंत १९३७ पासून जवळजवळ १९ विधानसभेचे अध्यक्ष होऊन गेलेले आहेत. १९ जुलै १९३७ रोजी तत्कालीन बॉम्बे स्टेट विधानसभेची पहिली बैठक संपन्न झाली त्यानंतरच्या सुमारे ८५ वर्षांच्या या गौरवशाली कारकिर्दीमध्ये सर्व श्री. गणेश वासुदेव मावळकर, कुंदनमल फिरोदिया, डि. के. कुंटे, सयाजी सिलम, बाळासाहेब भारदे, शेषराव वानखेडे, बाळासाहेब देसाई, शिवराज पाटील, प्राणलाल व्होरा, शरद दिघे, शंकरराव जगताप, मधुकरराव चौधरी, दत्ताजी नलावडे, अरुणभाई गुजराथी, बाबासाहेब कुपेकर, दिलीप वळसे-पाटील, हरीभाऊ बागडे, नाना पटोले, भास्करराव जाधव अशा सर्वांची विधानसभा अध्यक्ष म्हणून थोर परंपरा महाराष्ट्र विधानसभेला लाभली आहे. यासर्वांनी आपल्या कार्याने महाराष्ट्र विधानसभेत संस्मरणीय व आदर्श परंपरा निर्माण करुन विधीमंडळाची, राज्याची, संसदीय लोकशाहीची एकुणच संपूर्ण भारत देशाची प्रतिष्ठा वाढवली आहे.

महाराष्ट्राची राजकीय वाटचाल – महाराष्ट्र राज्याची स्थापना १९६० मध्ये झाल्यामुळे तेथपासून राजकारणाचे नवे पर्व सुरु झाले असले, तरी खरे तर १९५६-५७ पासूनच महाराष्ट्राच्या राजकारणातील काँग्रेस वर्चस्वाची चौकट उदयाला येत होती. काँग्रेसचे हे वर्चस्व अखिल भारतीय पातळीवरही होते. १९६७ मध्ये उत्तर भारतात काँग्रेसच्या वर्चस्वाला धक्के बसू लागले, तरी महाराष्ट्रात १९७५-७६ पर्यंत काँग्रेस वर्चस्व अबाधित राहिले. १९५७ मध्ये यशवंतराव चव्हाण मुख्यमंत्री झाले. त्यानंतर त्यांनी महाराष्ट्रातील काँग्रेसची सत्ता बळकट करण्यावर भर दिला.तसेच ''बहुजन समाजाची सत्ता'' आणि ''बेरजेचे राजकारण'' या दोन वैशिष्ट्यांनी काँग्रेस वर्चस्व टिकून राहिले. एकंदर १९५७ ते १९७५-७६ या काळात महाराष्ट्रातील राजकीय स्पर्धा ही मराठा समाजाचे पुढारीपण, सहकारी संस्थांचा आधार व बहुजन समाजाची सत्ता अशी वैचारिक भूमिका यांच्या चौकटीत घडली. त्यामुळेच १९७१-७२ च्या सुमारास इंदिरा गांधींच्या नेतृत्वाची वावटळ येऊनही मराठा नेतृत्व, सहकारी संस्थांचे जाळे, स्थानिक राजकारणाचा पाया इ. महाराष्ट्राच्या राजकारणाची वैशिष्ट्ये चिवटपणे टिकून राहिली.

इंदिरा गांधींच्या व्यूहरचनेत राज्यपातळीवरील मजबूत नेतृत्वाला स्थान नव्हते. शरद पवार यांनी त्यावर मात करण्यासाठी इंदिरा गांधींचे नेतृत्व झुगारुन देण्याचामार्ग १९७८ ते १९८५ या काळात स्विकारला. नेमक्या या प्रयत्नातच मराठा नेतृत्वात फुट पडून इंदिरानिष्ठ, वसंतदादांचे अनुयायी व पवारांचे अनुयायी असे तीन गट पडले. त्यातून १९७७-७८ नंतर महाराष्ट्राच्या राजकारणाला कलाटणी मिळाली व पुढे जवळजवळ आघाडीच्या राजकारणाला प्रारंभ झाला.

१९७८ मध्ये महाराष्ट्रातील काँग्रेस पक्षात फूट पडून इंदिराविरोधक गटाचे ६९ आमदार निवडून आले. त्यापैकी ४८ आमदार हे मराठा समाजाचे

होते (२/३). इंदिरानिष्ठ आमदारांची संख्या ६२ होती व त्यात २१ आमदार मराठा होते. जनता पक्ष या नव्यानेच स्थापन झालेल्या पक्षात महाराष्ट्रातील समाजवादी व जनसंघाचे पाठीराखे हे प्रामुख्याने होते. या पक्षाला तेव्हा ९९ जागा मिळाल्या. पण पुढे या पक्षाला आपले बळ टिकविताआले नाही.

१९७८ नंतरच्या बदलत्या राजकीय परिस्थितीत महाराष्ट्राचे राजकारणातील स्पर्धात्मकता प्रचंड प्रमाणावर वाढली. कोणत्याही पक्षाचे यश गृहीत धरुन चालता येणार नाही अशी स्थिती उद्भवली. सत्ता आलटून पालटून विविध पक्षांकडे जात राहिली हेच भारताच्या संसदीय लोकशाहीचे यश आहे. प्रथमच बिगर काँग्रेस पक्ष १९७८ मध्ये सत्तेत सहभागी झाले. जनता पक्षाखेरीज शे. का. पक्ष हाही बाटेकरी झाला. उलटपक्षी १९७८ ला प्रथमच काँग्रेस पक्षाच्या कार्यकर्त्यांना सरकार विरोधाचे राजकारण करावे लागले. प्रथम इंदिरा काँग्रेसला (१९७८-८०) तर १९८० पासून दिर्घकाळ पवारांच्या अनुयायांना महाराष्ट्रात विरोधी पक्षाच्या भूमिकेत वावरावे लागले. त्यामुळे काँग्रेस विरोधी म्हणजे बिगर काँग्रेसवादाचे राजकारण बाजूला पडून नवे राजकीय आकृतीबंध साकार होत राहिले.

महाराष्ट्र विधानसभा निकाल-२००४, २००९, २०१४ व २०१९ (प्रमुख राजकीय पक्ष)

पक्ष	२००४	२००९	२०१४	२०१९
काँग्रेस	७१	८२	४२	४४
राष्ट्रवादी	७१	६२	४१	५४
भाजपा	५४	४६	१२१	१०५
शिवसेना	६१	४५	६३	५६

महाराष्ट्रविधीमंडळसचिवालय, विधानभवन, मुंबई.

आघाडीचे राजकारण – १९८६ नंतर शरद पवार व त्यांचा काँग्रेस पक्ष इंदिरा काँग्रेसमध्ये सामील झाला. त्याच सुमारास शिवसेनेचा राज्य पातळीवरील पक्ष म्हणून उदय झाला. परिणामी काँग्रेस (एस) च्या गैरहजेरीमुळे निर्माण होऊ पाहणारी पोकळी शिवसेनेने (भाजपाबरोबर) भरुन काढली. मुख्यतः मराठवाडा व विदर्भात सेनेचा विस्तार झाला व १९९० मध्ये शिवसेना हा सर्वात मोठा विरोधी पक्ष बनला. स्पर्धात्मक राजकारणाचा व बहुपक्षीय, आघाडीच्या राजकारणाचा हा पुढचा टप्पा मानता येईल. तिसरा टप्पा १९९५ मध्ये सेना-भाजपच्या विजयाने गाठला गेला. याच वेळी काँग्रेस पक्षात अभूतपुर्व बंडाळी होऊन बंडखोर काँग्रेस आमदार मोठ्या संख्येने (३५) निवडून आले. महाराष्ट्रात इतर पक्षांची वाताहत झाली, परंतु दोन्ही काँग्रेस पक्ष आणि सेना-भाजप एवढेच प्रमुख पक्ष राज्यात अस्तित्वात राहिले.

वाढत्या स्पर्धात्मकतेमुळे एकपक्षीय सरकारांचा जमाना मागे पडला. प्रथम दोन पक्षांचे सरकार (१९७८), मग पुरोगामी लोकशाही दलाचे बहुपक्षीय सरकार (१९७८-८०), त्यानंतर काँग्रेस व रिपब्लीकन पक्ष यांचे सरकार (१९९०-९५), सेना-भाजप आणि अपक्ष यांचे युती सरकार (१९९५-९९), दोन्ही काँग्रेस, शे. का. पक्ष, बहुजन महासंघ, अपक्ष इत्यादींचे लोकशाही आघाडीचे सरकार (१९९९) व पुन्हा दोन काँग्रेस पक्षांचे सरकार (२०००, २००४, २००९) त्यानंतर पुढे सेना-भाजप युतीचे सरकार (२०१४) व आज दोन्ही काँग्रेस पक्षांसह शिवसेनेचे महाविकास आघाडी सरकार (२०१९) अशी आघाडयांची सरकारे येत राहिली. अर्थातच आघाडयांच्या राजकारणामुळे राजकीय तडजोडी महत्वाच्या बनल्या. राजकीय पक्षांची ध्येयधोरणे, कार्यक्रम, भूमिका आणि विचारप्रणाली यांचे महत्व कमी झाले. तीव्र सामाजिक विषमता असलेल्या समाजात अशा प्रकारचे आघाड्यांचे राजकारण व सहमतीचे राजकारण हे वर्चस्वाच्या व्यवहारांना फायदेशीरच ठरते. एकीकडे आघाडीच्या राजकारणाने स्पर्धात्मकता तीव्र होतानाच धोरण विषयक बाबी संकुचित होत जाऊन लोकशाही अवकाश प्रत्यक्षात सिमीत होतो. हे बहुपक्षीय आणि आघाडयांच्या राजकारणात एक वैशिष्ट्य असते (पळशीकर-देशपांडे २००३). त्याची प्रचिती महाराष्ट्राच्या बदलत्या राजकारणातून येते.

Today the three-party alliance forming the government is surely a turning point in Maharashtra politics. The Sena has an urban face, while the Congress, NCP are largely rural parties. Hence they can have a strong combination. The BJP, on the other hand, will get the benefit of occupying the entire opposition space, said Hemant Desai, a political analyst. (Hindustan Times).

समारोप –

स्वातंत्र्याच्या अमृत महोत्सवाच्या पार्श्वभूमीवर भारतीय संसदीय लोकशाहीची वाटचाल महाराष्ट्राचा विशेष संदर्भ अभ्यासताना महाराष्ट्र राज्याची एकूणच राजकीय स्थिती मांडण्याचा प्रयत्न केलेला आहे. महाराष्ट्रात विविध राजकीय पक्षांनी १९६० पासून निवडणुकीच्या माध्यमातून संसदीय लोकशाहीची वाटचाल यशस्वी केलेली आहे. सुरुवातीला १९७८ पर्यंत काँग्रेस वर्चस्वाचा काळ असून त्यानंतर मात्र आघाडीचे राजकारणाची सुरुवात झाली ती आजही कायम आहे. संसदीय लोकशाहीच्या तत्त्व व परंपरेनुसार विधानसभेचा ही कारभार सुरू असून लोकप्रतिनिधींनी महाराष्ट्रात विविध आदर्श परंपरा निर्माण करण्याचा प्रयत्न केला आहे. अलीकडे मात्र आघाडीच्या राजकारणामुळे विचारप्रणालीचा अंत झालेला दिसतो आहे. तत्त्वशून्य तडजोडी, पक्षांतर, धोरणाची अस्थिरता सतत महाराष्ट्राच्या राजकारणात दिसत आहे. वैचारिक वारसा, धोरण विश्व आणि लोकशाही राजकारण या बाबतीत महाराष्ट्राने चांगले योंगदान दिले आहे. आज महाराष्ट्राचे राजकारण, शासन व्यवहार आणि एकूणच राज्याची स्वप्न या सर्वांची नवकल्पना करण्याचा क्षण आहे. अशी कल्पकता दाखवण्याची क्षमता आपल्या राजकारणात आहे का? हा खरा प्रश्न आहे. कोरोना महामारीत दगावलेल्या व्यक्तींचे स्मरण ठेवून आरोग्य, शिक्षण, उपजीविका आणि पोलीस या अशा विविध क्षेत्रांमध्ये तातडीने लक्ष देणे आवश्यक आहे. राज्याच्या राजकारणातील स्पर्धा वाढल्यामुळेही सर्व पक्ष आर्थिक, सामाजिक, सांस्कृतिक अशा सर्वच क्षेत्रात साधारणपणे एक सारखेच वर्तन करताना दिसतात. त्यामुळे महाराष्ट्राचं राजकारण हे बिनचेहऱ्याचं ही बनू पाहात आहे असं वाटते. महाराष्ट्र विधानसभेचे संदर्भात अध्यक्षांची भूमिका ही गौरवास्पद आहे. विधानसभेचे कामकाज पाहताना अध्यक्षांनी समतोल, पक्षातीत व न्याय्यअशा प्रकारची भूमिका ठेवण्याचा प्रयत्न केलेला दिसतो अलीकडे मात्र यामध्ये कमी अधिक पक्षीय अभिनिवेश आलेला दिसतो. खऱ्या अर्थाने संसदीय लोकशाही यशस्वी होण्यासाठी विधानसभेच्या कामकाजही अधिक योग्य पद्धतीने चालणे आवश्यक आहे.

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३) ११ वी. १२ वी,१३. वी,१४ वी विधानसभा,महाराष्ट्र विधानमंडळ सचिवालय,विधान भवन,मुंबई.
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१४. भारतीय लोकशाही समोरील आव्हाने

श्री. पी. एन. कपले
संशोधक विद्यार्थी, गो.वि.म.क. महाविद्यालय, मलकापूर.
श्री. डॉ. श्रीराम येरणकर
मार्गदर्शक, जिजामाता महाविद्यालय, बुलडाणा.

सारांश

जगातील सर्वात मोठा लोकशाही देश म्हणून भारताची ख्याती आहे. लोकशाही प्रकार, भारतीय संसदीय लोकशाही, त्यापुढील आव्हाने, समस्या, अडचणी अभ्यासणे आवश्यक आहे. गरीबी, बेरोजगारी, भ्रष्टाचार, वैचारिक बैठकीचा अभाव, राजकरणातील गुन्हेगारी, राखीव जागांचा पेच, राजकरणातून साधनशुचिता हरवणे इ. आव्हाने भारतीय लोकशाही समोर प्रामुख्याने अनुभवास येतात. तसेच इतरही आव्हाने या लोकशाही समोर आजपर्यंत आपण अनुभवत आलेलो आहे. या पार्श्वभूमीवर लोकशाही ही एक जीवनपद्धती, विचारप्रणाली, शासनपद्धती आज जगात व भारतात सकारात्मक वाटचाल करते आहे. कारण ती सतत चालणारी एक प्रक्रिया आहे असे दिसून येते.

प्रस्तावना

आपण भारतीय स्वातंत्र्याचे अमृत महोत्सवी वर्ष साजरे करत आहोत. भारताने बादशाही, पातशाही, राजेशाही यांच्या नंतर ब्रिटिश साम्राज्यशाहीशी मुकाबला करून लोकशाही राष्ट्र प्रस्थापित केले. भारतीय राज्यघटनेतील एक महत्त्वाचे मूल्य म्हणून लोकशाहीकडे आपण सारेजण पाहतो. जगातील सर्वाधिक मोठ्या लोकसंख्येची लोकशाही म्हणून भारताची लौकिक राहिलेला आहे. मात्र गेल्या काही वर्षात भारतीय लोकशाही संकोचत असून हुकूमशाही विकृती वाढताना दिसते आहे. शेतकरी आंदोलन ते पेट्रोल दरवाढ आणि प्रचंड महागाई ते वाढती बेरोजगारी, अनाकलनीय व अतार्किक निर्णयांचे गंभीर परिणाम सर्वसामान्य भारतीय नागरिक अनुभवतोच आहे. पण जागतिक माध्यमेही त्याची नोंद घेत आहेत. भरीसभर म्हणून गेल्या 2 वर्षापासून कोरोना संकटामुळे लोकशाहीची एकप्रकारे कुचंबना होत आहे असे दिसते. भारतीय लोकशाही समोर आव्हाने या विषयाची चर्चा करावीशी वाटणे याचा अर्थ ही आव्हाने आहेत हे उघड आहे. भारतीय राज्यघटना आणि त्यातील संसदीय लोकशाही मानणाऱ्या प्रत्येकाला आज ही आव्हाने जाणवत आहेत. भारतीय राज्यघटनेचा आणि राजकरणाचा लोकशाही हा केंद्रबिंदू आहे. आज लोकशाही मार्गाने निवडणुका होत असल्या तरी कारभार मात्र हुकूमशाहीची जोपसना करणारा दिसत आहे. भारतीय राज्यघटनेत स्वातंत्र्य, सार्वभौमत्व, संघराज्यीय एकात्मता, धर्मनिरपेक्षता, समाजवाद, लोकशाही, ही मूलभूत तत्वे म्हणून सरनाम्यात समाविष्ट केली आहेत. मात्र या प्रत्येक मूल्याला आज तडे दिले जात आहेत. ही आव्हाने भारतीय राज्यघटने समोर पर्यायाने या देशाच्या लोकांसमोर आज उभी आहेत. याचाच अर्थ ही सर्व आव्हाने भारतीय लोकशाही समोरील आहेत. अर्थात हे असले तरीही आपण स्विकारलेली संसदीय लोकशाही पद्धत अधिक लोकाभिमुख आहे हे निश्चित. कारण लोकशाही ही केवळ शासन पद्धती नसून ती जीवनपद्धती व प्रक्रिया आहे.

Principal
Jijamata Mahavidyalaya
Buldana

Jijamata Mahavidyalaya Buldana

संशोधनाची उद्दीष्ट्ये

1. लोकशाही संकल्पनेचा अभ्यास करणे.
2. लोकशाहीचे प्रकार समजून घेणे.
3. भारतीय लोकशाहीच्या स्वरूपाचा अभ्यास करणे.
4. भारतीय संसदीय लोकशाही समोरील आव्हानांचा अभ्यास करणे.

संशोधनाची गृहित कृत्ये

1. जगात लोकशाही ही प्रभुत्वशाली विचारप्रणाली ठरली आहे.
2. भारतात संसदीय लोकशाही यशस्वी झालेली दिसत आहे.
3. भारतीय संसदीय लोकशाही समोर अडथळे, आव्हाने आहेत.
4. भारतीय संसदीय लोकशाहीकडून लोकांना खूप अपेक्षा आहेत.
5. लोकशाही ही एक जीवनपद्धती आणि प्रक्रिया आहे.

तथ्य संकलन

प्रस्तुत शोधनिबंधाच्या लेखनासाठी दुय्यम तथ्य संकलन पद्धतीचा उपयोग केला आहे. जगात लोकशाही ही प्रमुख विचारप्रणाली व शासन पद्धती आहे. भारतीय संसदीय लोकशाही, तिच्यासमोरील आव्हाने यावरील विश्लेषकांचे लेख, राज्यशास्त्राच्या अभ्यासकांचे संदर्भ, इंटरनेट वेबसाईट, ब्लॉग आदी तथ्यांचा उपयोग केला आहे.

संशोधन पद्धती

प्रस्तुत शोधनिबंध हा भारतीय लोकशाही समोरील आव्हाने या शिर्षकाच्या अनुषंगाने सादर करण्यात आला आहे. सामाजिक संशोधन पद्धतीतील विश्लेषणात्मक, वर्णनात्मक व ऐतिहासिक शोधपद्धतीचा उपयोग या शोधनिबंधात केला आहे.

शोधनिबंधाची व्याप्ती

प्रस्तुत शोधनिबंध सामाजिक शास्त्रातील राज्यशास्त्र या विषयाच्या भारतीय लोकशाही व त्यासमोरील आव्हाने यासंदर्भात सादर करण्यात आला आहे. लोकशाही ही संकल्पना, लोकशाहीचे प्रमुख प्रकार, भारतीय संसदीय लोकशाही, भारतीय संसदीय लोकशाही समोरील आव्हाने त्या आव्हानांची सखोल व सविस्तर मांडणी करण्याचा प्रयत्न केला आहे. भारतीय संसदीय लोकशाही ही जगातील वैशिष्ट्यापूर्ण व सर्वात मोठी लोकशाही ठरते. कारण भारतात अनेक प्रकारची विविधता आहे. या संबंधी अभ्यासपूर्ण मांडणी केली आहे. एकंदर भारतीय लोकशाही, तिच्या समोरील आव्हाने स्पष्ट केलेली आहे.

लोकशाही

लोकशाही ही जगातील बहुतांश ठिकाणी स्विकारलेली प्रभावशाली विचारप्रणाली आहे. एकविसाव्या शतकात या प्रभुत्वाचा अविष्कार वेगवेगळ्या रूपांनी होत आहे. जगभरातले लोकशाही शासनपासून दूर राहिलेले प्रदेश लोकशाहीच्या प्रभाव कक्षेत यायला लागली आहे. शासन व्यवहारांच्या लोकशाही करणांचे नवे प्रयोग करण्याविषयी प्रयत्न सुरू आहे. लोकशाही म्हणजे प्रौढ मतदाराच्या आधारे, खुल्या व निःपक्षपाती निवडणुकांद्वारा लोकांनी

निवडून दिलेल्या प्रतिनिधींद्वारे चालणारे राज्य. लोकशाही हा **'डेमॉक्रसी'** या इंग्रजी संज्ञेचा मराठी प्रतिशब्द. डिमॉस (Demos) म्हणजे सामान्य लोक आणि क्रसी (Cracy) म्हणजे सत्ता. अथेन्समध्ये लोकशाही राज्यपद्धतीचं बीज आढळतं. ग्रीकाप्रमाणे प्राचीन रोमनांनी प्रजासत्ताकाद्वारे रोममध्ये लोकशाहीचा प्रयोग केला. लोकशाहीचे प्रत्यक्ष आणि अप्रत्यक्ष लोकशाही असे दोन प्रमुख प्रकार सामान्यतः मानले जातात. आधुनिक काळात **'लोकशाहीचे'** हा शब्दप्रयोग सामान्यपणे अप्रत्यक्ष लोकशाही या अर्थानेच केला जातो. पण स्वित्झर्लंड आणि ऑस्ट्रेलिया या दोन देशांतून मात्र प्रत्यक्ष लोकशाही अस्तित्वात आहे.

भारतामध्ये लोकशाही शासनप्रणाली बऱ्याच काळापासून अस्तित्वात आहे. राजेशाही जरी होती तरी गावपातळीवर गावातील पंचायत गावाच्या शासनासंबंधी सर्व निर्णय घेत असे. राजाची जबाबदारी मुख्यत्वे संरक्षण व दोन किंवा अधिक गांवामधील तंट्याबाबत असे. सध्याची व्यवस्था पश्चिमी देशाकडून घेतली आहे व तीमध्ये त्रुटी आहेत. त्या त्रुटी दूर करून लोकशाही व्यवस्था अधिक कार्यक्षम बनवणे आवश्यक आहे. या करता उमेदवाराच्या पात्रतेपासून शासन चालवण्यापर्यंत सध्याचे अडथळे जाणून घेऊन नियम बनवले पाहिजेत.

लोकशाहीचे प्रकार

प्रामुख्याने लोकशाहीचे प्रत्यक्ष आणि अप्रत्यक्ष असे प्रकार सामान्यतः मानले जातात. प्रातिनिधिक लोकशाहीचे संसदीय व अध्यक्षीय लोकशाही असे सांप्रत कार्यवाहीत असलेले दोन प्रमुख प्रकार आढळतात. संसदीय लोकशाहीमध्ये मंत्रिमंडळ आणि संसद परस्परांवर अवलंबून असतात आणि मंत्रिमंडळ हे संसदेला जबाबदार असते. बहुमतातील पक्षाचा नेता हा पंतप्रधान असतो. भारतासह ग्रेट ब्रिटन, कॅनडा, ऑस्ट्रेलियात ही पद्धत रूढ आहे. अध्यक्षीय शासनपद्धतीत मंत्रिमंडळ संसदेपासून अलिप्त असतं आणि अध्यक्षाची जनतेकडून सरळ निवड होते. ही पद्धत प्रामुख्याने अमेरिकेत आढळते. थोड्याफार फरकाने फ्रान्स, श्रीलंका इ. देशांतूनही ती प्रचारात आहे.

लोकशाहीची जी मुलतत्वे आहेत स्वातंत्र्य, समता, न्याय, बंधुत्व, या तत्वावर भारतीय लोकशाही टिकून आहे असे म्हणता येईल. परंतु ज्या वेळेस विचार करतो की भारतीय लोकशाहीसमोर अनेक आव्हाने उभी आहेत त्यावेळेस आपण आश्चर्यचकित होतो. आपण खऱ्या अर्थाने 1947 ला स्वतंत्र झालो. तेव्हापासून जर आपण 72 वर्षांचे परीक्षण करून पाहले तर फार मोठे सकारात्मक आणि नकारात्मक बदल झालेले आपणास दिसून येईल. असंख्य हुतात्म्यांचे रक्त सांडून या देशाला स्वातंत्र्य मिळाले. त्यांच्या बलिदानाची किंमत आपण विसरून गेलो आहे. भारत हा जगातील सर्वात मोठा लोकशाही असलेला देश आहे. भारतीय लोकशाही ही जगात आदर्शलोकशाही म्हणून ओळखली जाते. युरोप देशात लोकशाही दिसून येते, परंतु या देशांची लोकसंख्या मर्यादित आहे. लोकसंख्येने जगात दूसरा क्रमांक असणारा व अनेक बाबतीत विविधता असलेला भारत हा एकमेव लोकशाही प्रधान समाज आहे.

भारतीय संसदीय लोकशाही पुढील आव्हाने

India is a Parliamentary Democratic Republic in which the President of India is the head of state and the Prime Minister of India is the head of government. It is based on the federal structure of government, although the word is not used in the Constitution itself. अशी लोकशाही भारतात आढळते.

ब्रिटीश राजवट ठप्प करण्यासाठी स्वातंत्र्यपूर्व काळात असहकार आणि सत्याग्रह यांचा अवलंब करण्यात येत असे. ब्रिटीश सरकार हटविण्यासाठी कित्येकांनी मृत्यूला कवटावले, संगिनीच्या गोळ्याही झेलल्या, कारावास भोगले. शांततामय मार्गाने भारत स्वतंत्र होऊन घटनात्मकदृष्ट्या लोकशाही मार्गाने कारभार करू लागला. जवळजवळ 75 वर्षाच्या वाटचालीत भारतीय संसदीय लोकशाही समोर प्रामुख्याने पुढील आव्हाने आहेत.

1. बेरोजगारी

आज बेरोजगारी दर स्वातंत्र्यानंतर सर्वात जास्त आहे. हजारो, लाखो उद्योगधंदे बंद पडत आहेत. दरवर्षी दोन कोटी नोकऱ्या निर्माण करण्याची बात राहू दे उलट आटोमोबाईल क्षेत्रापासून पार्ले जी पर्यंत सर्वत्र लोकांना असलेल्या नोकऱ्यांवरून काढले जात आहे, कृषी, बांधकाम, वाहन आदी क्षेत्रे घसरत आहेत, रेल्वे मालवाहतुकीपासून हवाई वाहतुकीपर्यंत सर्वत्र मंदी आहे, दैनंदिन वापरातील तेलापासून बिस्किटा पर्यंतच्या मागणीत कमालीची घट होते आहे. रिझर्व्ह बँकेचा राखीव निधीपैकी वीस–पंचवीस टक्के रक्कम सरकारला वापराला घ्यावे लागतात याचा अर्थ रिझर्व्ह बँकेलाही पर्यायाने देशातील जनतेला अडचणीत आणले जातेय. गुंतवणूकदार धास्तावले आहेत. सार्वजनिक क्षेत्रे बंद पडत आहेत अर्थात ती खाजगी भांडवलदारांच्या घशात घालण्यासाठी बंद पाडली जात असण्याची शक्यता जास्त आहे. खाणउद्योगासह अनेक उत्पादन क्षेत्रात शंभर टक्के थेट परकीय गुंतवणुकीला (एफडीए) ला परवानगी दयावी लागली आहे.

2. राजकारणातील वाढती गुन्हेगारी

सर्वोच्च न्यायालयाच्या न्या.रोहिंटन फली नरीमन यांच्या अध्यक्षतेखालील खंडपीठाने गुरूवार ता. 13 फेब्रुवारी 2020 रोजी गुन्हेगारी पार्श्वभूमी असलेल्या उमेदवार, लोकप्रतिनिधिंची माहिती जाहीर करण्याचे आदेश दिले आहेत. सर्वोच्च न्यायालयाने 2018 साली उमेदवारांची गुन्हेगारी पार्श्वभूमी जाहीर करण्याचे आदेश दिले होते. पण या आदेशाचे पालन होत नसल्याचा दावा करत एक अवमान याचिका दाखल केली होती. भाजपा नेते अश्विनी उपाध्याय यांनी दाखल केलेल्या या याचिकेवरील सुनावणीच्या वेळी सर्वोच्च न्यायालयाच्या खंडपीठाने वरील आदेश दिला आहे. या सुनावणीच्या आदेशात म्हटले आहे, राजकारणात गुन्हेगारीचे प्रमाण काळजी करण्याइतपत वाढले असून सर्व राजकीय पक्षांनी त्यांच्या उमेदवारांविरूद्ध न्यायालयांमध्ये प्रलंबित असलेल्या गुन्हेगारी प्रकरणांची सर्व माहिती पक्षाच्या संकेतस्थळावर अपलोड केली पाहिजे. उमेदवारांविरूद्ध गुन्हेगारी प्रकरणे असतानाही त्यांनी उमेदवारी देण्यामागील कारणही राजकीय पक्षांनी संकेतस्थळावर अपलोड केली पाहिजे. तसेच ही माहिती फेसबुक, टिवटरसह एका राष्ट्रीय व एका प्रादेशिक वृत्तपत्रामध्येही प्रसिद्ध करावी. राजकीय पक्षांनी उमेदवारी निवडीनंतर 72 तासांच्या आत याबाबतचा अहवाल निवडणूक आयोगाकडे सादर करावा. 2004 मध्ये कलंकित 24 टक्के तर गंभीर गुन्हे असलेले 12 टक्के खासदार होते. 2009 मध्ये 30 व 14 टक्के होते, 2014 मध्ये 34 व 21 टक्के होते आणि 2019 मध्ये ते प्रमाण 43 व 29 टक्के झाले आहे. पंधरा वर्षात हे प्रमाण दोन–अडीच पटीने वाढणे हे राजकारणाच्या गुन्हेगारीच्या वेगवान व चिंताजनक वाढीचे द्योतक आहे.

राजकारणामध्ये गुन्हेगार डॉन, माफिया यांचा सुळसुळाट वाढला आहे. चित्रपट तारे–तारकांच्या ही वावर वाढला आहे. आदर्श संसदीय लोकशाहीचे हे मुळीच लक्षण नाही. राजकारण आणि गुन्हेगारी यांचे दिवसेंदिवस घनिष्ठ होणारे परस्पर संबंध राजकारणाच्या नैतिक अधिष्ठानाला तडा देणारे आहेत.

3. वैचारिक बैठकीचा अभाव

भारतीय समाजात जात, धर्म यांचे वर्चस्व वाढत आहेत. आर्थिक विषमता बेसुमार वाढली आहे. स्त्रियांवरील अत्याचार, दलितांवरचे अत्याचार याचे प्रमाण वाढले आहे. गुन्हेगारी वाढली आहे, अंधश्रद्धा फोफावली आहे. या सर्वांचे कारण फार मोठ्याा सामाजिक प्रबोधनाची कमरता आहे. हे प्रबोधन लोकशिक्षणा मार्फत होते. आपल्या शिक्षण संस्था म्हणजे केवळ पदव्या देणारे कारखाने झाल्याने त्या मुल्यसंस्कार करू शकत नाही. असे मुल्यसंस्कार न घडले तर लोकशाही संस्था धोक्यात येतात. आज भारतात असे होत आहे. संसद, विधानसभा, राजकीय पक्ष हे सर्वच लोकशाही प्रक्रिया एक दिखावा म्हणून राबवत आहेत. त्या प्रक्रियेमागे जी वैचारिक बैठक असायला हवी तिचा अभाव आहे असे दिसून येते.

4. गरीबी

आज समाजातील आर्थिक विषमता वाढलेली दिसते. काही मुठभर लोकांच्या हातात बेसुमार पैसा व बहुसंख्य जनता दारिद्र्या रेषेखाली, असे आजचे चित्र आहे. काळ्याा पैशाचे वर्चस्व तर बेसुमार वाढले आहे. न्याय, स्वातंत्र्य, समता अणि बंधुता यांचा लाभ सर्व नागरिकांना व्हायला हवा याचीच बेचैनी तरूणाईत आहे. देशभर सर्वत्र पसरलेल्या बहुसंख्य गरीब दुबळ्यांची स्थिती वर्षानुवर्ष वाढत आहे. विविध शासकीय अहवाल हे भारतातील दारिद्र्यरेषेखालील लोकांचे प्रमाण वेगवेगळ्या निकषानुसार दर्शवतात. यानुसार भारतात गरीबी अजूनही बऱ्याच प्रमाणात आहे. कोरोनामुळे अनेक संसार उघड्याावर आले आहे. अर्थव्यवस्था मंदावली आहे असे जाणवते. याच्या मुळाशी काय कारणे आहेत हे शोधून त्यावर मलमपट्टी ऐवजी कायमचा इलाज करण्याची गरज आहे. यावर राजकीय आणि आर्थिक धोरण बदलवण्याचे खरे आव्हान आहे.

5. राजकारणातून साधनशुचिता हरवणे

आज लोककल्याणाच्या मूव्हमेंट संपवून नेतृत्वाचा इव्हेंट करण्याकडे भर आहे. सर्व नीतिमूल्ये पायदळी तुडवली जात आहेत. राजकारणाचे रंग बदलले आहेत. राजकारणाने सेवेचे नाव घेत केवळ आणि केवळ सत्ताकारणाचा वेष परिधान केला आहे. स्वातंत्र्य आंदोलनात व स्वातंत्र्यानंतरही काही दशके राजकीय नेतृत्वाकडे लोकशाहीची चांगली प्रेरणा होती. मात्र आज त्याऐवजी सत्तेची व प्रसिद्धीची प्रेरणा दिसू लागली आहे. पंचा नेसणारा राष्ट्रपिता ते दहा लाख रूपयांचा सूट घालणारे नेते हा प्रवास सुद्धा राजकारणाच्या पर्यायाने लोकशाहीच्या कंगालीकरणाचे लक्षण आहे.

6. भ्रष्टाचार

सेंटर फॉर मीडिया स्टडीज (सीएमएस) या संस्थेने निवडणूक खर्चा बाबतचा अहवाल नुकताच जाहीर केला आहे. या अहवालानुसार नुकत्याच पार पडलेल्या सतराव्या लोकसभा निवडणुकीत साठ हजार कोटी रूपये खर्च झाले आहेत (अधिकृत व अनाधिकृत). 2024 सालच्या निवडणुकीत हा खर्च एक अब्जावर जाण्याची शक्यता आहे. हा अहवाल सादर करताना सीएमएसचे अध्यक्ष एन.भास्कर राव म्हणतात की, सर्व भ्रष्टाचाराचे मूळ हे या निवडणूक खर्चात आहे. आपण हे मूळ शोधू शकलो नाही तर भारतातील भ्रष्टाचार संपवू शकणार नाही. लोकसभेच्या पहिल्या निवडणूकीत (1952) 10.45 कोटी रूपये खर्च आला होता. तर 2014 मध्ये 3500 कोटी, 2019 मध्ये 6500 कोटी रूपये (अंदाजे) खर्च आला. हे सर्व आकडे थक्क करणारे आहेत. निवडणूक खर्च याबरोबरच भारतात वेगवेगळ्याा शासकीय, राजकीय क्षेत्रामध्ये भ्रष्टाचार पूर्वीपासूनच मोठ्याप्रमाणावर असल्याचे आपल्याला माहित आहे. भ्रष्टाचार विरोधी आंदोलन हे त्याचे उत्तर आहे. मुळात भ्रष्टाचार करणे ही मानसिकता बदली पाहिजे कारण समाजात अश्या

मनोवृत्तीमुळे अधिक प्रश्न निर्माण होतात. ती गुंतागुंतीची साखळी सुरूच राहते निवडणूकीत काळ्या पैशाचा प्रंचड वापर होतो आहे. काळा पैसा व गुन्हेगारी यांचे अतुट नाते बनले आहे. वैध धंद्यापेक्षा अवैध धंद्यांना प्रोत्साहन दिले जात आहे. एकूणच ही सर्व भ्रष्टाचाराची लक्षणे आहे. ती वेळीस ओळखून नष्ट केली पाहिजेत.

7. राखीव जागांचा पेच

शिक्षण नोकऱ्या यामध्ये राखीव जागा, छात्रवृत्त्या व अन्य सवलती यांची तरतूद करून घेण्यासाठी बाबासाहेबांनी महत्व दिले. पूर्वी अस्पृश्यांना या पद्धतीने जो कोटा मिळाला तो 60–70 वर्षापासून आहे. विभिन्न जातीमध्ये आढळणारे जुने पारंपारिक अंतर तर कमी झालेले नाहीच. शिक्षण, नोकऱ्या, निवडणूका यावरून उपस्थित झालेल्या स्पर्धेमुळे जातीय बैठक अधिक आग्रही व पक्की झालेली आहे. दुबळ्या जातींना खरी मुक्ता मिळवू शकली नाही. लोकशाहीच्या स्थापनेपासून आजपर्यंत देशाच्या निरनिराळ्या भागात आरक्षणाच्या मागण्या बऱ्याच वर्षापासून आहे. न्यायालयात देखील आरक्षणांसंदर्भात विविध खटले प्रलंबित आहेत. तामिळनाडू, महाराष्ट्र, राजस्थान आदी राज्यामध्ये राखीव जागा, आरक्षण हा पेच कायम असून तो भारतीय लोकशाही समोर आव्हान ठरतो आहेत.

समारोप

भारतीय संसदीय लोकशाही ही प्रगल्भ लोकशाही असून तिच्या विकासाची प्रक्रिया सुरू आहे. वर उल्लेख केलेली भारतीय लोकशाही समोरील आव्हाने विचारत घेता ती गंभीर आहेत. असे असले तरी सर्वसामान्य माणसांचा लोकशाहीवरचा विश्वास उडता कामा नये. सुदृढ लोकशाहीच सर्वांना चांगले जीवन देऊ शकते. हा विश्वास देण्याची गरज आहे. लोकशाही समोरील आव्हाने अजूनही बरीच आहे. तरी अंतिमतः लोकशाही ही स्थिर व्यवस्था नव्हे. तर सतत चालणारी प्रक्रिया आहे. म्हणूनच लोकशाही बाबत सतत प्रबोधन करत राहणे फार महत्त्वाच आहे. ते आव्हान लोकशाही मानणाऱ्या सुबुद्ध, सुशिक्षीत, विचारी व्यक्तींनी व संस्था, संघटना, राजकीय पक्ष आदींनी पेललं पाहिजे. आव्हान उभी राहीली तेव्हा त्यांना पेलून नेस्तबूत करण्याच काम इथल्या लोकशाहीने केले आहे. हा इतिहासही आहे. राष्ट्रपिता महात्मा गांधीजींनी एके ठिकाणी म्हटलं होतं, 'केवळ संख्याबळ हे लोकशाहीचे निदर्शक नाही. ज्या समाजाचे ते प्रतिनिधी समजले जातात त्या समाजाचे तेज, आशा व महत्त्वाकांक्षा त्यांच्यामार्फत नीट व्यक्त होत असतील तर अशा प्रतिनिधींच्या हाती असलेली सत्ता लोकशाहीशी विसंगत ठरण्याचे कारण नाही. मारपीट करून लोकशाहीचा विकास होणे शक्यच नाही. लोकशाहीची मनोवृत्ती बाहेरून लादता येणार नाही. तिचा मनातूनच उद्‌भव झाला पाहिजे.'

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Biodiversity and prevalence of helminthes parasites of Nalganga dam fishes of Buldana district (M. S.)

Kakde V R, Choudhari S N, Thakare P R
Department of Zoology, Jijamata Mahavidylaya, Buldana, Maharashtra, India

Abstract
The present study will be helpful for biodiversity status of helminthes parasites found in Nalganga Dam. A total of 300 fishes were examined from which about 50% fishes were infected with cestode parasites and 50% with nematode parasites. Present study suggest that cestodes mainly *Circumoncobothrium spp, Senga spp., Lytocestus spp., Polyoncobothrium spp.*, and nematodes mainly *Eustrongylides spp., Rhabdochona spp., Syphaciella spp., Contracaecum spp., Ascardia spp.*,and *Trichuris spp.*, are the main intestinal parasites of Nalganga dam fishes (*viz. Mastacem bellusarmatus, Wallago attu, Ophiocephalus punctatus, and Clarius batrachus*) are the main intestinal parasites of Nalganga dam fishes. The incidence of parasite infection was higher in winter season whereas intensity of infection was higher in Mansoon.This report summarizes the data of incidence, intensity, and index of incidence in fresh water fishes in relation to environmental factor. Present study is carried out during July 2019 to June 2020.

Keywords: helminthes, parasites, Nalganga dam, cestodes, nematodes

Introduction
The survey of helminth parasites in freshwater fishes was undertaken to investigatethe internal helminth parasitic environment of thehost and the environmental factor such asseason, temperature, humidity, age of the host. The common parasites of fishes causing the Economic losses includes the helminth parasites. One objective of this study was to determine monthly incidence of infection to various organ of the host body. Parasites are extremely abundant and diverse in nature, representing a substantial portion of global biodiversity. Fishes are important components of ecosystem from ecological, medicinal, nutritional and economical point of view. These fishes are parasitized by helminthes parasites, which reduce the food value of host fish. Study of helminthes parasites is therefore an urgent necessity of today. Helminthes infections are very common in people who consume improperly un-cooked meat, unhygienic habits and poor sanitation. These helminthic infection leads to various disorders i.e. anemia. Population dynamics of parasite increases rapidly andresults in fish mortality because of PIHM (Parasite induced host mortality) and thus fish population infected firstly (Arora 2010). The parasitic infections are sometimes very fatal and cause high mortalities when their life cycles are well supported by Intermediate hosts. (Shakir, 2006) [14]. Survey of seasonal infection of fish infected with *Caryophyllids* has been done in other countries by different workers Hanley, Anderson (1976) [1], Karnaev (1960) in carps,
The current study will expect to helpful for futuristic researchers on helminthes infection on fresh water fishes in Buldana region. Keeping that point of view, the importance of Piscean helminthes, present study was undertaken to investigate and evaluate prevalence of helminthes on freshwater fishes *Mastacem bellusarmatus Wallago attu, Ophiocephalus punctatus and Clarius batrachus* and distribution of Piscean helminthes *Molnaria intestinalis, Ascardia spp. Trichursis spp. Syphaciella spp, Rhabdochona spp Polyoncobothrium spp., Eustrongylides spp. Circumoncobothrium spp. Lytocestus spp & Senga spp.*

Materials and Methods
The fresh water fish collected from Nalganaga dam during July 2019 to June 2020. Fishes were opened up dorso-ventrally and the internal organs examined.The various organs of the viscera such as stomach, liver, intestine and Skin. All these organs which are infected by helminthes placed under separate petridish containing normal saline water. Infection of each group of parasites was treated as follows:
Collected cestodes and Nematode were first relaxed and then fixed in hot 4%formalin and stained using Harris haematoxyline. Stained parasites were washed in distilled water, dehydrated in ascending grades of alcohol, cleared in xylene, mounted in D.P.X. Nematodes were fixed in hot 10% Glycerol and cleared in lacto phenol. Drawings were made using a camera lucida. The identification is made with the help of "Anatomy of Helminthum" by Yamaguti (1961). Then organs are examined and recorded the data of infected and fresh host. After that separating and counting the data of helminthes and fresh water fishes, the collected helminthes parasites preserved in separate bottle. Few of helminthes parasites might be useful for taxonomic study. The calculation of prevalence of infection was obtained by the following formula:

$$\text{Incidence of Infection} = \frac{\text{Infected host} \times 100}{\text{Total hosts examined}}$$

Observation

The infections of *Lytocestus spp.* are observed in only *Clarius batrachus* and *Senga sp, Circumoncobothrium sp.* are heavily found in *Mastacembelus armatus.* The infection of *Senga spp* in *Channa punctatus & Molnaria intestinalis and Ascardia spp is* found in *Wallago attu,* because of the host specificity. Morphological, physiological and ecological factors play important role in the host specificity. *Senga spp, Circumoncobothrium spp.* were specifically recovered from intestine *M. armatus* and *W. attu. Lytocestus* are recovered from stomach of *C. batrachus.* This suggests that the worms are site specific and probably derive certain nutrients from the organs.

Table 1: Incidence of Helminthes parasites in fresh water fishes from Nalganga Dam during July 2019 –June 2020

Sr. No.	Parasites/ Helminthes (Cestodes & Nematodes)	No of Hosts Infected	Organ Infected
1	*Polyoncobothrium sp.*	22	Intestine
2	*Senga sp.*	48	Intestine
3	*Circumoncobothrium sp.*	62	Intestine
4	*Lytocestus sp.*	21	Intestine
5	*Trichuris sp.*	10	Large Intestine
6	*Ascardia sp.*	48	Intestine
7	*Molnaria intestinalis*	49	Intestine
8	*Syphaciella spp*	17	Body cavity, mesentery & Intestine
9	*Rhabdochona spp*	16	Intestine
10	*Eustrongylides spp*	07	Skin, Intestine
Total = 300			

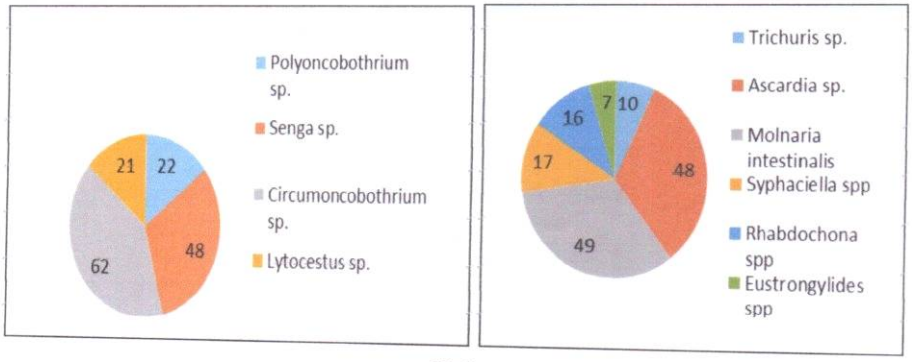

Fig 1

Table 2: Showing prevalence of helminthes *Molnaria intestinalis* on *Wallago attu* during August 2019 to June 2020.

Season	No. of hosts examined	No. of Hosts infected	No. of parasites collected	Prevalence %
Rainy	21	11	13	52.40%
Winter	30	20	22	66.70%
Summer	28	18	31	64.30%

Table 3: Showing prevalence of helminthes *Ascardia spp*, on *Wallago attu* during August 2019 to June 2020

Season	No. of hosts examined	No. of Hosts infected	No. of parasites collected	Prevalence
Rainy	22	7	10	31.8%
Winter	30	19	16	63.3%
Summer	26	22	09	84.6%

Graph 1: Prevalence of *Molnaria intestinalis & Ascardia spp* on *Wallago Attu* during August 2019 to June 2020

Result and Discussion

The study has established that the *Mastacembalus armatus* fish is one of the most heavily infected fish species as compare to *Clarius batrachus*, *Wallago attu* and *Channa punctatus*

In Buldana region the fishes were heavily infected with the cestode and nematode while the other parasites occurred in low quantity. The current investigation suggests in given table no. 1 and 2. There were two helminthes parasites were recorded as *Molnaria intestinalis &Ascardia spp.* High incidence of infection found from that species of helminthes over fresh water fishes and recorded data season wise, in Summer (64.30% 84.60%) followed by winter (66.70% - 63.3%) whereas infection was recorded low in Monsoon (52.40%-31.8%). Through the seasonal analysis the highest rate of infection occurred in summer as compared to rainy and winter season (Krishna and Shreeramalu (1996); Laxma Reddy et. al (2006); Laxma Reddy and Bannergii (2008, 2012).

According to the Kennedy (1970, 1974 and 1977) [5, 3, 4] the temp, humidity and rainfall, feeding habits of host, availability of infective host and parasite maturation, and such factors are responsible for influencing the parasitic infections. Experimental studies by Kennedy (1971) have shown that the cestode *Caryophyllaeus lattices* can establish in fish and survive for longer period at low temperature. Hence he explained the temperature is major controlling seasonal periodicity of infection and the parasitization. He explained the infections are more in warm seas than in old ones. Jadhav, Bhure (2006) [2] explained the development of parasites should be needed high temperature, low rainfall and sufficient moisture. Hence the high prevalence occurs in summer followed by other season. Pennuyuick (1973), reported fishes and other animals were infected with large number of parasites in late winter to end of summer months, as environmental conditions are favorable in these months. Jadhav and Bhure, (2006) [2] reported high temperature, low rainfall and sufficient moisture are necessary for development of parasite. The parasites causes depletion of the nutritional contents in host's body and results in the low productivity & loss of weight in fish industry (Satish Saraf 2019) [13]

Conclusion

After the analysis of data the present study can be concluded that the high infection of *Molnaria spp.* helminthes parasites *&Ascardia spp.* are occurred in summer season followed by winter where as low in monsoon season. This type of results indicated that environmental factors and feeding habitat are influencing the seasonality of parasitic infection either directly or indirectly. However, the above study can only be complete if it covers a whole season to investigate the variation in parasite fauna with the diet of the host and variation in infection with habitat type.

Regarding the parasitic diversity and population study cestode and Nematode indicates abundance population as compare to nematode parasites. The incidence of infection of nematode *Ascardia spp*, on *Wallago attu* during 2019-20 was maximum (84.6%) in summer season, followed by winter season (63.3%) and slightly lower in monsoon season (31.8%). The incidence of infection of nematode *Molnaria spp*, on *Wallago attu* during 2019-20 was maximum (66.7%) in winter season, followed by summer season (64.3%) and slightly lower in monsoon season (52.4%). This report is beneficial for investigation and evaluation of prevalence of helminthes on freshwater fishes *viz., Mastacem bellusarmatus Wallago attu, Ophiocephalus punctatus and Clarius batrachus.* And distribution of Piscean helminthes *Molnaria intestinalis, Ascardia spp. Thelaziasis spp. Syphaciella spp, Rhabdochona spp Polyoncobothrium spp., Eustrongylides spp. Dirhamoncobothrium spp. Lytocestus spp & Senga spp* in fresh water fishes of Vidarbha region of Maharashtra.

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Scanning electronic microscopic study of antenna of *Tribolium Confusum* (Confused floor beetle)

P R Thakare*, V R Kakde
Department of Zoology, Jijamata Mahavidyalaya, Buldana, Maharashtra, India

Abstract
Arthropods bears short appendages, jointed legs containing most of the beetle species in the biodiversity. Beetles in the form of varied families in the phylum Arthropoda shows different mouth structures with abdominal forms. Red floor beetle *(Tribolium castaneum)* and confused floor beetle (*Tribolium confusum*) showed similar external appearance except antennal structure and smooth abdomen without any row of pits. Scanning electronic microscopic study of the dorsal and lateral view of the confused flour beetle shows varied numbers of sensilla. These sensilla types are viz., ST (Sensilla trichodea), SC (sensilla chaetica), SB (Sensilla basiconica) and Amp (ampulacea). Antenna is clavate type and having 4 to 11 segments with widely separated antennal insertions, distance between them more than the length of first antennal segment. Antenna has four enlarged segments (antennal club) at the terminal end. Raw deep pits are present over the dorsal surface of the beetle. Scanning electronic microscopy is done under used the Lyzer Zoom Stereoscopic Microscopy, Trinocular model ZSM-3 Light microscope. SEM study observed specifically antennal sensilla segments with length in micrometer. Sensilla trichoidea typically innervated by one to several neurons can be solely mechanoreceptors, contact chemoreceptors, thermo sensitive, or olfactory in function. Sensilla chaetica responsible for mechanoreceptors or contact chemosenstive in function. Sensilla basiconica are short hairs (pegs) or cones that are innervated by one to several neurons. Sensilla ampullacea are positioned in deep pits with narrow openings and innervated by two to several neurons.

Keywords: scanning, electronic microscopy, *Tribolium confusum*, *Tribolium castaneum*, Lyzer, zoom stereoscopic microcopy etc

Introduction
Coleoptera is an order of class-Insecta commonly called beetles. Beetles comprises the largest group of insects with over quarter of million described species. The word 'Coleopteran' comes from the Greek word, keleos meaning "Sheath"; and petron means "wing", thus "sheathed wings". They are to be found in almost every habitat and range in size from 1-100 mm in length. The heaviest known insect is Scarab beetle. Most beetles have two pairs of wings. Front pairs are hard, leathery called "elytra" provides sheath like projections for the rear pair which is transparent, membranous and thus protect the rear part the beetle dorsal and ventral body. The spiracles open into the body cavity, an adaptation which reduces water loss during respiration and protect the abdomen from desiccation, (Watt, 1983). The order coleopteran includes more species than any other order of insects constituting almost 25% of all known life forms. About 40 % of all described insect species are beetles (about 400,000 species) and new species are discovered frequently. There are about 500 recognized families and subfamilies. One of the first proposed estimates of the total number beetles species on planet. Coleopteran are found in nearly all natural habitats including fresh water and marine habitats, everywhere there is vegetative foliage from trees and there bark to flowers, dead and decaying matter and even cow dung. (Choate, 1999) [5]. About 600 beetle species in 34 families are associated with stored grain or food materials made from grains. However, stored fruits and vegetables are also attacked. Some beetles are associated with stored food because they feed on the mold and fungi growing on these substrates or they are predators of insects or arthropods that are the primary invaders. (Campbell, 2015) [4].

Family: Tenebrionidae
This family comprises over 1200 species in North America but more than 80% of them are restricted to the South Western Unites States. Only 139 species occurs within the Canadian and Alaskan borders. Many Tenebrionidae live in semiarid areas and deserts but in Canada, most species are found in rotten wood, fungi, under logs and stones and the bark of dead trees. Tenebrionidae often commonly referred to as darkling beetles. Many Tenebrionidae species inhabit dark places. Exceptions include many species in genera such as *Stenotarsa* and *Onymacris* which are active by day and inactive at night. Tenebrionidae is a family of the beetles with some 20,000 described species worldwide. Of these around 8,000 species are found in the Palearctic region (Kaszab and Smetana, 2008) [8]; the European fauna is represented by almost 1,800 species. They are extremely variable in

shape, size and ecological requirements. Tenebrionidae beetles occupy ecological niches in mainly deserts and forests as plant scavengers.

***Tribolium confusum* (Confused Floor Beetle)**

Food and Nutrition- The confused floor beetle, *Tribolium confusum* is a common insect that attacks stored grains and foods in the pantry. This insect has a word-wide distribution and it is very abundant in the United States. It lives in almost any kind of flour, cracked grain, breakfast food or meal. A list of specific foods in which these beetles are found and includes whole wheat flour, bleached & unbleached white flour, bran, rice flour, rye flour, corn meal, barley flour and oat meal. The Confused flour beetle and the Mediterranean flour moth have long been recorded as serious pest of stored grain products. Good, 1933 [7] also reports the beetles living in chocolate, spices (red pepper) and various kinds of nuts and sometimes feeding on specimens in insect collections. Arthropods in the living environment affect the quality of life through their mere presence, or their ability to damage, food, fiber and the structure, or by threatening human health (Robbinson, 1996). Life cycle- The life cycle of confused flour beetle takes place from 40 to 90 days and adult can live for three years. All forms of the life cycle may be found in infested grain products at the same time. Although small beetles about 1/8 of an inch long, the adults are long-lived and may live for more than three years (Walter, 1983). Female beetles of *Tribolium confusum* can lay 300-400 eggs and produces 6-7 generations in one year. Breeding takes place in a temperature range of 20^0 C and 37^0 C. Optimum developments occurs in the range of 32^0 C to 35^0C. Confused flour beetle has one of the highest rates of population growth for stored-product insects. The beetle is able to breed under cooler conditions than the red flour beetle. Both the red and confused flour beetles live in the same environment and complete for resources (Ryan *et al*, 1970). The pupae are lighter in color, being white to yellowish. The eggs white, microscopic and often have bits of flour stuck to their surface. The slender larvae are creamy yellow to light brown in color. They have two dark pointed projections on the last body segment. The red flour beetle may fly, especially before a storm but the confused flour beetle does not fly. Eggs, larvae and pupae from both species are very similar and are found in similar environments (Ryan et.al.1970).

Economic Importance

Tribolium confusum confused flour beetle is probably the most serious pest of the genus *Tribolium* and one of the most economically important beetles. It is notorious as a pest of cereal products although the adults and larvae also feed on a wide variety food stuffs including sound grain. According to Aditi Pai, Gregor Bucher 2019 [2], the storage pest of *Tribolium confusum* commonly known as flour beetles, are of great economic importance because of their cosmopolitan distribution and affinity for stored grain. More recently *T. confusum* has become an important model organism for functional genetics, used in evolutionary developmental biology.

Matrials and Methods

Tribolium confusum beetles were collected from flour mills during the month of November 2021. The adult beetles of the genus *Tribolium confusum* (confused flour beetle) stored in 70% alcohol and allowed to air dried, then put into 90% alcohol followed by xylene. This specimen allow to air dried, whole beetle mounted on specimen bronze stub. Then examined different sensilla were done under JEOL 6380 scanning electron microscope at Visvesvaraya National Institute of Technology, Nagpur. The varied patterns of sensilla were observed over dorsal and ventral surface of antenna along with the antennal length were obtained from the micrographs.

Result and Discussion

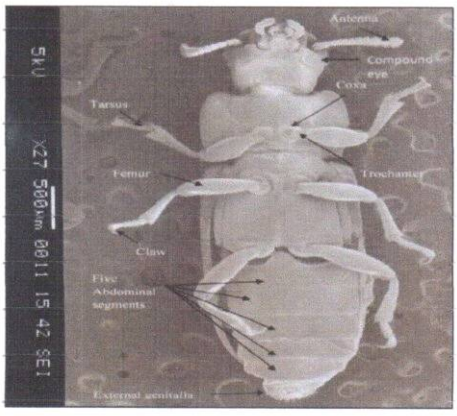


Fig 1: SEM of ventral view of *Tribolium confusum*

The confused flour beetle apparently received this name due to confusion over about its identity as it is identical so similar to the red flour beetle at first glance. Although small beetles, about 1/8 of an inch long, the adults are long-lived and more than three years (Walter).The Scanning Electron Microscopic Study of the dorsal surface of beetle *Triboilum confusum* showed variations in the types of sensilla *viz.*,trichoidea, chaetica, basiconica, coeloconica, ampullacea.

Antenna is clavate type in Confused flour beetle and having 11 segments with widely separated antennal insertions, distance between them more than length of first antennal segment. Along with this, antenna has four enlarged segments antennal club at the terminal end. Antennal segment are shiny lighter in color and terminal antennal segment vertical and horizontal length respectively 98.5 micrometers and 115 micrometer. The length of antennal segment from starting scape up to the terminal tip segment varying increased in phase. There are five major types of sensiila are observed over antennal segment of beetle *Triobolium confusum* i.e., Sensilla trichoidea 1 (ST1), Sensilla trichoidea (ST2), Sensilla chaetica (SC), Sensilla basiconica, (SB), Sensilla ampullaceal (SA).

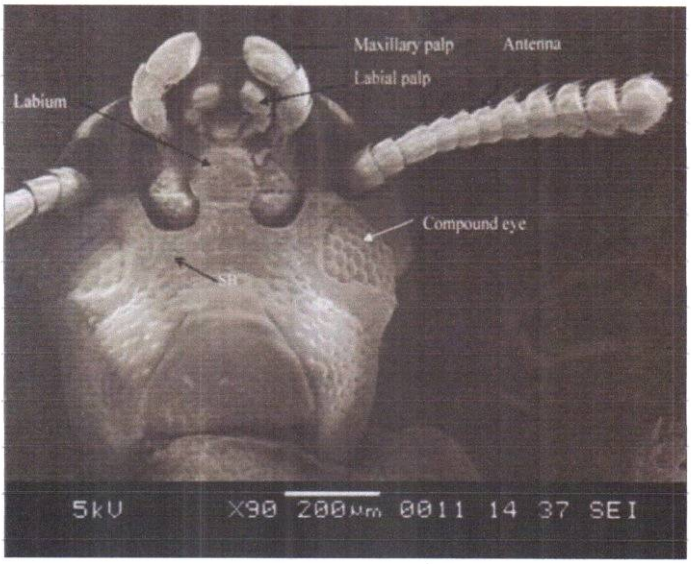
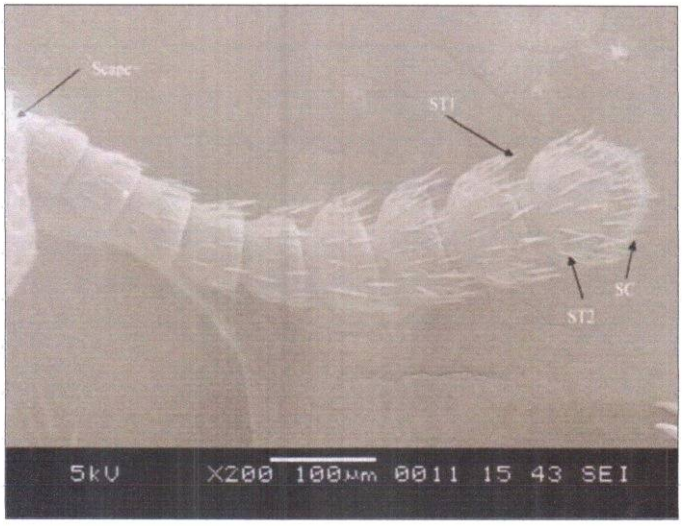


Fig 2: SEM of mouth parts of *Tribolium confusum*



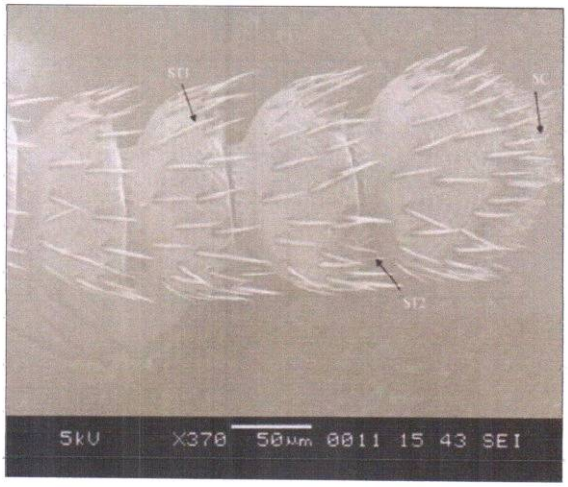


Fig 4: SEM showing the sensilla on last segment on antenna of *T. confusum*

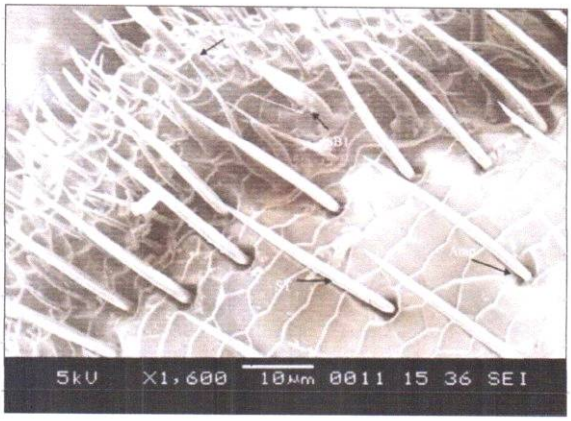


Fig 5: SEM showing sensilla on terminal segment in antenna of *T. confusum*

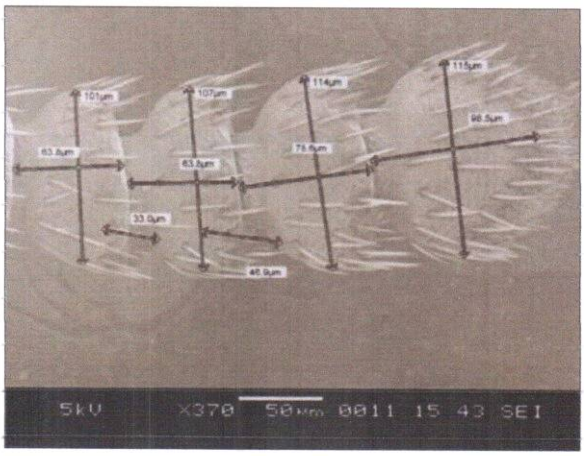


Fig 6: SEM showing length of terminal four antennal segments of *T. confusum*

Conclusion

The antennal segments of *Tribolium confusum* scanned and observed by using Scanning Electronic Microscopy. Through this study, it is concludes that whole beetle is measured from its dorsal and lateral view. With the help of SEM length of antenna and each of antennal segments are measured. Five types of sensilla found *viz.*, Trichoidea, Chaetica, Basiconica, Coeloconica and Ampulacea.

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REVIEW ON BACTERIAL INFECTION IN FRESHWATER FISHESH

Chaudhari Sharda N; Kakde Vandana R

Department of Zoology

Jijamata Mahavidyalaya, Buldana, Maharashtra, India

Abstract: Fishes are the main element of aquatic communities, and they can directly affect the exploitation of all its communities as a protein source for human consumption. Pathogenic infection can strongly affect the rate of reproduction and survival capacity of fish. Therefore, knowledge of fish diseases has a great relevance through both from a scientific as well as an applied point of view. In this review, we focus on the individual and co-infections by homologous or heterologous pathogens in fish. More research is needed to better understand the immune response of fish during single or mixed infections as these could have an important impact on the development of new strategies for disease control programs in the field of fishery.

Key Words: Freshwater fishes, pathogenic exploitation, bacterial infection.

Introduction: Fishes are the main element of aquatic communities, and they can directly affect the exploitation of all its communities as a protein source for human consumption. Last from three decades, culture fishery strongly developed along with capture fishery and the percentage contribution of inland fish production increased to 71% out of the total fish production. More than Rs. 45000 crores had been credited to national treasury by means of inland fishery every year. The number of culturable fish species is steadily increasing and the search for suitable species for fish-farming is still being on. (Handbook on fisheries Statics, 2019). As fish is daily consuming and luxury food, it gives much importance to the fish community. For all of this must have credited to scientist, researchers and fish farmers, as they take lots of efforts for this big achievement.

Many times, much of the fish stocks available for rearing and fishing are decline due to many reasons. Fish diseases are one of the main abstracts in the success of the fishery industry. Disease-related economic losses can be destructive, where disease outbreaks occur suddenly, spread progressively with much of mortality rate and disappear with same speed or develops very slowly with less severity, but persist for long time. Diseases are a major threat to all types of fishes. Much of the factors associated with ecosystem regarding the fish farming supports and promotes the action of pathogens. As a matter of fact, disease outbreaks occur more often in culture environment than free ecosystem. It can be a major factor that influence the abundance and distribution of fish species in distinct geographical areas. Pathogen induced alterations in health and growth of fish community. It can strongly affect the rate of reproduction and survival capacity of fish also. Therefore, knowledge of fish diseases is of great significance through both scientific as well as applied point of view. (Jorge C. 2008). This literature tries to focus on bacterial

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Bacterial species infected in fish community: Normally disease is the result of an interaction between the host (fish body) and the disease-causing factor of concern environment. It may be pathogens, physical factor, unfavorable environmental change, low hygiene and external stress regarding the ecosystem. Before the appearance of symptoms of disease, there may be demonstrable damage and weakening of the host body occurs. The list of fish pathogens has extended substantially since 1980, but the current literature focused on bacterial infection only. Until today, various techniques are discovered to detect and isolate the pathogen from host body. The isolation of bacteria from diseased fish is taken as evidence of infection. Commonly infective species of bacteria found in fresh water fishes are as:

Anaerobes: fish infected by these members have been observed to exhibit sluggish, erratic swimming, appeared to be restless, and may alternately float and sink, before showing temporary rejuvenation, repeated pattern was continued until death. (Cann and Taylor, 1982). Anaerobic bacteria include *Eubacterium tarantellae, Catenabacterium* spp.

Gram-positive bacteria: Infection by member of this group cause extensive damage in the liver, kidney and spleen. In some cases, petechial hemorrhages in the muscle and hyperemic air bladder occurs. (Hiu *et al*., 1984), Generally the fish which are under stress due to handling and spawning are more susceptible to tl infection. Disease symptoms were varied to specimen. Muscle abscesses and internal hemorrhaging is noticed in some fish. Some of the members of this group are *Enterococcus faecalis, Vagococcus salmoninarum, Lactococcus garvieae, Lactococcus piscium, Streptococcus dysgalactiae, Streptococcus agalactiae, Streptococcus shiloi,* (Duremdez *et al*, 2004; Eldar *et al*., 1994; Nomoto *et al*, 2004; Teskeredzic *et al*., 1993).

Aerobic, Gram-positive rods and cocci: Infection of this members reported to occur in 13 species of salmonids. Wounds create in the snout caused by tagging can become infected by bacteria may spread to internal organ. Salmon infected by this pathogen shows exophthalmia, lesions in eyes, swollen abdomen, formation of ulcers/abscesses (Fryer and Sanders, 1981;). Lesions may develop in the kidney, brain, liver, heart and spleen (Speare, 1997). Some of the members of this group are (*Bacillus cereus, Bacillus mycoides, Bacillus subtilis* (Goodwin et al, 1994). *Corynebacterium aquaticum, Micrococcus luteus, Mycobacterium abscessus* (Teska *et al*, 1997; Chang *et al*, 2006), *Staphylococcus aureus* (Wang *et al*, 1996), *Staphylococcus epidermidis* (Kubilay and Ulokoy, 2004), *Staphylococcus warned* (Gil *et al*, 2000). N ardia spp (Chen *et al*., 2000). Rhodococcus spp. (Claveau, 1991).

Gram-negative bacteria: Infected fish indicate signs of hemorrhages on the body, intestine filled with bloody exudate, bulging liver and spleen, and liquefying kidney. Infected individual suffers with eye disease and haemorrhagic septicaemia. (Ogara *et al,* 1998). Infection mostly occurs to cyprinidae by cutaneous ulcer. *Pseudoalteromonas piscicida, Shewanella putrefaciens* are related to whitening of eggs and mortality of eggs (Nelson and Ghiorse, 1999). *Arcobacter cryaerophilus* cause upper jaw darkening or alternatively pale pigment, fin rot, pale gills, hemorrhaging in the muscle, hemorrhage, ulcer formation in intestine and skin (Aydin *et al*, 2002). Some members of this group are *Aeromonas spp*, *Citrobacter freundii*, *Escherichia vulnevi*, *Flavobacterium spp. Janthinobacterium lividum*, *Pseudomonas spp.*, *Vibrio anguillavum*

Table-1: list of Infective bacterial species along with host fish

Sr.No.	Bacterial Type:	Bacterial Species:	Infected Host Fish:	Disease:
1	Anaerobes:	*Catenabacterium* spp:	*Mugil cuvatus*	- visceral toxicosis

		Clostridium botulinum	*-Salmonids & Ictalurus punctatus*	-botulism, visceral toxicosis
2	**Gram-positive bacteria:**	*Eubacterium tarantellae*	*- Mugil cephalus*	-eubacterial meningitis
		Carnobacterium maltaromaticum	*- Coregonus clupeaformis & Oncorhynchus spp.*	- pseudokidney disease meningoencephalitis
3	**Aerobic, Gram-positive rods and cocci:**	*Bacillus cereus, B. mycoides, B. subtilis*	-Many freshwater fishes including *Pangasius hypophthalmus, Morone saxatilis, Ictalurus punctatus, Cyprinus* spp.	- branchionecrosis, ulceration
		Staphylococcus aureus	*-Hypophthalmichthys molitrix, Clarias gariepinus*	- eye disease, jaundice.
4	**Gram-negative bacteria**:	*Aeromonas salmonicida*	-salmonids, cyprinids	- furunculosis, carp erythron-dermatitis, ulcer disease.
		Providencia vermicola Salmonella enterica	- Indian major carps	- fin and tail disease, septicaemia
		Flavobacterium columnare	- many freshwater fish species	- columnaris, saddleback disease

(Campbell et al., 1979; Kinne O, 1980; Koskiniemi et al.,2012; Pennisi E., 2002; Skerman etal., 1980; Stevenson L. H., 1978; Torrella F, Morita R. Y., 1981; Brian Austin and Dawn A. Austin, 2016)

External signs associate with bacterial infection: Twirling, spiral or erratic movement. Faded pigments, darkened pigment/melanosis, eye damage (exophthalmia), hemorrhaging in the eye, mouth, Erosion of the jaws or mouth, opercula region, gills, gill damage, white nodules on the gills or skin, damaged or rotted fins,

Internal signs associate with bacterial infection: Hemorrhaging on the surface and in the muscle, Necrotizing dermatitis, Ulcers section, Furuncles or boils on internal organs, hemorrhaging around the vent, Inappetence Nevertheless, loss of appetite, Stunted growth, Sloughing off of skin or external surface lesions, dorsal rigidity skin/external surface lesions. These are common signs of many infections caused by bacterial pathogens in fish.

Pattern of Infection: However, it is considered that disease is not necessarily caused by single bacterial taxa. Instead, there may will be synergistic interactions between two or more taxa. It also referred as co-infection.

Infection by single species: some of the members of bacteria are very specific able to cause deformities in host body alone. According to Kanno *et al.* (1989) the primary mode of transmission of *Vibrio anguillarum* to host body is by direct contact in crowded conditions. (Ronald *et al.*, 1993)

Infection by multiple species: It also referred as co-infections or mutual infection. It defined as infection of the host by two or more genetically different pathogenic member and cause individual effects on host body. (Cox FEG, 2001; Bakaletz L O, 2004). In such infection, pathogen is of two types, homologous and heterologous. In homologous mode of infection both pathogens are bacteria. In heterologous mode of infection bacteria infect the host along with virus, fungus or with any other parasite. Naturally, it is conformed that some taxa are secondary pathogens which invades through already damaged tissues, whereas other taxa are already infect the host as a primary pathogen. Details indicates in table-2

Table- 2: Bacterial co-infection

Sr. No.	Type of co-infection:	Infected Host fish species:	First Pathogen:	Second Pathogen:
1	Bacterial co-infections	*Chinook salmon, Oncorhynchus tshawytscha*	*Renibacterium salmoninarum*	*Aeromonas. hydrophila*
2	Bacterial and viral co-infections	*Rainbow trout, Oncorhynchus mykiss*	*Flavobacterium psychrophilum*	*Infectious pancreatic necrosis virus*
3	Parasitic and bacterial co-infections	*Nile tilapia, Oreochromis niloticus*	*Gyrodactylus niloticus (Helminth)*	*Streptococcus iniae*
4	Fungal and bacterial co-infections	*Nile tilapia, Oreochromis niloticus*	*Fusarium oxysporum*	*Aeromonas. hydrophila*

(Loch TP et al, 2012; Evensen and Lorenzen, 1997; Cutuli et al., 2015; Xu DH et al, 2007 Kotob et al., 2016)

Histopathology is one of the important tools for verification and diagnosing in fish diseases. Generally, gross observations are enough for correct diagnosis, but some time extra information is necessary to determine the perfect reason for clinical aliment. (Reimschuessel, 1999). As the susceptibility of fish to different pathogens could be changed during mixed infections causing the appearance of sudden outbreaks in fish, effect of infection has still received limited inspection in fish and available data on this subject is still scarce. In this review, we focus on the individual and co-infections by homologous or heterologous pathogens and represent a reviewed summary about the knowledge regarding infections in fish.

Conclusions: Members of many bacterial taxa are associate with fish body for one or many times. However, may not all these taxa be considered as fish pathogens. They may be contaminants of medium in which fish present or they may be innocent saprophytes. The interactions can be either collaborative or sympathetic, might be result in the upgrading and inhibition of one or more pathogens along with bacteria, increasing or decreasing the severity of the disease. So that there may be great confusion about the precise meaning of disease. Such interactions can have an important impact on the growth and development of the fish species and should be important during the course of treatment and vaccination. It is evident that more research is needed in the future to improve knowledge concerning to the interactions of pathogens with fish and how they interact with the immune response of the fish. This will enrich our knowledge of understanding of the disease process and pathogenesis and will be useful for disease management in the field of fishery.

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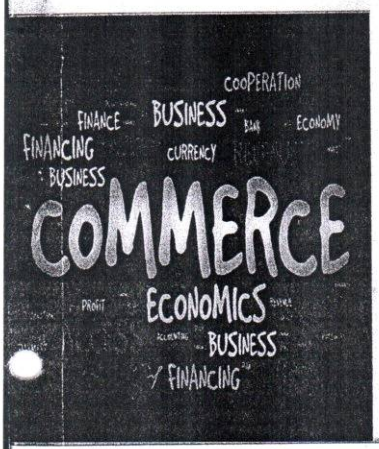

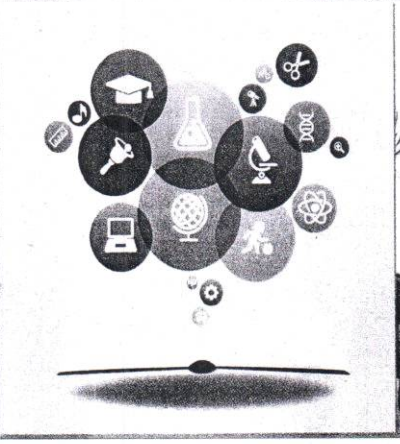

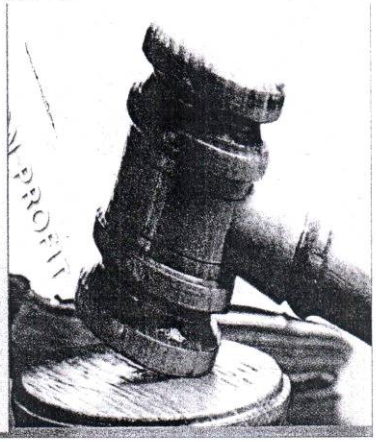

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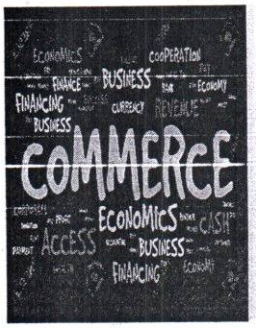

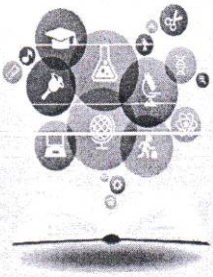

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Sustainability Of Indian Agriculture: Issues, Challenges And Opportunities

Dr. D. J. Kande
Assistant Professor & HEAD, Department of Economics, Jijamata Mahavidyalaya Buldana

I. INTRODUCTION:

Agriculture is most important private business in India providing income and employment opportunity to more than half of the population. Hon'ble Prime Minister, Shri Narendra Modi while addressing the need for farmer's welfare in his Independence Day speech he rename the name of Ministry of Agriculture as the "Ministry of Agriculture and Farmers Welfare". The Government is aware of the roadmap outlined by NITI Aayog for reforms in agriculture sector and doubling farmer's income up to 2022. Agriculture plays a significant role in India's economy to provide means of livelihood to rural masses.The agriculture sector contributes 17% in country's Gross Value Added. Government of India have been taken several steps for sustainable agriculture development. The existing effort like improvement in soil fertility on a sustainable basis through introduced Soil Health Card Scheme, 'Pradhan Mantri Krishi Sinchai Yojana' for efficient access of irrigation and increased water efficiency. To support organic farming system through the 'Paramparagat Krishi Vikas Yojana' and minimization of risk in agriculture sector a new scheme "Pradhan Mantr iFasal Bima Yojana has been launched and implemented for Kharif crop from 2016. Sustainable agricultural practices have to balance environmental health and economic profitability in order to promote social and economic equity. Therefore, stewardship of both natural and human resources is very importance. In simple terminology Sustainable Agriculture involves the processes that would enable us to meet the current and long term societal needs for food, fiber and other resources, Agriculture have been dominant sector in India for economic prediction and the situation will remain same in future. The dependency on agriculture sector has not minimize as proportionate the sectoral contribution of agriculture decline in India's GDP from independence. The dependency of population decline from 75% to 58% but at same time the sect oral contribution fallen from 61% to 17% in the Gross Domestic Product of the country. The comparative picture at world level shows that the share of our population in total world's population is 16.8% but in support only 4.2% water resources and 2.3% land resources. The world's average of resources availability is four to six time more than our national average. This conditions create pressure on agriculture sector in two way like satisfied primary need of population and diversion of land to non-agriculture uses. The current cropping intensity is 136% which grow 25% from last sixty year. The ground water resources is a dominant water source for agriculture hampered and rich at exit level. All this inverse situations negatively influence agriculture productivity in India. So this agrarian nation has need for permanent solution on their existing problem as well as upcoming challenges. Indian agriculture is highly divert sector in case of cropping, climate, availability of natural resources. We have golden opportunity to take advantages of its nature and meet the present and future needs from this sector. For that sustainable agriculture development is a only one way to protect our self in all types of competition. In following discussion we can identified what is the existing condition of Indian agriculture sector, challenges and opportunities.

II. OBJECTIVES OF STUDY:

1. To elaborate the concept of sustainable agriculture.
2. To examine the current situation of India agriculture at various dimension.
3. To study the issues and challenges with status of the agricultural sector and trends.
4. To identify the impact of economic reform on Indian agriculture and key factors those encourage the growth of agriculture sector.
5. To identify areas of intervention that could achieve sustainable agricultural growth.
6. To suggest the remedial measures and highlight various opportunities for Indian agriculture sector.

III. MEANING OF SUSTAINABLE AGRICULTURE:

Sustainable agriculture means production of food, fiber, or other plant or animal products using farming techniques that secure environment, public health, human communities, and animal welfare.

IV. INDIAN AGRICULTURE SECTOR:

Agriculture is one of the most preeminent sectors of the Indian economy. It is the source of livelihood for almost two third of the rural population workforce in the country residing in rural areas. Indian agriculture provides employment to 65% of the labor force, accounts for about 27% of GDP, contributes 21% of total exports and raw material to several industries. The livestock sector contributes an estimated 8.4% to the country GDP and 35.85% of the agriculture output. In India about 75% people are living in rural areas and are still dependent on agriculture, about 43% of India's geographical area is used for agriculture activities. The estimated food grain production is about 211.17 metric tons in the country. The total geographical area comes under the agriculture are 329 MH out of which 265MH represent varying degree of potential production. The net sown area is 143 MH out of which 56MH are net irrigated area in the country.

V. AGRICULTURAL PRODUCTION IN INDIA:

Indian Agriculture production in most part of the country is close related to the optimum use of available natural and human resources of the country. Therefore, riding on the back of agro climatic condition and rich natural resource base, India today has become the world's largest producer of numerous commodities. The country is a leading producer of coconuts, mangoes, milk, bananas, dairy products, ginger, turmeric, cashew nut, pulses and black pepper. It is also the second largest producer of rice, wheat, sugar, cotton, fruit and vegetables. Indian agriculture production is closely related to sufficient and wise water management practices. Most of the agriculture practices in India confined to a few monsoon months. During the monsoon season, India is usually endowed with generous rainfall; although not infrequently, this bountiful monsoon turns into terror, causing uncontrollable floods in different parts of the country and ultimately affecting agriculture production.

VI. SUSTAINABLE AGRICULTURE DEVELOPMENT:

The issues of sustainable development can be discussed under three broad types of farming systems viz. traditional production system, modern agriculture system and sustainable agriculture system. Further, we can compare them across three dimensions, ecological, economic, and social sustainability.

a) **ECOLOGICAL SUSTAINABILITY:** Most of the traditional and conventional farm practices are not ecologically sustainable. They misuse natural resources, reducing soil fertility causing soil erosion and contributing to global climatic change. But sustainable agriculture has some major advantages over traditional practices.

b) **SOIL FERTILITY:** Continuous fall in soil fertility is one of the major problems in many parts of India. Sustainable agriculture improves fertility and soil structure.

c) **WATER:** Irrigation is the biggest consumer of fresh water, and fertilizer and pesticides contaminate both surface and ground water. Sustainable agriculture increase the organic matter content of the top soil, thus raising its ability to retain and store water that falls as rain.

d) **BIODIVERSITY:** Sustainable agriculture practices involve mixed cropping, thus increasing the diversity of crops produced and raising the diversity of insects and other animals and plants in and around the fields.

e) **HEALTH & POLLUTION:** Chemicals, pesticides, and fertilizers badly affect the local ecology as well as the population. Indiscriminate use of pesticides, improper storage etc. may lead to health problems. Sustainable agriculture reduces the use of hazardous chemical and control pests.

f) **LAND USE PATTERN:** Over-exploitation of land causes erosion, landslides, and flooding clogs irrigation channels and reduces the arability of the land. Sustainable agriculture avoids these problems by improving productivity, conserving the soil etc

g) **CLIMATE:** Conventional agriculture contributes to the production of greenhouse gases in various ways like reducing the amount of carbon stored in the soil and in vegetation, through the production of Methane in irrigated field and production of artificial fertilizers etc. By adopting sustainable agriculture system, one can easily overcome this problem.

h) **ECONOMIC SUSTAINABILITY:** For agriculture to be sustainable, it should be economically viable over the long term. Conventional agriculture involves more economic risk than sustainable agriculture in the long term. Sometimes governments are inclined to view export-oriented production systems as more important than supply domestic demands. This is not right. Focusing on exports

alone involves hidden costs: in transport, in assuring local food security, etc. Policies should treat domestic demand and in particular food security as equally important to the visible trade balance.

i) SOCIAL SUSTAINABILITY: Social sustainability in farming techniques is related to the ideas of social acceptability and justice. Development cannot be sustainable unless it reduces poverty. The government must find ways to enable the rural poor to benefit from agriculture development. Social injustice is where some section of the society is neglected from development opportunities. But having robust system of social sustainability can bridge the gap between "haves" and "have-nots". Many new technologies fail to become applicable in agriculture sector due to lack of acceptability by the local society. Sustainable agriculture practices are useful because it is based on local social customs, traditions, etc. Because of being familiar, the local people are more likely to accept and adopt them Moreover, sustainable agriculture practices are based on traditional know-how and local innovation. Local people have the knowledge about their environment crops and livestock.

VII. SECTORAL COMPOSITION OF GDP IN INDIA 2000 TO 2021:

Indian Agriculture progress after 2000 is quite low or unsustainable in case of employment opportunity and achieved satisfactory income. The contribution of agriculture in national product has continuously downfall but dependency of population on agriculture sector is remain same. Basically the agriculture sector has root cause of all social and economic problems in the country. Like hunger, poverty, unemployment and so many problem make dip influence on agriculture sector as well as countries economy. The following data elaborate sect oral contribution of three core in India's GDP during study period.

Table No. 1

Years	Agriculture & Allied sector (%of GDP)	Industry (%of GDP)	Service (% of GDP)
2004-05 at constant price			
2000-2001	22.26	27.25	50.98
2001-2002	22.39	26.54	51.98
2002-2003	20.13	27.39	53.13
2003-2004	20.33	27.22	53.25
2004-2005	19.03	27.93	53.05
2005-2006	18.27	27.99	53.74
2006-2007	17.37	28.65	53.98
2007-2008	16.81	28.74	53.45
2008-2009	15.77	28.13	56.11
2009-2010	14.64	28.27	57.09
2010-2011	14.59	27.92	57.48
2011-2012	14.37	28.22	57.42
2012-2013	13.95	27.27	58.79
2013-2014	13.94	26.13	59.93
2011-12 at constant price			
2014-2015	16.5	31.3	52.2
2015-2016	15.4	31.6	53.0
2016-2017	15.3	31.5	53.2
2017-2018	14.8	31.0	54.2
2018-19	17.6	25.92	54.89
2019-20	13.9	28.3	55.3
2020-21	20.2	29.34	54.27

Source: Economic survey of India 2007 to 2021.

The contribution of three sectors in countries GDP has different trends. The most important agriculture sector has continuously contributing in GDP from 2000 to 2021 at constant price of 2004-05 and 2011-12. After globalization the LPG policy and WTO agreement has adversely influenced on Indian agriculture sector. The Indian average farmers cannot compete with global competition. The growth of service and industrial sector also one of the causes to minimize the contribution of

agriculture in India's Gross Domestic Product. The lack of employment and income opportunity and commercialization of agriculture sector has lost its value or interest of people. From 2012 to 2021 the world agricultural product prices have comparatively low which also impact on agriculture export from India. The rate of net profit in agriculture become negative in case marginal farmers but on the other side they hold 85% share in total farmers. This collective hurdles adversely impact on agriculture sector and cause to decline share in total GDP of India.

VIII. AREA AND FOOD GRAIN PRODUCTION IN INDIA:

"Per Drop More Crop" the slogan given by Prime Minister Narendra Modi highlight the importance natural resources and need of large production. The availability of food grain in India has instantly change after green revolution. The ministry of agriculture in their third advanced estimation disclosed that the total food grain production reach at 308.86 mt. as and also expected 350.7 mt. food grain production in 2020-21 with assume normal monsoon season. But in another side India has upgrade their rank in global hunger index from 97 to 100 in last year. Hunger is serious problem in India, out of 119 countries we are behind the North Korea, Bangladesh and Iraq. Our requirement for food grains in order to provide for our population is projected to be 300 million tunes by 2025-26.The earlier estimate of food grains production in 2020-21 is 308.86 million tones. This implies that the crop output needs to grow more than its annual average. There is marginally increase in the area under food grain production compare to change in total food grain production in India. The average yield agriculture increases because of productive capacity of agriculture sector has uplift during the study period. The following table describe the actual situation of food grain production and area under food grain production in India.

Table No. 2

YEAR	Total Food grain production (Million Tones)	Area under Food grain production (Million hectares)
2000-2001	196.81	121.05
2001-2002	212.85	122.78
2002-2003	174.77	113.86
2003-2004	213.19	123.45
2004-2005	198.36	120.08
2005-2006	208.60	121.60
2006-2007	217.28	123.71
2007-2008	230.78	124.07
2008-2009	234.47	122.83
2009-2010	218.11	121.33
2010-2011	244.49	126.67
2011-2012	259.29	124.75
2012-2013	257.13	120.78
2013-2014	265.05	125.05
2014-2015	252.03	124.30
2015-2016	251.54	123.22
2016-2017	275.11	129.23
2017-2018	285.01	127.52
2018-19	285.21	124.78
2019-2020	297.5	126.99
2020-2021	308.86	129.34

Source: Agricultural Statistics at a glance 2021

The first and second green revolution has largely influenced on food grain availability in India. In 2001 the total food grain availability is 196.87 mt. The bad monsoon session adversely influenced on availability of food grain in year like 2002-03, 04-05, and 2014-15. After 2015 the trend became positive and gradually increased. In the present year 2021 expected total food grain

availability is 308.86 mt. means the net food grain availability increases 112.05 mt. during the study period. The area under food grain production has marginally increased from 121.05 to 129.34 mt. means only 8.29% increase in total area under food grain production in India. This fact explore the need and opportunity of agriculture sector to expand.

IX. PER CAPITA NET AVAILABILITY OF FOOD GRAIN IN INDIA 2000 TO 2021:

The policy for food grain production and its available for masses have huge differences. The food grain availability during 2000 to 2021 has given in the following table. The food grain availability in kilo gram per year and gram per day has given as follows.

Table No. 3

Years	Years Food grains (Kgs Per Year)	Food grains (Grams Per Day)
2000	165.9	454.4
2001	151.9	416.2
2002	180.4	494.1
2003	159.7	437.6
2004	168.9	462.7
2005	154.2	422.4
2006	162.5	445.3
2007	161.6	442.8
2008	159.2	436.0
2009	162.1	444.0
2010	159.5	437.1
2011	170.9	468.2
2012	169.3	463.8
2013	179.5	491.9
2014	178.6	489.3
2015	169.8	465.1
2016	177.7	486.8
2017	178.4	488.7
2018	176.8	484.3
2019	180.5	494.7
2020	187.1	512.5

Source: Agricultural Statistics at a glance 2021

The result present table no.4 reveals that 6.16%. growth in food grain availability in India during the period 2000 to 2021. The highest availability of kg. Per year existed in year 2002 and less in 2001. In present year the food grain availability kg. Per year is 187.1. The consider period shows less increase in food grain availability in India. The food grain availability gram per day also increases 21.2% during the study period. This both indicator explore the real task that the production targets should be expand and sustainable increase in availability of food grain to community of India.

X. ISSUE & CHALLENGES BEFORE INDIAN AGRICULTURE:

- The conservation and enhancement of ecological foundations for sustainable agriculture, which included¬ land, water, biodiversity, and marine resources. Urbanization and non- agricultural land uses to create tremendous challenge before agriculture.
- The 80 percent farmers in India having small size of land. They are not economically sound and lack of market attachment
- The net income from agriculture of small and marginal farmer's quite low or some time it become negative. Because of large increase in production cost in agriculture sector.
- The contribution of private sector in agriculture investment quite low and declined trend of public investment in agriculture after 2000.
- The agriculture productivity is very low and hamper income of the farmers. The per unit area productivity also low in case of major crop producing in countries.

- The fall in the ground water level generate more pressure on other irrigation facilities and create hurdles in the way of agriculture development in India.
- Lack of competitiveness in Indian farmers is another hurdles rise in between between improve agriculture development. The farmers are less risk bearing and unskilled which adversely impact on their income from agriculture.
- Natural risk in agriculture is a common phenomenon but most of the farmers not get benefits of crop insurance scheme. The agricultural insurance schemes are inefficient to overcome various risk in agriculture sector.
- Low profitability is a main cause behind the farmers indebtedness and suicide problem existed in many state of India in the last few years.
- The spending on agriculture subsidy has increased year by year but problem remains same and continuously grow-up.

XI. OPPORTUNITY FOR INDIAN AGRICULTURE:

The following key recommendations has given to ensure higher and inclusive growth in Indian agriculture sector.

- Increasing agricultural productivity is a key challenge for ensuring national food security. To increase production, exploiting the potential of existing yield gaps offers a tremendous opportunity.
- Rain fed areas have a huge potential to raise production and increase farm income. These grey areas can soon be made green to harness a second green revolution.
- Linking farmers to markets is a pre-requisite for augmenting farm production and farmers' income. Role of innovative institutions would be critical in this context to reap the benefits of emerging opportunities.
- There is a dire need to significantly expand the capital investment in agriculture by both public and private institutions in the non-green revolution regions, particularly in the eastern and north-eastern India, where there is a great potential for agricultural growth.
- Water will be the most critical natural resource for the future growth of agriculture. Currently, the water sector for irrigation is invariably neglected both at the central and state levels.
- Climate change has added a new dimension to future agricultural growth, which is a major concern. The worst affected would be small farm holders located in the marginal and under-privileged areas.
- There is an urgent need for agricultural diversification by identifying the key crops/ commodities which can help small farm holders to raise their income.
- Food processing and distribution sector needs to be strengthened by evolving policies for larger private sector participation in the entire value chain.
- Globalization of agriculture create huge opportunities for enhanced agricultural production and export.

XI. CONCLUSION:

In short, after the brief discussion on current position of Indian agriculture, the major challenge is to secure sustainability of agriculture. Global warming and climate change all adversely impact on overall agriculture productivity and production in India. The future demand for food grain and raw material will not be satisfied from agriculture sector. Less production from agriculture and expansion in demand create bourdon on agriculture production and food inflation in India. But another side is that the agriculture production, productivity, profitability of marginal farmers has declined. On that ground the sustainable agriculture development is only way to overcome this problem and further development.

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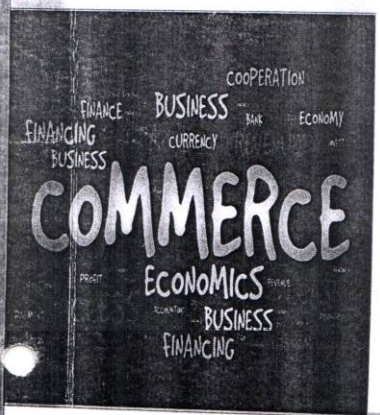

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Various aspect of Human Development Index (HDI)

Prof. Ganesh Shivaji Kiroche

All over the world ,human working for healty and happy life, everyone increase there income for best life, living of standerd, everyone try to fulfill there all needs. Therefore one of the best measure of Human living Standerd or Human Development is HDI. In HDI three basic dimensions of human development—

1. A long and healthy life(life expectancy) ,
2. Knowledge(Education) and
3. standard of living. (per capita Income)

Human Development Index 2020 is a report published by the United Nations Development Programme (UNDP). In 2020, UNDP has released planetary pressures-adjusted Human Development Index. According to the UNDP's report, Norway topped the index, followed by Ireland, Switzerland, Hong Kong and Iceland. Germany, Sweden, Australia, Netherlands and Denmark are the other top 10 countries ranked in the Human Development Index.And India rank to 131, out of 189 countries in the world. Human development index, released by the United Nations Development Programme (UNDP).2020

Rank-wise list of top 10 high HDI-

Contry	value	rank
Norway	0.957	1
Ireland	0.955	2
Switzerland	0.955	3
Hong Kong	0.949	4
Iceland	0.949	5
Germany	0.947	6
Sweden	0.945	7
Australia	0.944	8
Netherlands	0.944	9
Denmark	0.940	10
India	0.645	131
Niger	0.394	189

In india position-

1- Long and healthy life: For Indian's, life expectancy at birth is 69.7 years in the report. This is slightly lower than the South Asian average of 69.9 years. Also, between 1990 and 2019, India's life expectancy at birth increased by 11.8 years.

2- Knowledge: The expected years of schooling in India was 12.2 years in the report. Also, between 1990 and 2019, India's mean years of schooling increased by 3.5 years, and expected years of schooling increased by 4.5 years.

3- Standard of living: India's Gross National Income (GNI) per capita is USD 6,681 which increased by about 273.9% between 1990 and 2019.

Meanwhile, the life expectancy of Indians at birth in 2019 was 69.7 years while Bangladesh has a life expectancy of 72.6 years and Pakistan 67.3 years, the 2020 Human Development Report said. India's HDI value for 2019 is 0.645 which put it in the medium human development category. India has been positioned at 131 out of 189 countries and territories, according to the report. India had ranked 130 in 2018 in the index.

India ranked at 131st position out of 189 countries in the index, felling in the medium human development category with an HDI value of 0.645. In the year 2019, India ranked at 129th position.

It is to be noted that between 1990 and 2019, India's HDI value increased from 0.429 to 0.645, an increase of 50.3%.

In this way with reference of India india"s HDI value(0.645) is low.according to other contry.

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AN INVESTIGATION OF FUNGAL DISEASES THAT AFFECTS THE TREE SEEDLINGS IN SOME FOREST NURSERIES

Ananta T. More*, Sumia Fatima
Department of Botany, Jijamata Mahavidyalaya, Buldana
**Department of Botany, Dr. Rafiq Zakaria College for Women, Aurangabad
Corresponding author – atmore555@gmail.com

ABSTRACT

In this study, we concentrated on ten plant species that are often grown in forest nurseries throughout the Buldana region of the Indian state of Maharashtra. The study was done many times over the course of the five-month period, from May 2021 to October 2021. The major goal of our investigation in this study was to identify the diseases that affect the chosen common tree species that are widely distributed throughout Maharashtra in their seedling or nursery stages. Kigelia africana, Aegle marmelos, Bauhinia variegata, Azadirachta indica, Cassia fistula, Pongamia pinnata, Delonix regia, Thespesia populnea, Tectona grandis, and Albizia lebbeck were among the plant species present. Eight different pathogenic fungi that induced varying levels of infection in various plant species are among the common fungi infections that we recorded. We calculated the overall percentage of infected seedlings for each species of forest plant based on this infection investigation. Out of all these data, it was noticed that Cassia fistula observed the highest infection rate. Bauhinia variegata recorded the lowest rate, according to the data. An average of 33.13 percent of the seedlings were infected. Meliola, Phomopsis, Alternaria, Colletotrichum, Fusarium, Curvularia, Phyllachora and Phellinus are among the regularly seen pathogenic mycoflora. to identify any remaining fungal diseases in the same plant species, along with different geographical and climatic zones that will allow for future research.

KEYWORDS - Forest, Nursery, Diseases, fungal, pathogenic, mycoflora

INTRODUCTION

Diseases are one of the difficulties in forest renewal and sometime fungi can cause heavy death in nursery. Many of the fungal pathogen passing out through seeds and develop on seedlings. Apart from these seed borne fungal pathogens, soil borne fungal pathogens have also been shown to be devastating by attacking young seedlings in forest nurseries. These seedlings are at risk to numerous diseases due to their tender tissues and they often have difficulty in establishing themselves (Rai and Mamatha, 2005). When these diseased seedlings used for planting then multiply the disease in forest. Seedlings grown in forest nurseries are the main source of planting reserve, it is necessary to explore seedling diseases and use the control measures at seedling stage. It is important to finding these pathogens and diseases they cause.

World's forests continue to decline as human populations continue to grow and demand for food and land increases, the rate of net forest loss has been cut by over 50 percent. In 1990 the world had 4128 million ha of forest, by 2015 this area had decreased to 3999 million ha (Global Forest resources assessment, 2015). This is change from 31.6 percent of global land area in 1990 to 30.6 percent in 2015. The largest forest area loss occurred in the tropics.

The environment and plants interact closely. Not all species are necessary valuable because of the species' naturally slow development rates and the diverse makeup of the natural forest. One of the key subjects of the forest department is understanding the origins and mechanisms of a disease epidemic. Particularly in plantations, where sudden environmental changes could cause devastating losses in the event of a disease epidemic. Under such conditions, observing the forest nursery provides a useful model for comprehending ecological metamorphosis. Forest nurseries may have a variety of diseases, such as damping off, root rot, stem rot, leaf curl, wilt, canker, rust, decay etc. In the current investigation, we discovered that different and widespread tree diseases were caused by fungal infection and creates the diseased issues in forest nurseries across Buldana district of Maharashtra.

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R. solani reproduces asexually by way of hyphae (vegetative mycelium) and sexually by way of the development of basidiospores. The stinging stage of R. solani needs sclerotia to survive the winter and other harsh circumstances. Sclerotia may persist for many years in the soil (Baker 1970; Echandi 1965). Phytophthora which belongs to the domain Eukaryota, superphylum Heterokonta, class Oomycetes, order Pythiales, family Pythiaceae, and genus Phytophthora, can infect 255 genera in 90 families (Cline et al. 2008), causes billions of dollars' worth of crop losses every year throughout the world (Kamoun et al. 2014; Wa Blair et al. 2008; Erwin and Ribeiro 1996).

MATERIALS AND METHOD

In the Buldana district of Maharashtra, forest nurseries were surveyed for disease in five different nurseries in eight different tehsils areas i.e., Deulgaon Mahi, Shegaon, Mehkar, Motala, Chikhali, Buldana, and Nandura. This survey was conducted in between May 2021 to October 2021. Disease specimens were collected and brought to the lab for the isolation and identification of the pathogenic organisms. Disease incidence, severity, and spread were recorded using a disease grading scale.

To prevent aerial contamination, samples of seeds and leaves from plants and trees were obtained from nurseries and carried to the lab in polythene bags. For the purpose of isolating mycoflora associated with leaves, the International Seed Testing Association's (1966) suggested Agar plate method was used. Surface leaf fragments were first disinfected with sodium hypochlorite solution containing 0.01 percent, followed by a sterilized water wash. These were cultured in Petri dishes with PDA medium for 7–10 days at 24–25 0C. Colonies of microbes growing on leaves were isolated and characterized. After being stained with cotton blue, spore slides were made and placed on glass slides. The slides were inspected under a microscope, and the book Introduction to Fungi by Webster & Weber was used to identify the causative fungus (2007).

RESULTS AND DISCUSSION

Disease survey conducted in forest nurseries located at different parts of the district revealed that forest seedlings are almost free from soil-borne fungal diseases like damping-off, collar rot and wilt irrespective of the conducive climatic conditions prevailed in the nurseries. However, most of the species raised in forest nurseries suffered from one or the other foliage diseases, mostly incited by air-borne inoculum of pathogens, the severity of which varied from nursery to nursery depending on the nursery management practices and prevailing environmental conditions. The common nursery pathogens like Meliola, Phomopsis, Alternaria, Colletotrichum, Fusarium, Curvularia, Phyllachora and Phellinus which cause various diseases at different growth phases of seedlings were seldom recorded in root forest nurseries. Colletotrichum and Curvularia, the most potential pathogen in forest nurseries which exists in different Anastomosis groups (Mohanan 2001) and having a wide host range was not encountered iin the forest nurseries during 2021 and 2022. The details on the diseases affecting the seedlings Kigelia africana, Aegle marmelos, Bauhinia variegata, Azadirachta indica, Cassia fistula, Pongamia pinnata, Delonix regia, Thespesia populnea, Tectona grandis, and Albizia lebbeck and their causal agents are given in Table 1.

Seedling congestion was found to be the major factor for the incidence and spread of foliage diseases. Pathogens like Meliola, Phomopsis, Alternaria, Colletotrichum, and Phellinus were found associated with the foliage diseases of seedlings

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Sr.No.	Host Plant species	Pathogenic fungi found
1.	Kigelia africana	Meliola kigeliae
2.	Aegle marmelos	Phomopsis, Alternaria
3.	Bauhinia variegata	Colletotrichum
4.	Azadirachta indica	Fusarium
5.	Cassia fistula	Curvularia
6.	Pongamia pinnata	Phyllachora
7.	Delonix regia	Phomopsis
8.	Thespesia populnea	Phellinus noxius
9.	Tectona grandis	Phomopsis
10.	Albizia lebbeck	Colletotrichum capsici

Table -1 Host Plant and Pathogenic fungal found on it

In general, severity and spread of foliage diseases caused by most pathogens was low in all the nurseries, except the foliage blight caused by P. glomerata. The pathogen was found widespread in nurseries and caused severe foliage infection in teak. In teak seedlings caused severe damages. In teak, the pathogens cause dark greyish brown necrotic lesions on foliage, usually at the margin and tip of the leaves or at the base of the petiole which coalesce and spread to the entire leaf lamina. The infected leaves show an upward curling and become brittle and withered. The disease also affects the leaf petiole and seedling stem. Severe infection leads to seedling blight. In Cassia fistula, the pathogen caused severe leaf blotch which led to defoliation and seedling mortality.

Inoculum of most of the nursery pathogens activates in presence of a susceptible host under conducive edaphic and environmental factors. However, in Most of the soil-inhabiting, disease causing fungi subsist mainly on dead organic materials and the presence of surplus, readily available nutrients in organic compost in root trainer cells makes less competition among the pathogens for the nutrients and thus least attractive for infection of seedlings.

Total No.2. of plants observed in all Forest Nurserie Diseased Plants Recorded

Sr.No.	Host Plants	Total No. plants	No. of diseased plants	% of Diseased Plants
1.	Kigelia africana	1764	556	31.52
2.	Aegle marmelos	2268	832	36.68
3.	Bauhinia variegata	4377	946	21.61
4.	Azadirachta indica	8456	2476	29.28
5.	Cassia fistula	2835	1230	44.55
6.	Pongamia pinnata	3864	1232	31.88
7.	Delonix regia	4756	1056	22.20
8.	Thespesia populnea	1895	718	37.88
9.	Tectona grandis	4412	1910	43.89
10.	Albizia lebbeck	2116	780	36.86
	Total	40271	13341	33.13

Harsh et al. (1989) briefly documented 14 foliar diseases that were caused by fungi in Madhya

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Pradesh nurseries. According to Mehrotra, R. solani caused foliar infections in forest nurseries (1990). According to Maji et al. (2012), certain mulberry kinds had foliar diseases such powdery mildew, leaf rust, myrothecium leaf spot, and pseudocercospora leaf spot. The majority of soil-borne illnesses weren't present in the nurseries (Mohanan 2000). Ailanthus excelsa Roxb. was affected by a leaf spot and top dying ailment that Dadwal et al. (2012) claimed was caused by Colletotrichum dematium in India's New Forest's Dehra Dun, Uttar Pradesh. Some plants have Alternaria species infection on their Azadirachta indica leaves (Singh et al 2017).

CONCLUSION

The foliage infections brought on by airborne fungi that damage the seedlings in forest nurseries may be the main element determining the occurrence and spread of the disease. The most significant fungi that infect foliage are Colletotrichum, Phomopsis sp., Curvularia sp., and Phellinus sp. Although the new technology allows for the creation of high-quality, healthy planting material, controlling leaf diseases still necessitates the timely application of the right fungicide(s). Otherwise, a little foliar infection could become severe and seriously harm the seedling crops.

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FUNGAL DISEASES IN SOME FOREST NURSERIES OF BULDANA DISTRICT, MAHARASHTRA STATE (INDIA)

Ananta T. More[1], Sumia Fatima[2]
[1]Jijamata Mahavidyalaya, Buldana*
[2]Dr. Rafiq Zakaria College for Women, Aurangabad
Corresponding author – **Ananta T. More**
Email- atmore555@gmail.com

Abstract

In this survey we were focussed on ten plant species which are generally raised in forest nurseries across Buldana region of Maharashtra state of India. The survey was completed in between duration of the five months i.e., from September 2019 to February 2020 in multiple times. The main purpose of our study in this research was to find the seedling or nursery diseases of the targeted common tree species. The plant species in this were Acacia auriculiformis, Aegle marmelos Albizia lebbeck, Azadirachta indica, Cassia fistula, Dalbergia latifolia, Delonix regia, Gmelina arborea, Tectona grandis and Terminalia bellirica. The Common Fungal infections we recorded were includes seven different pathogenic fungi which were caused less or more infection level in different plant species. From this infection study we measured total percentage of diseased seedlingsof each forest plant species. Out of all these observations noted that the highest rate of infection in Tectona grandis. The lowest rate was recorded in Albizia lebbeck. The average percentage of the diseased seedlings were 29.13%. The commonly recorded pathogenic mycoflora includes Alternaria alternata, Curvularia, Fusarium, Phoma glomerata, Colletotrichum, Phomopsis and Pseudocercospora. To find out remaining fungal diseases in same plant species along with various geographical and variety of climatic conditions regions creating scope for future studies.

Keywords *- Forest, Nursery, Diseases, fungal, pathogenic, mycoflora*

Introduction

The forest provides man with wood, fuel, feed, and minor forest products while also preserving soil and water, regulating climate, providing food and shelter for wildlife, and meeting man's aesthetic and recreational needs. Plants and the environment have a close interaction. Due to the species' innately modest growth rates and the mixed composition of the natural forest, not all species are necessarily useful. Understanding the causes and mechanisms of a disease epidemic is one of the important topics of the forest department. Particularly in plantations, where a disease epidemic could result in catastrophic losses due to abrupt environmental changes. The observation of the forest nursery under such circumstances serves as a model for understanding ecological metamorphosis. Different types of diseases, including Damping off, Root Rot, Stem Rot, Leaf Curl, Wilt, Canker, Rust, Decay, etc., can be found in forest nurseries. In the current study, we found that fungal pathogens in trees were the cause of distinct and widespread diseased issues in forest nurseries in the Buldana district of Maharashtra (India). The importance of seedling health has increased, significantly broadening the range of Phyto-sanitary procedures. The method for producing seedlings has been standardised, and growing media appropriate for the plant species have been established. Under the conditions of nature, tree seeds germinate and trees grow quickly. In natural forests or

plantations, these tender young seedlings and young trees are subjected to unfavourable dry season circumstances and fierce competition from other species. In their crucial juvenile stage, forest nurseries may give seedlings the best care and attention, resulting in the production of healthy, vivacious seedlings. In many circumstances, nursery-grown seedlings are necessary for successful regeneration since degraded areas do not have the right conditions for natural vegetation or direct seeding. Until they are ready to be planted, tree seedlings are cultivated in a controlled environment called a forest nursery. It might be a little, unofficial agreement or a sizable business operation. One of the biggest issues facing nursery managers is maintaining the seedling crops in a tropical climate. If prompt action is not taken, disease concerns may arise one after another during this time, potentially destroying the entire seedling crop. The seedlings in forest nurseries may be managed rigorously because their maximum growth time is 200 days.

Materials and method

In the Buldana district of Maharashtra, forest nurseries were surveyed for disease in five different five nurseries in five different tehsils i.e., Khamgaon, Motala, Chikhali, Buldana, and Nandura. This survey was conducted in between September 2019 to February 2020. Disease specimens were collected and brought to the lab for the isolation and identification of the pathogenic organisms. Disease incidence, severity, and spread were recorded using a disease grading scale. To prevent aerial contamination, samples of seeds and leaves from plants and trees were obtained from nurseries and carried to the lab in polythene bags. For the purpose of isolating mycoflora associated with leaves, the International Seed Testing Association's (1966) suggested Agar plate method was used. Surface leaf fragments were first disinfected with sodium hypochlorite solution containing 0.01 percent, followed by a sterilized water wash. These were cultured in Petri dishes with PDA medium for 7–10 days at 24–25 0C. Colonies of microbes growing on leaves were isolated and characterized. After being stained with cotton blue, spore slides were made and placed on glass slides. The slides were inspected under a microscope, and the book Introduction to Fungi by Webster & Weber was used to identify the causative fungus (2007). Some types of Fungicides were screened against important fungal pathogens using standard techniques and most effective fungicides at appropriate dosage were recommended and applied in the nurseries for controlling the respective disease(s). Observations on the effect of chemical treatments against diseases were recorded from the nurseries. General nursery management practices followed in each nursery were recorded and data on growing media used, their composition and pH were also collected.

Results and discussion

Disease survey conducted in forest nurseries located at different parts of the district revealed that forest seedlings are almost free from soil-borne fungal diseases like damping-off, collar rot and wilt irrespective of the conducive climatic conditions prevailed in the nurseries. However, most of the species raised in forest nurseries suffered from one or the other foliage diseases, mostly incited by air-borne inoculum of pathogens, the severity of which varied from nursery to nursery depending on the nursery management practices and prevailing environmental conditions. The common nursery pathogens like Rhizoctonia solani, Cylindrocladium spp., Fusarium spp. and Pythium spp.

which cause various diseases at different growth phases of seedlings were seldom recorded in root forest nurseries. R. solani, the most potential pathogen in forest nurseries which exists in different Anastomosis groups (Mohanan 2001) and having a wide host range was not encountered in the forest nurseries during 2021 and 2022. The details on the diseases affecting the seedlings Acacia

auriculiformis, Aegle marmelos, Albizia lebbeck, Azadirachta indica, Cassia fistula, Dalbergia latifolia, Delonix regia,

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Gmelina arborea, L. Tectona grandis L., Terminalia bellirica their causal agents are given in Table 1.

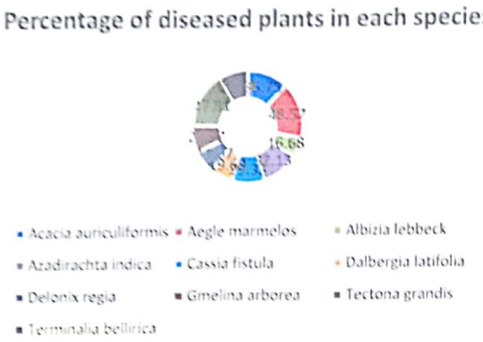
Sr. No.	Host Plant	Pathogenic fungi
	Acacia auriculiformis	*Alternaria alternata, Curvularia, Fusarium*
	Aegle marmelos	*Phomopsis, Phoma ,Alternaria*
	Albizia lebbeck	*Colletotrichum capsica*
	Azadirachta indica	*Fusarium*
	Cassia fistula	*Curvularia, Phoma glomerata*
	Dalbergia latifolia	*Colletotrichum, Phomopsis*
	Delonix regia	*Phomopsis*
	Gmelina arborea	*Pseudocercospora*
	Tectona grandis	*Phomopsis glomerata*
	Terminalia bellirica	*Phomopsis*

Table -1 Host Plant and Pathogenic fungal found on it

Seedling congestion was found to be the major factor for the incidence and spread of foliage diseases. Pathogens like Colletotrichum, Alternaria alternata, Phoma glomerata, Phomopsis were found associated with the foliage diseases of seedlings. In general, severity and spread of foliage diseases caused by most pathogens was low in all the nurseries, except the foliage blight caused by P. glomerata. The pathogen was found widespread in nurseries and caused severe foliage infection in teak. In teak seedlings, P. glomerata caused severe damage to the seedlings. In teak, the pathogens cause dark greyish brown necrotic lesions on foliage, usually at the margin and tip of the leaves or at the base of the petiole which coalesce and spread to the entire leaf lamina. The infected leaves show an upward curling and become brittle and withered. The disease also affects the leaf petiole and seedling stem. Severe infection leads to seedling blight. In Cassia fistula, the pathogen caused severe leaf blotch which led to defoliation and seedling mortality.

Sr. No.	Host Plant	Total No. of plants observed in all Forest Nurseries	Diseased Plants Recorded from Total Observed	Percentage of diseased plants (%)
	Acacia auriculiformis	3480	1244	35.75
	Aegle marmelos	1890	618	32.70
	Albizia lebbeck	3267	545	16.68
	Azadirachta indica	6573	2112	32.13
	Cassia fistula	5643	1655	29.33
	Dalbergia latifolia	4672	920	19.69
	Delonix regia	3964	756	19.07
	Gmelina arborea	2845	652	22.92
	Tectona grandis	5423	2593	47.81
	Terminalia bellirica	2643	667	25.24
	Total	**40400**	**11762**	**29.11**

Inoculum of most of the nursery pathogens activates in presence of a susceptible host under conducive edaphic and environmental factors. However, in Most of the soil-inhabiting, disease causing fungi subsist mainly on dead organic materials and the presence of surplus, readily available nutrients in organic compostin root trainer cells makes less competition among the pathogens for the nutrients and thus least attractive for infection of seedlings. The compost prepared from forest weeds is the major constituent of the growing medium in forest nurseries and is very resistant to environmental stress persisted in the compost and contributed to the development of disease.



In the nurseries of Madhya Pradesh, 14 fungal infections were briefly described by Harsh et al. (1989) as the source of foliar diseases. R. solani induced foliar infections in forest nurseries, according to Mehrotra (1990). Maji et al. (2012) noted that foliar diseases such as powdery mildew, leaf rust, *Myrothecium* leaf spot, and *Pseudocercospora* leaf spot were present in some mulberry types. Most of the soil-borne diseases were excluded from the nurseries (Mohanan 2000). In India's New Forest, Dehra Dun, Uttar Pradesh, noted leaf blight, a novel disease of *Ailanthus excelsa* Roxb. was affected by a leaf spot and top dying illness that Dadwal *et al.* (2012) reported as being brought on by *Colletotrichum dematium*. The infection of *Alternaria* species on leaves of *Azadirachta indica* found in some plants (Singh *et al* 2017).

Conclusion

In forest nurseries, foliage infections caused by air-borne fungal pathogens affect the seedlings and seedling congestion may be the primary influencing factor for the incidence and spread of the disease. Among the fungal pathogens causing foliage infection, *Colletotrichum*, , *Phomopsis* sp., *Phoma glomerata* and *P. eupyrena* are the important ones. Though, the new technology offers production of high-quality healthy planting stock, application of proper fungicide(s) at proper time is required to control the foliage diseases. Otherwise, mild foliage infection may flare up and cause severe damage to the seedling crops.

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Synthesis of Subtituted Pyrazoles using Ionic Liquid

Chandrashekhar G. Devkate*[1], Ganesh B. Andhale[2], Satish Kola[3], Mohammad Idrees M. Siddique[4]
*[1], Indraraj Arts, Commerce and Science College, Sillod, Aurangabad-431112
[2]Jijamatha Mahavidhyalaya Buldhana-443001
[3]M.G. Arts, Science and Late N.P Commerce College, Armori, Maharashtra, India 441208
[4]Dept. of chemistry, Government Institute of Science, Nagpur-440008
*[1]Corresponding Author Email: cgdevkate@gmail.com

ABSTRACT
Pyrazoles are well known five-membered nitrogen containing heterocyclic compounds possessing diverse bioactivities and are used extensively in pharmaceutical industry. Removing organic solvents in chemical synthesis is important in drive towards benign chemical technologies. Here we have screened different imidazolium-based ionic liquid and we found that 1-Ethyl-3-methylimidazolium Chloride is a better media for the synthesis of 1-substituted pyrazole and the method for the reaction system exhibited tolerance with various functional groups and gives good to excellent yields.

Keywords: Ionic liquid, Pyrazole, N-Tosylhydrazine.

INTRODUCTION
Pyrazoles and its derivatives possessing diverse bioactivities, such as analgesic agent, platelet aggregation inhibitors, and nonsteroidal anti-inflammatory agents, thus these compounds are widely used in the development of drug research [1] and agriculture [2]. They are also useful intermediates for many industrial products [3] ,[4] . Consequently, pyrazoles have attracted much attention, and various procedures for their synthesis have been developed [5]. As reported in the literature, the synthesis methods toward substituted pyrazoles include: (a) Condensation of α, β-unsaturated carbonyl compounds with hydrazines, which is used as a major strategy. [6]

A lot of syntheses of pyrazoles have been developed.[7] However, these syntheses are usually carried out in organic solvents. Recently, solventless organic reactions such as Michael additions,[8] aldol condensations,[9] Claisen condensation, [10] Stobbe condensation,[11] and Thorpe reaction16 have been studied. Compared with the reactions in organic solvents, solventless reactions are often rapid, regio- or chemoselective, occur in high yields and have environmental and economic advantages. [8] For these reasons, we studied syntheses of pyrazole derivatives by the solventless reaction of 1,3-dicarbonyl compounds with hydrazines.

Among these popular procedures for pyrazole synthesis, hydrazine hydrate is applied as a predominant nitrogen source, nevertheless, most of these transformations are dependent on a large excess amount of

hydrazine hydrate and oxidant or base. In 1987, Shechter et al. published the early report in which only 1.1 equiv of tosyl hydrazide with unsaturated ketone was used as
nitrogen source for the preparation of 1H-cyclooctapyrazoles. [12] Then, a remarkable number of novel 1H-pyrazole synthesis using substituted hydrazides, especially sulfonyl hydrazides as nitrogen transfer reagents have been reported. In 2011, Yu and co-workers established a highly efficient and eco-friendly protocol for the preparation of substituted 1H-pyrazoles by a one-pot condensation reaction of α,β-unsaturated carbonyl compounds with tosyl hydrazide promoted by stoichiometric tetrabutylammonium bromide in water [13].
Ionic liquids (ILs) has attracted the attention on scientific community in the last decade, due their particular properties and their applications in Organic Synthesis [14], catalysis [15], biocatalysis [16], liquid-liquid separations [17], extraction [18] and dissolution (celulose in microwave [19] and petroleum asphaltenes in microwave [20]) processes, nanomaterials synthesis [21], polymerization reactions [22] and electrochemistry [23]. ILs are an excellent alternative to substitute volatile organic solvents in more environmental friendly technologies ("green technologies"), since their very low vapor pressures, their thermal and chemical stability, their ability to act as catalyst, and their non-flammability and non-corrosives properties.

EXPERIMENTAL SECTION

General Considerations

All reagents and catalyst purchased from commercial sources were used as received. The solvents ionic liquids was prepared by reported procedure [24] and used. All reactions were carried out in oven-dried glassware and were magnetically stirred. FTIR spectra were taken on F.T. Infra-Red Spectrophotometer Model RZX (Perkin Elmer) and ^{1}H and ^{13}C spectra were taken on bruker AVANCE II 400 MHz spectrometer with TMS as internal standard $CDCl_3$ / DMSO as solvent. ESI-Mass spectral data were recorded on Q-TOF Micro Waters (ESI-MS) Spectrometer.

General Procedure for the Screening of ionic liquids:

A mixture of 1,3-dialdehyde (**1**) (13.8 mmol) and tosylhydrazine (**2**) (13.8 mmol) was dissolved in separately in five different imidazolium-based ionic liquids (5 ml) and stirred at room temperature for 20 min. After stirring the reaction mixtures for 20 min., the reaction mass were poured on crushed ice. The obtained solids were filtered, washed with water and dried. The crude compounds were crystallized using DMF-Ethanol. Then for every seven different aldehydes the procedure was repeated. After screening the imidazolium-based ionic liquids, it was found 1-Ethyl-3-methylimidazolium Chloride was a suitable and novel medium for carrying the cyclocondensation leading to title products with excellent yields (**Table 1**, entry 2). The advantage of 1-Ethyl-3-methylimidazolium Chloride is that, it is stable, easily synthesized, cost effective, and recyclable.

Table 1

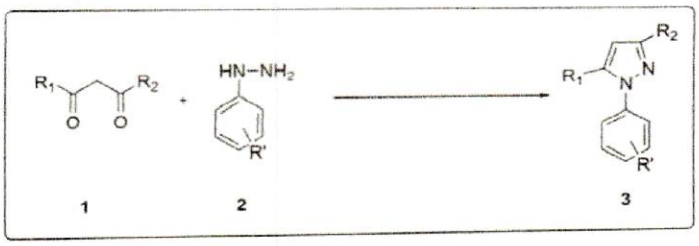
Screening of ionic liquids to search a suitable medium for one pot synthesis of phenyl pyrazoles (**2**)[a]

Entry	Ionic liquids	Time (min.)	Yield[b] %

1	1-Ethyl-3-methylimidazolium tetrafluoroaluminate	20	75
2	1-Ethyl-3-methylimidazolium Chloride	20	95
3	1-Butyl-3-methylimidazolium Chloride	20	60
4	1-Butyl-3-methylimidazolium hexafluorophosphate	20	65
5	1-Butyl-3-methylimidazolium tetrafluoroborate	20	56

[a]**Reaction conditions:** A mixture of 1,3-dicarbonyl (**1**) (13.8 mmol) and tosylhydrazine (**2**) (13.8 mmol) was dissolved in ionic liquids (5 ml) and stirred at room temperature for 20 min.

[b]Isolated yields.



General procedure for the synthesis of 3-substituted Pyrazoles (3a-g).

A mixture of 1,3-dicarbonyl (1) (13.8 mmol) and tosylhydrazine (**2**) (13.8 mmol) (**1a-g**) was dissolved in ionic liquid, 1-Ethyl-3-methylimidazolium Chloride (5 ml) and stirred at room temperature for 20 min.After stirring the reaction mixture for 20 min., the reaction mass was poured on crushed ice. The obtained solid was filtered, washed with water and dried. The crude compound was crystallized using DMF-Ethanol. For liquid compounds (**Table 2,** entry 3a,3d and 3g) the product was isolated as by pouring the compound on crushed ice to that ethyl acetate was added stir then sodium chloride was added, the two layers was separated then to the the organic layer sodium sulfate was added stir and filtered then residue was wash with ethyl acetate then the organic layer was separated and the finial compound was isolated by distillation.

Compound **3d**: Yield 94%; light yellow liquid; bp 141-142 ℃. FTIR Model RZX (Perkin Elmer) cm^{-1}: 1518 (C=N str., Pyrazolyl); 1199 (C-N str.); ^{1}H-NMR (400 MHz, $CDCl_3$): δ 7.13 (t, 1H, Pyrazolyl), 7.67 (d, 1H, Pyrazolyl), 7.76 (d, 1H, Pyrazolyl), 7.59-7.62 (m, 5H, Ar-H) ppm; ^{13}C-NMR (100 MHz, $CDCl_3$): δ 141.03, 140.12, 129.40, 126.81, 126.35, 119.02, 107.66 ppm;MS (ESI, m/z): calcd for $C_9H_8N_2$ ($M + H^+$) 144.0687; found: 145.1508.

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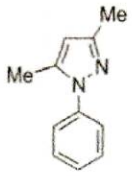
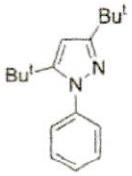
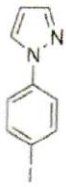
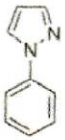
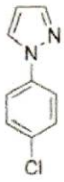
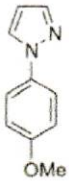
Table 2

One pot synthesis of phenyl pyrazoles (**3a-g**), carried in 1-Butyl-3-methylimidazolium tetrafluoroborate

Compound	R	R^1	R^2	Product	Yield	M. P./B.P (℃)
3a	-H	-Me	-Me		90	b.p;144-145
3b	-H	-Bu^t	-Bu^t		93	m.p;106-108
3c	p-I	-H	-H		90	m.p.;90-91
3d	-H	-H	-H		93	b.p;141-142

3e	p-Br	-H	-H		90	m.p;69-76
3f	p-Cl	-H	-H		87	m.p;88-91
3g	p-OMe	-H	-H		62	b.p;280

RESULTS AND DISCUSSION

The titled compounds have been synthesized by one pot synthesis by using readily available starting materials, such as different 1,3-dicarbonyl (**1a-g**) andp-toluenesulfonyl hydrazide ($TsNHNH_2$) (**2**). The ionic liquid, 1-Ethyl-3-methylimidazolium Chloride was prepared and used immediately.The reactions were carried out at room temperature for 20 min.The progress of the reaction was monitored by TLC. Various 1,3-dicarbonyls (**1a-g**) could give target pyrazoles through the same action with excellent yields (**3a-g**).

CONCLUSION

In conclusion, we have developed a simple, highly efficient, and environmentally friendly method for the synthesis of 1-substituted pyrazoles in ionic liquid, 1-Ethyl-3-methylimidazolium Chloride. Encouraged by this result, we have focused attention on the use of 1-Ethyl-3-methylimidazolium Chloride (dicationic ionic liquid) as solvent as well as catalyst. It was found that the ionic liquid worked well and the conversion found to take place rapidly giving excellent yield. Furtherstudies on the biological activities of the products and application of this methodology to other interesting pyrazole derivatives are underway in our laboratory.

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Evaluation of Acoustical Parameters of Some Substituted Ketimine Drugs Under Different % Composition In 75 % Dichloromethane (DCM)–Water Mixture At 30^{0}C.

Ganesh Andhale[1*], Prabhakar Kute[2], Chandrashekhar Devkate[3], Satyanarayan Arde[4], Atish Mehetre[5]

[1]P. G. Department of Chemistry Jijamata Mahavidyalaya, Buldhana, Dist. Buldhana, Maharashtra, India

[2]Department of Chemistry, Pratishthan Mahavidylaya, Paithan, Dist. Aurangabad-431107, Maharashtra, India

[3]Indraraj Arts, commerce & Science College Sillod, Aurangabad 431112, Maharashtra, India

[4]Department of Chemistry Y.C. Warana Mahavidyalaya, Warananagar- 416113, Maharashtra, India

[5]Shri Shivaji Science College, Kannad Dist. Aurangabad, Maharashtra, India

ABSTRACT

In the present investigation ultrasonic velocity of binary mixture of aromatic substituted ketimines and dichloromethane (DCM) under different percentage composition at 30^{0}C were evaluated using ultrasonic interferometer having 2MHz frequency. The obtained data was used to investigate the different acoustical parameters such as adiabatic compressibility, apparent molar compressibility, acoustic impedance, relative association, solvation number and intermolecular free length. The result is interpreted in terms of molecular interaction such as dipole-dipole interaction through hydrogen bonding between components of mixtures.

Keywords: Ultrasonic velocity, Dichloromethane (DCM), adiabatic compressibility, ketimines etc.

I. INTRODUCTION

The various techniques available to study molecular interactions in liquid are nuclear magnetic resonance, microwave, ultraviolet and infrared spectroscopy, neutron and X-ray scattering and ultrasonic investigation. NMR technique reflects effect on the proton bearing molecules, whereas microwave absorption provides information through dielectric constant. Neutron and X-ray scattering help in the study of molecular motion. The spectroscopic techniques provide useful information of interactions when the interaction energies involved are large. Weak molecular interactions cannot be resolved from the observed spectra. Ultrasonic techniques reveal very weak intermolecular interactions due to its useful wavelength range. In the recent years, determination of ultrasonic velocity evaluates various parameters of liquids for studying molecular and structural properties. There is an intimate relationship between the ultrasonic velocity on chemical and structural characteristics of molecule of liquids; this gives a property of basic importance to ultrasonic velocity

in molecular theory of liquids. At present, the ultrasonic and absorption studies especially in case of electrolyte solutions have led to new insight into the process of ion-association and complex-formation[1-2]. Many researchers such as M.S. Chouhan[3], S. Sasikumar[4], Shashi Kant[5], T. Sumathi[6], Chandami A. S.[7] and Azhagiri S.[8] have made ultrasonic study of electrolytic solutions and discussed about the variation of ultrasonic velocity with ion concentration. It has already been observed that extent of a lowering of compressibility and an increase in ultrasonic velocity with reference to that of water are proportionate to the number of ions existing in that medium. Most of the ultrasonic work in non-aqueous systems possesses an interpretation of solute-solvent interactions[9]. Solvation numbers have been obtained from the study of non-aqueous solutions by K.Kannagi et.al.[10], Harish Kumar[11].

In the present investigation, study of the interaction between solute-solute and solute-solvent of substituted ketimine in 75%, 80% and 85% (DCM+water) solvents by measuring ultrasonic velocity and density in different concentration of solute in different percentage of solvent has been done.

II. EXPERIMENTAL

All the chemicals used were of AR grade. The density measurements all the solutions were made with the precalibrated bicapillary pyknometer. All the weighings were made on one pan digital balance (petit balance AD-50B) with an accuracy of + 0.001 gm. The ultrasonic velocity was measured by using variable path crystal interferrometer (Mittal Enterprises, Model F-81) with accuracy of + 0.03 % and frequency 2MHz. The instrument was calibrated by measuring ultrasonic velocity of 75 % DCM-water mixture at 303 K. Elite thermostatic water bath was used, in which continuous stirring of water was carried out with the help of electric stirrer and temperature variation was maintained within + 0.1 oC. The ligands used in the present study are

5- Bromo-2-hydroxy-4-chloro (p-methyl phenyl) ketimine (LA)

5- Bromo-2-hydroxy-4-chloro (p-amino phenol) ketimine (LB)

III. THEORY AND FORMULATION

The distance traveled by micrometer screw get one maximum in ammeter (D), from the value of D, wavelength of ultrasonic wave is calculated using relation.

$2D = \lambda$ ..... (1)

Where λ is wave length and D is distance in mm. The ultrasonic velocity is calculated by using relation.

Ultrasonic velocity (U) = λ x Frequency x 10^3 .....(2)

Using the measured data some acoustical parameters have been calculated using the standard relations.

The adiabatic compressibility of solvent and solution are calculated by using equations

Adiabatic compressibility (βs) = $1/ U_s^2 x\ ds$ ..... (3)

Adiabatic compressibility (β_0) = $1/ U_0^2 x\ d_0$ ..... (4)

Acoustic impedance (Z) = Us x ds ..... (5)

Where U_0, Us are ultrasonic velocity in solvent and solution respectively. d_0 and ds are density of solvent and solution respectively

The apparent molal volume (ϕ_v) and apparent molal adiabatic compressibilities ($\phi_{k(s)}$) of substituted ketimines in solutions are determined respectively, from density (d_s) and adiabatic compressibility(β_s) of solution using the equations

$\phi_v = (M/d_s) + [(d_o-d_s)\ 10^3] / md_sd_o$ ..... (6) and

$\phi_{k(s)} = [1000(\beta_sd_o-\beta_od_s) / md_sd_o] + (\beta_s M / d_s)$ ..... (7)

Where, d_o and d_s are the densities of the pure solvent and solution, respectively. m is the molality and M is the molecular weight of solute. β_o and β_s are the adiabatic compressibility's of pure solvent and solution respectively.

Intermolecular free length (Lf) = $K\sqrt{\beta s}$ ..... (8)

Relative association (RA) = $(ds /d0) \times (U0 /Us)^{1/3}$ ..... (9)

Solvation number (Sn) = $\varphi^x / \beta 0 \times (M/ d0)$ ..... (10)

The value of Jacobson's constant is calculated by using relation

$K=(93.875+0.375 \times T)\times 10^{-8}$ ..... (11)

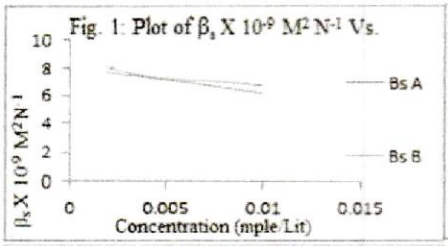
Where T is temperature at which experiment is carried out. The present investigation is carried out at temperature (T = 303K).

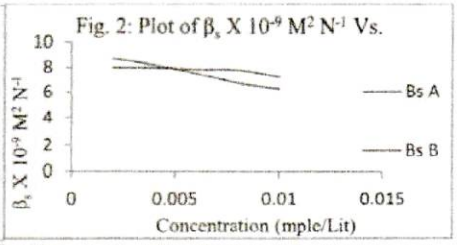
Table 1: Ultrasonic velocity, density, adiabatic compressibility (βS), Specific acoustic impedance (Z) Intermolecular free length (Lf) in 75% DCM solvent at 303K.

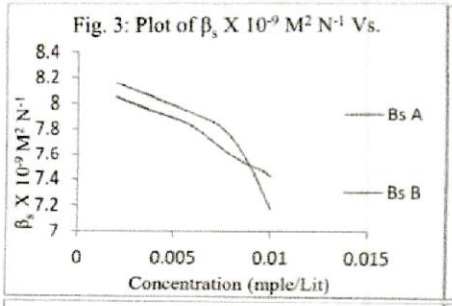
Conc. (m) Moles lit^{-1}	Density (ds) Kg m^{-3}	Ultrasonic Velocity(Us) m s^{-1}	Adiabatic Compressibility (β_s) x10^{-9} m^{2}N^{-1}	Inter molecular free length (Lf) x10^{-11} m	Specific acoustic impedance (Z) x10^5 kg m^{-2}s^{-1}
Ligand LA in 75% (DCM +water) solvent					
0.01	1224.1	3630.4	6.1983	5.1660	4.44397
0.008	1223.9	3529.6	6.5622	5.3155	4.31741
0.006	1222.3	3433.6	6.9394	5.4661	4.19689
0.004	1221.8	3342.4	7.3287	5.6173	4.08241
0.002	1216.0	3273.6	7.6739	5.7399	3.98070
Ligand LB in 75% (DCM +water) solvent					
0.01	1220.5	3504.0	6.6732	5.3602	4.27663
0.008	1219.6	3438.4	6.9354	5.4645	4.19347
0.006	1219.6	3401.6	7.0862	5.5236	4.14859
0.004	1218.7	3337.6	7.3660	5.6316	4.06753
0.002	1217.8	3188.8	8.0755	5.8966	3.88332
Ligand LA in 80% (DCM +water) solvent					
0.01	1225.3	3604.8	6.2805	5.2001	4.41696
0.008	1224.4	3483.2	6.7316	5.3836	4.26483
0.006	1223.5	3302.4	7.4940	5.6805	4.04048
0.004	1222.5	3158.4	8.2000	5.9419	3.86114
0.002	1217.1	3072.0	8.7062	6.1190	3.73893
Ligand LB in 80% (DCM +water) solvent					
0.01	1221.7	3371.2	7.2022	5.5686	4.11859
0.008	1220.8	3243.2	7.7876	5.7905	3.95929
0.006	1220.7	3236.8	7.8191	5.8022	3.95116
0.004	1219.9	3201.6	7.9500	5.8504	3.91734
0.002	1218.5	3211.2	8.006	5.8706	3.90115

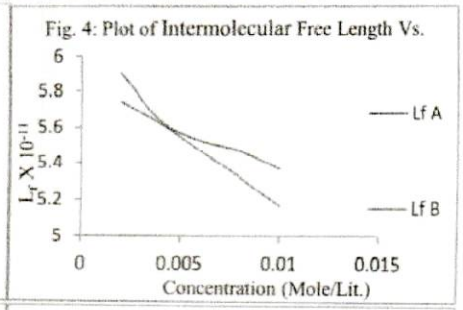
Ligand LA in 85% (DCM +water) solvent					
0.01	1226.5	3371.2	7.1740	5.5577	4.13477
0.008	1225.7	3249.6	7.7260	5.7676	3.98303
0.006	1224.6	3211.2	7.9190	5.8392	3.93243
0.004	1223.7	3188.8	8.0365	5.8823	3.90213
0.002	1218.3	3172.8	8.1538	5.9251	3.86542
Ligand LB in 85% (DCM +water) solvent					
0.01	1222.9	3320.0	7.4187	5.6517	4.06002
0.008	1221.9	3284.8	7.5848	5.7146	4.01369
0.006	1221.7	3236.8	7.1812	5.7998	3.95439
0.004	1220.9	3212.8	7.9351	5.8451	3.92250
0.002	1220.3	3192.0	8.0428	5.8846	3.89519

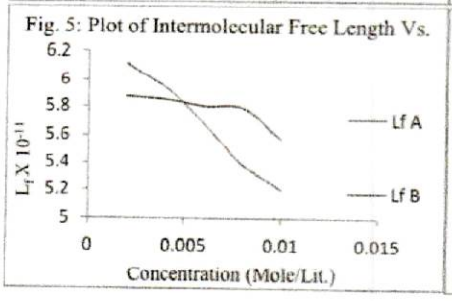
Plots of adiabatic compressibility βs of different ligand at different concentration in a 75%, 80%, 85% (DCM +water) solvent











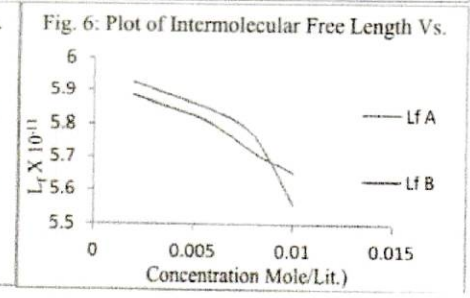


Fig. 7: Plot of Specific acoustic impendance

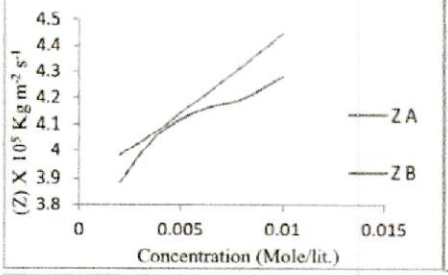


Fig. 8: Plot of Specific acoustic impendance

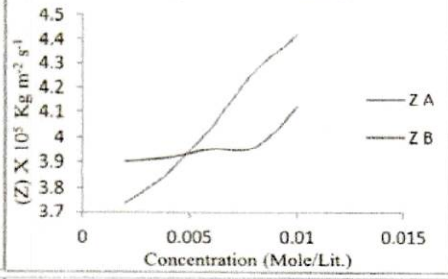


Fig. 9: Plot of Specific acoustic impendance

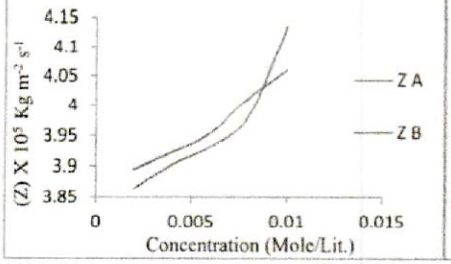


Fig. 10: Plot of Ultrasonic Velocity Us

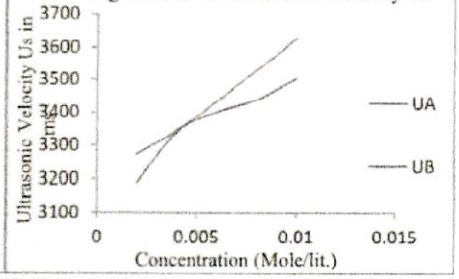


Fig.11: Plot of Ultrasonic Velocity Us in ms^{-1} Vs Concentration (Mole/lit.) in 80% DCM

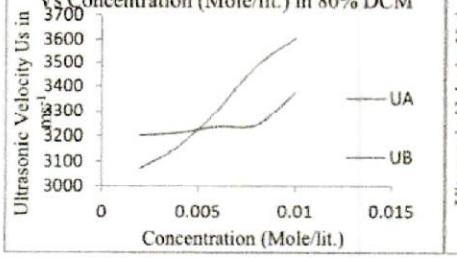
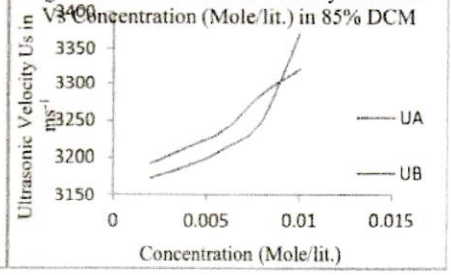


Fig. 12: Plot of Ultrasonic Velocity Us in ms^{-1} Vs Concentration (Mole/lit.) in 85% DCM



IV. RESULT AND DISCUSSION

In the present investigation, different acoustical parameters, such as ultrasonic velocity (U), adiabatic compressibility (βs), intermolecular free length (Lf), specific acoustic impedance (Z), of substituted chalconeimne in different percentage of DCM+water mixture at 303K have been studied. From table 1, it is found that ultrasonic velocity decreases with decrease in concentration for all systems. (Fig 10 to 12) This indicates that, there is significant interaction between ion and solvent molecules suggesting a structure promoting behavior of the added electrolyte. It was found that, intermolecular free length increases linearly on decreasing the concentration of substituted ketimines in different solution of DCM+water mixture (fig. 4 to 6). The intermolecular free length increase due to greater force of interaction between solute and solvent by forming hydrogen bonding. The value of specific acoustic impedance (Z) decreases with decrease in concentration for all substituted ketimines in different percent solutions of DCM+water mixture (fig.7 to 9). When concentration of electrolyte is decreased, the thickness of oppositely charged ionic atmosphere may

increase due to decrease in ionic strength. The increase of adiabatic compressibility with decrease of concentration of solution may be due to the dispersion of solvent molecules around ions supporting weak ion-solvent interactions (fig. 1 to 3).

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Determination of Acoustical Parameter of Glucose and Its Fe (III) Metal Complex by Ultrasonic Technique

G. B. Andhale
Jijamata Mahavidyalaya, Buldhana, Maharashtra, India

ABSTRACT

Ultrasonic waves are the vibration waves of frequency above normal hearing range, these type of waves are referred as 'Ultrasonic waves'. Ultrasonic velocity, viscosity and density have been measured in aqueous solution of glucose ligands and their metal complex of Fe(III) in distilled water at 306K. From the experimental data, various acoustical parameters such as adiabatic compressibility(β s),relative association(RA), specific acoustic impedance (Z), free path length(Lf), relaxation amplitude(α /f2), relaxation time(τ) , relative viscosity(ηr) etc. have been evaluated, which helps in understanding the molecular interactions occurring in these solutions. The Ultrasonic velocity determined by the equation

Velocity =Wavelength X Frequency

$V = \lambda x f$

Where $\lambda = 2d/n$

Key Words: Velocity, Density, Viscosity.

I. INTRODUCTION

In recent years the measurement of ultrasonic velocity has been adequately employed in understanding the nature of molecular interaction in pure liquids and liquids mixtures. Ultrasonic propagation parameters yield valuable information regarding the behavior of liquid systems, because intramolecular and intermolecular association, dipolar interactions, complex formation and related structural changes affect the compressibility of the system which in turn produces corresponding variations in the ultrasonic velocity.

Recently, the researchers have been focused to design Schiff base metalized complexes as better anticancer drugs and chemotherapeutic agents, due to the Schiff base- metal complexes have potent binding nature with DNA [1]. Schiff base derivatives in biological and chemical processes, prompted the researchers towards the design of novelaryl/heterocyclic Schiff base derivatives and the development of the new technologies for an environmentally benign processes (green chemistry) [3], which are both economically and technologically feasible [4,5]

In the present studies, the ultrasonic velocity and density in solutions of new glucose and their metal complex offe(III)) have been measured and various acoustical parameters have been calculated in aqueous medium at 306K.Ultrasonic velocity gives properties of basic importance to sound velocity in molecular theory of liquid.

Number of workers such as "Satyawati [6], Ramchandra [7], Prakash and Shrivastava [8], Marks [9], Agrawal and Bhatnagar [10] made their contribution to ultrasonic study of electrolyte solution and discussed about the variation of ultrasonic velocity with ion concentration.

II. METHODOLOGY

Acoustical properties: The computation of ultrasonic properties require the measurements of ultrasonic velocity (U), viscosity (η) and density (ρ). The densities of pure solvent, their solutionof ligand and their metal complex were measured by using a single capillary pyknometer, made of borosil glass having a bulb capacity of 10 ml. The ultrasonic velocity of pure solvent and their solutions of ligand and their metal complexes were measured by using single crystal variable path Ultrasonic Interferometer operating at 2 MHz. The accuracy of density and velocity are ±0.0001 g/cm3 and ±0.1% cm/sec respectively. Viscosity was measured with the help of calibrated Ostwald's viscometer (corning made) at 33 ± 0.01°C. Uncertainties in the measured viscosities were within ± 0.03%. Viscosity data were analyzed using Jone's Dole equation and Vand's equation. All the measurements were carried out at 306K. The uncertainty of temperature is ± 0.1 K. From the experimental data of density, viscosity and ultrasound velocity of pure solvent and solutions, various acoustical parameters were calculated using following standard equations reported earlier.

1) ADIABATIC COMPRESSIBILITY (βs)

From the ultrasonic velocity (U) and density (d) the isentropic compressibility can be calculated from the following equation.

$\beta s = 1/(U^2 d)$, $\beta^\circ s = 1/(U_0^2 d_0)$

2) RELATIVE ASSOCIATION(R_A)

The relative association expressed in terms of density of solution (d_s) and solvent (d_0) and also ultrasonic velocity of solution (U_s) and solvent (U_0). The relative association calculated by the relation.

$R_A = d_s/d_0 (U_0/U_s)^{1/3}$

3) SPECIFIC ACOUSTIC IMPENDENCE (Z)

It is also determine the solvation of solute. It is expressed in terms of ultrasonic velocity of solution and density of solution. It is given by the formula.

$Z = U_s . d_s$

4) FREE PATH LENGTH (L_f)

Free path length is responsible to determine the interaction between the ion and the solvent molecule. The free path length was calculated using the equation.

$L_f = [M \times m / V] \times \eta_r \times 293$

5) RELAXATION AMPLITUDE (α/f^2)

The relaxation amplitude is expressed in terms of viscosity (ηs), density (ρ) and ultrasonic velocity of solution. It is denoted by (α/f2) and measured in sec2/m.

$(\alpha/f^2) = 8 \pi^2 \eta_s / 3 \rho U^2$

6) **RELAXATION TIME (τ)**

The relaxation time is expressed in terms of viscosity (ηs), density (ρ) and ultrasonic velocity of solution. It is denoted by τ and measured in sec.

$\tau = 4\ \eta_s / 3\ \rho\ U^2$

7) **RELATIVE VISCOSITY (ηr)**

Relative viscosity (ηr) of various amino acids have been determined from density measurement and viscometric measurement using relation,

$\eta_r = d_s . t_s / d_o . t_o$

Oswald's Viscometer: The Oswald's viscometer used for measuring viscosity by theabove method. It is first thoroughly cleaned with chromic acid mixture and dried. The co-efficient of the solutions are determined with a Canon-Fenske viscometer. It is a special kind of Oswald viscometer and the principle used is the same. Relative viscosity of each solution is determined by following empirical formula.

$$\eta r = \frac{ds \times ts}{dw \times tw}$$

III. RESULTS AND DISCUSSION

Table-Ultrasonic properties of glucose and their Metal complexes in DMSO solvent at 306K

Acoustic properties		Ultrasonic properties of glucose in water solvent at 306K			Ultrasonic properties of glucose & Fe(III) complexes in water solvent at 306K		
Sr. No.	Concentrations	0.1M	0.01M	0.001M	0.1M	0.01M	0.001 M
1	Density (gm/cm3)	1.011	1.010	1.003	0.9809	0.9806	0.9761
2	Viscosity (Π)(m/s)	0.7560	0.7558	0.6669	0.8459	0.8020	0.7075
3	Ultrasonic Velocity (U)	1.5518	1.4490	1.3708	1.7337	1.5940	1.4408
4	Relative Association (RA)	0.7208	0.7008	0.7792	0.7180	0.8185	0.6873
5	Adiabatic Compressibility (βs)	1.3534	1.3898	1.4088	1.3378	1.3699	1.3944
6	Free path length (Lf) A0	1.6135	1.5268	1.3032	1.7046	1.5522	1.2028
7	Specific acoustic impedance (Z) (m/sec.gm/cm3)	988.12	90.61	8.5625	1898.02	172.858.	17.189
8	Relative viscosity(Π τ) (m/s)	0.9078	0.8825	0.9828	0.8945	1.0052	0.8498
9	Relaxation amplitude (α/f2)	30.401	30.001	23.002	34.426	23.989	32.012
10	Relaxation Time (τ)	1.4979	1.4856	1.1621	1.7493	1.6066	1.2532

In the present work, acoustic parameters such as, adiabatic compressibility (βs), relative association (RA), free length (Lf), acoustic impedance (z), relaxation amplitude (α/f2) and relaxation time (τ) have been calculated

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