ISSN 0972 - 3099

Environment Conservation Journal

An International Journal Devoted To Conservation of Environment

Volume- 8, Number (3), 2007

Action for Sustainable, Efficacious Development and Awareness (ASEA), India

Please Visit Our Website : www.environcj.com

Environment Conservation Journal

ISSN 0972-3099

Environment Conservation Journal

(ISSN 0972-3099)

An International Journal Devoted to Conservation of Environment

Volume 08, Number (1&2), 2007

Editorial Office
405, Vivek Vihar, Ranipur More, Opposite
Hotel Vinayak, Haridwar- 249 407
Uttarakhand, India

Published by: Action for Sustainable Efficacious Development and Awareness (ASEA)
Phone: 09897020147, 09412072917 www.environcj.com E-mail: environcj@gmail.com

INSTRUCTIONS TO AUTHORS

Aims and Scope: Environment Conservation Journal aims to publish original research/ review papers/ Book reviews/ Reports on conferences/ seminars/ important events, news of interest/ information on forthcoming seminar/ books on the environment related aspects. It encourages submission of two categories of papers. The first category comprises scientific papers and second category comprises engineering papers. The study of environment is inherently multidisciplinary. Therefore, the Journal publishes wide range of topics including.

Limnology	Environmental Modeling
Fish and Fisheries	Environmental Pollution
Toxicology	Conservation and Management of Natural Resources
EIA/ Environmental management	Environmental Legislations
Environmental Ethics	Occupational Safety and Industrial Hygiene
Environmental Microbiology	Mineralogy
Environmental Policies	Ethnobotany
Ethno Zoology	Ayurveda
Animal Physiology	Botany

Authors are requested to download the Consent to Publish and Transfer of Copyright form from the Website. Please send a completed and signed form by mail to the Environment Conservation Journal Office.
It supports a wide range of submission file formats, including MS Word, Adobe Pagemaker 5.0, RTF and GIF, JPEG for figures.
PDF is not the recommended format.

Manuscripts should be submitted to:

SUBMISSION@ENVIRONCJ.COM CC to Editor @ environcj.com

Manuscripts: Manuscript should be typewritten with double spacing and wide margins on high quality white paper. Subdivision of the paper into Abstract (50-100 words), Introduction, Materials and Method, Results and Discussion, Conclusion, Acknowledgements and References is recommended. In addition, section headings are often useful.
Page 1: of the manuscript should contain the Title of paper, Article type, Keywords for computer aided searching, Author(s) name, Affiliation(s), complete address for correspondence including electronic address, telephone and Fax number
Page 2: of the manuscript should contain the Abstract (50-100 words) and at least six keywords in alphabetical order.
Page 3: of the manuscript should contain Introduction, Materials and Method, Results and Discussion, Acknowledgement if any, References

References
These are to be cited in the text by the author's name and year of publication like Gautam, 1989 in between the sentence or (Gautam, 1989) at the end of the sentence. Reference should be listed alphabetically in an unnumbered list at the end of the paper in the following pattern.

Papers in Journals
Bhutiani, R. and Khanna, D.R., 2006. Ecological study of river Suswa: Modeling DO and BOD. Environmental monitoring and assessment, 125:183-196.
Edited Books/ Authored Books
Gautam, Ashutosh (ed.) 1998. Conservation and Management of Aquatic Resources, Daya Publishing House, New Delhi.
Ph.D. Thesis, Dissertation and Reports
Bhutiani, R., 2004. Limnological status of river Suswa with reference to its mathematical modeling, Ph.D. Thesis submitted to Gurukul Kangri University, Haridwar, Uttaranchal, India.

Papers in edited works

Goel, P.K. and Autade, V.B., 1995. Ecological studies on the river Panchganga at Kolhapur with emphasis on biological components In. Ashutosh Gautam and N.K. Agarwal (eds.), Recent Researches in Aquatic Environment, Daya Publishing House, New Delhi. pp: 25-46.

Tables

Tables should be typed on a separate page bearing a short title and numbered sequentially throughout the text.

Illustrations

All photographs, graphs and diagrams should be referred to as a 'Fig.' and they should be numbered consecutively (1, 2, etc.). All illustrations should be submitted separately, in a form suitable for direct reproduction, Illustration should be designed to allow 50 % reduction. These should be numbered sequentially. Captions and legends should be on a separate sheet.

Proofs

Proofs will be sent to the corresponding author by e-mail (if no e-mail address is available or appears to be out of order, proofs will be sent by regular mail). Your response, with or without corrections, should be sent within 72 hours. Always quote the Mss. No. and Journal Code (ECJ) along with your proof in the subject field of your email.

Color Figures

On demand color figures or photographs will be published with nominal charge of Rs. 5000/- per page (U.S. $ 200)

Reprints

A reprints order form will accompany the acceptance letter. The purchase of 25 reprints is compulsory and corresponding author will not receive reprints free of cost and Nominal cost will be charged for reprints.

Authors will be asked, upon acceptance of manuscript, to transfer copyright of the manuscript to the Society. This will ensure the widest possible dissemination of information under copyright laws.

Two hard copies of manuscript in original (not Xeroxed) along with online submission are to be submitted to: Prof. D.R. Khanna, Editor-in-Chief, Environment Conservation Journal, 405,Vivek Vihar, Ranipur More, Haridwar, 249407, Uttarakhand, India. or to Dr. Ashutosh Gautam, Executive Editor, India Glycols Ltd. Bazpur Road, Kashipur 244713, U.K. India.

For enquiry please contact:

Environment Conservation Journal: 405, Vivek Vihar, Ranipur More, Haridwar, 249407 (Uttarakhand) India
Tel: +91-09897020147, +91-09412072917
environcj@gmail.com

Abstracted/Indexed in:

Pollution Abstracts (U.S.A.)	Environment Abstract (U.S.A.)
Zoological Records (U.K.)	Paryavaran Abstracts (India)
Toxicology Abstracts (U.S.A.)	Environmental Engineering Abstracts (U.S.A.)
CAB Abstracts (U.K.)	Aquatic Sciences and Fisheries Abstracts (U.S.A.)

In case you encounter any difficulties while submitting your manuscript online, please get in touch with the responsible Editorial Assistant by clicking on "CONTACT US" from the toolbar.

It is a condition of publication that manuscripts submitted for publication in Acceptance of an Article/Paper by The Journal, the Author(S) will be asked to Transfer the Copyright of the Article to the ASEA, that will Environment Conservation Journal have not been published or submitted for publication simultaneously elsewhere.

Environment Conservation Journal 8 (3) 1-4, 2007
(ISSN 0972-3099)

Reduction of chromium (VI) by the application of a strong reducing reagent

Jatin Srivastava*, Harish Chandra, Ajay Singh***, Nishant Rai** and Sachin Chauhan****

* Department of Environmental Sciences, Institute of Biological science and Biotechnology, Chatrapati Sahu Ji Maharaj University, Kanpur

**Department of Microbiology, Gayatri College of Biomedical Sciences, G.M.S. Road, Near Ballupur Chowk, Dehradun

***Department of Chemistry, Gayatri College of Biomedical Sciences, G.M.S. Road, Near Ballupur Chowk, Dehradun

Abstract

Photochemical reduction of Cr (VI) into Cr (III) has been reported earlier in the presence of glycerol (Yurkow *et al.*, 2002). The introduction of EDTA salt in the reagent that is prepared to have an incomplete reaction enhances the rate of reduction as it enhances the ionic strength considerably. The acid and a carbon source was provided through the reaction of glycerol and concentrated Sulphuric acid. The reagent thus formulated is efficient enough to reduce the hexavalent chromium as evident by its appearance in the solution.

Keywords : *Glycerol containing solution, Ionic strength, Rate of reduction, reducing reagent.*

Introduction

The reduction of metals from higher reactive state to the lower at lower pH value in any liquid media is a common chemical phenomenon. The fate of chromium in the environment is strongly dependent on its valence state (Jeremy F. *et al.*, 2000). The industries such as electroplating, tanneries, and electronic equipments washing contain several heavy metals such as chromium, iron, nickel, silver etc in their effluents. However, chromium levels in air, water, and food are generally very low. The major human exposure is occupational (Chou 1989). Hexavalent chromium is reactive enough and a potent carcinogen (Gibb *et al.*) also exhibits high mobility in soil and groundwater as it forms CrO_4^{2-} the mobile anion. The carcinogenicity is generally attributed to the Cr (VI), due to being readily taken up by the cells. Trivalent chromium on the other hand is less toxic and essential in human and animal nutrition with almost no mobility in the soil and waters owing to almost insoluble. In North India tanneries are the main source of hexavalent chromium apart from the mining of chromite ($FeCr_2O_4$) ore that eventually introduce the metal into the ground water. It has been however, made mandatory for all tanners to reduce the level of such pollutants and to install the treatment plant to treat the wastewater prior to the discharge of the effluent. Chemically reduction of heavy metals is being given priority just to speed-up the process of pollution mitigation. Important reductants in natural systems are organic compounds and divalent iron. (Barlet et. al, 1988, Fendorf 1995, and Richard *et al.*, 1991). Iron divalent has been reported to be as good as any other reductant capable enough to reduce chromium hexavalent (Ignaz *et al.*, 1998). Very recently the use of polyols have been introduced for the photochemical reduction of Chromium (VI) to Chromium (III) (Yurkow *et al.*, 2002).

The chrome-reducing reagent is based on the same experiment (Yurkow *et al.*, 2002) with having a little chemical changes and the comprehensive understanding about the reactions. The reagent thus prepared is capable enough to reduce the chromium metal even in little amount.

Material and Method

Potassium dichromate was used to prepare the 1mg/liter solution at low pH. Cr (VI) and Cr (IV) forms can be generated in a test tube at different pH conditions viz., 7.3 to 7.5 and pH 6.8 respectively. The colours of the solutions were yellow initially before the mixing of the reagent. The colour profile was the basic parameters to know the reduction processes as was suggested by Yurkow *et al.*, 2002 that visible colour change from yellow to green following the chromium reduction.

Reagent was prepared by mixing two different chemical solutions i.e., organic part made of Glycerol in methanol with a little supplement of EDTA (di-sodium salt) to elevate the mobility of metal ions in the solution (Chen & Curtright 2001), and the inorganic part i.e., a strong acid especially we used Sulphuric acid but other such as hydrochloric and acetic acid may also be used as has already been tried. 10 ml of each solution of metal was taken into the 15 ml vials and were than mixed with the reagent 100 to 500 µl in the triplicates. The time of the change of color of solution was recorded . Increasing the pH value by the addition of sodium hydroxide precipitated the reduced metal out.

Results

Primary alcohol groups can chemically reduce chromium in reactions containing strong acids to produce trivalent chromium (Headlam and Lay, 2001). Acrolein produced in the reaction of sulfuric acid and glycerol with a supplement of EDTA and methanol found to be having strong reducing property. At low pH polyols can reduce the metals like chromium. EDTA that helps to bind metals in the solution (surrounding groups) also accelerated the speed of reaction. As in experiment three different solutions were prepared viz., glycerol with sulfuric acid, glycerol in methanol with sulfuric acid and glycerol in methanol with EDTA supplemented sulfuric acid. The time of the reduction processes varies greatly in accord with their chemical composition.

Sol. A < Sol. B < Sol. C

Sol. C i.e., having EDTA supplemented acrolein shows comparatively faster reduction and only with in a little amount used.

Discussion

Glycerol when reacts with sulphuric acid in concentrated forms Acrolein which, is in the solution due to the dehydration of Glycerol. Glycerol has two primary alcoholic groups that after the removal of two water molecules produce acrolein (1.1) an alkenic aldehyde, which is inflammable, volatile organic compound have a very pungent smell. In the reagent solution plenty of sulphuric acid is present thus there appears saturation where the production of acrolein stops and the solution starts to act as a strong reductant.

The reagent, which is made with the mixing of three different chemicals viz., Glycerol, EDTA and acid. The acrolein formed in due reactions is stable for several months and act as a confirm electron donor which enable the reduction processes. The basic requirement is acidity of solution where the acidity should remain near pH 2.0.

Now the reagent is mixed with the solution of potassium dichromate the reaction between chromate ions and the mixture of acrolein, glycerol and sulphuric acid where the sulphuric acid accounts more than others. Thus an oxidation process starts with the reduction of chromium in the solution. (1.2, 1.3, 1.4) EDTA increases the mobility of active chromate ions.

Reactions

1.1- $CH_2OH - CHOH - CH_2OH$ (Glycerol) $\xrightarrow{\text{Conc. } H_2SO_4}$ $CH_2 = CH - CHO + 2H_2O$ (Acrolein ↓ Functional Aldehyde)

1.2- $K_2Cr_2O_7 + H_2SO_4 \xrightarrow{\text{Redox react.}} K_2SO_4 + Cr_2(SO_4)_3 + 2H_2O$

1.3- [Glycerol + Sulphuric acid – Acrolein] + [EDTA] – Strong Reductant - {A}

[Sulphuric acid + Potassium di Chromate] – Strong oxidizing agent - {B}

1.4- $Cr_2O_7^{2-} + 14H^+ + 6e^- \leftrightarrow 2Cr^{3+} + 7H_2O$

Mixed reaction of {A} & {B}

A visible color change from yellow to green is observed following chromium reduction. And it has been suggested by Yurkow *et al*., 2002 that the conversion of hexavalent chromium Cr (VI) to Cr (III) was determined by measuring the increase in absorbance at 590 nm.

Summary

Concentrated Suphuric acid when reacts with glycerol produces Acrolein and plenty of sulphuric acid stops the reaction in a known quantity and volume. This stopped reaction further gets started when aqueous solution of potassium di chromate is introduced. Two reactions simultaneously occurs in the solution as the reagent it self is a strong reductant and the potassium di chromate solution and sulphuric acid acts as a strong oxidizing agent. Thus both the reactions ultimately results in the reduction of the chromium VI and render a green colour to the solution a characteristic feature of III valent Chromium.

References

Yurkow, E. J., Hong, J., Min, S. and Wang Su*; 2002. Photochemical reduction of hexavalent chromium in glycerol-containing solutions. ***Environmental pollution*** **,** 117:1-3

Chen, H. and Cutright, T., 2001. EDTA and HEDTA effects on Cd, Cr, and Ni uptake by Helianthus annuus. ***Chemosphere,*** 45:21 – 28.

Chou, I. N., 1989. Distinct cytoskeleton injuries induced by As, Cd, Co, Cr, and Ni compounds. ***Biomed. Environ. Sci.,*** 2:358-365.

Frank C. Lu, 1996. *Basic Toxicology*. Third Edition, published at Taylor and Francis publishers USA.

Gibbs, H. J., Lees, P. S., Pinsky, P. F., Rooney, B. C., 2000. Lung Cancer among workers in chromium chemical production. ***Am. J. Ind. Med.***, 38 (2): 115 – 126.

Headlam, H.A. and Lay, P.A., 2001. EPR spectroscopic studies of the reduction of chromium (VI) by methanol in the presence of peptides Formation of long lived chromium (V) peptide complexes. ***Inorg. Chem.,*** 40 (1):78 – 86.

Ignaz J. Buerge and Stephan J. Hug; 1998. Influence of Organic Ligands on Chromiumn (VI) Reduction by Iron (II). ***Environ. Sci. Technol***., 32:2092 – 2099.

Jeremy F., Joshua C., David F., Ken K., Bruce B. and Maxim B. Non-Metabolic reduction of Cr(VI) by bacterial surfaces under nutrient absent conditions. ***Journal of conference abstracts,*** 5(2): 396.

Calder, L.M., 1988. In *Chromium in the Natural and Human Environments;* Nriagu, I.O., Nieboer, E. Eds.; Wiley: New York, pp 215 – 229.

Bartlett, R. J. and James, B. R., 1988. In *Chromium in the Natural and Human Environments;* Nriagu, I.O., Nieboer, E. Eds.; Wiley: New York, pp 267 – 304.

Palmer, C.D.; Wittbrodt, P.R., 1991. *Processes affecting the remediation of chromium contaminated sites*. Enviorn. Health Perspectives 92: 25-40.

Environment Conservation Journal 8 (3) 5-7, 2007
(ISSN 0972-3099)

Crotalaria sericea - A miraculous ethnomedicinal plant for snake bite in north western tarai forest of U.P. - A new report

Babli Singh and T.P. Mall
Post Graduate Department of Botany, Kisan P-G. College, Bahraich (U.P.)

Abstract

During the taxonomic and ethnomedicinal survey for the Flora of the Dudwa Tiger Reserve on Nov 24, 2006 along with M.Sc. Botany students the authors were introduced by their guide Sri Baddal Ram Rana, a local Tharu tribe, to a miraculous ethnomedicinal plant, locally named as Van Sanai. The author were told by Mr. Rana that the leaf juice of the plant has a miraculous effect in case of snake bite. If a tea spoonful of leaf juice is anyhow administered to the patient through mouth, the effect of snake bite is neutralized within a very short time. Mr. Rana is resident of village Muen Nuchani (a tharu villege) P.O. Parsia, P.S. Chandan Chauki, Distt. Kheri Lakhimpur. His statement was later confirmed by Mr. Kewal Singh Rana resident of the same village and also working as guide over there, Mr. Mihi Lal Dangaura, a witchery (an elderly Jadu Tona specialist) resident of village Balera P.O. Dhuskiya, Distt. Kheri Lakhimpur and Mr. Rahul Kumar Singh residnt of Village & Post Semra Hardoo Distt. Kushinagar (U.P.).

Van Sanai was found in very few number in sporadic manner at Kharighat bank of Suheli River in Sonaripur range of Dudwa National Park. According to Sri Y.P. Shukla, The Chief wild life warden, Dudwa Tiger Reserve, the habitat of Van Sanai is a low land grass land vegetation having water logging for about 4-6 months starting from pre monsoon to upto retaining monsoon period. Van Sanai is identified as *Crotalaria sericea* Retz (Fabaceae) with the help of FUGP, 1994 and latter confirmed by Prof. S.K. Singh Retd. Prof. and Head of Botany, DDU Gorakhpur University, Gorakhpur.

The same plant but Single in number was observed by the author near Nishangara Forest Rest house in Kakarha Forest range of Katarniaghat wild life reserve of Distt. Bahraich on Jan 05, 2007 during survey. Since the plants are very few in number can be considered as endangered species, they are at the brink of extinction but mira culous and ethnomedicinally very important hence the plant needs conservation.

Kew Words : *Ethnomedicine, snake bite.*

Introduction

India is one of the twelve mega biodiversity countries of the world having rich vegetation with a wide variety of plants with medicinal value. Plants with medicinal value enjoyed the highest reputation in the indigenous system of medicine all over the world (Mehrotra, 1989). The two great epics- The Ramayana and Mahabharata which have originally written in Sanscrit language also have mention of numerous plant names and their role in the life of people of those days (Rao, 1989). Dudwa Tiger Reserve, which is one of the hot spot of biodiversity, situated in Kheri district of U.P. (India). The region is full of flora, fauna and Tharu tribal population. The indigenous traditional knowledge of medicinal plants which is mostly undocumented and transmitted orally from generation to generation, is fast disappearing from the face of world due to advent of modern civilization. The present study was under taken with a aim to collect and document the traditional indigenous knowledge of the plants and their ethnomedicinal use before its lost for ever.

Dudwa Tiger Reserve lies on the India Nepal border in the foot hills of the Himalaya and the plain of 'Tarai' region. The study area lies between 28º 30' 60" N and 80º 41'0" E and comprises 884 km² of Kheri district, Uttar Pradesh. The Tharus of Kheri district, live in villages situated in the vicinity of the Dudwa National Park and adjoining the territory of Nepal. The district is bounded on the East by the district Bahraich, on the South by Sitapur and Hardoi, on the West by Shajahanpur and Pillibhit district and on the North by the

territory of Nepal separated by the river Mohan. There are 41 Tharu villages in Kheri district, occupying an area of 8,194 hectare in the vicinity of Dudwa National Park. The district is inhabited mainly by the Rana Tharus, Danguria Tharus and Kathurias Tharu population.

Methodology

The survey was made on Nov 24, 2006 in Dudwa Tiger Reserve with M.Sc. Botany students to collect the ethnomedicinal plant and their ethnomedicinal use, under the guidance of Sri Baddal Ram Rana and Sri Kewal Singh Rana (both a local Tharu tribe) resident of village Muen Nuchani (a Tharu village) P.O. Parsia, P.S. Chandan Chauki, Distt. Kheri Lakhimpur. Questionnaire method was adopted for documentation of folk indigenous knowledge about medicinal plants and herbs (Shah, 2007). During the field survey, the plants were collected and their use by inhabitants were recorded in the field books. All the collected plants were pressed, dried, preserved, mounted and identified through the available taxonomic literature (F.U.G.P. 1994) and latter confirmed by Prof. S.K. Singh Retd. Prof. and Head of Botany. D.D.U. Gorakhpur University, Gorakhpur. All the collected and preserved plant specimens were deposited in the Herbarium maintained in the department.

Results and Discussion

After the survey of Dudwa Tiger Reserve about 55 plant species belonging to different family were collected. Out of these species the present study deals with an important medicinal plant of *Crotalaria sericea* Retz. (Fabaceae) locally called as Van Sanai, collected at Kharighat bank of Suheli river in Sonaripur range of Dudwa National Park. Our guide, Mr. Rana told us about the plant that the leaf juice of plant is very effective in case of snake bite. His statement was latter confirmed by Mr. Mihi Lal Dangaura a witchery resident of village Balera P.O. Dhuskiya, Distt. Kheri Lakhimpur and Mr. Rahul Kumar Singh resident of Village & Post Semra Hardoo Distt. Kushinagar (U.P.). It is an robust under shrub, 3-4 ft. high, branches stout, striated, nearly glabrous. Leaves shortly stalked, 2.6in. long, oblong, lanceolate, acute, glabrous, above finely silky beneath, stipules large, leafy, persistent. Racemes terminal, often one foot long, bracts ovate, leafy, persistent, pedicels longer than the calyx. calyx ½ in. long nearly glabrous. Corolla 4/5 in. much exerted, yellow colour. Flower during the cold season (F.U.G.P., 1994).

The man has deep involvement with plants and forest not only through history, culture, religion and philosophy but also through their livelihood. The local used of plants as a cure is as old as human civilization (Behera, 2006). Forest are the reservoir of medicinal plants and play a vital role in the economy of the Tharus . The tribal people of Kheri district who are residing in villages are very poor, illiterate and mostly dependent on the forest wealth and ambient vegetation for their food, clothing, oil, fibre, housing and medicine. They utilize root, rhizome, stem, leaf, flower, fruit and seed of medicinal plant in different ailments such as fever, cough, bronchitis, asthma, rheumatism, earache, toothache, leucorrhoea and as antidote to snake bite and scorpion sting. Medicinal plants have several curative properties due to the presence of various chemical substances of different composition. *Crotalaria sericea* Retz. have several important medicinal value but since the plant is found very few in number in the study area hence the conservation and regeneration of the plant is necessary. It is hoped that chemical analysis of the plants

and their pharmacotherapeutics will provide much needed lead for further research and new drug development.

Acknowledgments

The authors are thankful to Sri Mohd. Ahsan, Chief Wildlife warden, Uttar Pradesh, Lucknow for giving his permission for scientific research for the exploration of floral vegetation of the territory under his command and to Dr. S.P. Sing Principal, Kisan P.G. College, Bahraich for providing necessary laboratory and library facilities.

References

Behera, K.K., 2006. Ethnomedicinal Plants used by the Tribals of Similipal Bioreserve, Orissa, INDIA: A Pilot Study.

Duthie, J.F., 1994. Flora of Upper Gangetic Plain and of the adjacent Shivalic and Sub-Himalayan Trct, (Botanical Survey of India, Calcutta), Reprinted 1994.

Jain, S.K., 1989. Methods and Approaches in Ethnobotany (*Society of Ethnobotanists,* Lucknow).

Maheswari, J.K.; Singh, K.K. and Saha, S., 1981. The Ethnobotany of the Tharus of Kheri district Uttar Pradesh, Economic Botany Information Service, National botanical Research Institute Lucknow.

Mehrotra, B.N., 1989. Collection and Processing of Plants for Biological Screening, in Methods and Approaches in Ethnobotany, by S.K. Jain (*Society of Ethnobotanists*, Lucknow). 25-37.

Maheswari, J.K.; Singh, K.K. and Saha, S., 1986. The Ethnobotany of Tribal of Mirzapur district Uttar Pradesh. Economic Botany Information Service, National Botanical Research Institute Lucknow.

Rao, R.R., 1989. Methods and Techniques in Ethnobotanical study and Research: Some Basic Considerations, in Methods and Approaches in Ethnobotany, by S.K. Jain (*Society of Ethnobotanists,* Lucknow), 13-23.

Shah, M.G., Khan, M.A., 2007. Check list of Medicinal plants of Siran Valley Mansehra-Pakistan.

Environment Conservation Journal 8 (3) 9-11, 2007
(ISSN 0972-3099)

Air pollution tolerance index of few plant species affected by auto exhaust pollution around Haridwar

Abhishek Swami and Deepika Chauhan
Department of Zoology and Environmental Science
Gurukula Kangri University, Haridwar

Abstract

Present study was carried out to determine level of tolerance of air pollution by automobile exhaust of few tree species viz, Mango (*Mangifera indica*),Sagon(*Tectona grandis*), Sal(*Shorea robusta*) and Eucalyptus around Haridwar. On the basis of total chlorophyll content, ascorbic acid, pH, and relative moisture content, air pollution tolerance index value (APTI) of above tree species was determined. Highest value of air pollution tolerance index for polluted site was recorded for Sal (11.27) and lowest (7.19) value of APTI was recorded for Eucalyptus, whereas in control site, highest value (7.93) value of APTI was observed for Sagon (*Tectona grandis*) and lowest value (6.01) for Mango (*Mangifera indica*). Thus this study reveals that *S. robusta* is more suitable species to work as pollution sink and can be planted in areas, which are facing vehicular pollution.

Key words : *Air pollution tolerance index (APTI), Automobile pollution, Photosynthetic pigments, Ascorbic acid.*

Introduction

Automobile exhaust is the major cause of air pollution. It contributes 70% towards the air pollution as compared to any other sources of air pollution. Air pollution due to vehicular exhaust is not only the problem of big metro cities but it has become serious problem in small cities too. Automobile exhaust affects human as well as plant life. In case of plants chlorosis, necrosis, and inhabitation of plant metabolites are the common effects.

It has been suggested that plants have an excellent power to sink air pollution, which depends upon the level of tolerance of air pollution (Tiwari and Rai, 2000). Present study has been carried out to determine air pollution tolerance index (APTI) of some of the tree species.

Material and Methods

Present study is carried out around Haridwar. Four different tree species viz. Mango (*Mangifera indica*), Sagon (*Tectona grandis*), Eucalyptus and Sal (*Shorea robusta*) were selected for determination of APTI. Plant samples were collected just near roadside and 100 m out side the road.

Determination of Different Parameters

Chlorophyll contents of plant samples were analyzed using method proposed by Arnon (1949). pH and relative moisture content were determined as per Trivedi and Goel (1983). Ascorbic acid was estimated by the method of Sadasivam and Manikam (1991). Air pollution tolerance index was estimated by Singh and Rao (1983) method.

Discussion

Table -1 shows data on different plant parameters affected by automobile emission in comparison to control area.

Highest value of total chlorophyll content was found in *Mangifera indica* (10.01) whereas lowest value was found in *Tectona grandis* (2.35) in the polluted site. In case of control site highest value of total chlorophyll content was found in *Mangifera indica* (8.60) whereas lowest value was found in Eucalyptus (2.21).Garthy (1985) observed that decrease in chlorophyll content was at site affected by heavy traffic whereas sites with low traffic recorded a lower decreases in chlorophyll content.

In case of ascorbic acid at polluted site, highest value was found in Shorea robusta (2.00 mg/g), whereas lowest value of ascorbic acid was found in *Tectona grandis* (1.28 mg/g). Highest value of ascorbic acid in control area was found in *Tectona grandis* (2.76 mg/g) and lowest value of ascorbic acid was found in Eucalyptus (1.44 mg/g).

A decrease in ascorbic acid in the polluted site as compared to control is due to the impact of So_2. Ascorbic acid is powerful reductant, responsible for the photo reduction of photochlorophllide (Rudolph and Bukatsch, 1956) and its reduction power depends on its concentration. pH of polluted site plant show deviation towards acidic side, which may be due to the NO_2 and So_2.

The various factor of APTI such as ascorbic acid and all other factors as chlorophyll, leaf pH, and relative water content generally show depletion under stress. Plants, which can resist this depletion, become air pollution resistant. The highest air pollution tolerance index value was calculated by using formula of Singh and Rao (1983) observed in *Shorea robusta* (11.27) and lowest in Eucalyptus (7.19) at polluted site.At control it was highest in *Tectona grandis* (7.93) and lowest in Eucalyptus (7.66). Thus the present study reveals that *Shorea robusta* with highest APTI value has highest power to combat air pollution. It can thus be used in biomonitoring.

References

Tiwari S.L and Rai Shashi, 2000. Air pollution tolerance index of few tree species of Bhopal.*Current environment issue*.159-60.Madhu publications Bikaner.

Arnon, D.I, 1949. Copper enzyme in isolated chloroplasts, Polyphenoloxidase in *Beta vulgaris*. ***Plant Phsyiol***., 24:1-15.

Trivedi, R.K. and Goel, P.K., 1983. In : *Chemical and biological method for water and soil pollution, Environmental publication*, Karad, India

Singh, S.K. and Rao, D.N., 1983. *Proc. Indian Assoc. for Air pollution control*, Vol. 1., New Delhi.

Garty,J.,Fuchs, C., Zisapel, N. & Galun, M.,1985. Heavy metal in the lichen *Caloplaca aurantia* from urban, sub-urban and rural region in Israel (A comparative study). ***Water Air Soil Pollut.,***8:171-88.

Rudolph,E and F.Bukatsch.,1956. Die Protochlorophyll (id) umwndlung an ihre Beziehung Zur photo oxidation der scorbinsure bie etiolierten keimpflnzen . ***Plant,*** 69:124-134(1966).

Table 1- Average value of impact of roadside automobile emission on different plant parameters and air pollution tolerance index January 2004-April.2004

Tree Species	Polluted							Control						
	Chlorophyll 'a' mg/g	Chlorophyll 'b' mg/g	Total Chlorophyll mg/g	Ascorbic Acidic mg/g	pH	Relative water content (%)	Air pollution Tolerance index (APTI)	Chlorophyll 'a' mg/g	Chlorophyll 'b' mg/g	Total Chlorophyll mg/g	Ascorbic Acidic mg/g	pH	Relative water content (%)	Air pollution Tolerance index (APTI)
Magnifiera indica	5.50	4.50	10.01	1.88	5.93	63.73	9.58	6.53	2.06	8.60	2.01	6.08	32.33	6.01
Tectona grandis	1.72	0.63	2.35	1.28	5.64	62.58	9.29	2.74	0.74	3.49	2.76	6.37	63.32	7.93
Eucalyptus citridora	1.91	0.58	2.49	1.95	6.27	55.05	7.19	1.66	0.55	2.21	1.44	6.31	64.25	7.66
Shorea robusta	3.40	1.66	5.06	2.00	6.39	87.33	11.27	2.35	1.09	3.23	1.50	6.44	64.60	7.92

Environment Conservation Journal 8 (3) 13-16, 2007
(ISSN 0972-3099)

Folicolous Fungi of Medicinal Plants in North Western Tarai region of Uttar Pradesh

D.P. Singh and T.P. Mall
Post Graduate Department of Botany, Kisan P-G College, Bahraich (U.P.)

Abstract

The North Western Tarai belt of U.P. is next only to Eastern & Western ghats as one of the hot spots of Biodiversity in general and the diversity of fungal organisms inhabiting plant leaves in particular. Keeping the above view in mind a survey trip was organized for Bhinga forest range, Shrawasti on Oct 29, 2006 and Dudwa Tiger Reserve, Kheri Lakhimpur on Nov 23 and 24, 2006 for collection and documentation about ethnomedicinal plants as well as Folicolous fungi infecting the medicinal plants. During the survey more than fifty five ethnomedicinal plants were collected. Out of these plants about 25 plants species represented by 20 Genera of sixteen families have been found infected with sixteen different fungal species. *Cercospora* sp. and *Stenella* sp. are recorded to infected four plants each. *Cercospora* was recorded on *Cassia fistula, Momordica* sp., *Clerodendron* and *Lagerstraemia* where as *Stenella* sp. was recorded on *Celastrus paniculatus, Litisea grutinosa, Teliocora acuminata, Ficus sacra. Phoma* sp. was found on *Glycosmis pentaphylla, Teliocora* sp. and *Mallotus philipinsis. Zygosporium* was recorded on *Mallotus philipinsis* and *Sterculia balen* Remaining fungus were recorded only on single host viz. *Leptozyphium* on *Diosphros; Stenella cassiae* on *Cassia fistula; Alternaria* sp. on *Ichnocarpus frutiscens; Sirosporium* on *Carica carandas*; *Passalora* sp. on *Calotropis procera;* uredial stage of rust on *Tectona grandis; Pseudocercospora* on *Ziziphus; Meliola* sp. on *Mallotus philipinsis; Acremonium zonatum* on *Teliocora* sp; *Fuligomyces* on *Litisea chinensis; Cladosporium* on *Ficus carica* and *Cephaloros* sp on *Justicia* sp. *Teliocora* sp. had been recorded to be infected by three different fungus viz *Phoma* sp., *Stenella* sp. and *Acremonium zonatum* where as *Mallotus philippinsis* was found infected with *Zygosporium, Phoma* sp. and *Meliola* sp.

Keywords: *Folicolous fungi, Medicinal plants, Ethnomedicine,*

Introduction

India is inhabited a wide variety of about 563 tribal communities who dwell in forest areas and depend on surrounding resources for their livelihood. Plants with medicinal properties enjoyed the highest reputation in the indigenous system of medicines all over the world. The state of Uttar Pradesh is a rich repository of ethnomeidicinal plants diversity having large number of tribal communities, inhabiting in remote village and mostly in village of forest areas. Though there is nothing in this universe, which is non-medicinal, which can not be made use for many purposes and by many modes, Shankar *et al*., 2000. In tribes since the information about plants is passed from one generation to another orally as well as they have their own names for all the plants they recognize, it is necessary to document the names of the plants and their way of uses. The leaves provide a very suitable habitat for the growth and development of endophytic fungal pathogens by providing ample surface area and nutrient supply. Such leaf inhabiting fungi are known as "Folicolous" or "Foliar" and the invaded areas of the leaf as leaf spot or leaf lesions. The fungi interfere with the physiology of the host and develop a characteristic spot and produce toxins.

The North-Western Tarai belt of U.P. is next only to Eastern & Western Ghats as one of the hot spot for Bio diversity in general and the diversity of fungal organisms inhabiting plant leaves in particular.

Keeping the above views in mind a survey trip was organized for Bhinga Forest Range, Shrawasti on Oct 29, 2006 and Dudwa Tiger Reserve, Kheri Lakhimpur on Nov 23 and 24, 2006 for collection and

documentation about ethnomedicinal plants as well as Folicolous fungi infecting the medicinal plants.

Materials and Methods

Method of collection of ethnomedicinal plant and recording its data was followed as described by Jain, 1989. The selected specimens were pressed and dried by routine herbarium technique as described by Jain and Rao (1978). The specimens were processed and given a field note number and field note data showing name of the plant with family, local name, locality of collection, the plant parts used in different ailment, route of administration, form of medicines, mode of administration and any other special feature regarding ethnomedicinal uses and date of collection. Plants were identified with the help of different flora available in the Departmental library. The laboratory processing for fungus were done by scrap mount, Collodion preparation, Squash preparation and Hand cut section preparation. For identification of foliar fungi collected, a thorough survey of literature was done by going through publication made all over the world and consulting the different Mycological papers, Mycological Memoirs and other relevant Mycological monographs.

Result and Discussion

During the survey more than fifty ethnomedicinal plants were collected. Out of these plants about 25 plants species represented by 20 genera of 16 families have been found infected with sixteen different fungal species (Table1).

Cercospora sp. and *Stenella* sp. are recorded to infected four plants each. *Cercospora* was recorded on *Cassia fistula, Momordica* sp., *Clerodendron* and *Lagerstraemia* where as *Stenella* sp. was recorded on *Celastrus paniculatus, Litisea grutinosa, Teliocora acuminata, Ficus sacra. Phoma* sp. was found on

Table 1: Ethnomedicinal Plants infected with Folicolous Fungi

Sl. No.	Name of Ethnomedicinal Plant	Family	Name of Foliicolous Fungus
1-	*Carisa carandas L.*	Apocynaceae	*Sirosporium sp.*
2-	*Cassia fistula L.*	Caesalpinaceae	*Stenella cassia sp.*
3-	*Calotropis procera R.Br.*	Asclepiadaceae	*Passalora sp.*
4-	*Clerodendron sp. Linn.*	Verbenaceae	*Corenospora sp.*
5-	*Celastrus paniculatus willd.*	Apocynaceae	*Stenella sp.*
6-	*Diosphyros gurke*	Ebenaceae	*Leptozyphium sp.*
7-	*Dolichos lablab Linn.*	Fabaceae	*Cercospora sp.*
8-	*Ficus sacra*	Moraceae	*Stenella sp.*
9-	*Ficus carica Linn.*	Moraceae	*Cladosporium sp.*
10-	*Glycosmis pentaphylla Correa.*	Rutaceae	*Phoma/Phomopsis sp.*
11-	*Ichnocarpus frutiscens R. Br.*	Apocynaceae	*Alternaria sp.*

12-	*Justicia sp. Linn.*	Acanthaceae	*Cephaloros sp.*
13-	*Lagerstroemia paruiflora Linn.*	Lythraceae	*Cercospora sp.*
14-	*Litisea grutinosa Lamk.*	Lauraceae	*Stenella sp.*
15-	*Litisea chinensis Lamk.*	Lauraceae	*Fuligomyces. sp.*
16-	*Mallotus philippinsis Mull Arg.*	Euphorpiaceae	*Phoma sp.*
17-	*Mallotus philippinsis Mull Arg.*	Euphopiaceae	*Zygosporium sp.*
18-	*Mallotus philipinsis Mull Arg.*	Eupharbiaceae	*Meliola sp.*
19-	*Momordica sp. Roxb.*	Sapotaceae	*Cercospora sp.*
20-	*Sterculia balen L.*	Sterculiaceae	*Zygosporium sp.*
21-	*Tectona grandis Linn.*	Verbenaceae	*Uredo sp.*
22-	*Teliocora sp. Coleber*	Menispermaceae.	*Phoma sp.*
23-	*Teliocora acuminata Coleber*	Menispermaceae	*Stenella sp.*
24-	*Teliocora sp. Coleber*	Menispermaceae	*Acremonium zonatum*
25-	*Ziziphus sp. L.*	Rhamnaceae	*Pseudocercospora sp.*

Glycosmis pentaphylla, Teliocora sp. and *Mallotus philippinsis. Zygosporium* was recorded on *Mallotus philipinsis* and *Sterculia balen* Remaining fungus were recorded only on single host viz. *Leptozyphium* on *Diosphros; Stenella cassiae* on *Cassia fistula; Alternaria* sp. on *Ichnocarpus frutiscens; Sirosporium* on *Carica carandas*; *Passalora* sp. on *Calotropis procera;* uredial stage of rust on *Tectona grandis; Pseudocercospora* on *Ziziphus; Meliola* sp. on *Mallotus philipinsis; Acremonium zonatum* on *Teliocora* sp; *Fuligomyces* on *Litisea chinensis; Cladosporium* on *Ficus carica* and *Cephaloros* sp on *Justicia* sp. *Teliocora* sp. had been recorded to be infected by three different fungus viz *Phoma* sp., *Stenella* sp. and *Acremonium zonatum* where as *Mallotus philippinsis* was found infected with Z*iygosporium, Phoma* sp. and *Meliola* sp.

The ethnic and rural people of India have preserved a large bulk of traditional knowledge of medicinal use of plants growing around them. India is one of the twelve mega biodiversity countries of the world having vegetation with a wide variety of plants with medicinal value. Herbal medicines have good value in treating many diseases including infectious diseases. Ethnomedicinal knowledge can not only save lives of many, it is also important from humanitarian point of view in that in long run this knowledge may help to identify important medicinal uses that can help in curing health care around the world. So it is important to protect the traditional knowledge from disappearing and documenting the indigenous knowledge.

The folicolous fungal pathogens interfere with the manufacturing rate of food and other valuable substances by damaging the photosynthetic elements of living leaves; bringing about qualitative and quantitative dearangements in the living tissue of the host in various ways. Several leaf spot pathogens are known to produce toxins of various kinds, some of which are host specific. When the leaf spots are numerous or are large, there is a considerable reduction in the photosynthetic area of the leaf. In addition some times rapid defoliation occurs due to such infections. As such the productivity of the host plants is substantially reduced. The weeds and forest plants serve as reservoirs of leaf spot pathogens which on getting

opportunity may spread to agricultural and horticultural plants. The destruction caused by these enemies of leaves is a serious problem before us.

References

Jain, S.K., 1989. *Methods and Approaches in Ethnobotany*. (Society of Ethnobotanists, Lucknow).

Jain, S.K. and Rao, R.R., 1978. *A Hand book of field and herbarium methods*. (Today and Tomorrow Printers and Publishers, New Delhi), 33 –58.

Shankar, D., Ved, D.K. and Geetha, U.G., 2000. *A green Pharmacy Indian health Traditions*. The Hindu special Issue with the Sunday Magazine October 08, 2000: Page 1-2.

Environment Conservation Journal 8 (3) 17-22, 2007
(ISSN 0972-3099)

Effect of leaf leachates of potato plants on germination of *Phytophthora infestans* sporangia and zoospores

Navneet and Deepika
Department of Botany and Microbiology
Gurukula Kangri University, Haridwar

Abstract

Leaf leachates of two cultivars of potato i.e. Kufri Chandramukhi (KCM) and Kufri Jyoti (KJ) contain nine amino acids. Total sugar content of KCM and KJ leachates varied between 0.10 and 0.37 µg per sq. cm and 0.02 to 0.23 µg per sq. cm. respectively. The sugars exuded more by KCM. Total phenol content of KCM and KJ leachates varied between 1.00 to 2.0 µg per sq. cm and 1.05 to 3.16 µg per sq. cm respectively. The percentage germination of *P. infestans* sporangia in KCM and KJ cultivars was more in mature leaf leachates as compared to young leaves, moreover it was less in KJ cultivar as compared to KCM. The germ tube length of *P. infestans* zoospores in leaf leachates was inhibited in both the cultivars except in mature leaf leachate of 94 days old Kufri Chandramukhi.

Introduction

Leaf leachates play a vital role in stimulating or inhibiting the growth of propagules settled down on leaf surface. The nature of leaf leachates varies from plant to plant and is influenced by the age of the organ.This paper deals with the composition of leaf leachates of two cultivars of potato i.e. Kufri Chandramukhi (KCM) and Kufri Jyoti (KJ) and their role in germination of *Phytophthora infestans* sporangia and zoospores.

Material and Method

Leaf leachates of young leaves (second leaf from top) and mature leaves (fifth/sixth leaf from top) of each variety were collected in sterilized plastic boxes by the method of Godfrey (1975) in 22nd, 222rd and 5th sampling the age of plants were 42, 67 and 94 days respectively. Amino acids were qualitatively analysed by unidirectional ascending paper chromatography (Block *et al*. 1958). Total sugar contents of leachates were estimated by anthrone reagent test (Morris, 1948). Total phenols were estimated by the method of Farkas and Kiraly (1962).Germination of *P. infestans* sporangia were estimated by placing 0.02 ml of leachate plus 0.02 ml of sporangial suspension in one concavity of sterilized double concavity slide. The other concavity served as control was inoculated by 0.02 ml of sterilized distilled water plus 0.02 ml of sporangial suspension. The slides were incubated at 8 ^{0}C for 1-1/2 hours, 2 hours and 2-1/2 hours. Five non overlapping fields were observed for percentage sporangial germination.Germination of *P. infestans* zoospores were estimated by placing 0.02 ml of leaf leachate plus 0.01 ml of zoospore suspension in one concavity and the other concavity which served as control was inoculated with 0.02 ml of sterilized distilled water and 0.01 ml of zoospores suspension. The slides were incubated at 25 ^{0}C for hours. The germ tube length was measured.The present inhibition in germ tube length was calculated by using the formula suggested by Vincent (1947).

Results

Nine amino acids viz.. L-glutamic acid, DL-serine, DL- threonine, L-ornithine monohydrochloride, L-arginine

monohydrochloride, DL-α-alanine, L-proline, L-cystine and DL-valine were detected in the leaf leachates of two cultivars of potato i.e. KCM and KJ. Two amino acids, DL-serine and L-arginine monohydrochloride were exclusively detected in the leachates of KJ cultivar. While the rest seven were common in both the cultivars. Four amino acids viz. DL-threonine, Dl- α-alanine, L-proline and DL-valine and five amino acids viz. DL-serine, DL-threonine, L-arginine monohydrochloride, L-cystine and DL-valine were detected from young leaves of KCM and KJ cultivars respectively.

Total sugars and phenol content of leachates of young and mature leaves of KCM and KJ cultivars of potato were given in Table 1. Total sugar content of KCM leachates varied between 0.10 and 0.37 µg per sq. cm. The lowest amount of sugars was exuded by leaves of 2^{V} sampling. In 22^{nd} and 25^{th} sampling the sugar content was more in young leaf leachates as compared to mature ones. Similarly the total sugar content of KJ leaf leachates varied between 0.02 to 0.23 µg per sq. cm. The maximum amount of sugar was present in the leachates of mature leaves of 22^{nd} sampling. The sugar content was more in the leachates of young leaves of the 22^{nd} and 222^{rd} sampling. On comparing the sugar content of leaf leachates of cultivars it was found that sugars was exuded more by KCM.

Total phenol content of KCM leachates varied between 1.00 to 2.0 µg per sq. cm the phenols were present more in young leaf leachates of 22^{nd} and 222^{rd} sampling as compared to mature leaf leachates, while the reverse was true for 25^{th} sampling. The phenol content of KJ leachates varied between 1.05 to 3.16 µg per sq. cm. In all the samplings total phenol content was more in young leaf leachates and the maximum amount was found in the young leaf leachates of 25^{th} sampling. On comparing the phenolic content of KCM and KJ leachates we found that in 22^{nd} and 222^{rd} sampling more phenols were exuded by young leaves of KCM and mature leaves of KJ. In the 25^{th} sampling phenolic content was much higher in young leaves of KJ cultivar as compared to other samples of leaf leachates.

The percentage germination of *P. infestans* sporangia in the leachates of KCM and KJ cultivars of *Solanum tuberosum* at different time intervals is given in Fig.1. After 1-1/2 hours percent sporangial germination was found enhanced except young leaf leachates of 22^{nd} sampling when compared to control in both the cultivars, germination While, sporangial germination was inhibited when compared to control after 2 hours and 2-1/2 hours. Moreover, it was found that percent sporangial germination was more in mature leaf leachates in comparison with young leaf leachates in all the samplings. It was found that percent sporangial germination of *P. infestans* was less in the leaf leachates of KJ cultivar as compared to that of KCM cultivar.

Germ tube length of *P. infestans* zoospores in leaf leachates of two cultivars of potato is given Fig.1. The germ tube length was inhibited in the leaf leachates of both the cultivars except in case of mature leaf leachates of 25^{th} sampling of Kufri Chandramukhi (Table.2) where the germ tube exceeds that of control. In Kufri jyoti leaf leachates the germ tube length never exceeds those of control. In 25^{th} sampling when environmental conditions were favourable for late blight of potato the leaf leachates caused more inhibition of germ tube length as compared to control.

Discussion

The influence of leachates on plant surface microbial populations is very complex. Microorganisms

themselves respond in different ways to leachates from different plants (Chet *et al.*, 1973). Purnell (1971) provided evidence to suggest that leachates may contain some components which stimulate growth and at the same time others which are inhibitory.

The amount of sugar exudation changes from sampling to sampling and between young and mature leaves of the same cultivar. Sugar exudation was more on the surface of KCM cultivar and hence microflora was more on this cultivar as also reported by Collins (1976) that *Antirrhinum majus* Nanum exuded more sugar than *A.majus* Fi hybrid which supported less phylloplane microflora. Bansal *et al*. (1988) reported that sugar exudation was more on the surface of WH 157 cultivar as compared to NP 830 cultivar of wheat at any given time hence microflora was more on WH 157 cultivar.

The percentage germination of *P.infestans* sporangia in the leachates of KC and KJ cultivars of potato were found enhanced after 1-1/2 hours of incubation except in young leaf leachates of 22nd sampling, while sporangial germination was inhibited as compared to control after 2 hours and 2-1/2 hours of incubation. The stimulating effect of sporangial germination in leaf leachates is usually regarded as nutritional and attributed largely to the presence of carbohydrates and amino acids. Godfrey (1974) showed that a relatively aqueous leachates from fronds of *Pteridium aquilinum* increase the germination hyphal length of *Botrytis cinerea.* The nutrients released from leaf surface have a stimulatory effect on phylloplane microorganisums (Bahadur and Sinha, 1970;Sadasivam *et al.*, 1976; Mishra and Tewari, 1978). Wang and Pinckard (1973) found leachates from cotton bolls inhibited the germination of *Diplodia gossypina* spores and suggested that this inhibitory effect was due to phenolic compounds in leachates of lilac *(Syringa vulgaris)* contained tree phenolic substances which inhibited the percentage germination *Alternaria alternata* and *Botrytis cinerea* when compared with deionized water control. Singh *et al*. (1986) found exudates of leaves of *Spinacia oleracea* stimulated the percentage of conidial germination and germ tube growth of all test fungi except *Cercospora beticola* where inhibitory effect was observed by the exudates of young leaves. The percent sporangial germination was less in the leaf leachates of KJ cultivar as compared to KCM cultivar. Particularly in the 25th sampling when the environment conditions were favourable for the disease development, the sporangial germination was much higher than disease development the spoirangial germination was much higher in the leaf leachates of KCM cultivar. Similarly the germ tube length of *P. infestans* zoospores in mature leaf leachates of 25th sampling of KCM exceeds that of control while the same was inhibited in case of KJ. This indicated the resistance of KJ against *P. infestans*. Link and Walker (1933) found resistance of red or yellow pigmented varieties of onion to *Colletotrichum circinans* was due to higher concentration of phenolic acids, catechol and protocatechuic acid in the scale leaves. Germination of *Peronospora tabacina* was greatly reduced on leaves of *Nicotiana tobacum*, compared to other tobacco species (Shepherd and Mandryk, 1963). The inhibition in germination was attributed to the presence of phenolic compounds in the droplets removed directly from the leaves.

Sharma and Sinha (1971) recorded that exudates from young leaves were more effective in causing inhibition of germination of conidia of *Colletrichum graminicola* than those from mature leaves. Schneider and Sinclair (1975) found that leachates from leaves of resistant varieties of *Vinca unguiculata* inhibited germination of *Cercospora varieties* of *Vinca unguiculata* inhibited germination of *Cercospora canescens*

spores. They suggested the presence of a specific inhibitor in the leaf washings. Singh and Gupta (1983) found the stimulatory effect of leaf exudates on conidial germination of rice leaf scald fungus, *Rhynchosporium oryzae,* was higher in those collected from the susceptible cultivar (Jaya) than the resistant cultivar (Dular). The significance of amino acids in the growth and development of *P.infestans*

Table 1: Total sugars and total phenols in the leaf leachates of two cultivars of *Solanum tuberosum*

Sampling number		Sugars µg/cm^2		Phenol µg/cm^2	
		KCM	KJ	KCM	KJ
II	Young	0.37	0.20	2.80	1.84
	Mature	0.12	0.23	1.09	1.50
III	Young	0.20	0.11	1.91	1.22
	Mature	0.31	0.02	1.00	1.05
IV	Young	0.14	0.22	1.23	3.16
	Mature	0.10	0.15	1.44	1.21

Table 2: Percentage inhibition in germ tube length of *P. infestans* zoospores in the leachates of cultivers of *Solanum tuberosum*

Sampling number		KCM	KJ
II	Young	3.81	38.16
	Mature	45.03	19.08
III	Young	26.71	20.61
	Mature	54.19	28.24
IV	Young	26.71	11.29
	Mature	-16.48	5.64

was emphasized by French (1953) and Child and Fothergill (1967). No definite correlation could be established between amino acids and resistance of potato plants to infection by *P.infestans*. However, differences have been observed in the composition of amino acids in the leacheats of KCM and KJ cultivars.

References

Block, R.J. and Durham, and E.L. and Zweig, G., 1958. *A Manual of Paper Chromatography and Paper Electrophoresis*. Acadmic Press, New York, 710pp.

Bansal, B. K., Navneet and Mehrotra, R.S., 1988. Phyllosphere mycoflora of wheat in relation to leaf leachates and its resistence to *Helminthosporium* blight. ***Indian Phytopath,*** 41: 398-405.

Bahadur, P. and Sinha, S.,1970. Studies on spores germination of *Uromyces cicerisarietini* influence of leaf exudates of gram. ***Indian Phytopath.,*** 23: 644-649.

Chet[2]. , Ziberstein, Y. and Henis, Y., 1973. Chemotaxis of *Pseudomonas lachrymans* to plant extracts and to water droplets collected from leaf surfaces of resistant and susceptible plants. ***Physiological Plant Pathology,*** 3: 473-479.

Collins, M. A. and Hayes, A.J., 1976. The seasonal incidence of microbes on the surface of first year needles of Norway spruce. ***Trans. Br. Mycol. Soc.,*** 66: 457-461.

Child, J. J. and Fothergill, P. G., 1967. The amino acid content of potato plant varieties and their resistance to attack by *Phytophthora* species. ***J. Sci. Fd. Agric.,*** 18: 3-7.

Farkas, G. L. and Kiraly, Z., 1962. Role of phenolic compounds in the physiology of Plants disease and disease resistance. ***Phytopath.,*** 44:105-150.

French, A. M., 1953. Physiologic differences between two physiologic races of *Phytopthora infestans*. ***Phytopathology,*** 43:513-516

Godfrey, B. E. S., 1974., Phylloplane mycoflora of braken, *Pteridium aquilinum. Trans. Br. Mycol. Soc.* 62: 305-311.

Link, K. P. and Walker, J.C., 1933. The isolation of catechol from pigmented onion scales and its significance in relation to disease resistance in onions. ***J. Boil. Chem.,*** 100: 379-383.

Morris, D.L., 1948. *Quantitative determination of carbohydrates with Dreywood's anthrone reagent.* Science, 254-255.

Mishra, R. R. and Tewari, R. P., 1978. Studies on pyllosphere fungi: Germination behaviour of certain fungi in leaf extract and exudates of wheat and barley. ***Acta Bot. Indica,*** 6: 21-30.

Purnell, T. J., 1971. Effects of pre-inoculation washings of leaves with water on subsequent infections by *Erisyphe cichoracearum*. In Ecology of Leaf Surface Microorganisms (Preece, T. F. and Dickinson, C. H., Eds.). Academic Press, London, pp.269-275.

Sadasivam, K. V., Rangaswami, G. and Prasad, N. N., 1976. Studies on pyllosphere microflora of tapioca (*Manihot utilissima* Pohl.). ***Zbl. Bakt. Abt.[22] Bd.***,131: 632-643.

Singh, P.N., Sindhu, I.R. and Gupta, K., 1986. Effect of leaf exudates and extract of spinach on some phylloplane fungi. ***Acta Bot. Indica.,*** 14: 104-110.

Shepherd, C.J. and Mandryk, M., 1963. Germination of conidia of *Peronospora tabacina.* [22]. Germination in

vivo. ***Aust. J. Boil. Sci.,*** 16: 77- 87.

Sharma, J.K. and Sinha, S., 1971. Effect of exudates of *Sorgum* varieties varying in susceptibility and maturity on the germination of conidia of *Colletotrichum graminicola* (Ces.) Wilson. In Ecology of Leaf Surface Microorganisms (Preece, T.F. and Dickinson, C.H., Eds.)., Academic Press, London, pp.597-601.

Singh, S.A. and Gupta, P.K.S., 1983. Effect of leaf exudates and extracts on conidial germination of rice leaf scald fungus, *Rhynchosporium oryzae*. ***Indian J. Plant Pathol.,*** 1:109-113.

Schneider, R.W. and Sinclair, J.B., 1975. Inhibition of conidial germination and germ tube growth of *Cercospora canescens* by cow pea leaf diffusates. ***Phytopathology.,*** 65:63-65.

Vincent, J.M., 1947. Distortion of fungal hyphae in the presence of certain inhibitors. *Nature* (London), 159: 850.

Wang, S.C. and Pinckard, J.A., 1973. Spore germination of *Diplodia gossypina* in the presence of carbohydrates and phenolic compounds in relation to boll rot of cotton. ***Phytopathology,*** 63: 1181-1185.

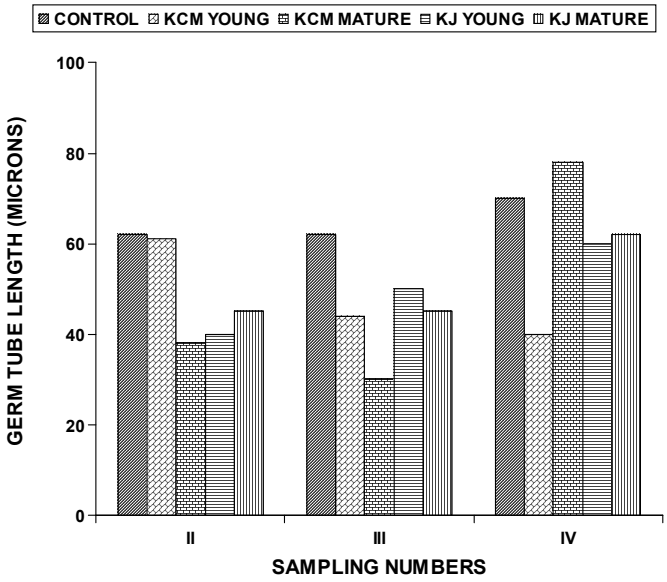


Fig 1: Growth of germ tube length in control and leachates of Kufri Chandramukhi and Kufri Jyoti cultivars.

Environment Conservation Journal 8 (3) 23-26, 2007
(ISSN 0972-3099)

Water quality of River Ganga in respect of physico-chemical characteristics at Shyampur, District Haridwar

Unnati Vishnoi, Jagjeet Kaur* and S.K. Pathak**
Deptt. of Chemistry, K.L.D.A.V. (P.G.) College, Roorkee
*M.S. (P.G.) College, Saharanpur
**Deptt. of Zoology, Govt. P.G. College; Mhow, (M.P.)

Abstract

The water quality status of River Ganga at Shyampur was studied with respect to physico–chemical characteristics. Parameters studied were pH, total solids, total dissolved solid, T.S.S., conductivity, alkalinity, hardness, D.O., B.O.D. and C.O.D. The nature of water quality of Ganga with respect to pH is alkaline.

Introduction

Shyampur (District Haridwar), is situated at the east bank of river Ganga where number of people and cattle take bath daily. Shyampur is connected by the Haridwar –Najibabad road. Ganga river passed through the Haridwar, Kangri and Gendi khata villages. The waste water of near by village is ultimately mixes into the river.The washing and bathing activity by village may also affect the physico–chemical parameters of the river. Number of workers have carried out their investigations on water quality of river Ganga with respect to different physico – chemical characteristics from its origin to merging point (Singh *et al*.,1988,91, Khanna *et al.,*2003, Gautam and Sati 1987).But no study has been conducted to assess the water quality of river Ganga at Shyampur . Therefore it was proposed to conduct a study on water quality of river Ganga at Shyampur. The present paper include one year study (Jan. –Dec. 2005).

Materials and Method

Water samples of river Ganga were collected in neat and clean two litre white plastic Jericanes for physcio chemical parameters. Samples for Dissolved oxygen (DO) were collected in a neat and clean 300 ml. Borosil glass stoppered DO bottles ,DO was fixed by using 1ml. of each reagent MnSO4 and alkaline azide on the spot. Grab sample collection methods was adopted through out the study. Sample preservation and analytical methods were adopted as per APHA,AWWA, WPCF-1992, Khanna and Bhutiani (2004).
Two sampling stations were selected as Upstream Shyampur denoted as sampling station A and Downstream Shyampur denoted as sampling station 'B'. sampling station A is approximate 500 meter in Upstream of Shyampur and sampling station 'B' is situated 1 Km in Downstream of Shyampur .

Result and Discussion

Results of samples analyses for physico-chemical parameters are given in Table-1 to 3. The values of studied parameters pH, TS, TSS, TDS, alkalinity, total hardness, chloride, free CO2, conductivity, water temperature varied between 7.0-8.8, 120.9-232 mg/l ,30.9-52.2 mg/l ,55-98 mg/l ,11.6-89 mg/l , 6.9-116 mg/l , 6.9-27.4 mg/l , 1.8-3.8 mg/l , 0.11-0.60 mg/l , 12.2-22 mg/l; at sampling station-A where as at sampling station-B the values of these parameters ranged from 7.0-8.6, 133-266 mg/l, 98-189 mg/l, 32-81 mg/l, 60-107 mg/l, 62-99 mg/l, 7.4-59.1 mg/l, 1.5-4.1mg/l, 0.15-0.68 mg/l, 13-21.5 mg/l. respectively; and of DO, COD, BOD, ranged between 9.5-12.5 mg/l, 11.0-30 mg/l,0.5-1.5 mg/l. at sampling station A where as at sampling station B the

values of these parameters ranged from 8.5-11.0 mg/l , 9.5-28.2 mg/l , 0.8-3.1 mg/l respectively. The average value of pH, TS, TDS, TSS, conductivity DO, COD, alkalinity, total hardness and chloride were obtained within the tolerance limit of drinking purpose where as average values of BOD was found 1.03 mg/l at sampling station-A and 2.2 mg/l at sampling station-B (Table-3) .

Maximum values of the studied parameters were observed during monsoon season except DO and minimum values of these parameters obtained during winter, lower values of DO were observed during rainy period at both sampling station which may be due to dilution in rainy season and super saturation of Oxygen at lower temperature and less human activity like bathing/ washing etc. in winter. After winter period as temperature of water rises free CO_2, COD, BOD was increased and DO decreased of river Ganga , Khanna *et al.* 2003 has also found the similar trend. Water quality of river Ganga with respect to pH is alkaline similar trend of water quality of river Ganga were also found by Singh (1988) and Khanna (1993).

References

APHA-AWWA-WPCF 1992 : *Standard methods for the examination of water and waste water* American Public Health Association, 18th edition, Washington DC.

Khanna , D.R., 2003 : *Ecology and Pollution of River Ganga. Ashish Publishing House,* Delhi. pp 1-241 .

Khanna , D.R., Singh, Shakun, Gautam, Ashutosh and Singh, J.P., 2003. Assessment of water quality of River Ganga in district Bulandshahar (UP) India. ***J. Nat. Con.,*** 15 (1): 167-175.

Khanna , D.R. and Bhutiani, R., 2004. *Water Analysis At A Glace.* Pub. ASEA. pp. 1-116.

Khanna , D.R. and Chugh, Tarun, 2004. *Microbial Ecology* Discovery Publishing House, Delhi. pp. 1-277.

Singh, J.P., Yadav, P.K. and Singh, L., 1988. Pollution status of sangam and its adjoining river before the Kumbh Mela at Allahabad. ***Indian J. Environment Protection,*** 8 (11) : 839-842.

Singh, J.P., Yadav, P.K., Singh, Shakun and Prasad, S.C., 1991. BOD Contamination in kali river at Sadhu Asharam in Aligarh. ***I.J.E.P.,*** 11 (5): 325- 326.

Table-1: Variation in physico-chemical characteristics of river Ganga at sampling station A of Shyampur (Haridwar), during January to December 2005.

Parameters	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Water Temp.	12.2±0.2	14.0±0.63	19.4±0.4	19.6±0.3	21.3±0.3	22.0±0.4	19.0±0.2	18.7±0.1	18.6±0.12	18.3±0.12	20.0±0.12	14.8±0.07
T.S.	125±2.0	120.9±1.0	130.0±2.8	160.0±2.1	179.1±7.6	213.0±10	224.2±18	232±0.20	222±0.20	223.9±0.12	200.0±8	187.0±4.6
T.D.S.	94±1.4	90±0.9	92±2.0	120±3.4	129±2.9	161±4.5	172±3.0	180±3.4	179±3.0	182±3.0	160±3.4	148±1.5
T.S.S.	31.0±0.6	30.9±1.0	38.0±1.0	40.0±0.8	50.0±0.9	52.0±1.3	52.2±1.2	52±1.2	43.0±1.4	41.9±1.3	40.0±1.6	39.0±1.0
Conductivity	0.11±0.0	0.16±.0.0	0.21±0.0	0.20±0.02	0.25±0.02	0.30±0.03	0.60±0.02	0.48±0.4	0.50±0.00	0.40±0.01	0.3±0.01	0.22±0.0
pH	7.3±0.07	7.6±0.11	7.2±0.07	8.0±0.05	8.0±0.04	8.1±0.2	8.8±0.3	8.2±0.2	8.6±0.10	8.0±0.01	7.0±0.12	7.6±0.0
DO	12.5±0.2	11.8±0.02	11.0±0.1	11.0±0.7	11.2±0.5	10.0±0.4	9.5±0.7	10.5±0.6	10.5±0.1	11.0±0.04	11±0.01	12.0±0.0
Free CO_2	1.8±0.3	2.0±0.09	2.0±0.10	2.5±0.7	2.2±0.8	2.6±1.2	3.8±1.0	3.2±1.4	2.6±1.2	2.5±0.02	2.0±0.7	1.8±0.3
COD	11.0±0.2	12.4±0.11	12.5±0.11	13.0±0.8	17.0±0.9	21.0±1.2	25.0±1.0	30.0±1.5	24.0±1.2	12.2±0.02	19.0±0.8	14.5±0.3
BOD	0.60±.0.01	0.90±0.01	1.4±0.01	0.8±0.1	1.0±0.1	1.5±0.2	1.5±0.2	1.2±0.2	1.2±0.2	1.0±0.0	0.8±0.04	0.50±0.3
Alkalinity	55±1.1	59±0.6	60±1.0	64±0.3	72±1.0	74±1.2	75±0.7	80±1.0	72±0.8	98±3.0	89±0.07	75±1.1
Total Hardness	79.0±1.2	66.0±1.0	72.0±1.3	72.0±0.4	76.0±1.3	89.0±1.3	11.6±1.6	76.0±0.6	81.0±1.0	82.0±2.0	81.0±1.2	74.0±0.9
Chloride	6.9±0.1	7.2±0.02	7.7±0.02	11.9±0.5	18.0±0.7	20.0±0.0	27.4±0.3	24.0±0.3	17.6±0.2	9.0±0.1	7.0±0.03	7.0±0.02

Table-2: Variation in physico-chemical characteristics of river Ganga at sampling station A of Shyampur (Haridwar), during January to December 2005.

Parameters	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Water Temp.	13.8±0.2	13.0±0.4	19.3±0.2	20.0±0.1	21.0±0.09	21.5±0.25	21.0±0.10	19.6±0.1	18.7±0.1	20.4±0.3	19.1±0.1	15.0±0.10
T.S.	133±2.0	146±1.7	148±2.0	175±10.2	188±10.2	231±17.5	261±14	266±20.2	255±2.5	233±3.12	225±3.8	198±3.0
T.D.S.	101±3.2	110±2.7	98±1.5	138±2	130±3.2	179±3.2	189±4.1	185±7.2	181±3.9	188±2.5	161±3.8	137±4.9
T.S.S.	32±1.5	36±1.6	50±1.3	37±1.0	58±1.3	52±1.3	72±1.3	81±1.5	74±2.0	45±2.1	64±1.3	61±1.8
Conductivity	0.15±0.1	0.20±0.1	0.21±0.1	0.15±0.0	0.16±0.0	0.38±0.0	0.68±0.02	0.61±0.02	0.60±0.01	0.58±0.01	0.51±0.0	0.324±0.02
pH	7.0±0.5	7.0±0.3	7.1±0.5	7.1±0.10	7.2±0.25	7.3±0.2	7.9±0.45	7.8±0.25	7.6±0.2	7.7±0.45	8.6±0.2	7.6±0.15
DO	11±0.15	10.1±0.15	8.5±0.2	9.8±0.01	9.1±0.02	8.8±0.1	9.8±0.15	10.6±0.11	10.2±0.11	9.9±0.1	10.2±0.15	11.0±0.20
Free CO_2	1.5±0.2	3.0±0.2	2.3±0.12	3.0±0.1	2.5±1.2	3.9±0.02	4.1±0.01	2.9±0.02	2.8±0.03	3.4±0.1	2.9±0.7	2.7±0.09
COD	9.5±.04	11.0±0.03	11.5±0.04	12.0±0.15	15.5±0.14	20.2±0.15	23.5±0.15	28.2±0.40	23.4±0.25	10.2±0.20	17.5±0.07	13.5±0.05
BOD	2.8±0.02	0.8±0.03	1.9±0.02	2.2±0.05	2.9±0.02	3±0.03	3.1±0.02	1.6±0.01	1.8±0.0	1.5±0.1	2.1±0.01	2.9±0.20
Alkalinity	60±1.0	64±1.5	61±1.4	80±1.1	98±1.4	101±1.0	107±1.1	79±0.75	81±0.8	99±0.0	95±0.0	80±2.00
Total Hardness	62±1.2	65±1.5	79±1.2	81±1.3	93±1.0	98±1.1	99±1.6	80±1.7	95±1.0	90±1.5	98±1.6	89±1.6
Chloride	7.4±0.11	7.9±0.13	9.0±0.15	13.0±0.2	22.0±0.2	34.0±0.15	59.1±0.16	25.5±0.14	21.0±0.18	17.0±0.17	15.0±0.12	13.0±0.10

Table –3: Average value of physico - chemical parameters at sampling station a and b at Shyampur during period January to December 2005

Parameters	Jan. – Dec. 2005			Jan. – Dec. 2005		
	Sampling –A			Sampling -B		
	Min.	Max.	Average	Min.	Max.	Average
Water Temp.	12.2	21.3	18.1	13.0	21.5	18.5
TS	187.0	232. 0	184.7	133.0	226.0	204.9
TDS	90.0	182.0	142.2	98.0	189.0	142.3
TSS	31.0	52.2	42.5	32.0	81.0	55.1
Conductivity	0.11	0.6	0.31	0.15	0.68	0.38
pH	7.0	8.1	7.8	7.0	8.6	7.5
DO	9.5	12.5	11.0	8.5	11.0	9.9
free CO2	1. 8	3.8	2.4	1.5	4.1	2.9
COD	11.0	30.0	17.6	9.5	28.2	16.3
BOD	0.5	1.5	1.03	0.8	3.1	2.2
Alkalinity	55.0	98.0	72.7	60.0	107.0	83.7
Total Hardness	66.0	116.0	80.3	62.0	99.0	85.7
Chloride	6. 9	27.4	13.6	7.4	59.1	20.3

Environment Conservation Journal 8 (3) 27-29, 2007
(ISSN 0972-3099)

Sanaffar - A wonderful ethnomedicine from north western tarai forest of Uttar Pradesh – A new report

Babli Singh and T.P. Mall
Post Graduate Department of Botany, Kisan P-G. College, Bahraich (U.P.)

Abstract

During the ethnomedicinal and taxonomic survey for the flora of the Kishanpur forest range along with M.Sc. Botany Students on Nov 24, 2006, the authors were introduced by their guide to a tree plant at the bank of Jhadi Tal locally named as Sanaffar. Kishanpur forest range is about 25km. from Dudwa National Park head quarter. The author were told by their guide that some times newly born baby upto age of 6 month continuously cry/weep probably due to excessive pain because of certain ailment. Later the body become bluish. Since the baby can not speak about the ailment, some times it results to the death of the baby. In such case if the bark of Sanaffar is boiled in water and bath of the baby is taken place thrice a day or so with the Sanaffar bark boiled warm water, the baby become cure and stop crying. Our guide Sri Baddal Ram Rana is a Tharu tribe, local resident of a tharu village Muen Nuchani, P.O. Parsia, Distt. Kheri Lakhimpur told that they get their ethnomedicinal knowledge from their elders. They carry the flowering twigs from the forest & show to their different elders and note down the medicinal use if any. His statement was later confirmed by Sri Mihi Lal Dangaura, an elderly Jadu Tona (witchery) expert of the Dudwa locality. He is R/o Village Balera. P.O. Dhuskiya, Distt. Kheri-Lakhimpur. Sanaffar known locally can not be identified botanically because the plant was not in flowering stage at the time.

Key words - *Sanaffar, Ethnomedicine*

Introduction

India being an oriental country has large wealth of medicinal plants used for various kinds of ailments since time immemorial (Singh, 1989). All indigenous remedies have originated directly or indirectly from oral folk lores, rituals, magic and superstitions. The cure of disease and preservation of health are as old as human civilization. A fairly comprehensive information about medicinal plant has been recorded in *Charaka samhita* and *Shusruta samhita* the two most important works on Ayurvedic system of medicine (Bakhru, 2001). Rich phytogenic diversity and Tharu tribal population characterized Dudwa Tiger Reserve of Kheri district situated in North Western Tarai Forest of Uttar Pradesh. In Kheri district, the Tharu tribe uses many plant species for health care practices and have enormous knowledge about their medicinal uses. Unfortunately the cultures of rural area are now fast changing due to various reason. Keeping this in mind, the present study was undertaken for documentation of ethnomedicinal knowledge among Tharu tribes.

Dudwa Tiger Reserve lies on the India Nepal border in the foot hills of the Himalaya and the plain of 'Tarai' region. The study area lies between 28º 30' 60" N and 80º 41'0" E and comprises 884 km² of Kheri district, Uttar Pradesh. The Tharus of Kheri district, live in villages situated in the vicinity of the Dudwa National Park adjoining the territory of Nepal. The district is bounded on the East by the district Bahraich, on the South by Sitapur and Hardoi, on the West by Shajahanpur and Pilibhit district and on the North by the territory of Nepal separated by the river Mohan. There are 41 Tharu villages in Kheri district, occupying an area of 8,194 hectare in the vicinity of Dudwa National Park. The district is inhabited mainly by the Rana Tharus, Danguria Tharus and Kathurias Tharu population.

Materials and Method

For collecting the ethnomedicinal knowledge and flora of the Kishanpur Forest Range, the survey was made on Nov 24, 2006 along with M.Sc. Botany students, under the guidance of Sri Baddal Ram Rana and Sri Kewal Singh Rana (both a local Tharu tribe) resident of village Muen Nuchani (a Tharu village) P.O. Parsia, P.S. Chandan Chauki, Distt. Kheri Lakhimpur. During the field survey, the plants were collected and their use by inhabitants were recorded in the field books. The indigenous knowledge of local traditional healers about medicinal plants and their use were collected through questionnaire and personal interviews. All the collected plants were pressed, dried, preserved, mounted and identified through the available taxonomic literature (F.U.G.P. 1994) and latter confirmed by Prof. S.K. Singh Retd. Prof. and Head of Botany. D.D.U. Gorakhpur University, Gorakhpur. All the collected and preserved plant specimens were deposited in the Herbarium maintained in the department.

Results and Discussion

After the ethnomedicinal and toxonomical survey of Dudwa Tiger Reserve about 55 plant species belonging to different family were collected. Out of these species the present study deals with an important medicinal tree plant of Sanaffar (locally called) collected at the bank of Jhadi Tal, in Kishanpur Forest Range of Dudwa National Park. Sanaffar plant known locally can not be identified botanically because the plant is not in flowering stage at that time. Our guide, Mr. Rana told us that, some times newly borne baby up to age of 6 months continuously cry probably by excessive pain, because of certain ailments. Due to continous cryness the body of baby become bluish and some times it results to the death of the baby. In such case if the bark of sanaffar tree is boiled in water and bath is given to the baby with this warm water thrice a day, baby becomes cure and stop crying. His statement was latter confirmed by Mr. Mihi Lal Dangaura a witchery resident of village Balera P.O. Dhuskiya, Distt. Kheri Lakhimpur.

A number of organization with in India are concerned with maintaining India's Traditional Medicine system. Nearly 80% of the world population depends upon traditional system of health care (Behera, 2006). The tribals of Kheri district totally dependent on plant resources mainly for herbal medicines, food, forage, construction of dwelling, making house hold implements, sleeping mats and for fire and shade. Herbal medicine have good value in treating many diseases such as skin disease, snake bites, stomach ache, nervous disorders, infectious disease and hypertension etc. Traditional knowledge of medicinal plants and their use by indigenous cultures are not only useful for conservation of cultural traditions and biodiversity but also for community health care and new drug development.

Acknowledgments

The authors are thankful to Sri Mohd. Ahsan, Chief Wildlife Warden, Lucknow Uttar Pradesh, for giving his permission for scientific research for the exploration of floral vegetation of the territory under his command and to Dr. S.P. Singh Principal, Kisan P.G. College, Bahraich for providing necessary laboratory and library facilities.

References

Bakhru, H.K., 2001. *Herbs that heal: Natural Remedies for Good Health*. Rakesh Press. New Delhi- 110028.

Behera, K.K., 2006. *Ethnomedicinal Plants used by the Tribals of Similipal Bioreserve*, Orissa, INDIA: A Pilot Study.

Duthie, J.F., 1994. *Flora of Upper Gangetic Plain and of the adjacent Shivalic and Sub-Himalayan Trct*, (Botanical Survey of India, Calcutta), Reprinted 1994.

Jain, S.K., 1989. *Methods and Approaches in Ethnobotany* (*Society of Ethnobotanists,* Lucknow).

Kumar Akhiles, Tewari, D.D. & Tewari, J.P., 2006. Ethnomedicinal knowledge among Tharu tribe of Devipatan division, in. ***Indian Journal of Traditional knowledge,*** 5(3): 341-313.

Maheswari, J.K., Singh, K.K. and Saha, S., 1981. *The Ethnobotany of the Tharus of Kheri district Uttar Pradesh,* Economic Botany Information Service, National botanical Research Institute Lucknow.

Mitra Roma, 1989. *Therapeutic terms used in Medico Botany*. Methods and Approaches in Ethnobotany, by S.K. Jain (*Society of Ethnobotanists*, Lucknow).

Maheswari, J.K., Singh, K.K. and Saha, S., 1986. The *Ethnobotany of Tribal of Mirzapur district Uttar Pradesh.* Economic Botany Information Service, National Botanical Research Institute Lucknow.

Rao, R.R., 1989. *Methods and Techniques in Ethnobotanical study and Research* : Some Basic Considerations, in Methods and Approaches in Ethnobotany, by S.K. Jain (*Society of Ethnobotanists,* Lucknow), 13-23.

Singh, N., 1989. *Pharmacology-its role in development of new herbal drugs from traditional/folk-lore medicine*. Methods and Approaches in Ethnobotany, by S.K. Jain (*Society of Ethnobotanists,* Lucknow), 13-23.

Environment Conservation Journal 8 (3) 31-33, 2007
(ISSN 0972-3099)

Antibacterial activity of Nirgundi (*Vitex negundo* Linn.)

Sanjay, Navneet and M. M. Tiwari*
Department of Botany & Microbiology,
*Faculty of Engineering & Technology,
Gurukul Kangri University, Hardwar, 249404 (Uttarakhand).

Abstract

The antibacterial activity of Nirgundi (*Vitex negundo*) extracts were tested against bacterial dental infections (*Staphylococcus aureus*, *Streptococcus mutans*, *S. sanguis*, *S. salivarius* and *Lactobacillus acidophillus*) and some other pathogens (*Bacillus subtilus*, *E. coli*).The aqueous, methanolic and petroleum ether extracts of plants were tested for their antibacterial activity using well diffusion method at the sample concentration of 200 mg/ ml. The methanolic extract showed maximum activity as compared to other extracts. The methanolic extract was most active against *S. salvarius* followed by *Staphylococcus aureus*, *Streptococcus mutans*, *S. sanguis* and *Lactobacillus acidophillus*.

Keywords: *Vitex negundo, dental plaque, Antibacterial activity.*

Introduction

The different systems of medicine practiced in India, Ayurveda, Siddha, Unani, Amchi and local health traditions, Utilize large number of plants for the treatment of human diseases. Most of these medicinal plants have been identified and their uses are well documented and described by different authors (Nadkarni,1976, Dastur, 1985, Saradamma,1990, Jain, 1991, Kirtikar and Basu, 1991), but the efficacy of many of these plants are yet to be verified. In order to evaluate the efficacy of these plants by scientific investigations, an interdisciplinary programme was started with the aim of screening plants for their antimicrobial activity. Selection of the plants from the literature were made on the basis of their common use in the treatment of infectious diseases like fever, bronchitis, ulcer, diarrhoea, dysentery and skin disease. The medicinal herbs represent a rich source of antibacterial and antifungal activity (Ahmad *et al*., 1998). *Vitex negundo* has shown activity against *Escherichia coli*, *Klebsiella aerogenes*, *Proteus vulgaris*, *Pseudomonas aerogenes* (Perumal Samy, 1998). But there is no record of its antibacterial property against dental infections caused by *Streptococcus mutans*, *S. sanguis*, *S. salivarius*, *S. aureus* and *Lactobacillus acidophillus*. In this paper the antibacterial activity of *V. negundo* is presented along with references to their traditional uses.

Materials and Method

Plant material & extracts

The plant was collected from the foot hills of Shivalik range of Himalayas in Hardwar and identified at Botanical Survey of India, Dehradun, Uttarakhand. The plant was shade dried at room temperature and then powdered plant material was loaded in soxhlet assembly and extracted in four different solvents such as petroleum ether, acetone, methanol and water. The polarity of the solvents would leach out compounds

Table-1: Antibacterial activity of *Vitex negundo* extracts in different solvents.

Inhibition Zone (mm)*					
	Extracts				Antibiotic
Microorganisms	**Pt. ether** 100 mg/ml**	**Acetone** 100 mg/ml**	**Water** 100 mg/ml**	**Methanol** 100 mg/ml**	**Ampicillin 100 mg/ml**
Staphylococcus aureus	20	21	22	20	24
Streptococcus mutans	19	20	22	21	25
S.salivarius	21	23	22	23	26
S.sanguis	17	17	20	19	21
L.acidophillus	18	17	19	21	23
B. subtilus	9	10	12	11	21
E. coli	13	14	17	16	22

soluble in particular solvents .The extracts were concentrated by using vacuum evaporator.

Antibacterial assay

The well diffusion or cup plate method is used for antibacterial activities. The 8mm diameter wells were punched in the agar and filled with extracts and respective solvents for control and standard antibiotic ampicillin (100 mg /ml) was used as positive control, the plate were incubated at 37 ^{0}C for 24 hours. The antibacterial activity was evaluated by measuring the diameter of inhibition zone in mm.

Results and discussion

The plant shows broad spectrum antimicrobial activity (Table 1) i.e. the methanol, water, acetone and petroleum ether extracts were active against both gram positive and gram negative bacteria. The *V. negundo* extracts were found to be less effective as compared to ampicillin. The methanolic extracts exhibited the highest degree of antibacterial activity as compared to aqueous, acetone and petroleum ether extracts. The extracts were highly inhibitory to *S. mutans* and *S. salivarius*, but the maximum inhibition zone 23 mm was attained with methanol extract of *V. negundo*.

The medicinal plants are used by large proportion of the Indian population because there is a true improvement of disease condition after herbal treatment with no harmful side effects and high cost of other forms of treatment. *V. negundo* extracts show broad spectrum of action against microbes causing dental

caries. Ampicillin is more effective against microorganisms because it is used in a pure form as compared to crude extract of *V. negundo* in different solvents.

The methanolic extracts exhibited the highest degree of antimicrobial activity as more compounds i.e. alkaloids, steroids, terpenoides and glycosides are extracted by methanol in comparison to petroleum ether and acetone.

Further work is going on to locate the active principle from the various extracts and these preliminary results of this investigation indicates that *V. negundo* has a wide spectrum of antibacterial activity.

References

Kirtikar, K. R. & Basu, B.D., 1991. *Indian medicinal plants* 2nd ed , Bishen Singh Mahendra Pal Singh, Dehradun, India.

Jain, S. K., 1991. *Dictionary of Indian folk medicine and ethanobotany*. Deep Publications A-3/27A, DDA Flat, New Delhi.

Dastur, J. F., 1995. *Medicinal plants of India and Pakistan*. D. B. Taraporevala, Bombay.

Nadkarni, K. M., 1976. *India materia medica*. Bombay popular Prakashan, India.

Saradamma, I., 1990. *All India co-ordinated research project on ethnobiology.* Final technical report. RRI Drug research, CCRAS, Government of India, Poojapura, Trivandrum, Kerala, India.

Valsaraj, R., Pushpangadan, P., Smith, V. W., Adsersen,A. & Nyman, V., 1997. Antimicrobial screening of selected medicinal plants from India.. ***Journal of ethanopharmacology,*** 58: 75-83.

Ahmad, I., Mehmood, Z. & Mohammad, F., 1998. Screening of some Indian medicinal plants for their antimicrobial properties. ***Journal of ethanopharmacology,*** 62: 183 193.

Perumal Samy, R., Ignacimuthu, S. & Sen, A., 1998. Screening of 34 Indian medicinal plants for antibacterial properties. ***Journal of ethanopharmacology***, 62: 173-182.

Environment Conservation Journal 8 (3) 35-38 , 2007
(ISSN 0972-3099)

Dyeing of wool and cotton fibres with fruit rind of *Juglans regia* as natural dyes, and standardization of ancient dyeing procedure

J. S. Jangwan*, Maneesha Dobhal* and S.C. Sati**
*Department of Chemistry, H.N.B. Garhwal University Campus Badhshanithul Tehri, Garhwal
**Department of Chemistry, H.N.B. Garhwal University Campus Srinagar, Garhwal

Abstract

Vegetable dyes and their uses are known in ancient time more than 2000 years ago. It was found that the discovery of synthetic dyes reduce the use of natural dyes and consequently the export of same was affected in large extent. However due to non toxic nature, eco-friendly behaviour and properties to impart variety of colours once again natural dyes are getting more attention of chemists and dyers. The present paper deals with optimization of dyeing and mordanting of wool and cotton samples with fruit rind of *Juglans regia* and standardization of ancient dyeing procedure and also the fastness studies of dyed samples toward light and washing.

Introduction

The *Juglans regia* (Ankhrot) belong to family Juglandaceae is a large tree. Flowers are green, male and female appearing with the leaves. The bark of *Juglans regia* (Ankhrot) were known to contain substances that could be used for colouring the fabrics, cloths, utensils, and house hold implements. The colouring matter presents in the bark of *Juglans regia* is a mixture of Lignins, Tannins, Anthocyanins and Xanthones. The bark is credited with astringent properties. The fresh bark powder and seed coat of the plant are used as biopesticide in agriculture. (Gaur, 1999 and Lemmens and Soetijipto, 1991).

Materials and Method

The fruit rinds of the plant were collected from the forests of Ranichauri Distt.- Tehri Garhwal, Uttrakhand. During rainy season, and dried in shade. All the chemicals used as mordant were of L.R/A.R and BDH fine chemicals. The white wool and cotton samples were freed from traces of protein, gums and oil impurities by washing it with detergent or soap for a required periods, followed by kneading, squeezing and rinsing with lot of water, till it was free from traces of detergent. It was then dried in shade and ironed before dyeing and mordanting, the cotton and wool samples wer soaked for an hour. The optical density was recorded by using digital spectrophotometer.

The optimum concentration of dye material and the time for extraction of the dye and dyeing of cotton and wool were found out by taking different concentration of dye material (2-12gm) in different beakers.

In order to find out optimum time for dyeing one gram of cotton and wool fibers was added to seven beakers and dyed for 30, 45, 60, 75, 90, 105, and 120 minutes. The samples were stirred occasionally to obtain an even dyeing. The dyed samples were taken out from beakers and dried in shade. The evenness of dye, depth of shade and overall appearance are evaluated by a panel of judges. The highest percentage rating was calculated by Judgment Table 2.

Number of shades were obtained by mordanting the cotton and wool with different concentration of mordants such as chrome, alum, copper sulphate, ferrous sulphate, stannous chloride etc. and also using

Table-1: Optimum concentration of dye materials

Conc. of Dye material g/100 ml of water	Optical density	Percentage rating
2 gm	0.081	52
4 gm	0.097	55
6gm	0.121	60
*8 gm	*0.137	*67
10 gm	0.128	59
12 gm	0.123	62

Wavelength 320 mn
*Selected sample

The optimum time for extraction of dye was found out by extracting the optimum concentration of dye material at 80 ^{0}C for 30, 45, 60, 75, 90, 105 and 120 minutes and the optical density of the liquor was measured (Table II).

Table-2: Optimum time for extration of dye and dyeing

Time for extraction of dye(min.)	**Cone. of dye material (gm)**	**Optical Density**	**% absorption**	**%rating**
30	8	0.142	0.72	
45	8	0148	0.75	
60	8	0.153	0.82	
*75	8	*0.162	*0.84	*0.84
90	8	0.160	0.83	
105	8	0.161	0.82	
120	8	0.161	0.82	

Wavelength 320 mn
*Selected sample

the pre-mordanting (mordanting before dyeing) Post-mordanting (mordanting after dyeing) and simultaneous mordanting (dyeing and mordanting together in same pot.)

Analysis of samples towards light and washing fastness

The dyed samples of cotton and wool to be tested for the light fastness were cut into specimens of 3x 6cm, numbered and mounted on a cardboard frame. The blue wool and cotton sample (five of each) standard having a light fastness rating from low to high (1 low-5 high cotton, 1 low-5 high wool) were stapled on cardboard strip. A strip of thick black chart paper was pinned in such a manner that half of it lies on the specimen and the standards thereby leaving the samples half exposed and half covered (Bird, C.L. 1972). A strip of thick black paper was put inside the fluorescent lamp. The specimens and standards were checked at regular intervals. The samples were compared with blue wool and cotton standards and rated. The different methods of mordanting produce good range of colours having various shades ranging from dark brown to brownish black, black to greenish, brown to black. The premordanting method gave the best results/colours with Stannous Chloride and Ferrous Sulphate. A variety of shades was also obtained with post and simultaneous mordanting process.

The washing fastness of sample was done by marking the specimens of 5 x 7 cm size and placed between two layers of the fabric of the same size. These layers were seen from a complex specimen. The soap or detergent solution was prepared by dissolving 10 gram of soap or detergent in 1000ml of water. Each composite sample was treated with soap solution in Launderometer for 30-40 minutes at a temperature of 60 ^{0}C. The samples were then removed and rinsed thoroughly under running tap water, dried and ironed. The rating of washing fastness was done on the basis of the staining of the fabrics. Washing brought a considerable change in the colour of dyed sample Chrome, Alum and Stannous chloride mordanted samples showed very poor fastness. Cotton was stained with SnCl2 whereas wool was noticeably stained with Alum (Sati *et al.,* 2003).

Ferrous Sulphate mordanted samples has fair washing fastness while Copper Sulphate and Chrome mordanted samples have poor to fair washing fastness. Chrome and $SnCl_2$ showed slight stain on wool.

Results and Discussion

From the data of Table 1 and 2 it is evident that 8gm of rind power was optimum to give the maximum optical density of dye liquor while 75 minutes of extraction time and dyeing time was found to be optimum. Best shades of colours were obtained by using 12 gm of Alum, 5 gm of Chrome, 8 gram of $CuSO_4$, 10 gram of $SnCl_2$ and $FeSO_4$ respectively per 100gm of wool and cotton.

In present study it was observed that cotton samples was noticeable stained with Stannous Chloride using post mordanting technique, while wool was noticeably stained with Alum using same procedure. The washing fastness of both sample of cotton and wool was found fairly good.

Efforts was also made to mordant the samples with naturally occurring mordants of plants origin like bark of *S. racemosa*, seed rind of *P. granatum,* bark of *M. esculenta* etc. which produces a number of beautiful shades on wool and cotton samples.

The whole study points out that the dye extracted form fruit rind of *Juglans regia* can be use to obtained

array of colours either alone or in combination with mordants (natural/synthetic) with different fabrics. The optimization of mordanting has not only rendered the dyed wool with good wet fastness but has also helped in achieving eco-friendly processing parameters in terms of effluent within tolerance limit for the residual heavy metal content.

References

C.L., Bird, 1972. *Theory* and *Practice of Wool Dyeing*. Society of Dyers and Colourist, 4 Edn.

Gaur, R.D., 1999. *"Flora of District Garhwal"* 1st edition, Transmedia, Srinagar Garhwal.

R.H.M.J, Lemmens and N. Wulijarni-Soetijipto, 1991. *Dye and Tennin Producing Plants*, Plant Resources of South East Asia, Vol-3.

Sati, S.C., Rawat, U., Sati, O.P., Srivastav, B., 2003. *Colourage*, 44.

Environment Conservation Journal 8 (3) 39-45, 2007
(ISSN 0972-3099)

Aquatic birds Diversity at Yashwant Nagar Talaab, Mhow (M.P.)

Gopal Sahay Saxena, M.M. Prakash* and B. Arora
Dept. of Zoology, Govt.P.G.College, Mhow.
*Dept. of Biotechnology & Bioinformatics, Holkar Science College, Indore.

Abstract

Present study describes the seasonal variation of aquatic birds. Total 19 species of water birds were reported from this water body including 7 species of winter visitor and 7 species of local migratory. Species wise monthly count also discussed in this paper.

Keywords: *Water fowl, monthly count, migratory birds, winter visitors.*

Introduction

Aquatic birds play an important role in wetland ecosystem because they act as a consumer in trophic levels of such system. They are also considered as an indicator of the changes occurring in the aquatic environment. Various workers such as (Bezzel, 1974; Karlson *et al*, 1976; Nilsson and Nilsson, 1976; Erikson, 1984; Koskimies, 1987 and Shukla *et al*, 2004) also expressed similar view and stated that all most all types of aquatic organisms can serve as an indicator. Literature available stated that very few scientists worked on the diversity of aquatic birds in M.P. (Prakash and Saxena, 2005; Malhotra *et al* 2005 and Mishra, 2006). Looking to the importance of aquatic birds in the management of local small water bodies, hence the present study was undertaken to study the aquatic avian diversity at Yashwant Nagar Talaab, Mhow.

Materials and Method

Yashwant Nagar Talab, Mhow (M.P.) is a perennial water body, situated on the A.B. road and 23 km away from Mhow, Indore. This talaab was constructed in 1934 by Holkar State on river Karam. It is used by local people to irrigate agricultural land and for bathing and washing purposes.

The water birds were identified with the help of binoculars, consulting Wood Cooks (1983) and Ali and Ripley (1983). The counting was carried out during morning hours strictly throughout the year.

Results and Discussion

Results obtained in the present investigation are summarized in Table 1- 4. Total 19 species of waterfowl were observed. They were belonging to 7 orders and 9 families. Out of 19 species, 7 species were migratory, 7 species were local migratory and 5 species were resident (table-1). Prakash (1999) described 12 species of aquatic birds from Bahadur sagar (Jhabua,) M.P. However, Malhotra *et al.* (2005) reported 32 species of waterfowl from Sirpur tank (Indore. M.P.) belonging to 10 families and 7 orders. Out side from M.P. Pandey (1993) reported 54 species of water birds from Pongdom reservoir (Himachal Pradesh). Joyti *el al*. (2001) studied Gharana wetland reservoir (Jammu) and reported 24 species of waterfowls. Barman *et al*. (1995) described 62 species of water birds from Deepar Beal wildlife sanctuary (Assam). Kumar and Bohra (2002)

recorded 103 species of birds belonging to 43 families and 13 orders from Udhuwa Lake (Jharkand).

Waterfowl observed in the present investigation were kept in 9 grouped viz Grebes, Cormorants and Darters, Herons and Egrets, Storks, Geese and Duks, Cranes, Coot, Waders and Tern. Similar grouping was observed by Prakash and Saxena (2005) from krishnapura talaab, Indore. On the basis of count and percent contribution (Table 2) the most dominated group in the present investigation was of Geese and Ducks 7 months followed by Waders dominated in three months, while Herons and Egrets dominated in two months. In most of the month's species wise also Geese and Ducks dominated this water body, followed by Herons and Egrets (2nd rank). On third place Cormorants was placed. Rest came under the 4th place as they were supported by only one species. In most of the months Tern was lowest except in November where Cranes took this position. The order of sequence of dominance of various groups in descending orders can be represents as under:-

Geese and Ducks > Coot > Waders > Cormorant and Darter > Grebe> Herons and Egrets> Crane> Tern.

Species wise study of water fowl at Yashwant Nagar Talaab showed that species number were highest from November to March (19) followed by October (18), and April to June (14). From the species point of view rainy months were very poor as they included only 9 species (table 2 & 3). Similar trends were followed by total monthly count. The presence of maximum number of species during winter was may be due to the inclusion of some migratory species. In rainy season when present water body was full of water and forcely overflow (which washed all the vegetation etc.) the count and species number reduces in these months because of absence of their food materials and flood condition. The month wise order of dominance of various species in descending order can be presented as:-

April: Waders > Coot > Geese and Ducks> Grebe> Herons and Egrets> Cormorant and Darter > Tern > Storks> Crane.
May : Waders > Geese and Ducks> Coot > Herons and Egrets> Grebe>Cormorant and Darter > Storks> Tern. > Crane.
June : Waders > Geese and Ducks> Herons and Egrets> Coot > Cormorant and Darter > Grebe> Tern > Storks> Crane.
July : Geese and Ducks> Cormorant and Darter > Grebe> Herons and Egrets> Waders > Tern.
August : Herons and Egrets> Cormorant and Darter> Grebe> Geese and Ducks= Waders > Tern.
September : > Herons and Egrets> Geese and Ducks= Waders > Coot > Grebe>Cormorant and Darter > Storks> Tern. > Crane.
October : Geese and Ducks> Coot > Waders > Herons and Egrets> Grebe>Cormorant and Darter > Tern.> Crane.
November : Geese and Ducks> Coot > Waders > Herons and Egrets> Grebe>Cormorant and Darter > Tern > Storks> Crane.
December : Geese and Ducks> Coot > Waders > Grebe> Herons and Egrets> Cormorant and Darter > Storks> Tern > Crane.

January : Waders > Geese and Ducks> Coot > Waders > Grebe> Herons and Egrets> Cormorant and Darter > Storks> Tern.> Crane.
February : Geese and Ducks> Coot > Waders > Grebe> Herons and Egrets> Cormorant and Darter > Tern > Storks> Crane.
March : Geese and Ducks> Waders > Coot > Grebe> Herons and Egrets> Cormorant and Darter > Tern > Storks> Crane.

Thus present study suggest that this water body can be a good house of aquatic birds specially in winter and summer, if properly managed and keep free from hunting and anthropogenic activities. The interesting point of this water body is the presence of three sided cover of good vegetation which provides good resting and nesting place for various birds.

Acknowledgement

Authors are thankful to Dr.N.K.Dhakad, Principal, Holkar Science College, Indore and Prof. P.C.Chinchore, Principal, Govt. P.G. College, Mhow for facilities and encouragement.

References

Ali. S. and Riplcy S.D., 1983. I *Hand book of the bird of India and Pakistan*- Oxford Univ. Press. New York.

Bergman, R . Saikia P. Singh H. J . Talukdar B K. and Bhattacharjee, P.C, 1995. Study of the population trends of water bird m deeper or heal wildlife sanctuary. ***Assam Pavo.,*** 33 (1&2): 25-40.

Bezzel, E., 1974. *On the evaluation of waterfowl hiotopes*. Int. Conf. Conser. Wetland and waterfowl Hcligenhanfen FRG. 2-6, 12 : 294-299.

Erikson. M. O. G., 1984. Acidification of lakes : *Effect of water birds in Sweden* Amhio, 115 : 260-262.

Green. A., 1993. *Threatened waterfowl recovery plans of Asia*. Proc. oflnt. Symp. Karachi. Pakistan (14-20 Dec., 1991) IWRB. Special Publication, 25 : 80-84.

Jyoti. M. K.. Sharma. K K., Sharma. P. S. and Singh. P., 2001. *Bio-diversity of Gharana wetland reserve with special reference to water birds*. Abstract in Nat. Sem. on Biodiversity conservation at Jiwaji Uni. Gwalior. (Nov. 26-28) pp. 16.

Karlson. J., Lndergrecn. A and Rudebcek. G., 1976. *Drastiska for andringer Och flagelfauna; krankesjon Och Bi-orkesakrasion*. 1973-1976 (In Swedish) Anser, IS 165-184.

Koskimies, P., 1987. *Monitoring finish bird fauna. Bird as environmental indicator* (In finish with English summary) Pub. Ministry environment rcr. A., 49 : 1-255.

Kumar, A. and Bohra. C.J., 2002. *Faunistic composition. Communities structure. Population dynamics and Ethology of the birds of Udhuw'a lake (Santhal Pargana) and the strategics for the conservation in new millennium*. In : Ecology and Consen-ation of lakes, Rese rvoir and River Vol. II (ed. A. Kumar) ABD Publisher. Jaipur., 411-434.

Malhotra, Manjcel, Prakash. M.M. and Pawar, K., 2005. Diet variation in waterfowl during winter at Sirpur

Tank, Indore. ***Indian J. Environ. & Ecoplan.***, 10(1) : 129-138.

Mishra P.K., 2006. Conservation of water birds in M.P. (India). ***Env. Cons. Journal,*** 7 (3) : 59-62.

Nilsson, S.G. and Nilsson. I.N, 1976. Valuation of South Swedish Wetland for conservation with the proposal of a new method for valuation of" wetland as breeding habitat for birds (In Swedish with English summary) fauna. ***Ack Flora,*** 71 : 136-144.

Pandey. Sanjeev, 1993 Changes in water birds diversity due to the construction of Pong Dam reservoir. Himachal Pradesh, India. ***Ecological and Conservation,*** 66 : 125-136.

Prakash, M. M., 1999. Impact of anthropogenic activities on the aquatic birds population at Bahadur Sagar (Jhabua. M.P.). In : *Advances in fish and wildlife ecology and biology* (ed. B. L. Kaul). Day a Publishing House. New Delhi, 2: 174-178.

Kash, M.M. and Saxena Gopal, 2005. Population Dynamics of Water fowl at Kishanpura Talab, Indore (M.P.). ***National Journal of Life Science,*** 2 (122) : 45-48.

Shukla, R.N., Shrivastava, R.K., Dubey, K.K., Shukla, Alok and Shrivastava, A.K., 2004. Biological monitoring : An ideal tool for water pollution studies. ***Nat. J. of Life Sciences,*** 1(1): 169-171

Woodcocks, M., 1983. *Collins hand guide to the birds of the Indian sub-continent William* Collins Sons & Co. Ltd., London.

Table-1. Water birds along with classification and status in Yashwant Nagar Talaab, Mhow.(2005-06)

S. NO.	GROUPS	Common name	Order	family	Status
I	**GREEBS**				
1.	***Podicepus ruficollis***	Little grebe	Podicipediformes	Podicipedidae	RLM
II	**CORMORANTS & DARTERS**				
2.	***Phalacrocorax.nigar***	LittleCormorant	Phalacrocoraciformes	Phalacrocoracirae	RLM
3.	***Anhingra rufa***	Dartes	Phalacrocoraciformes	Phalacrocoracirae	RLM
III	**HERONS AND EGRETS**				
4.	***Ardeola grayii***	Pond Heron	Ciconiformes	Ardeidae	R
5.	***Bubulcus ibis***	Cattle Egret	Ciconiformes	Ardeidae	R
6.	***Egretta garzetta***	Little Egret	Ciconiformes	Ardeidae	R
IV.	**STORKS**				
7.	***Ibis leucocephala***	Painted Stork	Ciconiformes	Ciconiidae	RLM
V.	**GEESE AND DUCKS**				
8.	***Dendrocygana javanica***	Lesser whistling teal	Anatiformes	Anatidae	RLM
9.	***Anas acuta***	Pintail	Anatiformes	Anatidae	WV
10.	***Anas platyrhynchos***	Mallard	Anatiformes	Anatidae	WV
11.	***Anas clypeata***	Shoveller	Anatiformes	Anatidae	WV
12.	***Aythya ferina***	Pochard	Anatiformes	Anatidae	WV
13.	***Aythya fuligula***	Tufted duck	Anatiformes	Anatidae	WV
VI.	**CRANES**				
14.	***Grus antigone***	Sarus Crane	Gruiformes	Gruidae	RLM
VII.	**COOT**				
15.	***Fulica atra***	Coot	Gruiformes	Rallidae	WV
VIII.	**WADERS**				
16.	***Himantopus himantopus***	Blaekwinged Stilt	Charadriiformes	Chariidae	RLM
17.	***Tringa hyoleucos***	Common Sandpiper	Charadriiformes	Chariidae	WV
18.	***Vanellus indicus***	Redwattled Lapwing	Charadriiformes	Chariidae	R
IX.	**TERNS**				
19.	***Sterna auranita***	Indianriver Tern	Charadriiformes	Laridae	R
		19	06	09	

Table-2: Species wise monthly count (2005-06) of water birds present at Yashwant Nagar talaab, Mhow

S. NO.	SPECIES GROUPS	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN
I.	GREEBS												
1.	*Podicepus ruficollis*	84	80	82	78	80	76	30	16	50	50	75	78
II	CORMORANTS& DARTERS												
2.	*P.nigar*	40	46	60	56	80	82	30	20	20	30	36	38
3.	Anhingra rufa	10	15	15	18	15	10	10	10	14	16	10	10
III	HERONS AND EGRETS												
4.	*Ardeola grayii*	12	15	15	18	15	10	12	15	16	18	16	16
5.	*Bubulcus ibis*	30	32	40	40	36	34	30	10	16	20	22	22
6.	*Egretta garzetta*	28	28	26	62	62	26	24	20	20	26	28	30
IV	STORKS												
7.	*Ibis leucocephalus*	6	10	10	12	10	0	0	0	0	3	10	10
V	GEESE AND DUCKS												
8.	*Dendrocygana jvana*	230	220	205	200	186	100	10	10	20	200	222	220
9.	*Anas acuta*	180	80	0	0	0	0	0	0	100	160	180	180
10.	*Anas. platyrhyncha*	30	20	0	0	0	0	0	0	5	10	30	30
11.	*Anas clypeata*	240	200	0	0	0	0	0	0	216	222	240	236
12.	*Aythya ferina*	100	70	0	0	0	0	0	0	20	90	100	100
13.	*Aythya. fuligula*	16	14	0	0	0	0	0	0	14	20	20	20
VI	CRANES												
14.	*Grus antigone*	2	2	2	4	4	0	0	0	2	2	2	2
VII	COOT												
15.	*Fulica atra*	400	200	200	150	100	0	0	0	200	410	400	400

Table-3: Species wise monthly percentage (2005-2006) of water birds present in Yashwant Nagar talab, Mhow.

GROUPS	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN
GREEBS												
Podicepus ruficollis	4.99	6.05	8.78	8.42	9.14	21.46	18.29	13.67	5.63	3.32	4.60	4.85
CORMORANTS AND DARTERS												
P.nigar	2.37	3.48	6.43	6.04	9.14	23.16	18.29	17.09	2.25	1.99	2.20	2.36
Anhingra rufa	0.59	1.13	1.60	1.94	1.71	2.82	6.09	8.54	1.57	1.06	0.61	0.62
HERONS AND EGRETS												
Ardeola grayii	0.71	1.13	1.60	1.94	1.71	2.82	7.31	12.54	1.80	1.19	0.98	0.99
Bubulcus ibis	1.78	2.42	4.28	4.31	4.11	9.60	18.29	8.54	1.80	1.32	1.35	1.36
Egretta garzetta	1.66	2.11	2.78	6.69	7.08	7.34	14.63	17.09	2.25	1.72	1.71	1.86
STORKS												
Ibis leucocephalus	0.35	0.75	1.07	1.29	1.14	0	0	0	0	0.39	0.64	0.62
GEESE AND DUCKS												
Dendrocygana jvana	13.67	15.14	21.97	21.59	20.57	28.24	7.31	8.54	2.25	13.28	13.62	13.68
Anas acuta	10.70	6.05	0	0	0	0	0	0	11.27	10.63	11.04	11.19
Anas. Platyrhyncha	1.78	1.51	0	0	0	0	0	0	0.56	0.66	1.84	1.86
Anas clypeata	14.26	15.14	0	0	0	0	0	0	24.35	14.75	14.73	14.67
Aythya ferina	5.94	5.29	0	0	0	0	0	0	2.25	5.98	6.13	6.21
Aythya. Fuligula	0.94	1.05	0	0	0	0	0	0	1.57	1.32	1.22	1.24
CRANES												
Grus antigone	0.11	0.15	0.21	0.43	0.45	0	0	0	0.22	0.13	0.12	.12
COOT												
Fulica atra	23.78	15.14	21.43	10.79	11.42	0	0	0	22.54	27.24	24.55	24.87

Table- 4 Group wise monthly counts (2005-06) of water birds of Yashwant nagar Talaab, Mhow

GROUPS	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN
GREEBS	84	80	82	78	80	76	30	16	50	50	75	78
CORMORANTS & DARTERS	50	61	75	74	95	92	40	30	34	46	46	48
HERONS AND EGRETS	70	75	81	120	113	70	66	45	52	64	66	76
STORKS	6	10	10	12	10	0	0	0	0	3	10	10
GEESE AND DUCKS	796	604	205	200	186	100	10	10	375	702	792	786
CRANES	2	2	2	4	4	0	0	0	2	2	2	2
COOT	400	200	200	150	100	0	0	0	200	410	400	400
WADERS	260	275	266	276	275	10	10	10	168	225	232	202
TERNS	14	14	12	12	12	6	8	6	6	6	6	6
GRAND TOTAL	1682	1321	933	926	875	354	164	117	887	1508	1629	1608

Environment Conservation Journal 8 (3) 47-54, 2007
(ISSN 0972-3099)

Limnological studies of Gudavi Wetlands, Sorab, Shimoga Karanataka

Dayananda, G.Y., A. Naveed, K.L., Naik and B.B., Hosetti.
Department of Applied Zoology, Bioscience Complex, Jnana Sahyadri, Kuvempu University, Shankaraghatta Shimoga.

Abstract

A study on the water quality of three freshwater ponds connected in series at Gudavi village near Shimoga is studied for of physico-chemical factors. The DO was 8.81 mg/l in Kallambi, 3.84 mg/l in Vaddekere and 7.78 mg/l in Gudavi pond respectively and such a variation is attributed to the fecal (guano) droppings discharged by about 12,000 resident birds which include Egrets, Cormorants, Ibises, Herons, water fowls and other wetland dependent species in the Vaddekere of the sanctuary. A comparative study of nutrients and BOD levels in the three consecutive ponds revealed that the Vaddekere pond is most polluted. Due to this reason the water quality in the Vaddekere was altered and the emergent trees on the pond which were used for roosting and nesting by the birds are affected and evidenced by dying of trees. The death of island trees will lead to loss of roosting and nesting sites for Gudavi birds. Hence an urgent action plan to protect the trees or replanting new trees in the water bodies by creating islands every year is suggested.

Key words: *Limnology, Guano droppings, waterfowls, wetlands and Gudavi.*

Introduction

The natural freshwater which is available to man in the form of reservoirs, ponds and lakes is spread in an area of 0.72 million ha was reduced to about 0.65 million ha in the country (Saxena, 1996). It means there is a decline of 0.07 million ha of water spread area. According to a survey conducted by NEERI revealed that about 70% of the available water in India is polluted (Agarwal *et al.*, 1982). For limnological study evaluation of physico-chemical factor is a basic step in that each factor contributes in making up of specific ecosystem, which determines the trophic dynamics of the water body. The management of any aquatic ecosystem is a means of conservation of freshwater habitat with an aim to maintain the water quality or to rehabilitate the physico-chemical characteristics of water.

The lentic water systems are popularly referred as wetlands. These wetlands should be scientifically studied as potential productive areas. In a meeting on wetlands held at Ramsar, Iran in 1971 major emphasis was given to water fowls. It was well established that wetlands are very essential for migratory birds and other aquatic biota (Mahajan, 1981, 1988). Lentic wetlands are important not only for water fowls but also for various purposes viz, their role in flood control, reducing sediment load, recycling of biogenic salts, source of irrigation water, animal husbandry, aquaculture refuge for rare and endangered fauna and as agents for recharging ground water. In view of the above importance some ecological aspects of Gudavi wetlands is carried out and discussed in the present paper.

Materials and Method

Study Area

Gudavi wetlands are located in the Sorab taluk of Shimoga district, at about 13 km away from Sorab city and 0.5 km from Gudavi village. These wetlands occupies the water spread area is about 33 hectares. Remaining area is moist deciduous forest species interspread with grassy patches.

Gudavi wetlands lies between latitude of 14^0 25' 59" to 14^0 26' 41" and longitude 75^0 6' 43" to 75^0 1' 28". These

are connected in series, they are Kallambi, Vaddekere and Gudavi ponds. The rainfed water from Kallambi flows for a distance of 2 km through irrigation channel and enters into the Vaddekere. The outflow of water from Vaddekere enters into Gudavi pond, from there it is used for irrigation at the downstream croplands. Vaddekere and Gudavi ponds are separated by a common bund.

Sampling and Analysis

The water sampling has been carried out during breeding season with an interval of 15 days from June 2000 to February 2001. The parameters like air and water temperature, dissolved oxygen, biological oxygen demand, carbon dioxide, chlorides, calcium, phosphates and sulphates are determined according to standard methods (APHA, 2000 and Trivedi and Goel, 1984).

Results and Discussion

The important factor which influence the plankton dynamics in the pond water are temperature and light intensity (Hosmani, 2002). The change in physico-chemical characteristics are brought about by the fluctuation in climate conditions. The water temperature during the study period was around 24.96 ^{0}C in Kallambi, 24.57 ^{0}C in Vaddekere and 25.02 ^{0}C in Gudavi ponds respectively. It was always 1 ^{0}C below the ambient temperature. The temperature in the range 15 ^{0}C to 30 ^{0}C is found to be suitable for algal productivity, Hence the existing temperature triggered the algal photosynthesis inturn enhanced the fish productivity which is one of the main source of food for birds living in the wetlands of the sanctuary. One of the very interesting subject to note that always the water temperature remained lower than air temperature in all ponds at all seasons. The pH values varied around 7.63 ± 0.52 in Kallambi, 6.77 ± 0.94 in Vaddekere and 7.35 ± 0.85 in Gudavi water samples respectively (Table 1 to 3). In Kallambi pond the water pH was always alkaline during study period from June 2000 to February 2001. Where as it was acidic during September and October in the other two ponds and it was 6.5 to 6.0 in Vaddekere and 6.4 and 6.0 in Gudavi ponds respectively. However, it remained alkaline in later part of the season. Since all enzymes are pH dependent and will directly enhance metabolic activities (Hosetti, 1987). Hence, it is essential to maintain alkaline pH or around neutral to support sustainable fish and algal productivity in these ponds.

The DO is a vital factor used in qualifying water samples. Most of the desired fishes may not survive if the DO falls below 4 mg/1. In the present study DO was always above 5 mg/ 1 in Kallambi and Gudavi tanks. It was recorded an average 8.81 mg/l in Kallambi and 7.78 mg/l in Gudavi tanks, but in contrast to the two ponds, Vaddekere pond always showed low levels of oxygen except during January 2001. It was below 3 mg/ 1 in September 2000 to December 2000 and a maximum of 6.5 mg/ 1 in January 2001, when there was no bird activity. Such a drastic low levels of DO in Vaddekere during breeding seasons are attributed to biodegradation of guano dropped by birds (Dayananda, 2001).

The minimum DO which supports most of the desired fish species is above 4 mg/1. The reduced DO level in Vaddekere pond revealed that water is pollute by oxygen demanding materials(Hosetti and Patil, 1998; Hosetti and Kumar, 2001) added through fecal pollution. This might be attributed to the reason that in

Vaddekere pond there were about 12,000 birds residing on emergent trees and discharged excreta. The uric acid and other organic matter which was present in excreta needed more oxygen to stabilize the waste biologically.

A humus material can be utilized by living organisms. But, once, it is discharged into an aquatic ecosystem, it will be consumed and oxidized by a variety of facultative organisms. The facultative organisms utilize the dissolved oxygen for the process of biodegradation. If all the oxygen is depleted then facultative aerobes also disappear. The quality of water will be further degraded, it will change into a saprobic system. Then water is considered to be polluted and evidenced by presence of oxygen demanding materials. Thus, the BOD is the amount of Oxygen required to oxidize biodegradable substance in an aquatic ecosystem under saprobic situations.

Biological oxygen demand is an indirect measure of organic load present in any aquatic systems. In the present study the 5 day BOD values 5.82, 21.82 and 10.6 mg/l recorded for Kallambi, Vaddekere and Gudavi ponds respectively. According to drinking water standard BOD should be less than 6 mg/l, but it was above the drinking water standard in Vaddekere and Gudavi ponds. The relatively high BOD levels in Vaddekere pond was due to the discharge of fecal matter by large number of birds. The high BOD in Gudavi tank attributed to two reasons. The water from Vaddekere entering into Gudavi tank gets diluted and hence low BOD values were recorded in Gudavi pond.

In tropical slow flowing polluted rivers and in stagnant water bodies a group of microbes dominated by algae and bacteria play a key role in process of purification in a symbiotic manner. That is bacteria degrade organic matter into simpler molecules of nutrients and release oxygen available back to the bacteria for use, ultimately leading to up gradation of water quality evidenced through reduced BOD and increased DO levels (Hosetti et al., 1995). Another reasons are human activities like washing and bathing in Gudavi pond which are also responsible for high phosphates and BOD. The study on BOD level of the water sample of the three ponds revealed that, it is necessary to reduce the BOD level by artificial management, such as removing of sediment in summer and managing the water retention time at least in Vaddekere pond where birds reside during breeding seasons in large numbers.

The CO_2 level was 33.6, 61.5 and 34.9 mg/ l recorded in the ponds, Kallambi, Vaddekere and Gudavi respectively. The higher amount of CO_2 was recorded and may affect the pH levels. Hence the water was acidic. The increase in the amount of CO_2 indicates that the ponds are inadequately aerated (Kumar, 1996; Singh, 1997). It also indicates that these ponds are filled with large amount of silt and sediments. The bacteria and fungi living in their sediments undertake decomposition of organic substances and also release CO_2 during the respiration processes.

Chlorides are gradually considered as nutrients. Presence of high levels of chlorides indicates that the water is polluted. The chlorine level was 54.2, 56.1 and 49.2 mg/l in the water samples from Kallambi, Vaddekere and Gudavi ponds respectively. In drinking water samples usually chlorine is around 20 mg/l. In contrast to this the three ponds showed chloride three times more than that of drinking water standards.

Such high levels of chloride perhaps originated from agricultural activity. Large amount of fertilizer and manures used in agriculture might have percolated in these ponds. The fecal discharge of birds is also responsible for increase in chlorides in Vaddekere(Hosetti *et al*., 1995). According to Thresh *et al*. (1944) it is advocated that the presence of high chloride is an indication of pollution of animal origin. Chlorides are antibiotic in nature and the presence of large amount of chloride is lethal to pathogenic bacteria and chloride around 29 mg/l is considered to be favorable for freshwater community. However, chloride itself along with phosphate and nitrates makes the water eutrophic (Schmitz, 1996).

Calcium was 22.7, 23.4 and 20.7 mg/l in respective ponds. The levels of calcium in all these three ponds are comparable. Under high chloride levels the impact of calcium ions is yet to be studied. In freshwater ponds relatively high levels of calcium may be originated from the soil. Calcium is a micronutrient required for all organisms for metabolic activities (Gautam, 1995).

Phosphates are important macronutrients essential for plant growth. It was 0.37, 2.00 and 1.48 mg/l recorded in Kallambi, Vaddekere and Gudavi ponds respectively. Phosphate contents considered to be nutrients of major importance in the production process. It was within irrigation standards in both Kallambi and Gudavi ponds and it was very high in Vaddekere pond. Higher levels of phosphates are originated from the guano discharged by the birds. Due to this particular reason the Vaddekere pond became eutrophic (Kumar, 1996). The eutrophic nature of pond is evidenced by large growth of floating hydrophytes which include Lemna major, Lemna minor, Pistia, Salvinia , Trapa, etc. Due to availability plenty of phosphates and other nutrients the hydrophytes grown and occupied large surface area in the second and third ponds, the light penetration was checked and the algal photosynthesis also hampered(Hosetti and Latha, 1996) and low level of oxygen was recorded in such places as we found in Vaddekere pond samples. This change has also checked the free movements of the Ducks viz. Coot, Grey duck, Moorhen and Jacanas in these ponds.

The major sources of sulphate in natural water are rocks, fertilizers and waste discharges from industries. The amount of sulphate in water is a factor of concern in determining the magnitude of problems that can arise from reduction it into hydrogen sulphides. In the present study, the sulphate varied around 0.06, 0.07 and 0.08 mg/l recorded in Kallambi, Vaddekere and Gudavi ponds respectively. In this study sulphate recorded a highest concentration of 0.08 mg/l in Gudavi pond, which is well within the tolerance limit prescribed by ISI standards. Hence, it can be concluded that the ponds under study are oligotrophic (based on sulphate content), However the Vaddekere was always eutrophic with reference to other nutrients viz. phosphates, nitrates and chlorides.

The data on the evaluation of water quality revealed that due to guano droppings by large number of birds in small area of Vaddekere the water quality was deteriorated. Due to changes water quality in the Vaddekere the roosting trees viz, *Vitex leucoxylon*, *Kirganelia reticulate* and *Phyllanthus polyphyllus* are also affected. In order to avoid this there is need to plant more trees so that the birds aggregation can be spread and thereby pollution of water in Vaddekere may also be controlled. Now, it is good to exploit the water from the Vaddekere and the Gudavi for irrigation purpose for the crop land situated in the downstream regions.

References

Agarwal, A., Sharma, K. and Sharma, R., 1982. *State of India's environment*: A citizens report. Centre for Science Environ. New Delhi.

APHA., 2000. *Standard methods for the examination of water and wastewater.*16th Ed. Washington D.C.

Dayananda, G.Y., 2001. *Water quality evaluation with reference to Gudavi wetlands, Sorab, Shimoga,Karnataka.* M.Phil Dissertation. Kuvempu University. Shimoga.

Arvind Kumar., 1997. Comparative hydrological studies of tropical waterbodies with special reference to sewage pollution in South Bihar. ***J.Ecobiol.,*** 9(4): 255-262.

Gautam, A.,1995. *Recent Researches in aquatic environment.* Daya Publishing House, Delhi.

Hosetti, B.B., 1987. *Studies on use of some important groups of microbes in the treatment of waste waters*. Ph.D.Thesis. Karnataka University, Dharwad.

Hosetti, B.B. and H.S.Patil. 1998. *Evaluation of catalase activity in relation to changes in physico-chemical parameters in a polluted river cited in Thretened habitats* Eds, V.P.Agarwal and I.D. Charurvedi, Society of Biosciences.India.

Hosetti, B.B. and P. Latha.,1996. Impact of plankton and weeds on distillory effluents meandering through natural ponds. ***Advances in Bio Sciences***,15:63-70.

Hosetti, B.B. and Arvind Kumar., 2001. *A text book of Applied Aquatic biology,* Daya Publishing House, Delhi, India.

Hosetti, B.B., R.S.Shivaprasad and S. Natraja., 1995. *Limnology of a eutrophic pond with reference to physico-chemical factors at Navile, Shimoga.* Cited In Recent Researches in Aquatic Environment Eds. Asuthosh,G and Agrawal,N.K.Daya Publishers, Delhi. pp-99-105.

Hosmani, P.S., 2002. *Ecological diversity of algae in freshwaters*. Cited in: Wetlands Conservation and Management (Eds) B.B.Hosetti. Poiter Publishers, Jaipur.pp.65-87.

Kotpal, R.L. and M.P., Bali., 1989. *Concepts in ecology*. Vishal Publishers, New Delhi, India.

Kumar, A., 1996. The limnological profiles of a tropical fish pond at Dumka (Bihar.). ***J. Ecolbiol.,*** 8:117-122.

Mahajan, K.K., 1981. *Wetlands of India* - A survey report and suggestions for their optimum utilization. In: Proc. Int. Symp. Water Resources Conservation, Pollution and Abatement, Roorkee, Pp.371-378. December.11-14.

Mahajan, K.K., 1988. *Dangerously threatened habitats: The wetlands- an overview and suggestions for their conservation as harbours of living natural resources*. In : Threatened Habitats. New Delhi:Jahmandir Book Agency. Pp.241-268.

Saxena, S., 1996. *Ecological studies of Gauri tank at with special reference to organic productivity* Ph.D. Thesis, Jiwai University, Gwalior.

Schimitz, R.J., 1996. *Introduction to water pollution biology*. Asian Book PVT. Ltd., New Delhi, India.

Singh., 1997. *Limnological studies of River Mayurakshi in Santal pargana Bihar*. Ph.D. Thesis, S.K. University, Dumka.

Thresh, J.C., E.V. Suckling and J.F. Deadle, 1944. *The examination of water and waste water supplies* Ed. Taylor.

Trivedi, R.K. and P.K. Goel, 1984. *Chemical and biological Methods for water pollution studies*. Env. Pub. Karad, India.

Table- 1. The Physico - Chemical characteristics of water from Kallambi pond.

Month of Sampling 2000-01	Air Temp. ^{0}C	Water Temp. ^{0}C	pH	DO mg/l	BOD mg/l	CO_2 mg/l	Cl mg/l	Ca mg/l	TA mg/l	PO_4 mg/l	SO_4 mg/l
June	25.5	23.0	7.5	8.04	6.76	36.44	48.96	32.00	84.0	0.32	0.01
July	23.6	21.7	7.0	6.86	6.00	29.80	66.03	26.70	67.0	1.02	0.03
August	22.1	21.0	7.5	7.48	5.25	32.0	54.40	25.06	78.0	0.48	0.05
September	25.0	23.0	7.0	9.66	4.80	35.2	65.32	22.40	85.0	0.15	0.08
October	27.0	26.2	7.2	8.26	3.90	28.0	17.04	19.23	50.0	0.40	0.08
November	28.6	26.5	8.0	10.11	5.25	34.12	61.33	20.00	82.0	0.15	0.04
December	28.5	27.0	8.0	10.0	7.00	36.02	64.00	21.00	23.0	0.12	0.06
January	30.2	27.5	8.0	10.11	7.50	35.0	61.00	18.00	21.0	0.50	0.10
February	30.0	28.8	8.5	8.75	5.92	36.02	50.15	20.00	90.0	0.22	0.10
Mean ± SD	26.72 ± 2.85	24.96 ± 2.81	7.63 ± 0.52	8.81 ± 1.22	5.82 ± 1.14	33.62 ± 3.01	54.24 ± 15.33	22.71 ± 4.46	64.44 ± 26.85	0.37 ± 0.28	0.06 ± 0.03

Table- 2. The Physico - Chemical characteristics of water from Vaddekere.

Month of Sampling 2000-01	Air Temp. ^{0}C	Water Temp. ^{0}C	pH	DO mg/l	BOD mg/l	CO_2 mg/l	Cl mg/l	Ca mg/l	TA mg/l	PO_4 mg/l	SO_4 mg/l
June	26.0	23.8	6.0	5.04	22.34	66.60	41.20	27.03	98.00	1.78	0.07
July	23.6	21.5	6.0	5.28	26.04	70.00	53.00	22.20	88.00	1.84	0.04
August	23.1	22.3	6.0	4.62	20.20	62.00	68.00	21.08	69.00	2.06	0.08
September	25.0	21.0	6.5	2.40	28.00	61.60	71.00	22.14	90.00	2.13	0.12
October	28.4	27.0	6.0	1.72	24.00	72.00	36.92	24.34	75.00	2.18	0.10
November	28.6	27.0	7.2	2.20	24.00	70.00	68.16	24.04	100.0	2.20	0.10
December	29.5	28.0	8.0	3.00	18.00	48.00	63.00	21.50	81.00	2.00	0.06
January	29.0	26.0	8.5	6.53	12.00	42.00	48.13	25.00	21.00	1.86	0.06
February	-	-	-	-	-	-	-	-	-	-	-
Mean ± SD	26.65 ± 2.38	24.57 ± 2.58	6.77 ± 0.94	3.84 ± 1.63	21.82 ± 4.73	61.52 ± 10.26	56.17 ± 12.34	23.41 ± 1.90	77.75 ± 23.65	2.00 ± 0.15	0.07 ± 0.74

Table- 3. The Physico - Chemical characteristics of water from Gudavi pond.

Month of Sampling 2000-01	Air Temp. ℃	Water Temp. ℃	pH	DO mg/l	BOD mg/l	CO_2 mg/l	Cl mg/l	Ca mg/l	TA mg/l	PO_4 mg/l	SO_4 mg/l
June -	26.0	24.5	7.0	8.20	12.11	17.10	28.68	22.08	80.0	2.50	0.05
July-	23.6	22.0	7.5	8.75	12.73	22.00	34.20	18.33	67.0	1.86	0.10
August-	23.1	22.2	7.0	7.83	10.15	24.00	36.00	20.68	64.0	2.02	0.09
September-	25.0	21.0	6.4	11.20	17.20	26.40	76.68	17.63	85.0	1.18	0.07
October-	27.0	27.0	6.0	6.80	10.80	52.00	25.56	24.04	40.0	1.12	0.10
November-	28.6	27.0	7.8	8.13	14.13	44.00	66.61	18.63	65.0	1.18	0.09
December-	28.5	28.0	8.5	5.00	6.15	51.00	67.61	20.63	67.0	1.50	0.07
January-	29.0	26.0	8.5	6.40	5.20	34.00	65.00	21.00	60.0	0.86	0.05
February-	29.2	27.5	7.5	5.28	6.93	44.00	43.02	24.04	80.0	1.12	0.10
Mean ± SD	26.66 ± 2.35	25.02 ± 2.67	7.35 ± 0.85	7.78 ± 1.71	10.6 ± 3.96	34.94 ± 13.19	49.26 ± 19.57	20.78 ± 2.33	67.55 ± 13.46	1.48 ± 0.53	0.08 ± 0.02

Environment Conservation Journal 8 (3) 55-57, 2007
(ISSN 0972-3099)

Isolation and Structure determination of new anthraquinone from the flowers of *Tagetes erecta*

J.S. Jangwan*, M. Dobhal* and S.C. Sati**
*Department of Chemistry HNB Garhwal University Campus Badhshaithal, Tehri Garhwal
**Department of Chemistry HNB Garhwal University Campus, Srinagar, Garhwal

Abstract

***Tagetes erecta* belongs to family asteraceae is found plentifully in most of the places of India, either cultivated in gardens or wild. The villagers use this plant in bronchial asthma, anusthans, different ceremony. The pastes of flowers were often applied on wound and cuts and leaves juice dropped in otalgia. *Tagetes erecta* are richest source of yellow dyes in ancient arts of Rajasthan and Orrisa. The present communication deals with the isolation and structure elucidation of a new anthraquinone together with quercitin and loganic acid. The structure of compound was described with the help of spectral data and chemical studies.**

Introduction

The family asteraceae is one of the largest family of plant kingdom, which includes about 1100 genera and 30,000 species. About 157 genera and 900 species are reported in India. *Tagetes erecta*(Gainda), is an annual, sparingly-branched, aromatic herb. Branches angular, ribbed. Leaves pinnate, oblong, acute, base decurrent. Flowers yellow or orange. Flowering throughout the year. It is most commonly cultivated in gardens in major parts of India. The pastes of flowers were often applied on wound and cuts and leaves juice dropped in otalgia (Gaur, 1999)

Most of the species of Tagetes were analysed for their essential oil compositions (Chawdhury, 2001). *Tagetes patula* is widely distributed in montane and sub montane Himalayan zone,Its leaves powder is used as an insect repellent and paste used in skin ailments.Flowers of *Tagetes erecta* are richest source of yellow dyes in ancient arts of Rajasthan and Orrisa (Lemmens and Wulijarni 1991).

Principle constituents isolated from flowers of *T. minuta* are anthocyanins and it derivatives (Putlano 2000). Some long chain fatty acids, aromatic hydrocarbons and phenyl acetaldehydes are extracted from floral extract of *T. erecta*. The present study describe the isolation and structure elucidation of a new anthraquinone glycoside together with quercitin and loganic acid.

Material and Methods

Collection of plant material

The flowers of *Tagetes erecta* was collected from the Pasulok Barrage Rishikesh of District, Dehradun, (Garhwal) in the month of August. The identity of the plant was confirmed by Dr. P.K. Uniyal, Department of Botany, H.N.B. Garhwal University Campus, Badshahithaul, Tehri Garhwal (U.A.) and the voucher specimen is available in the herbarium of Plant Identification Laboratory of Botany Department.

Extraction and isolation

The air-dried and coarsely powered flowers of the plant were defatted with light petroleum in a soxhlet. The defatted mass was exhaustively extracted repeatedly with 90 % aqueous EtOH, until the extractive became colourless. All the extracts were mixed and concentrated under reduced pressure using rotatory vacuum

evaporator.

The concentrated extract was adsorbed on Silica gel and fractionated through column chromatography using the solvent system of chloroform-methanol (95:5). The polarity of solvent was gradually increased by addition of methanol. Repeated column chromatography afforded compounds MT-1 (1.5 gm), MT-2 (0.5 gm),and MT-3 (0.7gm), with some other inseparable compounds.Compound MT-2 and MT-3 were identified as quercetin and loganic acid by their reported data ,mmp co TLC with an authentic sample.

M.P.were uncorrected.UV spectra were taken in MeOH.1H-NMR spectra were taken using TMS as internal standard and CDCl3 and CD3OD as solvent,all the signals are expressed as values downfield from TMS .CC was carried out on silica gel(60-120 mesh,Merck ,eluting solvent $CHCl_3$: MeOH).

Results and Discussion

The ethanolic extract of flowers of *Tagetes erecta* on repeated column chromatography over silica gel afforded compounds MT-1,MT-2 and MT-3.Compounds MT-2 and MT-3 were identified as quercetin and loganic acid by comparison with authentic sample and reported data (Potter and Thomas,1995).

Compound MT-1

It was crystallized from methanol as yellow powder.

Melting point	:	177-178°C
Molecular formula	:	$C_{15}H_{10}O_4$
Molecular weight	:	254 amu
U.V (max MeOH) nm	:	242(sh), 279, 310, 414.
I.R (maxKBr) cm-1	:	3240, 3040, 1895, 1660, 1625, 1450, 1250, 1190, 915
EI-MS (m/z)	:	255[M+H]+254[M]+,236[M-H2O]+, 226[M-CO]+,225[M-CHO]+152, 141,115.
1H-NMR (CDCl3 , ppm)	:	

13.19-8.27(1H,s),8.22-8.30(2H,m),7.74-7.80(2H,m),7.27(1H,s),2.23 (3H,s).

13C-NMR (CDCl3, ? ppm)

142.2(C-1), 142.8(C-2), 124.2(C-3), 124.1(C-4), 112.7(C-5), 151.3(C-6), 123.2(C-7), 158.2(C-8), 180.2(C-9), 179.2(C-10), 138.8(C-11), 113.3(C-12), 114.1(C-13), 139.8 (C-14), 29.8(CH3).

Compound MT-1 was crystallized from methanol as yellow powder.Its UV spectrum showed absorption bands at 242,279,310 and 414 nm,and IR spectrum displayed characteristic peaks for carbonyl group at 1625 cm^{-1}. Its IR spectrum also showed a bands at 3450, 1662 and 1630cm^{-1} for free hydroxyl, unchelated and chelated carbonyl groups, respectively. The EI mass spectrum of compound displayed the peak at m/z 254 [M]+ ,calculated for molecular formula $C_{15}H_{10}O_4$.The 1H-NMR spectrum of compound showed a peri hydroxyl group at 13.19 and two meta -coupled protons at 8.22 (2H,m) and 7.27(2H,m),and a singlets for methyl group at 2.23 (3H,s).

The 13C-NMR data of the compound indicate the presence of fifteen carbon atoms. The downfield signals in 13C-NMR appeared at 142.2, 142.8 and 153.16 were assigned for substituted C-1, C-3 and C-2 carbons respectively. Thus on the basis of above spectral findings the compound MT-1 was identified as 1, 3-dihydroxy-2-methyl anthraquinone (Figure-1) It was further confirmed by comparison of its data with that of reported compound (Thomson, 1971 and Wijnsma and Ver poorte, 1986).

Refercnces

Chawdhury, A.R., 2001. ***J. Essential oil bearing Plants***, 4(1): 9-12.

Lemmens, R.H.M.J. and Wulijarni, N., 1991. ***Dye and Tannin Producing Plants***, 3.

Gaur, R.D., 1999. ***Flora of District Garhwal, Trans Media, Srinagar Garhwal***, 1st edition, 592.

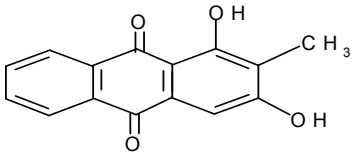
Potter, L., and Thomas, J.,1995. ***J. of Essential Oil Res.***, 7: 347.

Prakash Rao, Ramesh E.V.S. and Putlano, S., 2000. ***J. Med. Arom. Plants,*** 22:258-259.

Thomson, R.H., 1971. ***Naturally Occurring Quinones***, Chapman and Hall, London.

Wijnsma, R. and Verpoorte, R., 1986. ***Prog. Chem***. Org.Nat.Prod., 49, 79.

Figure 1:



Compound MT- 1

Environment Conservation Journal 8 (3) 59-62, 2007
(ISSN 0972-3099)

Optimization of dyeing processes by compounds isolated from bark of *Myrica esculenta* and their spectroscopy identification

**J.S. Jangwan, *Satish Chandra Sati and **Maneesha Dobhal
*Department of Chemistry, HNB Garhwal University Campus, Srinagar Garhwal (Uttarakhand)
**Department of Chemistry, HNB Garhwal University Campus, Badshahithaul, Tehri Garhwal (Uttarakhand)

Abstract

Myrica esculenta **(Myricaceae) commonly known as Kaphal is a small aromatic evergreen tree, abundantly grows in the sub-tropical Himalaya from Kashmir to Bhutan. Commonly associated with Oak and Rhododenderon forests. The bark of the tree is utilized for its astringent, stimulant and resolvent properties. The decoction of the bark along with cinnamone is given in chronic cough and piles. The bark of the plant is used as a dye in ancient Indian traditions and also as a natural mordant. The berries of the plant is one of the richest source of wax, used as a raw material for candle and soap making industries. A number of flavonoids, tannins, Xanthones, terpines and many other anthocyanins have been isolated from the different part of the plant. The present paper deals with isolation and characterization of secondary metabolites namely 2-methyl pyrane 3-O-α-D-glucoside and Flavone 3,'4,' dihydroxy 6-methyl 7-O-α-L-rhamnopyranoside from the plant and optimization of dyeing procedure with isolated compounds on different fibres like silk, wool, cotton etc with and without natural and synthetic mordants. Efforts will be made to check the washing and light fastness properties of dyed samples.**

Introduction

Myrica esculenta (Myricaceae) commonly known as Kaphal is a small aromatic evergreen tree, abundantly grows in the sub tropical Himalaya from Kashmir to Bhutan.Commonly associated with Oak and Rhododenderon forests.

Materials and Method

M.Ps. were incorrected , UV spectra were determined in methanol using $AlCl_3$ as shift reagent. IR recorded in KBr on a Perkin Elmer FT–IR spectrometer. ^{1}H-NMR were run at 300 MHz using TMS as internal standard and C_5D_5N and CD_3OD as solvent. ^{13}C-NMR recorded in 90MHz using CD_3OD as solvent. FAB-MS on a JOEL, JMS 700 Mstaion spectrophotometer.

Plant material:

The bark (2kg) of *Myrica esculenta* were collected from sainti Ghat, Chamoli Garhwal, Uttarakhand India and identified from ethanobotanical plant identification laboratory, Department of Botany HNB Garhwal University Srinagar Garhwal. A voucher specimen was deposited in herbarium of the department.

Extraction and Isolation

The air dried bark of the plant (2) Kg were exhaustively extracted with aqueous ethanol. The concentrated extract after evaporation on water bath was fractionated through column chromatography, using chloroform-methanol as eluting system. Increase in the polarity of methanol affords compounds 1 and 2 respectively. Compound 1 and 2 were identified as 2-methyl pyrane 3-O-α-D glucoside and flavone 3,'4,' dihydroxy 6-

methyl 7-O-α-L-rhamnopyranoside.

Compound 1: It was crystallized from ethyl acetate as yellow amorphous powder, **M.P. 325-327 ^{0}C, Molecular Formula $C_{12}H_{10}O_3$, IR(λ_{max}^{KBr})Cm^{-1}** -1655, 1612 (C=O).

^{1}H-NMR-(C_5D_5N, δppm) 7.17(1H,d,J=8Hz,H-5), 7.19 (1H,d, J=8Hz, H-6), 1.29 (3H, S, CH_3), 5.03 (1H, J=4Hz, H-1) (anomeric proton) 3.31-3.92 (Sugar protons) **^{13}C-NMR (C_5D_5N, δppm)-**132.6 (C-2), 163.0 (C-3), 199.4 (C-4), 131.6 (C-5), 117.2 (C-6), 26.4 (-CH_3), 101.6 (C-1'), 74.9 (C-2'), 77.9 (C-3'),71.2 (C-4'), 78.3 (C-5'), 62.3 (C-6').

Compound 2: It was crystallized from methanol as yellow crystalline solid, **M.P.-240-242 ^{0}C, Molecular Formula- $C_{22}H_{26}O10$, Molecular Weight- 450 amu, IR(λ_{max}^{KBr})Cm^{-1}** -3410, 1650, 1600,1525, 1430.

FAB-MS (M/Z): 489 [M+K], 450 [M+H]$^+$, 307 [M+3H-146], 289 [M+3H-146+H_2O], 273 [M+3H-146+2H_2O]. 242 [M-(146+2OH+OCH_3)]

^{1}H-NMR-(C_5D_5N, δppm): 6.06 (d,J=1.2Hz, H-3), 7.7 (S, H-5), 7.1 (d, J=1.2 Hz, H-5'), 6.9 (d, J=3.2 Hz, H-6'), 7.3 (S, H-5), 6.38 (S, H-2'), 1.72 (rhamnose, 3H), 2.16 (S, OCH_3, 3H), 3.32-3.43 (rhamnose, 5H), 4.2 (S, rhamnose, H-1')

^{13}C-NMR (CD_3OD, δppm): 146 (C-2), 106.1 (C-3), 179.6 (C-4), 122 (C-5), 163 (C-6), 165.8 (C-7), 94.0 (C-8), 148.9 (C-9), 105 (C-10), 121 (C-1'), 116 (C-2'), 158 (C-3'), 159.6 (C-4'), 116.3 (C-5'), 116.9 (C-6'), 53.7 (OCH_3)

Rhamnose: 103 (C-1'), 72.0 (C-2'), 71.9 (C-3'), 73.2 (C-4'), 70.0 (C-5'), 17.6 (C-6')

Results and Discussion

Ethanolic extracts of dried and powdered bark of *Myrica esculenta* after repeated column chromatography afforded compound 1 and 2.

Compound 1: It was crystallized from ethyl acetate as yellow amorphous powder, M.P.-325-327 ^{0}C. It gave positive test with Molish reagent thereby indicating the glycosidic nature of compound. The IR Spectrum displayed a peak at 1655 and 1612 cm-1, which showed the presence of carbonyl function.

^{1}H- NMR spectrum of compound showed two separate doublets each integrating for one proton at ä 7.17 (J=8.0 Hz) and ä 7.79 (J=8.0 Hz) were attributed to the C-5 and C-6, while a singlet appeared at ä1.29 was assigned for a methyl group present in the compound.

The ^{1}H-NMR spectrum further shows a doublet at ä 5.03 (J=4H2) was assigned for C-1' carbon atom of glycosidic linkage. The other suger protons are appeared in between d3.31-3.92 ^{1}H –NMR spectrum.

^{13}C-NMR spectrum of a compound shows presence of twelve carbon atoms. The down field peak at ä 199.4 in ^{13}C-NMR spectrum indicating the presence of á,â un saturated carbonyl group present in the compound. C-5 and C-6 were found to be appeared at ä 133.6 and ä 117.2. Thus on the basis of above observations, it was identified as 2-methyl pyran -3-0- â-D- glucoside. Use of compound as a dye on some fibres (like silk, cotton, wool) proves its excellent deing properties (Results-Table.1)

Compound 2 –It was crystallized as yellow crystals from methanol, M.P 240-242 ^{0}C, Molecular Weight 450 (From FAB-MS). It gave positive Molish reagent test and also test with NaOH, $FeCl_3$, Mg- HCl, which indicates its glycosidic nature. IR absorption bands at 3410,1650,1600,1525,1430 were characteristics for

flavonoid glycoside. FAB-MS provides a peaks at 489 [M+K], 450 [M+H]$^+$, 307 [M+3H-146], 289 [M+3H-146+H_2O], 273 [M+3H-146+2H_2O]. 242 [M-(146+2OH+OCH_3)] shows the loss of one deoxy hexose two Hydroxyl and one methoxyl group respectively.

^{1}H-NMR spectrum displayed doublets of 1.2Hz coupling constant at 6.06 and 7.1 were characteristic for H-3 and H-5', where as singl*et at.,* ä7.3,7.7and 6.38 were assigned for H-2', H-8 and H-5. Further the two singlet at δ1.27 and δ2.16 were assigned for rhamnose and aromatic methoxyl. The position of singlet at δ4.2 indicate a configuration of rhamnose. In ^{13}C-NMR spectrum the down fill peak at δ179.6 assigned for C-4 (Keto group) δ163.4 (C-6), 159.6 (C-4'), 158.0 (C-3') and 165.8 (C-7) support substitution at these positions. Methoxy carbon function resonated at δ53.7 which was assigned at C-6 (δ163.4) in ring A. On acidic hydrolysis (with 7% methanolic HCl) it afford an aglycone identified as 3,'4,' dihydroxy 6-methyl flavone. (Comparison with reported data and authentic sample) and rhamnose (Rf values, PC). Thus on the basis of these observations compound 2 was identified as as flavone 3,'4,' dihydroxy 6-methyl 7-O-α-L-rhamnopyranoside. Compound is used as a yellow dye in dyeing processes. (Table-2).

Optimization of Dyeing processes with isolated compounds from *Myrica esculenta*

Compound 1: A pure yellow amorphous powder. Identified as 2-methyl pyrane 3-O-â-D-glucoside. It imparts yellow colour on wool and greenish yellow colour on cotton samples .The dyed fabrics showed 37% absorption in ultraviolet region in UV Spectrophotometer. Compound showed excellent washing and light fastness properties with and without mordants in different fibres.

References

C.L., Bird, 1972. *Theory and Practice of Wool Dyeing*, Society of Dyers and Colourist, 4 Edn.

Gaur, R.D., 1999. "*Flora of District Garhwal*" 1st edition, Transmedia, Srinagar Garhwal.

M. Mizuno, M. Kato, N. Hosoi, N. Linuma, T. Tanaka, A. Kimura, H. Ohashi, H.Sakai and T. Kajita,1992. ***Heterocycles,*** 31, 1409.

R.H.M.J, Lemmens and N. Wulijarni-Soetijipto 1991. ***Dye and Tannin producing plant.*** Plant Resources of South East Asia, Vol-3.

Sati, S.C., Rawat, U., Sati, O.P., Srivastav, B. 2003. ***Colourage***, 44.

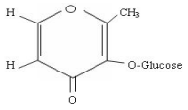
Table:1- Dyeing of Cotton and Wool Samples with Isolated Compound-1

Textile	Wool and Cotton fibres
Ingredients	5 mg compound+100 ml H_2O+2 ml CH_3COOH
Pots	Stainless steel/glass
Water	Tape water enough to cover the yarn.
Mordants	Chrome/Symploccous bark powder
Method of Dyeing	Pre-mordanting
Results	1. Yellow colour on wool fibres. 2. Greenish yellow to brown on cotton.

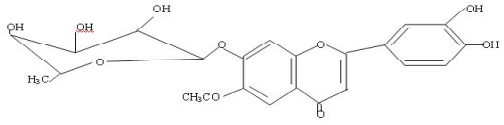
Compound 2: Pure yellowish crystals. Identified as **Flavone 3,'4,' dihydroxy 6-methyl 7-O-α-L-rhamnopyranoside,** produce yellowish grey colour without any mordant with excellent fastness properties toward washing and light. But colour changes was observed from yellow to brown when mordanted with different natural and synthetic mordants. It shows 48% absorption in mordanting stage whereas only 27% absorption without mordant in ultraviolet region.

Table:2- Dyeing of Cotton and Wool Samples with Isolated Compound-2

Textile	Wool and Cotton fibres
Ingredients	5 mg compound+100 ml H_2O+2 ml CH_3COOH
Pots	Stainless steel/glass
Water	Tape water enough to cover the yarn.
Mordants	Chrome/Symploccous bark powder
Method of Dyeing	Pre-mordanting
Results	1. Dark yellow colour on wool fibres. 2. Muddy yellow colour on cotton firbres. 3. Faint yellow colour without mordant.



COMPOUND-1



COMPOUND -2

Environment Conservation Journal 8 (3) 63-65, 2007
(ISSN 0972-3099)

Conservation Practices and Utilization strategies of Medicinal Plants in Bhandare districtrict of Vidarbha Region M.S. India

D.D. Ramteke, S.B. Zade and C.J. Khune
Dept. of Botany and Biotechnology, Samarth Mahavidyalaya Lakhani Dist- Bhandara
P.G. Dept. of Zoology and Sericulture, M. B. Patel College Sakoli Dist- Bhandara (Maharashtra)

Abstract

Herbal remedies have attained much more popularity in the treatment of minor ailments due to increasing awareness of personal health maintenance through natural products. Indeed the market and public demand has been so great that there is extinction risk to many medicinal plants and obviously the loss of genetic diversity demanding immediate innervations for conservation. The present investigation has been done in Bhandara of Vidarbha region of Maharashtra state. The paper includes important medicinal plant, which is under endangered and threatened categories. It also include survey, conservation, cultivation along with their utilization with respect to economic, ethanobotanical and ethanomedicinal properties.

Keywords -: *Conservation, medicinal plants, Vidarbha region, ethanomedicinal.*

Introduction

Medicinal plants are the local heritage with global importance. Herbs have always been the principle form of medicine in India. It is estimated that around 70 thousand plant species at one time have been used for medicinal purposes. The Rigveda, Yajurveda, Charak samhita, sushrut samhita describes properties and types of various medicinal plants in Ayurvedic system of medicine.

There is a great commercial demand of pharmacopoeias drugs and their products in India, efforts have been made to introduce much drug plant under conservation and utilization by tribal people of the Bhandara district of the vidarbha region. The present works have undertaken studies on conservation along with utilization of medicinal plants, which are economically, ethanobotanically and ethanomedicinally important. There is need to give priority to conservation of endangered & threatened medicinal plants through in-situ and ex-situ preservation of these species.

Methodology

The survey of various medicinal plants, which are found in the region, are considered for this study. These plants are ethanomedicinally as well as ethanobotanically very important. These plants are collected for their morphotaxonomic studies. Information related to their chemical nature and mode of action is studied by trial on tribal peoples. Information regarding to the one of particular plant or its part to cure various diseases have been collected. Some times decoction of plants or in some cases plant parts are mixed together and use as drug.

The specimens are preserved in h4erbarium. The visual charts of plants with various information are prepared and stored in the laboratory. Further research should also link management and conservation of medicinal plants with the development of these resources. First of all conservation of vulnerable species is done at grass root level. For this purpose sustainable collection and management practices on public

land has been adopted. It takes place by means of agricultural development. These researches have focused to improve basic knowledge about cultivation practices and dissemination of plant species.

Discussion

Since a decade the need was felt to have compressive conservation and management. The total scenario demands sustainable system approach. The plants have different habit and habitats. Generally it is herbs, shrubs or tree. These plants are naturally occurring in the region and need special care. Conservation practices and management of medicinal plant for the benefit of life including humankind of biosphere. So that it may yield sustainable benefit to present generation.

In-situ Conservation

Medicinal plants mentioned in this paper conserve at the genetic, species and eco system level on long-term basis. There are also endemic species. Conservation of these widely spread population is possible only through setting up a network of representative medicinal plant reserve.

Ex-Situ Conservation

Development of ethanomedicinal and ethnobotanical plant garden of important plant known to various ethic communities of the Bhandara District. Gene banks are developed for medicinal plants found in the region with priority to known rare, endangered, threatened and endemic Species. Nursery network is most urgent task in order to ensure immediate availability of plants.

Utilization strategies

Medicinal plants have curative properties due to presence of various complex chemical substances of different chemical compositions, which are found as secondary plant metabolites. These plant metabolites according to their composition are grouped as alkaloids, glycosides, corticoids, essential oils etc. The alkaloids form largest group which includes morphine & codeine (poppy), Strychnine and brucin (nuxvomica), quinine (cinchona), scolaphomine (datura), reserpine (rauwolfia), Glycosides from another important group by sycurhizine (liquorice), barboline (aloe), Cannocides (senna) etc. Corticosteroides have been reported from solasodine (Solarium sp.), senocides (senna), etc.

The plants considered for study are naturally occurring. Due to limitation of paper it is not possible to name all the plants here but some important plant species are listed here with botanical Nomenclature. The present work is done for study conservation of medicinal plant diversity in ancient literature, their taxonomic status, database management, Biotechnology and gene pool maintenance of some medicinal and herbal plants like *Abelmoschus moschatus*, *Acrous calamus*, *Andrographis paniculata*, *Asparagus resimosus*, *Bacopa moniera*, *Berberis aristata*, *Centella asiatica*, *Clotolaria ternatea*, *Commiphora wighii*, *Curcuma amada*, *Cassia angustifolia*, *Coleus barbatus*, *Emblica officinales*, *Gloriosa superba*, *Hemidesmus indicum*, *Lepidium sativum*, *Mucuna prurita*, *Lepidum sativum*, *Phyllanthus niruri*, *Picrorhiza kurroa*, *Piper longum*, *Plumbago zylanica*, *Rauwolfia serpentima Sassuria costus, Semicarpus anacardium*, *Solanum nigrum*, *Stevia rebaudiana*, *Swertia chirata*, *Tinosora cordifolia*, *Withania somnirera etc*. The present work done for study conservation and utilization of some importance medicinal plants found in area of Bhandara district in ancient literature, their status, database management, Biotechnology and gene

maintenance.

Conclusion & Result

The strategic multidiscipline research in a holistic manner will check the depletion rate of these important medicinal plants, Available genetic resources of these plants after a huge resource of such utilzing phyto molecules of varied applications. This need not only to conserve & characterized but also used to be protected in terms to provide a sustainable source.

Acknowledgements

The authors are thankful to Dr. S. G. Poharkar, Principal, Samarth Mahavidyalaya Lakhani for his precious help for study. The authors also express appreciations to Dr. R. D. Singh Principal, M.B. Patel College, Sakoli for help research work.

References

Ambekar, G.R., 1927. The crops of the Bombay presidency, their Geography and Statistic, Part II, Department of Agricultural bulletin No. 146 .

Blater, E. and Mcann, C., 1935. The Bombay grasses, Indian Council of Agricultural Research Scientific Monograph No. 5, Delhi, i-xxi and 1-324.

Chopra, R.N., 1932. The Indigenous Drugs of India, Calcutta .

Cooke, T., 1901-1908. The Flora of the Presidency of Bombay, I-II, Londan .

Health Bulletin, 1941. The Nutritive Value of Indian foods, etc., Indian research Fund Association, Health Bulletin No. 23, Calcutta .

Hooker, J.D., 1875-1891. Flora of British India, I-III, Londan .

Kirtikar, K.R., 1896. Poisonous plants of Bombay.

Nadkarni, K.M., 1927. Indian Plants and Drugs with their Medicinal Properties and Uses, Bombay.

Pandit, C.G., 1949. Annual Report for the year 1949 of the Indian Research Fund Association.

Patwardhan, G.B., 1928. Field, Orchard, and Garden Crops of the Bombay Province, Bombay Departmentof Agriculture Bulletin No. 30.

Talbot, W.A., 1909-1911. Forest Flora of the Bombay presidency and Sind, I-II, Poona.

Watt, George, 1889-1893. Dictionary of the economic Products of India, I-IV, Calcutta .

Environment Conservation Journal 8 (3) 67-71, 2007
(ISSN 0972-3099)

Water Quality Assessment of a Polluted Urban Lake with respect to Zooplankton

Suresh B. Zade* & Shashikant R. Sitre**
* P.G. Dept. of Zoology, M.B.Patel College, Sakoli District – Bhandara.
**Department of Zoology, Govt. Institute of Science, Nagpur.

Abstract

The plankton community is a heterogeneous group of tiny plants and animals adapted to suspension in the water bodies of the entire globe. The movements of plankton are so feeble that they essentially remain at the mercy of water currents i.e. waves and tides. The producers of the aquatic ecosystems are the plant plankton i.e. phytoplanktons while consumers are the animal plankton i.e. zooplankton. The phyto & zooplankton constitute a dynamic chain on which fish fauna sustains & grows to be useful for the benefit of mankind. The pollution of water bodies is increasing day by day and a large number of water bodies are progressing towards eutrophication. The status of a water body is known from the presence of various kinds of species in it. The organic enrichment favours growth of a large number of species in a water body which results in its growth and development. Keeping these points in view assessment of water quality of a urban water body (Sonegaon lake) situated in the Nagpur city is done during monsoon and post monsoon months to know the exact status of zooplankton species prevailing in lake water. The lake water is polluted due to Ganesh idol immersion, garland immersion as well as load of detergents from washing and other activities. The lake is slowly progressing towards eutrophication as evident from the present studies on zooplankton.

Keywords : *Zooplankton, Water quality.*

Introduction

Today the freshwater lakes of the world are undergoing fast degradation subsequently leading to eutrophication (Rao & Durve, 1989). The anthropogenic sources viz. activities of man are mainly responsible for polluting the freshwater resources all over India. The freshwater lakes are closed ecosystems in which zooplankton hold a key position in the metabolism of water bodies, trophic levels, food chains & energy flow. The occurrence & abundance of zooplankton in freshwater lakes depends on its productivity, which in turn is influenced by physico-chemical parameters & available nutrients. The organically enriched water bodies sustain a large variety of zooplankton species throughout the year. Keeping these points in view a freshwater lake of Nagpur city is investigated with respect to biodiversity of zooplankton during monsoon & post monsoon months.

In India studies on freshwater zooplankton were carried out by many prominent investigators like Babu Rao (1997), Chandrasekhar (1996), Rai (1982), Sharma & Hussain (2001), Verma & Dutta Munshi (1987), Dhanpathi (2000), Rao & Durve (1989), Dutta *et al.*, (1987), Somani & Pejaver (2004) and Kodarkar (1994).

Materials & Method

The Sonegaon lake is a old lake situated on Southern side of Nagpur city. Previously the habitation was very sparsle, near the lake. But due to rapid progress of Nagpur city the localities expand & now at present the lake is covered from all the sides by residential colonies. Some part on Western bank of lake is encroached by localities & built houses therein. Previously the lake was surrounded by fields & the water

was abundantly available but now due to encroachment on banks the water seeping into the lake basin has reduced to a large extent, the effect is that during extreme Summer months the volume of water shrinks to a size of very small pond in the center. Two old temples are situated on eastern bank of this beautiful lake which is visited by many devotees. During "Ganesh idol immersion programme" a lot of garlands & other pooja material are dumped into the basin thereby enriching the lake waters. Some local residents also utilize the lake for washing and bathing activities daily thereby adding detergent load to waters polluting it. The lake base is shallowed down and water table is hardly four feet in the lake due to siltation of banks. During winter months lots of migratory birds are frequently observed in the lake water. In order to study the zooplankton biodiversity in this beautiful lake. Zooplankton samples were collected from littoral zone of surface water during monsoon and post monsoon months by filtering 50 litres of Sonegaon lake water through plankton net made of silk bolting cloth (mesh size 45 μ m) in early morning hours twice a month. The zooplankton samples were immediately preserved in 4% formalin solution for further analysis & kept in laboratory till further analysis. The samples were observed under "Sedgwick Rafter Counting Cell" (S R Cell) having dimensions 50 mm x 20 mm x 1 mm, under light microscope. The identification of zooplankton was done using standard literature (Battish 1992, Edmondson 1992, Dhanpathi 2000, Ward & Whipple 1958). The different forms were observed and recorded individually.

Results and Discussion

The Zooplankton of Sonegaon Lake is represented by five different groups viz. protozoa, cladocera, copepoda, ostracoda & rotifera (Table I). The ostracoda group is represented by 2 species rotifers by 12 species cladocera by 8 species, copepoda by 3 species & protozoa by 2 Species during monsoon & post monsoon season in general. During monsoon months the ostracoda group is represented by 2 species while in post monsoon it is represented by *Cypris species* alone. Tonapi (1980) has reported higher population of ostracoda during monsoon months due to abundance of fine detritus available during this period of the year on which ostracods feed vigorously & develop.

The most abundant species during monsoon months were rotifers represented by about 12 different forms; while in post monsoon it is represented by about 8 different Species. The pollution indicator sps. *Rotaria rotatoria* was observed in post monsoon months indicating that after rain, pollution level of nutrients & organics has slowly increased in lake water. The most abundant species observed in lake water was *Brachionus calyciflorus* from rotifera group. The occurrence of indicator species such as *Brachionus forficula* (Rao & Durve, 1989) and *Filinia longiseta* (Schindler & Noven 1971, Mishra & Saksena, 1998) indicates that slowly the lake water is progressing towards eutrophication stage.

The freshwater zooplankton form an important group which in turn is consumed by variety of secondary consumers including commercially important groups of crustaceans such as prawns & fishes.Thus zooplankton community constitute an important component of aquatic ecosystem & many species are suitable for aquaculture practices.

Rotifers play an important role as grazers & suspension feeders within the zooplankton community. The difference in periodicity & population density of different rotifer species is due to biotic interactions & nutritional content of the lakes. Rotifers exhibit marked differences in their tolerance & adaptability to changes in physico-chemical & biological parameters. Such changes are dramatic & sudden in the case of

urban ecosystems. Chandrasekhar (1996) observed that in summer & monsoon months the factors like water temperature, turbidity, transparency & dissolved oxygen play an important role in controlling the diversity & density of rotifers.

Most of the cladocera species are primary consumers and feed on microscopic algae & fine particulate matter in the detritus thus influencing cycling of matter & energy in benthic food chain. The factors like turbidity, materials in suspension, transparancy, dissolved oxygen of the water play a key role in controlling the diversity & density of cladocera. According to Datta & Munshi (1995) abundance of cladocera can be attributed to thick deposit of organic matter in an aquatic ecosystem. In the present investigation it is noticed that during monsoon months due to turbulence in water a large amount of organic detritus is made available to cladocera on which about 8 different forms thrived which were reduced to about 4 types in post monsoon months.

So it can be inferred from the present study that the aquatic ecosystem of the urban polluted lake has abundant biodiversity represented by various forms during monsoon & post monsoon seasons. The lake water is slowly progressing towards eutrophication as indicated by the presence of indicator species.

References

Baker, R.L., 1979. Specific status of K*eratella cochiearis* (Gosse) & *K. earlinare* Ahlastrom (Rotifera, Brachionidae) Morphological & Ecological considerations. ***Can. J Zool.,*** 57 (9):1719 – 1722.

Battish, S.K., 1992. *Freshwater Zooplankton of India*, Oxford & IBH publishing Co.:223.

Babu Rao, M., 1997. *Studies on the ecology & fish fauna of an oligotrophic lake*, Himayatsagar, Hyderabad, A.P. Recent Advances in Freshwater Biology. Vol. III ed. Rao,K.S. : 73-97.

Chandrasekhar, S.V.A., 1996. *Ecological Studies on Saroornagar Lake, Hyderabad with Special reference to Zooplankton communities*, Ph.D. Thesis Osmania University, Hydrabad.

Dutta, N.C., Mandal, N., & Bandyopadhyay, B.K., 1987. Seasonal abundance of Rotifers in a perennial freshwater pond in Calcutta. ***J.Environ.Biol.,*** 8(1):63-71.

Datta Munshi, J. & Datta Munshi, J.S., 1995. *Fundamentals of Freshwater Biology*, Narendra Publishing House, New Delhi:222.

Rao, I.S., 1982. *Ecology of the Manjira Reservoir Sangareddy*, A.P., Ph.D. Thesis, Osmania University, Hyderabad, 294.

Sharma, B.K. & Hussain, M.D., 2001. Abundence & Ecology of Zooplankton in a tropical floodplain lake, Assam (N.E.India). ***Ecology Environment & Conservation.,*** 7 (4):397-403.

Verma, P.K. and J.S. Dutta Munshi, 1987. Plankton Community Structure of Bada reservoir of Bhagalpur (Bihar). ***Trop. Ecol***., 28:200-207.

Yousuf, A.R., Balhi, M.H. and Quadri, M.Y., 1986. Limnological features of a forest lake of Kashmir. ***J. Zool. Soc***., 58 (1-2):29-42.

Dhanpathi, M.V.S.S., 2000. *Taxonomic noters on the rotifers from India* (from 1889-2000). IAAB, Hyderabad.

Rao, N.G. & Durve ,V.S., 1989. Cultural eutrophication of the lake Rangasagar, Udaipur, Rajasthan. ***J. Env.***

Biol., 10:127-134.

Mishra, S.R. and Saksena, D.N., 1998. Rotifers and their Seasonal Variation in a Sewage Collecting Morar (Kalpi) river, Gwalior. ***J. Environ. Biol.,*** 19:363-374.

Schindler, D.W. and Noven, B., 1971. Vertical distribution and seasonal abundance of zooplankton in two shallow ontario lakes. ***J. Fish. Res. Bd. Can.,*** 28:245-256.

Somani, V. & Prejaver, M., 2004. Crustacean zooplankton of lake Mkasunda, Thane, Maharashtra. ***J. of Aqua. Biol***., 19(1):57-60.

Kodarkar, M.S., 1994. Biodiversity of zooplankton in Saroornagar lake, Hyderabad. ***J. Aqua. Biol***., 9(1&2):30-33.

Table - I: Zooplankton Species Observed in Sonegaon Tank

	Group	Species	Time Monsoon	Post Monsoon
1)	**Ostracoda**	*1. Cypris Species*	+	+
		2. *Stenocypris*	+	-
2)	**Rotifera**	*1. Asplanchna Species*	+	+
		2. Asplanchna intermedia	+	-
		3. Brachionus forficula	+	+
		4. Brachionus caudatus	+	+
		5. Keratella tropica	+	+
		6. Philodina	+	-
		7. Testudinella	+	-
		8. Filinia longiseta	+	-
		9. Brachionus rubens	+	+
		10. Epiphanes	+	-
		11. Monostyla bulla	+	+
		12. Rotaria rotatoria		+
		13. *Brachionus calyciflorus*	+	+
3)	**Cladocera**	*1. Simocephalus*	+	-
		2. Macrothrix	+	+
		3. Chydorus	+	+
		4. Alona Species	+	+
		5. Bosmina longirostris	+	+
		6. Diphanosoma Species	+	-
		7. Pleuroxus Species	+	-
		8. *Sida Species*	+	-
4)	**Copepoda**	*1. Cyclops Species*	+	+
		2. Diaptomus Species	+	+
		3. *Copepod nauplius*	+	-
5)	**Protozoa**	*1. Difflugia Species*	+	+
		2. *Arcella*	+	-

Environment Conservation Journal 8 (3) 73-74, 2007
(ISSN 0972-3099)

Investigation of Ethnomedicinal properties of *Mutela Occidentales* used by trible peoples of Bhandara District Vidarbha region, Maharshtra, India

D.D. Ramteke*, S.B. Zade and C.J. Khune***
*Dept. of Botany and Microbiology
**P.G. Dept. of Zoology and Sericulture, M.B. Patel College Sakoli, Dist-Bhandara, (Maharashtra)

Abstract

Use of faunal wealth for medicinal purposes have been employed since dawn of civilization for protecting life of man by combating various ailments. Ancient tribal societies around the world have learned to utilize their neighbourhood wealth for curative as well as offensive purposes. The knowledge developed in their human laboratories through century's perfectly documented from generation to generation as domestic practices. The present investigation deals with study of ethnomedicinal use of *Mutella occidentales* an insect from order hemiptera.

Keywords: - *Ethnomedicinal, Mutella occidentales, Vidarbha .*

Introduction

Today the system of allopathic is still unknown to the people inhabiting in interior areas. Most of the peoples depend on Ayurvedic, unani and traditional folk medicines to cure various human problems. In India we have rich tradition of medicine and health case for safety and efficacy. Tribal and rural peoples in the area of Vidarbha region of Maharashtra. State uses the natural wealth for maintaining their health. The local practitioners used wild plants as well as some animals for ethnomedicinal purposes. The present paper deals with ethnomedicinal uses of *Mutella occidentales* an invertebrate insect from order Hemiptera. It is beautiful colored insect, which is smooth, small, shiny, and hairy in appearance measuring about 12mm in length. The insect is known by various names by tribal and innate peoples of district like Birbahuti, Indrawadhu, Vershakit etc. It is burrowing insect and can be observed during commencement of monsoon and comes out from soil after first showers during rainy season in month of June. It is present in mountains buried in soil and sandy loamy soils of gardens. After touching it becomes inactive and gets contracted. The present communication was done about ethnomedicinal use of *Mutella occidentales*. It is generally sold by unani and ayurvedic practitioners as "Kirme mukhmukh" or indrawadhu. The insect has several applications in rural and tribal health care.

Materials & Method

In the present investigation ethnomedicinal properties of *Mutella occidentales* were studied. The tribal people of district widely use this insect for curing various ailments. It is collected during monsoon season from various localities like mountains, gardens etc. where soil is rich in humus content. It is used for various ethnomedicinal purposes to cure diseases. It is preserved by drying and store for long time use wherever necessary. Generally it is eaten directly with fresh with water. The dried insect is eaten directly

or in powdered form. Some times other formulations are prepared by mixing together with honey, ghee, yogurt, or jiggery. It is also taken by mixing it with "Paan or vida". The present investigation has been done in Bhandara distinct of Vidarbha region of Maharashtra state. The paper includes important medicinal animal, which is under study. It also include survey, conservation along with their utilization with repect to economic ethnomedicinal properties.

Result and Discussion

The innate people of Bhandara district of Vidarbha region are poor and mostly depend on agriculture. During their daily work they observe nature carefully and their folk knowledge is used for treatment of various ailments. They are nature loving and used natural wealth carefully.

Tribal peoples of Bhandara District of Vidarbha region of Maharashtra State commonly use *Mutella occidentales*. The insect is used ethno medicinally as toner for various parts of body to tone up. The dried insect is mixed with milk and applies on part of body, which is affected. The peoples of District widely used this insect on inflammation. It is applied with Indian wax; it is generally boiled with Indian wax and applied on affected part. It is very effective on paralysis, joint pains and heart diseases and used internally by the tribal peoples. It is used as generally stimulated and used in improvement of mortality. Special oil is prepared by boiling it with coconut or sesame oil for massage. It is also used to cure acne and pimples by girls and women's of this region.

Acknowledgements

The authors are very thankful to Dr.R.D.Singh Principal, M.B.Patel College Sakoli for his precious help during research work.

References

Rick Imes, 1996. Insects, ***The Practical Guide To Entomology ;***Quantum Books Ltd.London.

Anantkrishnan,T.N., 1969. *Indian Thisanoptera* CSIR Zool. Monograph 171pp.

Anantkrishnan,T.N., 1973. *Biology and control*; Macmillan ind. Pvt. Ltd 120pp.

Anderson, S.O. and T. Weiss-fog, 1964. *Advances in insect physiology*, 1-65pp.

Ayyar, T.V.R., 1963. *Handbook Of Econonomic Entomology*; Govt. Press Madrass;22-40pp.

Bursel, E., 1970. *An introduction to insect physiology*, Academic press N.Y.,pp1-94.

Busvine, J.R., 1966. *Insects and hygiene*, Methuum and co Ltd., London,pp1-95.

Clark, L.R., P.W., Geier, R.D., Hughes, R.F. Morish, 196. *The ecology of Insect population*, Methuen and co Ltd,London:12-56.

Davey, K.G., 1965. *Reproduction in the insects,*Freeman and co.:1-50.

Environment Conservation Journal 8 (3) 75-85, 2007
(ISSN 0972-3099)

Rational design of non-convective zone of salt gradient solar pond considering turbidity and biological growth in water.

A.K. Saxena[*], S. Sugandhi[**], M. Husain[***]
[*]Samrat Ashok Technological Institute, Vidisha. M.P. India.
[**]Jawaharlal Institute of Technology, Borawan, Khargone M.P., India
[***]SSBT's College of Engineering & Technology, Bambhori, 94 Jalgaon (M.S.), India.

Abstract

The optimum size of non-convective zone of a Salt Gradient Solar Pond is determined from the heat balance considerations of the storage zone. The equation governing heat flow in storage zone are simplified considering a linear heat flow through the storage zone to the upper convective zone.The radiation absorption in pond liquid is estimated considering the effect of various Environmental parameters in pond like turbidity and biological growth in it. This has made the analysis more confirming to the real work situation for a pond. The ambient parameter like temperature and radiation are accounted to vary hourly. One significant observation is that the influence of turbidity on pond's performance is so drastic that at turbidity value higher than 0.8\ NTU, the optimum Non-Convective Zone (NCZ) size is not obtained analytically.

Keywords: *Non Convective Zone, optimum size, salt gradient solar pond, stability, thermal performance, turbidity*

Introduction

Salt gradient solar ponds are known as reliable and economical source for long-term heat collection and storage since over hundred years (Weinberger, 1964). With the dawn of new millennium as the energy and environmental crises have got exaggerated, ponds have appeared as environmental friendly and reliable energy alternative. Israel is working with an ambitious plan of fulfilling its entire energy demand by solar pond in near future (Amnon Einav, 2004). Substantial research work has been done on thermal as well as stability aspects of solar ponds. (Zangrando, 1991), (Singh *et al*, 1994), (Punyasena *et al*, 2003), (Angeli and Leonardi, 2004), (Jaefarzadeh, 2004), (Angeli and Leonardi, 2005) have done pioneer work on the stability aspect. For the maintenance of experimental solar ponds with variety of salts and different operating conditions, (Ouni *et al*, 2003), (Huseyin, 2006) have contributed their research experiences. (Huanmin *et al*, 2004) has given a glossary of major works in the maintenance of pond. The first analytical solution of pond was obtained by (Weinberger, 1964). (Tybout, 1966) proposed use of iterative methods for analyzing the pond. Estimation of radiation flux is a very important aspect of pond thermal behavior analysis. Many researchers have explored this aspect (Hull, 1982; Husain *et al*, 2004 and Kooi, 1981). Few investigators observed the effect of turbidity on performance of pond (Husain *et al*, 2004; Sugandhi *et al*, 2006; Wang J and S Yagoobi, 1994,1995).

Kooi, 1979 has proposed an analytical approach for determining optimum size of non-convective zone (NCZ) of the pond. With this optimum size (x_M), the pond retrieves maximum heat at steady state. How ever there is a limitation in the approach of Kooi. The pond takes a very long span of time for its warm up. Kooi's optimum size does not give efficient performance of the pond during warm up phase. Husain *et al*, 2003 have proposed an approach for optimum size of NCZ for rapid warm up of pond. All these

researchers considered the pond liquid to be clear water. However in reality, pond is exposed to ambient and receives dust load continuously (Wang and Yagoobi, 1994). Also some biological growth in the pond is unavoidable. These parameters create turbidity in water which affects the radiation transmission so drastically that no realistic analysis of the pond can be done ignoring turbidity (Wang and Yagoobi, 1995; Husain *et al*, 2004).

In the present work, an expression is developed to estimate optimum size of NCZ for rapid warm up (x_m), considering the turbidity in water. Thermal performance of the pond is analyzed with this Optimum (x_m) size of NCZ. Further, it is proposed that in the beginning (during maturation phase) the NCZ size may be kept as x_m and may be later change to x_M.

Theory

Heat balance in the storage zone of SGSP is given as (Sukhatme, 1994**;** Duffie *et al*,1981)

$$r C_p l_3 dT/dt = -KdT/dx - Q_{LOSS} - Q_{LOAD} + I_{STZ} \qquad (1)$$

Where r is density of pond liquid, C_p is specific heat, K is Conductivity, T is Temperature, t is time, l_3 is size of STZ, x is thickness of NCZ, Q_{Loss} is losses towards ground, Q_{LOAD} is heat extraction, I_{STZ} is radiation absorbed in STZ. Since pond is not loaded in the warm up phase, $Q_{LOAD} = 0$. Bottom and sides are considered as insulated. Hence $Q_{LOSS} = 0$. Equation (1) is rewritten as

$$r Cpl_3 (T_{STZ} - T_{amb})/Dt = -K[(T_{STZ} + T_{amb})/2 - T_{amb}]/ (l_1 + x_n) + I_{STZ} \quad (2)$$

I_{STZ} is calculated by considering turbidity in water. x_n is the thickness of NCZ.

Equation (2) is differentiated with respect to x_n to obtain its optimum value. This equation deals the over all heat balance for the period Dt. In which initial temperature of STZ is increase from T_{amb} to T_{STZ}. Where T_{amb} is ambient temperature, x_n is thickness of NCZ. The term $K[(T_{STZ} + T_{amb})/2 - T_{amb}]/ (l_1 + x_n)$ account for the conductive heat losses from STZ to surface, through NCZ assuming a linear temperature profile. Rewriting equation (2) as

$$(T_{STZ} - T_{amb})/Dt = (- KDT_m/(l_1 + x_n) + I_{STZ}) /rCpl_3 \qquad (3)$$

Where $DT_m = (T_{STZ} + T_{amb} / 2) - T_{amb}$

In equation (3), x_n is variable. Equation (3) is differentiated with respect to x_n and equated to zero to find its maxima. Maxima is denoted by x_m.

$$d/dx_n(-K (DT_m/(l_1 + x_n) + I_{STZ})/rCpl_3 = 0. \qquad (4)$$

Say $f(x) = 0$

Solving which, the optimum NCZ thickness x_m is obtained. The analysis is given in appendix-I. Using this value of x_m, the warm up time is calculated. Optimum size of NCZ is also calculated by Kooi's method for comparison. Analysis is presented in appendix II.

Input Data

Hourly varying ambient temperature and solar radiation is considered for city of Jalgaon (21^0 N, 75^0W) (Mani and Rangrajan, 1982). UCZ temperature of pond is estimated by Weinberger's, 1964 approach. Bottom and sides are considered to be insulated. Bottom is considered to be black. Turbidity of water is varied between 0.3 NTU to 1.0 NTU. Pond depth is taken as 1.75 m and UCZ size is taken as 0.2m. The target (desirable) temperature of STZ is varied in the range of $70\ ^0$C to $85\ ^0$C.

Result and Discussion

1. Fig. 1 shows the influence of NCZ size on warm up time of pond. It is seen that, with an increase in NCZ size, the warm up time is getting reduce continuously. While in case of no turbidity the warm up time comes out to be minimum wit h about $\mathbf{0.8x\acute{\epsilon}_{m,}}$ where $\mathbf{x\acute{\epsilon}_m}$ is the optimum size of NCZ as proposed by (Husain *et al,* 2003).
2. At calculated x_m value and values of NCZ lower than this, the target temperature is not achieved. At NCZ values higher than x_m, the target STZ temperature achieved as shown in fig. 1-7.
3. In over all, the use of value close to x_m is advantageous because, too large size of NCZ will be practically difficult and infeasible to be maintained from stability considerations also.
4. Because the over all depth of pond is constant, an increase in NCZ size results in the decrease of STZ size. Lower STZ size means, in over all reduction in storage of quantum of heat. This further justifies the use of x_m as close to the optimum size of NCZ, which gives a lower warm up time, still results into a higher storage of heat in STZ.
5. Similar observation can be obtained from fig. 1 to 7, in which other parameters are varied like turbidity, target temperature of STZ etc.
6. The optimum size of NCZ, x_M according to the Kooi's approach (Kooi 1979), is always constant for fig. 1 to 7, irrespective of target temperature of STZ.
7. The optimum size of NCZ obtained by Kooi's approach does not result into target STZ temperature within reasonable time duration. This is a significant observation with variable ambient parameters while considering constant parameter optimum NCZ size has always obtained target temperature.
8. At lower turbidity range, the optimum size of NCZ (x_m) according to present approach is coming out to be always close to the size (x_M) proposed by (Kooi, 1979). It is different to the findings of (Husain *et al,* 2003) for turbidity free water in which $x\acute{\epsilon}_m$ is always less than x_M.
9. For higher STZ temperature and higher turbidity values, optimum value of x_m does not exist. While considering constant ambient conditions, optimum value of x_m is always obtained. [Sugandhi *et al*, 2006 communicated]. This is a typical observation with variable parameters.
10. For higher turbidity values like 0.8 and 1.0 NTU, The $x_{m,}$ values are not found to be in practical range. The values obtained are too small like 10 cm or so. This strongly suggests that the pond turbidity must be maintained below 0.8 NTU. This is an important guideline for pond's operation and maintenance.

Conclusion

Turbidity is an unwanted reality of SGSP. The forgoing analyses explicitly maintain that the turbidity has a very profound influence on optimum NCZ size. In the present case, 0.3 to 1.0 NTU turbidity is considered. The analysis indicates that turbidity greater than 0.8 NTU becomes too high for the pond and the optimum size of NCZ is not obtained. Any real pond exposed to ambient and maintained regularly by coagulant, will always have turbidity; but it must be maintained below 0.8 NTU. For a realistic analysis of SGSP, turbidity must be accounted. The present paper provides an analytical rational approach of determining optimum size of NCZ for faster warm up and over all optimum performance of the pond, considering the turbidity aspect, with hourly varying ambient data. This makes the analysis more realistic as compared to considering constant ambient parameters.

Nomenclature

C_p	*Heat capacity of liquid in pond (kJ/kg/^{0}C)*
h	*Transmission function defined by Wang and Yagoobi*
I	*Symbol for radiation flux*
Io	*Radiation flux incident at surface (W/m^2)*
I_{STZ}	*Radiation energy absorbed in STZ (W/m^2)*
I_{xin}	*Radiation flux incident at depth x (W/m^2)*
K	*Thermal conductivity of liquid in pond (W/m/^{0}C)*
l_1	*Thickness of UCZ (m)*
l_2	*Depth from surface to the interface of NCZ-STZ (m)*
l_3	*Thickness of STZ (m)*
L	Depth of pond (m)
NCZ	*Non-convective zone*
STZ	*Storage zone*
UCZ	*Upper convective zone*
Q_{LOAD}	*Heat extraction rate (W/m^2)*
Q_{LOSS}	*Loss of heat through bottom and sides of the pond (W/m^2)*
t	*Symbol used for denoting time*
T	Symbol used for denoting temperature
T_{amb}	*Ambient temperature (^{0}C)*
T_{STZ}	*STZ temperature (^{0}C)*
x_n	*Thickness of NCZ*
x_m	*Optimum Thickness of NCZ for rapid warm up while considering the turbidity*
x_{m}	*Optimum Thickness of NCZ proposed by Husain et al.*

x_M *Optimum Thickness of NCZ according to the Kooi's approach*

f *Turbidity of water in NTU*

r *Density of liquid in pond (kg/m³)*

Appendix - I

The equation (1) is solved here. In requires estimation of I_{STZ}. *Which is done by (Wang and Yagoobi, 1995) method considering turbidity. Wang and Yagoobi proposed following correlation based upon their experimental investigation to estimate radiation flux.*

$$I_{xin}(f, x) = I_0 h(, x)$$

Where I_0, *f and* x *are the radiation flux incident at the surface, turbidity of water in Nephelo-metric turbidity units (NTU), and depth in meter, respectively. The non-dimensional transmission function* h *is defined as*

$h(f, x) = h(0.3, x)\ r(f, x)$

Where $h(0.3, x) = 0.58 - 0.076 \ln(100x)$ and

$r(f, x) = 1.0 - 0.1975x(f - 0.3) + 0.0144x(f - 0.3)^2$

$r(f, x)$ accounts for turbidity greater than 0.3 NTU.

Solution of equation (4) is done as

$$f(x) = Dx_n [-KDT_m / (l_1 + x_n) + I_{STZ}]/rCpl_3 = 0$$

$$f(x) = d/dx (-KDT_m)/(l_1 + x_n) + d/dx\ I_{STZ} = 0$$

Because $rCpl_3$ is a constant.

$$f(x) = KDT_m/(l_1 + x_n)^2 + d/dx\ Io[(a - b\log_e(100(l_1 + x_n))$$

$$(1 - 0.1975(l_1 + x_n)(f - 0.3) + 0.0144(l_1 + x_n)(f - 0.3)^2]$$

$$f(x) = K DT_m/(l_1 + x_n)^2 + Io[(a - b\log_e(100(l_1 + x_n))(0 - 0.1975(f - 0.3) + 0.0144(f - 0.3)^2) + (1 - 0.1975(l_1 + x_n)(f - 0.3) + (0.0144(l_1 + x_n)(f - 0.3)^2)\ (0 - b\ d/dx(\log_e 100(l_1 + x_n))]$$

$$f'(x) = d/dx\ f(x)$$

$$f'(x) = -2KDT_m/(l_1 + x_n)^3 + Io[b/(l_1 + x_n)\ [0.1975(f - 0.3)$$

$$- 0.0144(f - 0.3)^2] + b/(l_1 + x_n)^2$$

The solution is obtained numerically with the help of computer program

Appendix- II

Kooi's expression for steady state optimum thickness of NCZ x_M given as

$$? \ (I_T)dx - x_M I_{(l1+xM)} = KDT/I_0 \qquad (5)$$

Say $y(x) = 0$

For determination of x_M, equation (5) is solved using Wang and Yagoobi correlation.

$$I_{xin}(f, x) = Io\ h(f, x)$$ as given in appendix (1)

$$y(x) = ? \ (I_T)dx - x_M I_{(l1+xM)} - KDT/I_0 = 0$$

$$y(x) = Io \ ? \ (a - b\log_e 100x)(1 - 0.1975x(f - 0.3) + 0.0144x(f - 0.3)^2$$

$$- Io\ x_M [a - b\log_e 100\ (l_1 + x_M)][1 - 0.1975(l_1 + x_M)(f - 0.3)$$

$$+ 0.0144(l_1 + x_M)(f - 0.3)^2] - KDT/Io = 0$$

$$y(x) = Io[a - b\log_e 100[x_M - (x_M^2 + 2l_1 x_M)/2\ (0.1975(f - 0.3)$$

$$- 0.0144\ (f - 0.3)^2)] - b[(l_1 + x_M)\log_e(l_1 + x_M) - l_1 \log_e l_1 - x_M]$$

$$+ b\ (0.1975\ (f - 0.3) - 0.0144(f - 0.3)^2)$$

$$[(l_1 + x_M)^2/2\ (\log_e(l_1 + x_M) - 1/2) - l_1^2/2\ (\log_e l_1 - 1/2)]]$$

$$- Io\ x_M [a - b\log_e 100(l_1 + x_M)]\ [1 - 0.1975(l_1 + x_M)(f - 0.3)$$

$$+ 0.0144(l_1 + x_M)(f - 0.3)^2] - KDT/Io = 0$$

$$y'(x) = d/dx\ y(x)$$

$$d/dx\ y(x) = Io\ [(a - b\log_e 100)d/dx\ x_M - [(a - b\log_e 100)(0.1975(f - 0.3) -$$

$$0.0144f - 0.3)^2)]\ d/dx(x_M^2 + 2l_1 x_M)/2 - b\ (d/dx\ (l_1 + x_M)$$

$$\log e(l_1 + x_M) - d/dx\ l_1 \log_e l_1 - d/dx\ x_M) + b\ (0.1975\ (f - 0.3) -$$

$$0.0144(f - 0.3)^2)d/dx(l_1 + x_M)^2/2\ (\log_e(l_1 + x_M) - 1/2) - d/dx$$

$$l_1^2/2(\log_e l_1 - 1/2)] - Io\ d/dx(x_M [a - b\log_e 100(l_1 + x_M)]\ [1 -$$

$$0.1975(l_1 + x_M)(f - 0.3) + 0.0144(l_1 + x_M)(f - 0.3)^2])] - d/dx\ KDT/Io$$

$$y'(x) = Io\ [a - b\log_e 100\ [1 - (0.1975(f - 0.3) - 0.0144(f - 0.3)^2)(l_1 + x_M)]$$

$$- b[\log_e(l_1 + x_M)] + b[0.1975(f - 0.3) - 0.0144(f - 0.3)^2][(l_1 + x_M)$$

$(\log_e(l_1 + x_M) - 1/2) + (l_1 + x_M)/2]\ ]$

$- Io\ [[a - b \log_e 100\ (l_1 + x_M)[1 - 0.1975(l_1 + x_M)(f - 0.3) + 0.0144(l_1 + x_M)(f - 0.3)^2]$

$- x_M\ [b(0.1975(f - 0.3) - 0.0144(f - 0.3)^2)][1 + \log_e(100(l_1 + x_M)\ ]$

$- a\ x_M\ (-0.1975(f - 0.3) + 0.0144(f - 0.3)^2) + b\ x_M / (l_1 + x_M)\ ]$

The solution is obtained numerically with the help of computer program

References

Agha, K.R., S.M. Abughres and A.M. Ramdan, 2004. Design Methodology for a salt gradient solar pond coupled with an evaporation pond. ***Solar Energy***, 73(5):447-454.

Amonon Enav, 2004. Solar Energy Research and Development Achievements in Israel and Their Practical Significance. ***Journal of Solar Energy Engineering***, 126(3): 921-928.

Angeli, C. and Leonardi, E., 2004. One-dimensional numerical study of the salt diffusion in a salinity-gradient solar pond. ***International Journal of Heat and Mass Transfer***, 47(1):1-10.

Angeli, C. and Leonardi, E., 2005. The effect of thermo diffusion on the stability of a salinity gradient solar pond. ***International Journal of Heat and Mass Transfer***, 48:4633-4639.

Duffie, J.A. and W.A. Beckman, 1981. *Solar Engineering of Thermal Processes*. John Wiley:78-80.

Hull, J.R., 1980. Computer Simulation of Solar Pond Thermal Behavior. ***Solar Energy***. 25,33-40.

Hull, J.R., 1982. Calculation of solar pond thermal efficiency with a diffusively reflecting bottom. ***Solar Energy***, 29 (5): 385-389.

Husain, M., Patil, S.R., Patil, P.S. and Samdarshi, S.K., 2003. Optimum size of non-convective zone for improved Thermal Performance of Salt Gradient Solar Pond. ***Solar Energy***, 45: 73-81.

Husain, M., Patil, S.R., Patil, P.S. and Samdarshi, S.K., 2004. Combined Effect of Water Turbidity and Bottom Reflectivity on Thermal Performance of Salt Gradient Solar Pond. ***Energy Conversion & Management***, 45: 73-81.

Husain, M., Patil, S.R., Patil, P.S. and Samdarshi. S.K., 2004. Simple Methods for Estimation of Radiation Flux in Salt Gradient Solar Pond. ***Energy Conversion & Management***, 45:303-314.

Huseyin kurt and Mehmet Ozkaymark, 2006. Performance evaluation of a small-scale sodium carbonate salt gradient solar pond. ***International Journal of Energy Research***, 30(11):905-915.

Huanmin Lu, Andrew, H.P., Swift, Hobert, D. Hein, 2004. Jr and John Walton. ***Journal of Solar Energy Engineering,*** 126(2): 759-767.

Jaefarzadeh, M.R., 2004. Thermal behavior of a small salinity-gradient solar pond with wall shading effect. ***Solar Energy***, 77(3): 281-290,

Kooi, C.F., 1979. The Steady state salt gradient solar pond. ***Solar Energy,*** 25:7-45.

Kooi, C.F., 1981. Salt gradient solar pond with reflective bottom: application to the 'saturated' pond. ***Solar Energy***, 26:113-120.

Mani, A. and S. Rangrajan, 1982. *Solar Radiation Over India.* Allied Publishers Private Limited, NewDelhi, India.

Ouni, M., A. Guizani, H. Lu. and A. Belghith, 2003. Simulation of the control of a salt gradient solar pond in the south of Tunisia. ***Solar Energy,*** 75(2): 95-101.

Punyasena, M.A., C.D. Amarasekara, J.R.P. Jayakody, P.A.A. Perera and P. Ehamparam, 2003. An investigation of rain and wind effects on thermal stability of large-area saltpan solar pond. ***Solar Energy***, 74(6):447-451.

Singh, T.P., A.K. Singh and N.D. Kaushika, 1994. Investigations of thermodynamic instabilities and ground storage in a solar pond by simulation model. ***Heat Recovery Systems & CHP.,*** 14(4):401-407.

Sugandhi, S., Saxena, A. K. and Husain, M., 2006. Influence of Turbidity on Optimum Size of Non-Convective Zone of Salt Gradient Solar Pond. ***Energy Conversion & Management,*** Communicated.

Sukhatme, S.P., 1994. *Solar Energy-Principles of thermal storage and collection*. Tata McGraw Hill publishing co., New Delhi, India .

Tybout, R.A., 1966. A recursive alternate to Weinberger's model of the solar pond. ***Solar Energy***, 11:109-111.

Wang, J. and S. Yagoobi, 1994. Effect of Water Turbidity and Salt Concentration Levels on Penetration of Solar Radiation Under Water. ***Solar Energy,*** 52(5): 429-438.

Wang, J. and S. Yagoobi, 1995. Effect of Water Turbidity on Thermal Performance of a Salt Gradient Solar Pond. ***Solar Energy***, 54(5): 301-308.

Weinberger, H., 1964. The physics of the solar pond, ***Solar Energy,*** 8: 45-46.

Zangrando, F., 1991. On the hydrodynamics of salt gradient solar ponds, ***Solar Energy***, 46(6):323-341.

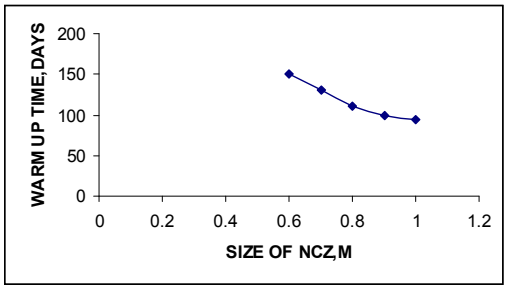


Fig.1: Variation of warm up time with NCZ size considering varying ambient parameters. T_{STZ} = 70 ^{0}C, l_I= 0.2 m, L = 1.75 m. Turbidity = 0.3 NTU. Bottom is Insulated and black. x_m = 0.5 m, x_M = 0.5 m.

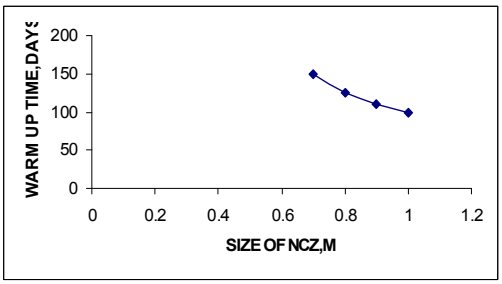


Fig. 2: Variation of warm up time with NCZ size considering varying ambient parameters. T_{STZ} = 75^{0}C, l_I= 0.2 m, L = 1.75 m. Turbidity = 0.3 NTU. Bottom is Insulated and black. x_m = 0.6 m, x_M = 0.5 m

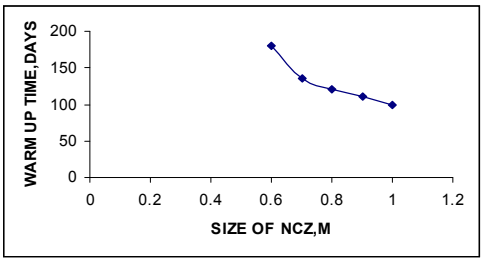


Fig.3: Variation of warm up time with NCZ size considering varying ambient parameters. T_{STZ} = 70 ^{0}C, l_I= 0.2 m, L = 1.75 m. Turbidity = 0.5 NTU. Bottom is Insulated and black. x_m = 0.45 m, x_M = 0.5 m.

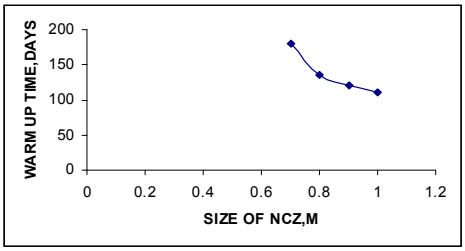


Fig.4: Variation of warm up time with NCZ size considering varying ambient parameters. T_{STZ} = 75 ^{0}C, l_1=0.2 m, L = 1.75 m. Turbidity = 0.5 NTU. Bottom is Insulated and black. x_m = 0.5 m, x_M = 0.5 m.

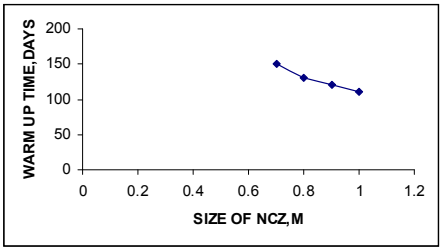


Fig.5: Variation of warm up time with NCZ size considering varying ambient parameters. T_{STZ} = 70 ^{0}C, l_1=0.2 m, L = 1.75 m. Turbidity = 0.8 NTU. Bottom is Insulated and black. x_m = 0.21 m, x_M = 0.5 m.

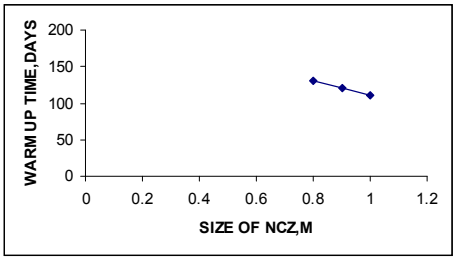


Fig.6: Variation of warm up time with NCZ size considering varying ambient parameters. T_{STZ} = 75 ^{0}C, l_1=0.2 m, L = 1.75 m. Turbidity = 0.8 NTU. Bottom is Insulated and black. x_m = 0.25 m, x_M = 0.5 m.

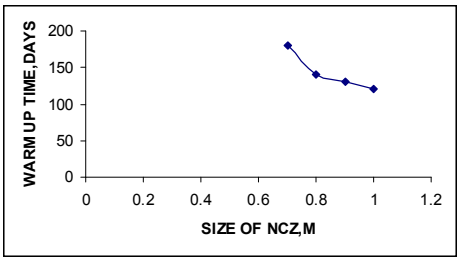


Fig.7: Variation of warm up time with NCZ size considering varying ambient parameters.T_{STZ} = 70 ^{0}C, l_1= 0.2 m, L = 1.75 m. Turbidity = 1.0 NTU. Bottom is Insulated and black. x_m = 0.1 m, x_M = 0.5 m.

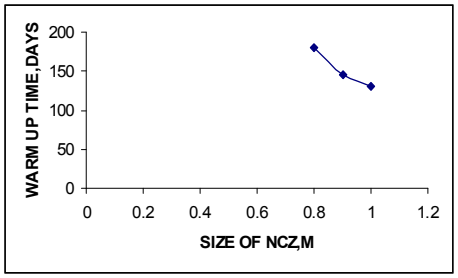


Fig.8: Variation of warm up time with NCZ size considering varying ambient parameters.T_{STZ} = 75 ^{0}C, l_1= 0.2 m, L = 1.75 m. Turbidity = 1.0 NTU. Bottom is Insulated and black. x_m = 0.1 m, x_M = 0.5 m.

Environment Conservation Journal 8 (3) 87-90, 2007
(ISSN 0972-3099)

A preliminary study of zoopalankton diversity of Ramala lake District Chandrapur, Maharashtra

Rajlaxmi R. Kulkarni, Dr. Suresh Zade*, S.B. Patharde
Department of Zoology, S. P. College, Chandrapur
*P. G. Deptt. of Zoology & Co-ordinator,
P. G. Deptt. of Sericulture.Manoharbhai Patel College, Sakoli Dist. Bhandara (M. S.)

Abstract

The present study reports the zooplankton community of Ramala lake in Chandrapur city, Maharashtra for period of 12 months from June 2006 to May 2007. The study showed much diversity. The lake is one of ancient, historical, man made water body, constructed by Gond Raja of Chandrapur. Monthly variation in the abundance of zooplankton were studied during the study period of 12 months. Total 18 zooplankton species were recorded, out of which 10 rotifera species ,02 copepoda species, 01 ostracoda and 05 cladocera species were found. The rotifer Brachionus was dominated throughout the study period.

Key words:- *Zooplankton, copepoda, rotifera, Ramala lake.*

Introduction

Zooplankton are most fascinating group of microorganism found in aquatic body. Diversity refers to the range of variation of difference among some set of entities, zooplankton diversity thus refers to variety within their community. They include a varied assemblage of taxonomically unrelated microscopic organism. Their common ecological characteristic being their habitat, they are found freely drifting in the epilimnion. They are abundant in shallow water areas of reservoir. They play a vital role as primary consumer which feed upon phytoplankton. The occurrence and abundance of zooplankton in a pond depends on its productivity which in turn is influenced by physico-chemical parameter and nutrients. Zooplankton has been used as indicators of water quality, trophic status and pollution level. They provide food for fishes in the freshwater ponds & play major role in the fish production. Zooplankton has been an interesting subject of study in India and several workers worked on are , Ganapati (1943) Sharma & Patnaik (1985), Chandrashekhar and Kodarkar (1996), Pawar & Madlapure (2002) Patil *et al*. (2005).

The paper deals with diversity of zooplankton in Ramala lake which was studied for a period of twelve months from June 2006 to May 2007. The lake is one of chief lakes, within the municipal limits of Chandrapur city, running along the north, east section of the historical city wall of Gondraja's fort. It is situated 761 feet above the sea level in 19^0 57' north latitude and 79^0 22' east longitude.

Materials and Method

The present study was conducted for the period of twelve months from June 2006 to May 2007. Monthy samples of zooplankton were collected from three different sampling sites, S_1, S_2 and S_3, far apart from each other. The zooplankton were collected with the help of a plankton net of standard bolting silk cloth No. 25 (mesh size 0.03 – 0.04 mm) by filtering 50 liters of water by a plastic container of 05 liters capacity. The collected samples then centrifuged and volume was adjusted to 30 ml. The samples then preserved by

using 4% formaline solution. Detailed microscopic examination of zooplankton under compound binocular microscope has been carried out . As per as possible the zooplankton were identified up to species level. Preliminary identification of zooplankton was made by using standard key & other literature like Ward and Whipple (1992), Tonapi (1980) Battish (1992) Chandrashekhar and Kodarkar (1995) and traxonomic notes on rotifers, copepods etc. (IAAB Publication). For the quantitative analysis of plankton a Sedgwick Rafter counting cell of 1 ml capacity was used.

Results and Discussion

The zooplankton of Ramala lake composed of four major groups (classes) rotifer, ostracoda, copepoda and cladocera. The number of species that were identified during the study period were rotifer 10 species, copepods 02 species, ostractoda 01 species and cladocera 05 species. The rotifers were found to be dominant. It was noted that the total number of zooplankton varied from 24 to 65 number per litre at sampling site I, 05 to 45 number per lit. at sampling site III. The zooplankton population showed depletion in the month of Dec. - March and maximum number of zooplankton was found to be in the month of July –August.

The seasonal variation of zooplankton in the order of abundance at three sites were as follows:-

S_1 Cladocera > Rotifera > Copepoda > Ostracoda

S_2 Rotifera > Cladocera > Copepoda > Ostracoda

S_3 Rotifera > Cladocera > Copepoda > Ostracoda

A : Rotifera

The monthly average and total number of rotifers varied from 02 to 19 per liter at S_1, 01 to 15 at S_2 and 03 to 20 at S_3. Rotifer populations are very useful in indicating the water quality particularly in pollution studies (Shadecek 1983). Rotifers play an important role as grazers, suspension feeder and predators within zooplankton community. Rotifer species exibit marked differences in their tolerance and adaptability to changes in physico- chemical and biological parameters. Among Rotifers, Hutchinson (1967) observed that *Brachionus spp*. are very common in temperate and tropical waters, which indicate alkaline nature of bodies. Ferenska and Lewkowiez (1996) and Schindler and Noven (1971) have mentioned in their treatise that the enormous growth of rotifers in lakes and reservoirs are indicators of autotrophic condition. Rotifers are commonly termed as 'Wheel- Animalcules'. The significance of rotifera is based on their abundance and their role in aquatic food web. According to Peijler (1957) there is no direct effect of pH on rotiferan population. Edmondson (1959) and Baker (1979) observed that the high rotifer population in winter could be attributed with favorable temperature and availability of abundant food. Chandrashekhar (1996) observed that in summer and monsoon, the factors like water temperature, and availability of abundant food. Chandrashekhar (1996) observed that in summer and mansoon, the factors like water temperature, turbidity, dissolved oxygen play an important role in controlling the rotifer population. In present study, the rotifer population was found to be maximum in the month of July 2006 at station S_3.

B- Copepoda

The monthly average and total number of copepods varied from 02 to 20 number per lit. at S_1, 02 to 14 at S_2 and 04 to 22 per lit. at S_3. Water temperature and availability of food organism affect the copepods. Allan (1976) observed the inverse, relationship between high population of rotifers and cladocera and low population of copepods. Sharma and Hussain (2001) have reported low copepode population in summer season. The quantitative dominance of copepods is also reported by Sharma and Hussain (2001). The copepod population was found maximum in August (19/lit) at S_1 sampling station whereas in May the number was comparatively less. The water with copepod abundance were regarded to be at a lower trophic stage than those with rotifer abundance (Yousuf, 1988). Lakes rich in organic matter support higher number of cychopoids (Subbamma 1992), suggesting their prepoderence in higher trophic state of water.

C-Cladocera

Most of the cladocera species are primary consumers and feed on microscopic algae and fine particulate matter in the detritus. The monthly average and total number of cladocera varied from 02 to 19 per liter at S_1, 01 to 12 at S_2 and 04 to 20 at S_3. Quadari and Yusuf (1980) investigated the influence of some physico-chemical parameters like temperature, dissolved oxygen, turbidity on the population density and diversity of cladocera. The monsoon population was observed maximum in the present study, this may be due to favourable condition of temperature and availability of abundant food in the form of bacteria, nanoplankton and suspended detritus or due to thick deposit of organic matter in aquatic ecosystem. Usha Choubey (1997) found the similar result i.e. high density of cladocera in the month of July.

D-Ostracoda

The monthly average and total number of ostracoda varies from 01 to 18 per liter at S_1, 07 to 12 per lit. at S_2 and 02 to 20 per liter at S_3. The abundance of ostracodes provides a good food for aquatic organism. In the present study only one species of ostracoda was found i.e. cypris, having the maximum number in the month of July.

List of Zooplankton species :

Rotifer

Asplanchana spp., *Asplachana intermedia*, *Keratella tropia (with one spine)*, *Keratella spp. Brachionus calyciforous, B. caudatus*, *B.durgae*, *B. bidentata*, *Beauchampiella cudactylotum*, *Filinia spp.*, *Tricocera spp.*

Cladocera

Moina micrura, Moinodaphnia macleayi, Chydorus spheericus, C. faviformis, Ceriodaphnia spp.

Copepoda

Cyclop, Mesocyclops spp.

Ostracoda

Cypris.

References

APHA, 1998. *Standard method for the examination of water and waste water*. American Public Health Association, Washington D.C. : 874.

Annapurna,C. and Chatterje Tapas, 1999. The freshwater ostracodas (crustacea, ostracoda) from Dhanbad, Bihar. ***J. Aqua. Biol.***, 14 (1 & 2):11-15.

Battish, S.K., 1992. *Fresh water zooplankton of India*. Oxford and IBH Publishing Co., New Delhi.

Chandrasekar, S.V.A. and Kodarkar, M.S., 1994. Biodiversity of Zooplankton In Saroornagar Lake, Hyderabad. ***J. Aqua. Biol.,*** 9 (1 & 2):30-33.

Dhanapathi, M.V.S.S.S., 2000.*Taxonomic notes on the rotifers from India* (from 1889- 2000) Pub., Indian Association of Aquatic Biologists (IAAB), Hyderabad., A.P.:178.

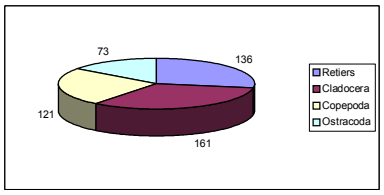
Edmondson, W.T., 1959. *Rotifera In fresh water Biology*. Ed : W.T. Edmondson. John Wiley & Sons, Inc. New York. London:420.

Nayar, C.K.G., 1970. *Studies on the Rotifer Population of the ponds at Pilani, Rajasthan*. J. 2001 Soc. India, 2:21-34.

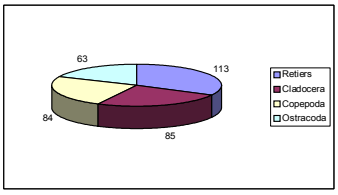
Pawar S.K., V.R. Madlapure and J.S. Pulle, 2003. Study of zooplanktonic community of Sirur dam water, near Mukhed in Nanded district. (M.S.), ***Indian J.Aqua. Biol.,*** 18 (2):37- 40.

Salaskar Promod, 1996. *Environmental Studies of Powai lake*. Ph. D. Thesis submitte to Uninversity of Bombay.

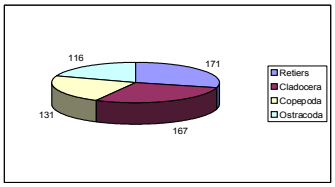
Ward, W.B. and Whipple, G.C., 1992. *Fresh water biology*. W.T.Edmondson edn.



Sampling site S_1



Sampling site S_2



Sampling site S_3

Environment Conservation Journal 8 (3) 91-94, 2007
(ISSN 0972-3099)

Impact of improper disposal of solid waste on ground water quality--A case study

S. C. Gupta and Seema Sambyal
Department of Environmental sciences, University of Jammu, Jammu

Abstract

The present study has been made to evaluate the ground water quality of Samba town of Jammu division of J & K state. The solid waste generated in urban areas is increasing day-by-day. Many municipalities and corporations are facing the problem of managing large volumes of solid waste generated in their area. One of the alternatives for disposal of solid waste is filling the depressions, drains, nallah, open spaces etc. In the persent study, a big nallah flowing through Samba town carries huge load of pollutants in the form of refuse and waste water opens at many places into self-created garbage pits. Ground water monitoring was carried out at two stations around garbage pit to assess the ground water quality of hand pumps used by the residents of the area for domestic and other uses. The study revealed that the quality of ground water, however, confirm to the drinking water quality standards but there is need for periodic evaluation of various water quality parameters as well as adoption of proper water quality management as natural quality of ground water is being degradaed near the garbage pit.

Keywords: *Solid waste, ground water quality, depressions, drains, nallahs, open spaces and samba town.*

Introduction

Due to rapid growth of population, Urbanization and industrialization, there is several fold increase in generation of waste and waste water. Due to improper disposal of solid waste, there is a great threat to the quality of groundwater.

In the present study, a nallah flowing through Samba town, carries huge load of pollutants in the form of waste and waste water. This nallah opens at many places into self-created garbage pits before draining into the river Basantar. In garbage pits, solid waste stays on the top but water percolates deep inside into the surface. Therefore, it is important to monitor the surface and ground water quality parameters. The monitoring programme was planned to measure groundwater quality with the objectives to evaluate, analyze and summarize existing groundwater quality, and to correlate the results of the data with permissible standards for drinking water quality.

Materials and Method

Study Area

The present study has been assess the quality of ground water of Samba town division of J & K stare. The solid waste generated in Samba town is mostly dumped in open land fills in low lying areas, drains, nallah etc. Since there is no sewage treatment plants and recycling facilities in the area, the sewage, and the solid waste is directed in the nallah which flows in the town. For this purpose, two different stations or study sites have been selected – Station –I (hand pump located near the garbage pit) and Station-II (hand pump located at a distance of 300 meters from the garbage pit).

Since the town has developed in an unplanned manner, there is no underground drainage system in the area. Moreover, the nallah opens up at many places into self-created garbage pits. In these pits the solid waste stays at the top and the stored water seeps into soil cover. Once the soil cover is saturated, the infiltered water moves to subsurface water through fissures and joints.

Materials and Method

A total of 6 representative samples were collected fortnightly from the study area during November 2005 to January 2006. The samples were collected from both hand pumps, which are being extensively used for drinking and other domestic purposes. The location of ground water sampling stations (Hand pumps) is shown in fig I.

Both physical and chemical methods was carried out according to Standard Methods (APHA, 1998). The various analyzed parameters include pH, DO, COD, chloride , nitrate, calcium, magnesium and total hardness.

Results and Discussion

For studying the impact of refuse and waste water of the garbage pit on ground water quality, the water quality parameters are presented in Table I. A comparison of ground water quality of the study area with drinking water standards as per as guidelines laid down by WHO (1971) and BIS (1990) is presented in Table II. A critical examination of the tables reveal that quality of water considerably vary from location to location. pH is a measure of intensity of acidity or alkalinity and the concentration of hydrogen ions in water. The pH of the water samples collected around the garbage pit ranged from 6.92 – 8.21, where as the samples are normally acceptable as per guidelines suggested by WHO(1971) and BIS(1990). These findings are in conformity with Murugesan *et al.* (2005), *i.e.* 6.62 -8.07; Mor *et al.* (2003), *i.e.* 7.2 – 8.6; and Aurangabadkar *et al.* (2000), *i.e.* 6.5 – 8.7 who have worked on the levels of ground water pollution in the urban environment.

Dissolved oxygen (DO) measured for all samples ranged between 1.48 – 4.00 ppm and 1.65 – 5.30 ppm at stations I and II, respectively. These values of DO are below 5.00 ppm which clearly indicate pollution which may be due to the contents of decomposable matter in the samples which is more in the watetr samples collected from Station I as compared to those from Station –II. These findings are comparable with the findings of Ravinder *et al* . (2005) whorecorded high DO values from wells situated away from the dump site and low DO values in the nearby wells of Warangal town while studying the impact of municipal solid waste (MSW) on ground water quality of Warangal. The COD values of Stations I and II are between 16.00 – 36.00 ppm and 13.00 – 24.00 ppm, respectively. These COD values illustrate that there is large amount of organic matter present in both the samples. However, it is clear from the study of table I that the COD value decreases with the increase in distance from the garbage pit. These findings are in conformity with Ravinder *et al.* (op.cit) who has recorded similar observation while assessing the ground water quality of Warangal town. The increase in COD value of water sample collected near the Station –I is due to high level of discharge of domestic sewage from nallhas.

Chloride concentration in the water samples collected from the Station-I ranged from 58.03 ppm to 138.00 ppm whereas it ranged from 14.40 ppm to 45.00 ppm in water samples collected at Station-II. Both these concentrations or levels of chloride are well within the permissible limits of WHO (1971) and BIS (1990). But chloride content from the Station-I showed higher content as compared to the Station-II. Therefore, it can be explained on the grounds that as there is regular addition of large quantities of sewage from nearby localities to the garbage pit, it is absorbed by the soil or it is leached into the soil and move with the groundwater. Moreover, food waste also contributes to the chloride content in water.

Sulphate content in the water samples of present study ranged from 17.50 ppm to 42.00 ppm from the Station-I and 1.50 ppm to 18.00 ppm from the Station-II. The higher concentration of sulphate in water samples of Station-I is due to the seepage of pollutants from the waste water which is being regularly added to the garbage pit by the nallah. But both the values of the sulphate are found to be within the prescribed limits of WHO (1971) and BIS (1990). The present values of sulphate content are in agreement with the values recorded by Mor *et al.* (2003) who have tried to work out the pollution status of ground water of Jind city.

Nitrate content in both the samples collected from Stations-I and Station-II ranged from 0.70 ppm to 16.80 ppm and 0.25 ppm to 9.00 ppm respectively. Table II shows that although both the values are within the permissible limits of 45 – 100 ppm as prescribed by BIS (1990), the Station-I values are higher as compared to the Station-II values which may be due to large addition of decayed vegetable and animal matter, sewage sludge, domestic effluents disposal to land, leachates from refuse dumps and atmospheric washout. Similar findings were recorded by Ravinder *et al.* (2005).

Calcium concentrations from Station-I and Station-II ranged 75.00 ppm to 135.82 ppm and 40.10 ppm to 87.37 ppm, respectively and this level/ concentration of Ca^{++} content is found to be within the maximum limit prescribed (75 – 200 ppm) by the Indian Standards (1990) but above (75 ppm) WHO (1971) standards. Again Ca^{++} content is high in the water sample collected from the Station-I which is due to fact that domestic waste water contributes ions to the groundwater. Magnesium concentration in the ground water samples collected from Stations-I and Stations-II ranged from 23.16 ppm to 38.50 ppm and 7.30 to 25.30 ppm, respectively and is well within the prescribed limits of WHO (1971) and BIS (1990). Hardness values ranged from 292.00 ppm to 459.67 ppm and 130.00 ppm to 291.32 ppm in water samples collected from Stations-I and II, respectively.

These values of Ca++, Mg++ and total hardness agree with the values recorded by Mor *et al.* (2003), while assessing the pollution status of groundwater due to landfills and septic tanks in Jind city of Haryana. Ca++ and Mg++ ions in greater quantities may be present in ground water either by leaching of soil deposits or through seepage from domestic waste water. The hard water causes ill-effects on digestive system and moreover, the possibilities of forming Ca++ oxalate crystals (leading to stone formations) in the urinary tracts.

Conclusion

From the above results, it is concluded that the groundwater of Samba town is not highly contaminated but there is an indication of increasing pollution due to discharge of sewage, solid waste in domestic waste water, sewage into river, nallah and other land sites which percolates into the ground and is thus responsible for groundwater pollution. Hence, there is an urgent need to take immediate necessary steps for the protection of this valuable natural resource in Samba town.

Acknowledgements

The authors are highly thankful to the Department of Environmental Science, University of Jammu, Jammu for providing necessary facilities in the department to undertake the present investigatio.

References

APHA, AWWA, WEF, 1998. *Standard methods for the Examination of Water and Waste water treatment* (20th ed.). American Public Health Association, Washington DC.

Aurangabadkar, K.K. Swaminath, S. Sandhya, T.S. Uma, N. Jyotikumar and R. Parammasivam, 2000. Ground Water Quality around a Municipal Solid Waste Dumpsite at Chennai, India. ***J. Environ. Prot*.,** 24 (94):323-327.

BIS, 1990. *Drinkng Water specification*. IS 10500. Bureau of Indian Sandards, New Delhi.

Mor, S., M.S. Bishnoi and N.R. Bishnoi, 2003. Assessment of groundwater quality of Jind city. ***Indian J. Environ. Prot.,*** 23 (6):673-679.

Murugesan, A., A. Ramu and N. Kanan, 2005. Characterization of ground water quality in Madurai region. ***Indian J. Environ. Prot.,*** 25 (10):885-892.

Ravinder, V., Ch. Ravinder and K. Vijaya Rao, 2005. Ground Water Pollution due to dumping of Muncipal Solid Waste at Warangal. ***Indian. J. Environ. Protec*.,** 25 (6):523-526.

WHO, 1971. *International standard for drinking water* (3rd edn.).World Health Organization, Geneva.

Environment Conservation Journal 8 (3) 95-97, 2007
(ISSN 0972-3099)

Production of Stoving paints and their testing

Unnati Vishnoi
Chemistry Department K.L.D.A.V. (P.G.) College, Roorkee

Abstract

Stoving paint is used in refrigerators, fans, scooters etc. This paint doesn't break because of high temperature. The stoving paint is prepared by the ball mill. After manufacturing, this paint is tested for flexibility and adhesion, hardness, resistance of acid and alkali, consistency and its volatile matter.

Introduction

The paint which are baked at 120 °C – 140 °C are called as stoving agents. These paints doesn't get hard on oxidation. It is used in refrigerators, fans, scooters etc. Marshall *et al.* (1988) revealed that a range of commercial stoving alkyd paints based on urea formaldehyde and melamine formaldehyde have been investigated using solid state N.M.R. technique.

Beck and Kruger (1996) say that cathodic deposition of paint is industrially exploited for the application of the polymer primer to metal mass ware surface. EIS was systematically employed for the first time for the characterization of the wet paint film prior to stoving on Al and Fe. Surface treatments as Zinc Phosphotation are also of some influence on the EIS results.

Benzer (2004) studied a raw material grinding circuit was modeled using plant data. Samples were collected from around the circuit and following a crash stop, from inside the mill. The size distributions of the samples were determined down to few microns. Using the data from inside the mill a modeling approach, based on perfect mixing, was developed. Chibwanand and Moys (2006) study the poor mixing in dry ball mills which can lead to insufficient presentation of find particle to the classifying air, over grinding of particles and wastage of energy in a ball mill. A video capture method has been used to study radial mixing kinetics in a dry bath ball mill. Experiments were conducted in a ball mill with PVC plastic powders being used as particles so that the effect of size reduction could be neglected.

Lameck *et al.* (2006), investigated the effects of three media shapes (cylpebs, spherical and worn ball) on load behaviour and mill power draw at various mill speeds and load filling. An inductive proximity probe was used to determine the load orientation of the grinding media charge while a load beam enabled measurement of power draw.

Materials and Method

Generally many ingredients are used in the preparation of stoving agents. These ingredients and their percentage are given in Table – I.

Generally Ball Mill is used for the preparation of stoving paint. It is a old technology and it takes 24 hours in grinding. It consist of a cylindrical drum lying on its side and provided with means by which it may be rotated. The drum rotates the balls are carried up the one side, rolling in relation to each other and then cascading downwards. Grinding is achieved partially by fraction between the balls and the walls of the drum, and partly by using crusting action which occurs during cascading.

Table – I. Ingredients their functions and percentage –

Ingredients	Functions	Percentage
Titanium Dioxide [TiO_2]	Pigment	18%
Zinc Ocatate	Dispersing agent	0.5%
Nill set	Antecetalic	0.1%
Coconut oil alkide	Binder	8%
Xylene	Thinner	4%
Coconut oil alkide	Binder	10%
Xylene	Thinner	5%
Coconut oil alkide	Binder	32%

The factors which affects the efficiency of a ball mill is of greatest importance and are as follows-

a. The rate of rotation.
b. The size, quantity and nature of the balls.
c. The amount and consistency of the material to the milled.

The balls may be made of a variety of materials the most usual being flint, porcelain, aluminium oxide or steel. The flint balls are not, strictly speaking, balls, but are natural most or less spherical pebbles which are collected from various, coats and sorted into suitable size ranges. The various types of balls are: -

Porcelain	2-3	flint, French	0.3-0.5
Granite	0.5-1	flint, Danish	0.2-0.3
Steel, High Carbon	0.3-0.7 steels	Chrome- manganese	0.1-0.3

The size of the balls may vary within wide limits, depending on their density, the size of the mill and so on. After preparing the stoving paint , we used this paint for their testing to that the prepare paint is good or not. For this purpose following parameters are analysed these are – consistency, flexibility & adhesion, Hardness, Resistance of alkali, Volatile matter.

Results and Discussion

In the present parameters consistency is measured by flow cup method, the paint are free flowing and take 80 seconds,(Table-2).

In flexibility & adhesion the painted panel is bent through 180^0 after specified drying period with the paint film outside in an apparatus and examined for any damage , detachment or cracking of the film, otherwise damage was not found after 48 hrs. The fill for protection was made from Al and Fe by Beck and Kruger(1996). Hardness is resistance to scratching under a specified load , of a dried film of the paint. The sample is passing the load of 2 Kg. which is according to the standard value.

In the resistance of acid or alkali, the colour is not vary more than slightly from that of untested portion of the test panel.

The volatile matter was found (51.40%) which was suitable match with the standard (50.0%$\pm$2), as also observed by Marshall *et al.* (1988). It is concluded that the sample is suitable matched with the standard.

Conclusion

The stoving paint after manufacturing has been tested, conducting various parameters. In which consistency is free flowing, flexibility & Adhesion is dry after 48 hrs. Hardness is passing the load of 2 kg., Resistance of acid and alkali has shown not more colour change from that of untested portion of the test panel and the volatile matter conduct 51.40% which are all according to the standard result, so we can conclude that paint is good and it impact the different environmental condition according to the values.

Table – 2 Showing Results in Various Parameters:-

S.No.	Parameters	Findings
1.	Consistency	free flowing after 80 Seconds
2.	Flexibility & Adhesion	Dry after 48hrs.
3.	Hardness	No cracking after passing 2 kg load
4.	Resistance of acid & alkali	colour will not very more than Slightly from the untested portion.
5.	Volatile matter	51.4%

References

Beck, F. and Kruger, U.A., 1996. Eis of cathodically deposited wet paint films prior to the stoving process. ***Electrochemica,*** 41(7/8):1083-1092.

Benzer, Hakan, 2005. Modelling and simulation of a fully air swest ball mill in a Raw Material grinding Circuit. ***Power Technology,*** 150:145-154.

Chibman, C. and Moys, 2006. Radial mixing of particles in dry batch ball mill. ***Power Technology***, 163:139-144.

Lameck, N.S., Kangr, K.K.and Moys, M.H., 2006. Effects of grinding media shapes on load behavior and mill power in a dry ball mill. ***Minerals Engineering***, 19:357-1361.

Marshall, G.L., Cuddy, M.E.A., Smith, K. and Harris, R.K., 1988. 13C CP-MAG Solid state n.m.r. spectra of stoving alkyd paints., ***Polymer,*** 29:501-1506.

Environment Conservation Journal 8 (3) 99-105, 2007
(ISSN 0972-3099)

Studies pertaining to environmental degradation caused by Fagla Landslide, Ramban area, Jammu and Kashmir State

Amita Fotedar*, R.K.Verma, B.K.Fotedar*** and Veerji Tikoo******
* Department of Environmental Sciences, Jammu University, Jammu
** G.G.M. Science College, Jammu
*** Modern Academy, Dalpatian, Jammu
****Directorate of Geology and Mining, J & K Government

Abstract

Fagla landslide at a distance of 160 km from Jammu, very near to Ramban area, national highway –IA, is one of the notorious landslides in J & K. Among many other causes, such as deforestation, high relief brittle nature of rocks, the main cause of landslide revealed from field investigation is great water ingress present in the rocks in the form of springs, nallas and water falls. The problem gets compounded during excessive rains – when phyllite salty rocks develop shear joints resulting in breaking apart big rock blocks from the main mass turning in to huge scree material and finally getting accumulated on the road. For mitigation of the slide, proper disposal of run off by digging wells and connecting the same to the horizontals tunnels readily(Tunake model) as applied in kamenose landslide in Japan successfully, is suggested for Fagla landslide, the only strengthened by anchoring at vulnerable ponts, An adequate forest cover in the water shed areas of the landslide site from Rambvan to Anokhi fall together with growing vetiver grass in the whole belt in the northeast are other methods suggested to control the slide successfully.

Keywords: *Mitigation, Fagla landslide, Ramban area, Jammu and Kashmir State*

Introduction

Geological and environmental factors have immense influence on land use. Because of this, the necessity of geotectonic map depicting all aspects of environment is strongly felt for large- scale development planning and programming all over the country. The areas of high energetic relief in various parts of Jammu and Kashmir Himalaya, the land slide aspects of environment atand directly in the way of any development activity. Many engineering structures get greatly affected, if there is no stability of landmasses. Engineers, road builders and repair departments worldwide are busy in studying the rock stability failures and the causes of land slide throughout the world.

The National Highway –IA in J & K is affected by number of slides occurring at number of places (Didwal, 1980, Kachroo asnd Hussain, 1980, Singh, 1991), The active landslide areas exist between Ramban to Banihal. Every year the land slides occur enroute Jammu Srinagar Highway causing accidents, besides the road remaining closed for days together, making Kashmir valley cut off from the other states of India. The effect is great during rains. Heavy rainfall and its associated landslides occur in lesser Himalayan belt of Himalaya. In lesser Himalaya, the major belt constitutes the autochthonous folded belt, the rocks get mostly squeezed and deformed dut to development of new share joints from time to time, as these lie between Murree thrust in the south and Panjal thrust in the north (Janpangi *et al,* 1986). The sheer joints get all the more dilated due to heavy rainfall and finally break apart, resulting in landslides af large magnitude (Greenwood, 1957; Hissain and Katti, 1980; Prasd and Verma, 1980; and Zaruba and Manel, 1969). Due to

great water ingress many a times, large rock masses get detached along deep joints and due to gravity, roll down in the form of land slides along with mud and scree material (Yidbhir, 1980). Although in the form of landslides has been taken up by investigators earlier but still much remains to be done. Fagla landslide, very near to Ramban area, is one of the notorious landslides and the present authors on this paper present detailed report of investigation in respect of this slide and suggest the necessary methods of control for the same.

Fagla landslide lies at 160 km distance from Jammu (Fig.1) near Bichlari nalla and Chenab Rivar confluence point. After crossing Ramban on the highway (151 km from Jammu) at a distance of 4 km on the road , one enters the Fagla lamdslide area near Seri. The fagla village is situated at a height of 1584 m above mean sea level. The debris of the slide includes scree material and mudflows, which are removed from time to time by the BEACONS and other agencies (Fig.2). The Fagla landslide is reached after traversing 5 km from Seri village. It is situated on the sharp bend on the national highway alongside Bichlari nalla flowing from Banihal. Bichlari nalla is the northwest and Chenab River in the southwest have carved deep gorges and from the road these gorgers are visible (Fig.3 and 4). The whole area from Seri to Anokhi fall (Fig.5) is a sinking area. The rocks are represented by slate/phyllite sequence. Towards north, these beds are thin and have an altitude of N20^{o}W,30^{o}E. The sinking area lies in between two nallas along which there is a local fault (Fig.6). In the east near the fault, the strata dips at 77^{o} – 80^{o} E and the rocks are represented by Olive –green phyllites. The whole area is a shooting stone area.

Towards north and northeast of Fagla, there are two forests Digdoul forest in the north and Balhot forest in the east, and through these numerous nallas flow towards the road side. Besides these, many springs and waterfalls occur in this zone. There is abundance of ground water drainage that percolates through phyllites/slates, which are abundantly present as the dominant rock type at Fagla road section (Fig.1). This results in the fracturing of the rocks in the form of big blocks and as such poses a danger for the vehicles that pass through this area. The whole area of Fagla stands at a height; therefore, wind erosion is also maximum in this area. During rainy season, not a single day misses when the scree material will not come to the toe portion of the slide. At times when there is maximum rain, the Bichlari nalla becomes torrential and that time through this narrow road, which is full of debris, the vehicles can hardly pass on such occasions the road remains closed for traffic for days together.

Geological Succession

The Fagla area and its environs have been mapped by a number of workers earlier, namely Bhatia and Bhatia (1973), Sharma *et al.*(1973,1979), Shah, (1980), Didwal (1980), Janpangi *et al,*(1986), Razdan and Dhir (1989). The revised geological succession of the area and the area to the northeast (including Kishtwar) has been studied in detail and geological succession discussed in detail by Raina *et al.* (1990).

The geological succession given by earlier workers and after the field investigation by the present authors, the stratigraphy of the road section is given as follows:

	SALKHALA GROUP	
	——————Panjal Thrust——————	
Sincha Formation	Phyllites, Slates, Quartzites	Late
	Dolomite, Marls and Pebby bands	Precambrian
	——————Unconformity——————	
Ramban Slates	Phyllites, Slates, Quartzites,	Early
	Sand Stone and Pebby bands	Precambrian
	——————Thrust and Local——————	
Baila and Gamir Formations (Undifferentiated)	Carbonaceous slates/phyllites	(?) Precambrian
	Limestone and Quartzite	
	——————Murree Trust——————	

Causes of Fagla Landslide

1. There is enough surface water and sub-surface water that drains the rocks of the slide area, making them cohesion less and hence triggering of slide occurs.

2. In the northeast of Fagla area, threr are number of springs where from oozing of water takes place. One soring occurs at Nunkot and the other at Dandhot. Yhere are also many more springs to the extreme north east and one can observe seepages at many places along with waterlogged spots. During rains these add to the debris that gets accumulated at the toe of the Fagla landslide due to action of more water.

3. The landslide develops from incipient movement caused by the various factors, including the loss of vegetal cover, poor soil strength, steep soil and presence of excessive surface for grazing of cattle and removal of firewood from the top of the soil.

Before giving the methods of the control of Fagla landslide, the following discussion is necessary to review the problems faced with this slide, which are entirely different from that encountered in many other landslides along the National Highway –IA between Jammu to Banihal, J & K State.

Discussion

A furious nalla named as Bichlari nalla in a gorge section below, from the base of which raise of retaining walls up to the road is very difficult. This means that toe cutting in case of fagla landslide is dangerous to think of. The slope of the landslide is exceptionally vertical and the road for vehicular traffic is narrow without having any provision for widening the same by toe cutting.

The third problem is about large ingress of water from varios nallas, springs and waterfalls that flow through the rocks in Fagla area. Unless a permanent solution to take huge run off out from the slide area beyond the land slide site, the rocks would continue to slide and mass wastage would never get minimized.

Besides the nallas, there occur many falls usually having a fall of 30m or 40m) percolate through the slide area and thus slope failure results. The rocks at Fagla zone are phyllitic in composition and phyllites are friable than other hard rocks. Thus large ingress of water becomes an active agent to disintegrate the phyllitic rocks, which usually roll down in big blocks and come down on the road. After the debris gets mixed with water due to force of gravity slides downwards and spread itself at the toe portion of the slide. (Hussain and Kitti , 1980; Prasad and Verma, 1980; Singer and Munn, 1987 and Singh, 1991).

The watershed area of Fagla zone is devoid of any forest cover and hence this can be one of the main causes that rocks lose stability. During the preceding decades, there has been unrestrained commercial exploitation of forests by several unscrupulous elements from the Himalayan slopes, resulting in denudation. The bared hill slopes not only present an ugly sight, but also led to soil erosion, frequent landslides, lowering of water table, decrease in rain and snowfall and related climatic changes in the region. Application of the mindset on the problems reveals that forests are important source from which soil underneath maintain soil fertility and also minimize the wastage of the nutrient rich soil to get washed off from vegetational farmyards. Forests are considered to regulate the environmental quality and hence it would be a positive step in this direction to conserve them (Chada 1990 and Aggarwal 1992). The pressure on forests because of human activities such as construction of roads and dams accompanying with mega projects are more severe than the direct influence from submergence.

Forests are closely linked to the life style of the hill prople. Unfortunately, the people have not learnt as yet how much loss is caused due to (Kulhari) axing of forests. It is an immense material loss to the economy of the state. Not withstanding the commendable efforts made by the project BEACON and other agencies, landslide problem along the highway and other surrounding areas has still now eluded a lasting solution and the main cause of it is the deforestation which is mainly occurring in almost all the hilly areas of Jammu and Kashmir State. Thus cutting of forests is the main cause at the grass root level which is responsible for the destruction of the crops on one hand, and landslides on the other hand.

Method of Control

The combination of following methods is suggested for the control of fagla landslide:-

1. The model of Japan is suggested by Tunake (1993) for Kamenose landslide area in Japan is applicable for better control of fagla landslide.

   Drainage tunnels may be taken right from Anokhi water fall. The drainage wells are required to be drilled 3.5 meters in diameter radially here in the run off water would get collected from the upper regions. From these wells horizontal holes 6.6cm in diameter should be made so as to drain water to drainage tunnels which through walls are connected to main central trunk drainage. This central drainage needs further to be bored in the landslide layer below the slip surface. The defector canals then finally take the drainage off the site of the landslide and would thus be made to fall in the Bichlari nalla flowing below the road almost parallel to it (as shown in Fig. 1) of the location map. This method will be best to control the large ingess of water in the fagla landslide area and also suited to the

topographic conditions existing.

2. Resatraining structures, shaft work at vulnerable points in the crown portion of the slide is also needed. Reinforced earth in the crown portion of the slide is alsosuggested to be taken in hand where there are sufficient joints present and the areas where water logging exists.

3. Anchoring at vulnerable points in the crown portions of the slide also would be best suited on the lines suggested by Zaruba and Manel (1969), Hobest and Zojic (1983), Chowdhury (1980).

4. As far as vegetation is concerned, trees with long roots as suggested by Natarajan and Gupta (1980) in the watershed areas will best serve the purpose to control the slide. Moreover, recently vetiver technology is becoming very popular in checking mass wastage in many parts of Himalaya (Lavania, 2000, 2004). Vetiver grass should be grown abundantly in the whole belt from Ramban to Anokhi fall area. It will bind the soil together and will prove helpful in controlling erosion, mass wastage and also contamination in waters (Tikoo, 2004; Fotedar , 2006).

5. There exist presently small breast walls which are incapable of arresting the slide material coming from the crown portion of the slide (Fig.7). The breast walls may be constructed on sound foundation having weep holes and raised to a reasonable height capable of checking the scree material rolling down from the face of the slide.

Acknowledgements

The authors are thankful to the Head of the department of Geology and that of Environmental Science, University of Jammu in providing space in their Department for completing this assignment. Also the authors are gratefully thankful to them for providing all types of field equipments needed by the authors for completing the field investigations.

References

Aggarwal, A. 1992. *The price of forests*. Centre for Science and Environment, Ne Delhi: 364

Bhatia, T.R. and Bhatia, S.K., 1973. *Sedimentology of the slate belt of Ramban, Banihaal area, Kashmir Himalaya.* Him. Geol., Wadia Institute of Himalayan Geology, New Delhi: 116-134.

Chanda, S.K., 1990. *Deforestation in the Himalaya*. Jullunder cooperative printing pres: 1-5.

Chowdhury, R.N., 1980. Recent progress in evaluation and control of landslides. ISL. Proc. Vol. IP I"V/14: 313-318.

Didwal, R.S., 1980. Occurrence of landslides in Jammu Province. J&K, and their control. ISL. Proc. V, IP 1/8: 37-40.

Fotedar, A., 2006. Ecology of Sewa river and its catchment. Unpublished Ph.D. thesi of Jammu University.

Greenwood, G., 1957. *Rain and Rivers*. Lengman's Green and Co. LTD. London: 53-74.

Hobst, L. and Zojic, L., 1983. Anchoring in rock and soil. Elsevier scientific publication, New York, pp: 570.

Hussain, B., and Katti, R.K., 1990. Behaviour of soil rock mixtures in sheara and compression. ISL, Proc. V.I.P. 11/3: 113-117.

Janpangi, B.S., Kumar, G., Rathore, D.R. and Datta, S., 1986. "Geology of autochthonous folded belt", Jammu and Kashmir Homalaya with special reference to Panjal thrust. Pal. Soc. Ind.: 39-51.

Kachroo, P.N. and Hussain, B., 1980. Genesis and analysis of Nashri slide. ISL. Proc. V.I.P. 111/7: 207-213.

Lavania, U.C., 2000. Vetiver grass technology for environmental protection and sustainable development. ***Curr. Sci.,*** 9:1-32.

Lavania, U.C., 2004. Vetiver sytem eco-technology for want of quality improvement and enhancement. ***Curr. Sci.,*** 86:11-14.

Nataranjan, T.K. and Gupta, S.C., 1980. Techniques of erosion control for surficial landslides. ISL, Proc. V.I.P. 4/7:413-417.

Prasad,C. and Verma, V.K., 1980. Slope failures: A case in the catchment areas of Alakuanda and Bhagirathi rivers, Farhwal Himalaya India, ISL. Proc. V.I.P., 1/9: 41-45.

Raina, B.K., Gupta, B.K., Sharma, B.L.M., Wangu, A. and Dhiman, L.C., 1990. A review of stratigraphy and structure of part of Kashmir basin in Banihal-Ramban-Desa-Chatru, belt Doda district, Jammu and Kashmir, Ind. ***Journ. Pal. Soc. Ind.,*** 35:77-89.

Razdan, M.L. and Dhir, N.K., 1989. Geology along the national highway IA between Batote and Kazigund, J&K state. ***J. Geol, Soc. Ind.,*** 35:70-81.

Shah, S.K., 1980. *Stratigraphy and tectonic setting of the lesser Himalayan belt of Jammu*. Stratigraphy and correlation of lesser Himalayan formation, Hindustan publishing corporation, New Delhi, India.

Sharma, VP, Verma, S.N. and Sharma, A.R., 1973. Systematic geological mapping Ramban-Banihal region, Doda district, Jammu and Kashmir state. Geol. Soc. Ind. field season, 1973-1974.

Sharma, VP, Verma, S.N. and Sharma, A.R., 1979. Stratigraphy and structure of Ramban-Banihal- Gulabgarh-Budil sectors of Pir Panjal Range, Jammu and Kashmir state. Him. Geol. Sem. N. Delhi, 1976. Misc. Publ. 41(1).

Singer and Munn, 1987, n Brabb, E.E. and Harold, B.L., 1989. Extent and economic significance of land slides. Balkema, Rotterdam. ISBN 9661918766:385.

Singh, A., 1991. Preliminary report on the geological investigation of landslide in Lander-Bhamag Area, Udhampur Distt. UN. Publ. Report of directorate of geology and mining, J&K state,pp-15.

Tikoo, Veerji, 2004. Geological aspects of environmental degradation along the national highway-IA, between Jammu and Banihal, Kashmir state. Unpublished thesis Jammu University.

Tunake, Rosoke, 1993. Planning and implementation of landslide control in Japan-A case study of Kamenese landslide area. ***Journ. of Hydroscience and Hydraulic Engineering,*** 5(1-4):182-188.

Verma, V.K., 1980. Some geomorphological aspects of landslide ISL. (International Seminar landslides), New Delhi. Proc. 5:73-75.

Yudbir, K., 1980. Field studies relating to natural slopes toe and cutting. ISL. Proc. 2:13-22.

Zaruba, Q. and Manel, V., 1969. Landslides and their control. Elsevier and Akudemia, Prague, p.205.

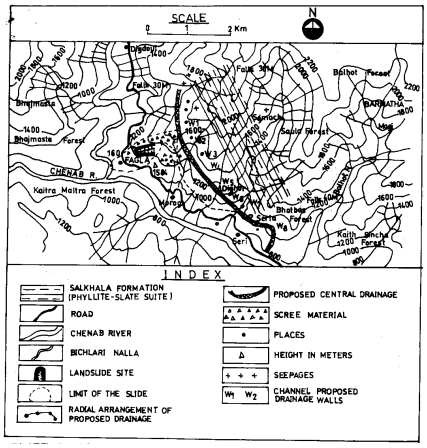


Fig.1: Location map showing Falgla landslide

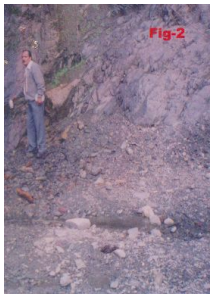


Fig.2: BEACONS

Fig. 3 & 4: Showing gorgers along Bichlari nalla

Fig. 5: Anokhi fall

Fig. 6: Siniking area along which visible fault

Fig. 7: Shooting stone area

Environment Conservation Journal 8 (3) 107-110, 2007
(ISSN 0972-3099)

Studies on helminth parasites of fresh water fishes in Nathsagar reservoir, Paithan, Aurangabad district

Nitin Podwal, B.V. Jadhav and D.B. Bhure

Department of Zoology, Dr. B.A.M.U., Aurangabad, (M.S.)

Abstract

Freshwater fishes from Nathsagar reservoir, Paithan, Dist. Aurangabad (M.S.) were collected from June 2004 to May 2006. The 1296 fishes were observed from helminthic infections, out of them 761 fishes (58.71%) were infected with helminth parasites. Thirty six species of helminthes were recovered throughout the investigation i.e. 10 species of the trematodes include the genera *Genarchopsis*, Ozaki, 1925; Orientochreadium, Tubangui, 1931; *Oudhia*, Dayal *et al*. Gupta, 1954; *Phyllodistomum*, Braun, 1899 and *Macrotrema*, Gupta, 1931. 20 species of the cestodes included six genera i.e. *Lytocestus*, Cohn, 1908; Senga, Dollfus, 1934; Shinde, 1968; *Proteocehalus*, Weinlend, 1858; *Gangesia*, Woodland, 1924 and *Silurotaenia*, Nybelin, 1942. And six species of the nematodes included two genera. *Rhabdochona*, Railliet, 1961 and *Camalanus*, Yeh, 1960. The high prevalence (75.69%) occur in summer season where low prevalence (37.5%) in monsoon season. The *Mastacembellus armatus* is highly infected (64.58%) with helminth parasites.

Keywords- *Helminth parasites, prevalence, Nathsagar reservoir, freshwater fishes.*

Introduction

Nathsagar reservoir is one of the major irrigated project in Maharashtra State. It has been constructed across the river Godavari. The catchment area of this dam is 21,750 km^2. Helminth parasites (cestodes, trematodes and nematodes) were collected from Nathsagar reservoir, Paithan. Parasitic infection may occur with man and animals. From the present investigations, the results will be the key for identifying the helminthes and controlling of helminthes infecting fishes.

Material and methods

Freshwater fishes were collected from different sites of Nathsagar dam during June 2004 to May 2006. The helminthes were collected, preserved, processed to a permanent slide and identified under a compound microscope, drawings are made-up with the aid of camera lucida and identified by Prof. B.V. Jadhav. Parasites distribution, host specificity, prevalence of helminthic infections were studied and recorded.

Results and Discussion

There were 1296 fishes of 09 species observed with helminthic infection. 36 species of helminthes were recovered. The ten species of monogenea trematodes were *Genarchopsis piscicola*, *G. ozakii*, *Orientocradium dayali*, *p. Phillppai*, *O. clariae*, *O. mahendrai*, *O. vermai*, *Oudhia horai*, *Phyllodistomum singhiai* and *Macrotrema macroni.* The twenty species of cestodes were *Lytocestus indicus*, *L. clarie*, *L. teranesnsis*, *L. bartrachusae*, *Senga maharashtrii*, *S. mohekarae*, *S. gachuae*, *S. paithanesis*, *Circumnobothrium aurangabadensis*, *C. alii*, *C. yamaguti*, *C. ophiocephali*, *C. khami*, *Proteocephalus vitellaris*, *P. gobiorum*, *gangeshia maharashtrii*, *G. dharurensis*, *G. mastacemali*, *Silurotaenia macroni* and *S. godavari*. Six species of nematodes were *Rhobdochona singhi*, *R. Mazeedi*, *R. alii*, *R. sailuensis*,

Camallanus anafantis and C. unispicutus. All worms of present investigation are shown in Table 1 with hosts.

Prevalence- The prevalence results are shown in Table-2. The higher prevalence occur in summer season (75.69%) followed by winter season (62.96%) and rainy season (37.5%). Because high temperature & sufficient moisture needed for the development of parasites. The higher incidence occur in host *Mastacembellus armatus* (64.58%), where as lower in *Wallago attu* (57.38%). Because these infections are host specific & morphological, physiological and ecological factors affect the host specificity. The valuable information pertaining to the influence of season on the helminth parasites was contributed by served workers like Tornquist (1931) who described about the systematic method of occurrence of certain fish parasites *Camallanus lacustrs* that the infective stages invade the host during summer, the growth and maturation take place during autumn & winter and release of their infective progeny occurs during summer. According to Gibbons (1976), heavier incidence of nematodes occurs during late spring or summer month. Kennedy (1968) reported that the temperature is the major factor in controlling the seasonal distribution of many parasites.

The present investigations also occur such type of results i.e. high infection as well as prevalence occur in summer months. The population investigations can prove data for the prediction of integrated methods to achieve the regulation of number of harmful parasites, because it has been stated that a single method of control or co-ordination acitivities are of little value since they ameliorate the infection (Kennedy, 1975 and 1978). This type of result indicates the morphological, physiological and ecological factor (seasons) affecting the distribution of parasites.

Acknowledgements

The authors are sincerely acknowledge, to the UGC, New Delhi for sanctioning the major research project no-30-193/2004 (SR), dated 10-11-2004 for financial assistance.

References

Anderson, R.M., 1976. Seasonal variation in the population dynamics of *Caryophyllacus laticeps*. ***Parasitology***, 72:281-395.

Dobson, A.P. and Roberts, M.G., 1999. The population dynamics of parasite helminthic communities. ***Parasitology***, 102 (supl.):507-510.

Gupta, 1951. On a new trematode *Phyllodistomium singhii* sp. of the subfamily, Allocreadinae Looss. 1899 from the intestine of a fresh water fish *Mastacembellus armatus*. ***Ind. J. Helm***., 3(1):21-28.

Hiware, C.J., 1999. Population dynamics of the Coryophylloeid cestode parasitizing freshwater air breathing predatory fish *Clarias batrachus* (Linnacus). *Ravi. Di. Para*, vol. XIX (LXIII) IV-I.

Kenndy, C.R., 1976. Ecological aspects of parasitology. North Holland Publishing company. Amsterdam Oxford.

Lawrence, J.L., 1970. Effect of season, host age, on endohelminthes of *Catastomus commersoni*. ***J. Para.***, 56(3):567-571.

Jadhav, B.V., Bhure, D.B. and Nitin Padwal, 2005. *A survey of cestode parasites of freshwater fishes from Pune and Ahmednagar district (M.S.)* India. Proc. Recent Trends in Para. At Secunderebad 29th-30th sept 2005:48-51.

Wongsawad *et al.*, 2004. Helminths of vertebrates in Mae-sa-stream. Chiangmai, Thailand. ***Southeast Asian J. Trop. Med. Publ. Health,*** 35(suppl):140-146.

Table-1: Helminths and their fish host

Helminths	Hosts
Trematoda	
1. *Genarchopsis piscicoal* (Srivastava, 1933)	*Channa punctus*
2. G. ozakii (Bashirullah et.al.1972)	*Channa punctus*
3. *Orientocreodiium dayali* (Dayal, 1949)	*Channa punctus*
4. *O. philippai* (Gupta, 1957)	*Channa punctus*
5. *O. clariae* (Chatterji, 1933)	*Clarias fatrachus*
6. *O. mahendrai* (Gupta, 1951)	*Clarias batrachus*
7. *O. vermai* (Gupta,1951)	*Clarias batrachus*
8. *Oudhia horai* (Dayal et. Gupta, 1951)	*Heteropneustes fossilis*
9. *Phyllodistomum singhiai* (Gupta, 1951)	*Mastacembellus armatus*
10. *Macrotrema macroin* (Gupta, 1951)	*Macronus cavasius*
Cestoda	
11. *Lytocestus indicus* (Moghe, 1925)	*Clarias batrachus*
12. *L. clarias* (Tandon *et al.,* 2005)	*Clarias batrachus*
13. *L. teranaensis* (Kadam *et al.,* 1999)	*Clarias batrachus*
14. *L. batruchusae* (Pawar *et al.,* 2002)	*Clarias batrachus*
15. *Senga maharashtyrii* (Jadhav *et al.,* 1991)	*Mastacembellus armatus*
16. *S. mohekarae* (Tat *et al.,*1997)	*Mastacembellus armatus*
17. *S. gachuae* (Jadhav *et al.,* 1991)	*Mastacembellus armatus*
18. *S. paithanensis* (Kadam *et al.,*1981)	*Mastacembellus armatus*
19. *Circumonobothrium aurangabadenis* (Jadhav *et al.,*1979)	*Mastacembellus armatus*
20. *C.yamaguti* (Jadhav *et al.,* 1990)	*Mastacembellus armatus*
21. *C. ophiocephali* (Shinde, 1968)	*Mastacembellus armatus*
22. *C. atii* (Shinde *et al.,*1994)	*Mastacembellus armatus*
23. *C. Khami,* (Shinde, 1977)	*Mastacembekkus armatus*
24. *Proteocephalus vitellaris* (Verma, 1929)	*Mystus seanghala*
25. *P. gobiorum* (Dogell *et al.,* 1939)	*Mystus seanghala*
26. *Gangesia maharashtrii* (Jadhav *et al.,*1995)	*Wallago attu*
27. *G. dharurensis* (Jadhav *et al.,* 1997)	*Wallago attu*
28. *G. mastacembali* (Wankhede, 2004)	*Wallago attu*
29. *silurotaenia macroni* (Shinde *et al.,* 1984)	*Mystus seenghala*
30. *S. gondavari* (Wankhede *et al.,* 2002)	*Mystus seenghala*
Nematoda	
31. *Rhabdochona singhi* (Ali, 1956)	*Labeo rohita*
32. *R. mazeedi* (Parsad *et al.,*1965)	*Labeo rohita*
33. *R. alii* (Kalyankar, 1972)	*Labeo rohita*
34. *R. sailuensis* (Khadap *et al.,* 2004)	*Labeo rohita*
35. *Camalanus anabantis* (Pearse, 1933)	*Channa gachua*
36. *C. unlspictus* (Khera, 1956)	*Channa gachua*

Table 2- Total number and total prevalence (%) of infected fishes in Nathsagar Reserooir, Paithan.

Name of Host	No.of Host dissected				No. of host infected				Prevalence(%)			
	M	W	S	T	M	W	S	T	M	W	S	T
Channa punctatas	48	48	48	144	18	26	34	78	37.30	54.16	70.83	54.86
Heteropneustus fossiliss	48	48	48	144	17	28	37	82	37.41	58.33	77.08	56.94
Mastacembellus armatus	48	48	48	144	20	33	40	93	41.66	68.75	83.33	64.58
Clarisa batrachus	48	48	48	144	20	37	35	92	41.66	77.68	72.91	63.88
Macronus cavasius	48	48	48	144	19	34	39	92	93.58	70.83	81.25	63.88
Wallago attu	48	48	48	144	16	24	34	74	33.33	50.00	70.83	51.38
labeo rohita	48	48	48	144	17	29	36	82	35.41	60.41	75.00	56.94
Mystus seenghala	48	48	48	144	18	31	35	84	37.50	64.58	72.91	58.33
Channa gachua	48	48	48	144	17	30	37	84	35.41	62.25	58.33	58.33
Total	432	432	432	1296	162	272	327	761	37.5	62.96	75.69	58.79

M- Monsoon season ,W- Winter season, S- Summer season, T- Total.

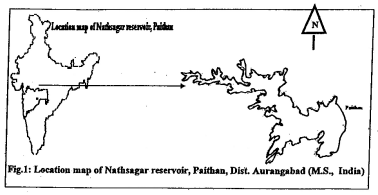
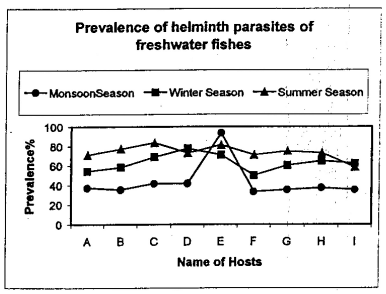


Fig.1: Location map of Nathsagar reservoir, Paithan, Dist. Aurangabad (M.S., India)



A. Channa punctatus B. Heteropneustus fossilis C. Mastacembellus armatus D. Clarias batrachus E. Macronus cavasius F. Wallago attu G. Labeo rohita H. Mystus seenghala I. Channa gachua.

Environment Conservation Journal 8 (3) 111-115, 2007
(ISSN 0972-3099)

Antibacterial activity of *Abutilon indicum Linn.*

Amit Kumar*, Navneet, Sanjay and Prabhat
Department of Botany & Microbiology, Gurukul Kangri University, Haridwar.
* Regional Drug testing laboratory, Chandigarh
Ministry of health and family welfare, Govt. of India.

Abstract

The *in vitro* antibacterial activity of leaves, stems, roots and seeds of *Abutilon indicum* Linn. have been investigated against human pathogenic bacteria i.e. *Klebseilla pneumoniae*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Streptococcus mutans*, *Bacillus megnetherium* and *Escherichia coli* . The ethanolic extract showed the maximum antibacterial activity followed by petroleum ether and aqueous against all pathogens.

Introduction

Plants have a great potential for producing new drugs of great benefit to mankind. There are many approaches to the search for new biologically active principles. Many efforts have been done to new discover new antibacterial compounds from various kinds of sources such as soil, microorganisms, animals and plants, one of such resources is folk medicine and systematic screening of them may results in the discovery of novel effective compounds (Parekh and Chanda,, 2006).The microbes are slowly becomes resistant to drugs and some genetic changes take place in these microbes in course of time. The resistant strains are continuously appearing, imposing the need for a permanent search and development of new drugs, there is a need to develop an alternative to these drugs for the treatment of microbial diseases. Some medicinal herbs represent a rich source of antibacterial activity (Prabhat *et al*, 2005).In present study the *in vitro* antibacterial effect of different parts of *Abutilon indicum* Linn against *Klebsiella pneumoniae, S. aureus*, *B. megnetherium , Escherichia coli* , *S. mutans* and *S. epidermidis* have been studied.

Material and Methods

The different parts (leaves, stems, roots, seeds) of medicinal plant *Abutilon indicum* Linn. were collected from the local areas of Meerut and were identified by Botanical Survey of India (BSI), Dehradun. All parts of the plant were powdered by using grinder and extracted with petroleum ether, ethyl alcohol and water and the obtained extracts were dried by using vacuum rotatory evaporator under reduced pressure.

Test Organisms

Staphylococcus aureus MTCC 1144, *Staphylococcus epidermidis* MTCC 435, *Streptococcus mutans* MTCC 890, *Bacillus megnetherium* MTCC 453, *Escherichia coli* MTCC 433 and *Klebsiella pneumoniae* MTCC 109 were used.

Antimicrobial assay

Antimicrobial study was carried out by cup plate method (Prabhat *et al* 2005). The medium used for assay was Muller Hinton Agar media (Hi media No. 173). The fresh culture of each organism was prepared by inoculating a loopful growth from respective media.105 CFU/ml of culture was mixed in Muller Hinton agar. well of 6mm diameter were punched into agar with sterilized cork borer and each well was filled with 45

micro liter(100mg/ml) of plant extracts, solvents for blank and antibiotic (Ampicillin 100mg/ml) for positive control. The plates were incubated at 37 °C for 24 hrs .After incubation, a clear zone of inhibition was formed around the disc. Measure it with the help of zone reader. The average zone of inhibitions were noted. The zone includes the size of cup (6mm) and % of potency was calculated from the mean values as (Reyes chilpa *et al* 1997).

$$\text{Percentage of potency} = \frac{C - T}{C} \times 100$$

Where, C= positive control, T= Test

Results and Discussion

Results of antibacterial activities of the isolated materials obtained through petroleum ether, ethanol and water are summarized in Table 1-4. *Abutilon indicum* has an important place in the Indian system of medicine and the most parts of the plant are used therapeutically (Ahmad *et al* 1999). The different parts i.e. (leaves, stems, roots and seeds) were extracted in petroleum ether, ethyl alcohol and water. Most of the extracts showed prominent antibacterial activity against microorganisms i.e. *S. aureus*, *S. epidermidis*, *K. pneumoniae*, *B. megnetherium*, *S. mutans* and *E. coli*, at the concentration of 100mg/ml. as given in Table (1-4). The ethanolic extract showed the maximum activity followed by petroleum ether and water against all pathogens. The petroleum ether extract of leaves is highly active against *S. aureus* followed by , *S. epidermidis, B. megnetherium* and *E. coli*, as compared to other solvents. The percentage of potency of leaves extract against all bacteria in comparison to antibiotic was maximum in ethanol followed by petroleum ether and water.

The petroleum ether extract of stem is highly active against *S. aureus*, followed by *S. epidermidis, K. pneumoniae*, *E. coli, S. mutans* and *B. megnetherium* as compared to other solvents. The percentage of potency of stem extract in comparison to antibiotic was much in petroleum ether and followed by water and ethyl alcohol. The root extracts of plant *Abutilon indicum* is highly active against *S. epidermidis* followed by *K. pneumoniae, S. aureus, B. megnetherium* and *S .mutans* .The percentage of potency of petroleum ether extract of roots is maximum and followed by water and ethyl alcohol. The water extract of seeds of *A. indicum* is highly active against *K. pneumoniae* followed by *S. aureus* and *B. megnetherium*.

The crude extracts (100mg/ml) of each part were used for determination of their potency against pathogens as compared with antibiotic (100mg/ml).The extracts based on inhibition zone diameter has described as low (12-18 mm) moderate (19-22 mm) and strong activity (23-38 mm) (Ahmad *et al* , 1999). In our study all parts of plant showed low to moderate activity against pathogens. The ethanolic extract is highly effective against pathogens because more organic compounds were leached in this solvent. Although water is reported by the traditional healers and herbalists to be the most commonly used solvent for extracting the active compound due to its easy availability. Screening of medicinal plants to detect antimicrobial activity has clearly demonstrated that alcohol is better solvent as compared to water and petroleum ether.

The various parts of *Abutilon indicum* were tested for their antimicrobial activity against large number of bacteria (*S. aureus, S. epidermidis, K. pneumoniae, B. megnetherium, S .mutans* and *E. coli*. The water

extracts of leaves were devoid of any antibacterial activity against *K. pneumoniae*, *E. coli* and *B. cereus* etc., but in our study it was active against both gram positive and gram negative bacteria. The above results showed antibacterial activity of this plant and are correlated with the traditional uses of this plant in ayurvedic system of medicine. Further work is required before they can be recommended as therapeutic agent. Our result shows that, the petroleum ether extract is highly active against *S .aureus, B. megnetherium* and *E. coli.* The chemical analysis of petroleum ether extract from roots of the plant showed the presence of caprylic, palmitic, myristic and oleic acid. Geta *et. al.* 1983 also reported that essential oils obtained from *A. indicum* exhibited antibacterial activity against *B. subtilis, P. vulgaris* while it is inactive against *S. pullorum, S. typhimurium* and *Klebsiella spp.*

Aqueous extract of the plant parts i.e. leaves stems, roots and seeds showed antibacterial activity against *S. epidermidis, B. megnetherium* followed by *S. aureus, K. pneumoniae, S .mutans* and *E. coli.* The water extract contain carbohydrates, amino acids, saponins and flavanoids. They have been found *in vitro* to be effective antimicrobial substances. This activity is probably due to their ability to complex with extracellular and soluble proteins and to complex with bacterial cell wall for quinones. More liphophilic flavanoids may also disrupt microbial membranes (Tsuchiya *et al.* 1996). Naqvi *et al.* 1991 found that aqueous extract of the plant at concentration of 5 to 10 mg/ml showed activity against *S. aureus, S. viridans, C. diphtheria E. coli, S. typhi, S. paratyphi A* and *B., S. flexneri* .Valsraj *et al.* (1997) reported that 80% of alcoholic extracts of the roots of *A. indicum* showed no activity against *E. coli, P. aeruginosa, B. subtilis* and *S. aureus.* In our study ethyl alcohol extract showed good activity against *E. coli* and *S. aureus*. The root of the plant was extracted in 95% ethyl alcohol and antimicrobial studies were carried out by cup plate method. The gallic acid was present during chemical analysis of the roots. Sato *et al.* 1995 reported that gallic acid is effective against *S. aureus*.

Mehta *et al*. 1997 while studying ethanolic and acetone extract of the roots exhibited significant antibacterial activity against *E. coli, Proteus* and *P. aeruginosa*. The hexane extract was active against *P .aeruginosa* and *S. aureus.* The chloroform and ethyl acetate extract showed good activity against most of the bacteria. Most of the Ayurvedic practioners use aqueous extracts. This substantiate the view that aqueous extract contain most of the polar and nonpolar compounds i.e. flavonoids, saponins, sugars etc and thus the aqueous extract is antibacterial in action. So, efficacy and toxicity studies remains to be tested before further exploitation of the drug for human treatment.

References

Ahmad, I., Mehmood, Z. and Mohammad, F.,1998. Screening of some Indian medicinal plants for their antimicrobial properties. ***Journal of Ethnopharmacology,*** 62:183-193.

Ahmad, I.Z., Beg, A.Z. and Mehmood, Z., 1999. Antimicrobial potency of selected medicinal plants with special interest in activity against phytopathogenic fungi. ***Indian Vet. Med. Journal,*** 23:299-306.

Geta, A. and Gupta, A.K., 1983. Chemical investigation of essential oil of *Abutilon indicum*. Perfum Flav 18,39.

Mehta, B.K., Negi, R., Kotra, S., and Mall, O.P.,1997. Antimicrobial activity of *Abutilon indicum*. ***Fitotropia,*** 68:273-274.

Naqvi, S.A.H., Khan, M.S.V. and Vohra, S.B.,1991. Antimicrobial, antifungal and anthelmintic investigations on Indian Medicinal Plants. ***Fitotropia,*** 62:221-228.

Parekh, J. and Chanda, S., 2006. In vitro antimicrobial activities of extracts of *Launaea procumbens* Roxb (Labiateae), *Vitis venifera* L (Vitaceae) and *Cyperus rotundus* L (Cyperaceae). ***African Journal of Biomedical research,*** 9:89-93.

Prabhat, Navneet, and Shrikrishna,2005. Antimicrobial activity of apamarga (*A. aspera).* ***indian Academy of Science Letters***, 28 (11-12):379-381.

Prabhat, Navneet, and Shrikrishna, 2005 Antimicrobial activity of *Mimusops elengi* (Bakul). ***Environment Conservation Journal*****.** 6(2) 59-61.

Reyes, C.R., Quiroz, V.R.I., Jiménez, E.M., Navarro, O.A., Cassani, H.J., 1997. Antifungal activity of selected plant secondary metabolites against *Corilus versicolar*. ***Journal of Tropical Forest Products,*** 3:110-113.

Sato, Y., Odetani, H., Syngyouchi, K., Ohtsubo, T., Kihara, M., Shibata, H. and Higuti, T., 1995. Flavones with antibacterial activity and carcinogenic bacteria. ***Journal of Ethnopharmacology,*** 48:161-164.

Tsuchiya, H., Sato, M., Miyazaki, T., Fujiwara, S., Tanigaki, S., Ohyama, M., Tanaka, T., Takase, I. and Namikawa, I., 1996. Comparative study on the antibacterial activity of phytochemical flavonones against methicillin resistant *S.aureus*. ***Journal of Ethnopharmacology,*** 5:27-54.

Valsraj, R., Pushpangadan, P., Smith, U.W., Adserson, A. and Nynan, U. 1997. Antimicrobial screening of selected medicinal plants from India. ***Journal of Ethnopharmacology,*** 58:75-83.

Table1 : The percentage of potency of plant *Abution indicum* leaves extract and antibiotic (ampicillin) against pathogens

S. No	Pathogens	Zone of inhibition (Antibiotic 100 mg/ml/.)			Zone of inhibition (Extra 100 mg/ml.)			% of potency		
		P. Ether	E. Alcohol	Water	P. Ether	E. Alcohol	Water	P. Ether	E. Alcohol	Water
1	*S. aureus*	16	18	19	No Zone	17	16	-	5.55	15.78
2	*S. epidermidis*	17	19	18	9	14	16	47.05	26.31	11.11
3	*K. pneumoniae*	15	17	17	No Zone	13	-	-	23.52	-
4	*B. megnetherium*	16	19	20	10	12	15	37.50	36.84	25.00
5	*S. mutans*	15	18	20	No Zone	12	14	-	33.33	30.00
6	*E. coli*	15	17	20	10	11	13	33.33	35.29	35.00

Table2 : The percentage of potency of plant *Abution indicum* stem extract and antibiotic (ampicillin) against pathogens

S. No	Pathogens	Zone of inhibition (Antibiotic 100 mg/ml/.)			Zone of inhibition (Extra 100 mg/ml.)			% of potency		
		P. Ether	E. Alcohol	Water	P. Ether	E. Alcohol	Water	P. Ether	E. Alcohol	Water
1	*S. aureus*	16	18	19	9	13	14	43.75	27.77	26.31
2	*S. epidermidis*	17	19	18	10	14	13	41.17	26.31	27.77
3	*K. pneumoniae*	15	17	17	10	13	12	33.33	23.52	29.41
4	*B. megnetherium*	16	19	20	11	12	13	31.25	36.84	35.00
5	*S. mutans*	15	18	20	10	11	11	33.33	38.88	45.00
6	*E. coli*	15	17	20	10	12	12	33.33	29.41	40.00

Table3 : The percentage of potency of plant *Abution indicum* roots extract and antibiotic (ampicillin) against pathogens

S. No	Pathogens	Zone of inhibition (Antibiotic 100 mg/ml/.)			Zone of inhibition (Extra 100 mg/ml.)			% of potency		
		P. Ether	E. Alcohol	Water	P. Ether	E. Alcohol	Water	P. Ether	E. Alcohol	Water
1	*S. aureus*	16	18	19	14	15	13	12.50	16.66	31.57
2	*S. epidermidis*	17	19	18	13	17	16	23.52	10.52	11.11
3	*K. pneumoniae*	15	17	17	11	14	13	26.66	17.64	23.52
4	*B. megnetherium*	16	19	20	10	13	15	37.50	31.57	25.00
5	*S. mutans*	15	18	20	11	12	14	26.66	33.33	30.00
6	*E. coli*	15	17	20	10	12	13	33.33	29.41	35.00

Table4 : The percentage of potency of plant *Abution indicum* seeds extract and antibiotic (ampicillin) against pathogens

S. No	Pathogens	Zone of inhibition (Antibiotic 100 mg/ml/.)			Zone of inhibition (Extra 100 mg/ml.)			% of potency		
		P. Ether	E. Alcohol	Water	P. Ether	E. Alcohol	Water	P. Ether	E. Alcohol	Water
1	*S. aureus*	16	18	19	11	14	13	31.25	22.22	31.57
2	*S. epidermidis*	17	19	18	10	15	13	41.17	21.05	27.77
3	*K. pneumoniae*	15	17	17	9	13	15	40.00	23.52	11.76
4	*B. megnetherium*	16	19	20	10	12	13	37.50	36.84	30.00
5	*S. mutans*	15	18	20	10	11	12	33.33	38.88	40.00
6	*E. coli*	15	17	20	11	12	12	26.66	29.41	40.00

*Zone of inhibition mm

Environment Conservation Journal 8 (3) 117-126, 2007
(ISSN 0972-3099)

A study of biotic and abiotic factors of Song River at Dehradun, Uttarakhand

D.R. Khanna, Vikas Singh, R. Bhutiani, Kumar Satish Chandra, Gagan Matta and Dheeraj Kumar
Deptt of Zoology & Environmental Science, Gurukula Kangri Vishwavidyalaya,Haridwar

Abstract

The present study deals with the analysis of physico-chemical parameters of the Song river at Dehradun, Uttarakhand during the pre-autumn, autumn and post-autumn months of 2007. In the present study of the Song river its physico-chemical characteristics viz temperature, velocity, total solids, total suspended solids, total dissolved solids, turbidity, pH, dissolved oxygen, free CO_2, BOD, COD, alkalinity, chlorides, sulphate and identification of fishes were done. The data revealed that 36 species of fishes are present in the Song river of Dehradun, Uttarakhand.

Keywords- *Physico-chemical, abiotic, biotic, Song river, Dehradun.*

Introduction

Through out history water has been considered a natural resource critical to human survival. Human history can infact be written in terms of interactions and interrelations between human and water (Biswas, 1970). Rivers are the most important resources in the world and in India in particular. Unfortunately, the same rivers are being polluted by indiscriminate disposal of sewage and industrial wastes as a plethora of human activities. Even piped water which is available in big cities becomes also mixed with number of impurities causing jaundice, cholera, typhoid and gastroenteritis (Kudesia, 1988). Pollution of a river first affects its chemical quality and then systematically destroys the community disrupting the delicate food web. River pollution has several dimensions; and effective monitoring, and control of river pollution requires the expertise from various disciplines (Trivedy, 1990).

Song River is a spring fed river originated from different small rivulets of the mountainous range of Dhanolti, crossing with Sahastradhara streams flow downward towards Doon valley basins and finally it assimilates into river Ganga at Raiwala. The river Song is located at 30°28' latitude and 78°8' longitude, with which peoples of Raiwala, Doiwala, Chiddarwala, and Lacchiwala are very much attached because this river is the only ultimate source of water for them travelling a total distance of approximately 42.5 Km. It merges into river Ganga at 78°48'27" longitude and 30°2' latitude after crossing Satyanarayana area. Therefore, in the present study of the Song river its physico-chemical characteristics viz- temperature, velocity, total solids, total suspended solids, total dissolved solids, turbidity, pH, dissolved oxygen, free CO_2, BOD, COD, alkalinity, chlorides, sulphate and identification of fishes were done.

Accurate assessment of water quality, whether in relation to the requirements of intended water uses or in order to determine the impacts of an activity on the water resource depends on the results generated by specific monitoring activities which define the physical, chemical and/or biological condition of the resource. Many workers from India and abroad discussed the different aspects of water quality time to time. Khanna (1993) made a study on ecology and pollution of River Ganga at Hardwar. Pandey *et al*. (1993) studied on the physico-chemical quality of water of river Kosi at Purnia. Khanna *et al*. (1999) studied fishes and their

ecology of the river Suswa at Raiwala, Dehradun. Khanna and Singh (2002) published a book on pond fish ecology and economics. Khanna *et al.* (2003) described a study of assessment of water quality of river Ganga in district Bulandshahar of Uttar Pradesh. Kaur and Joshi (2003) described seasonal variation in some physico-chemical parameters of river Ganga. Khanna and Bhutiani (2003) worked on limnological status of Satikund pond at Hardwar. Semwal and Akolkar (2006) had done the water quality assessment of sacred Himalayan Rivers of Uttarakhand. Bhutiani and Khanna (2007) have done ecological study of Suswa River with main reference to BOD and DO modelling.

Methodology

The water samples were collected from three sampling stations "A"- Raiwala, "B"- Chiddarwala and "C"- Lacchiwala in morning hours (From 8:00 A.M. to 10:00 A.M.). The samples were taken in Borosil glass bottles of 300 ml capacity and plastic containers. Fishes were collected in plastic jars and polythenes.The procedure, which was applied to analyse the sample for different physico-chemical parameters, were taken from APHA (1998), Trivedi and Goel (1986), Khanna and Bhutiani (2004), Santra (2004).

Results and Discussion

The physico-chemical parameter and fish species obtained during the study period are tabulated in table 1 to 15. In the Song River at Dehradun a difference in the fluctuation of water temperature was observed maximum (23.38^{o}C) in post-autumn month and minimum (18.36^{O}C) in pre-autumn month. The water temperature showed an upward trend from winter season to summer season. A more or less similar trend has been observed in the river Yamuna by Chakrabarty *et al.* (1959). Badola and Singh (1981) reported similar trend in river Alakhnanda.

The velocity started increasing after winter season. The maximum (0.95 m/sec) velocity was recorded in post-autumn month and minimum (0.82 m/sec) in pre-autumn month. In the present study it has been observed that the velocity and the total solids showed positive relationship. Maximum concentration (380 mg/l) of total solid was found during the post-autumn month which may be due to soil erosion or side cutting caused by the main stream and the minimum (300 mg/l) during the pre-autumn month as also observed by Joshi and Bisht (1993) in Ganga canal at Jwalapur, Haridwar.

During the study T.D.S. was found minimum (290 mg/l) in pre-autumn month and maximum (335 mg/l) in post-autumn month and increased value were probably due to heavy rain causing soil erosion and adding more suspended or dissolved solids from the nearby area as also observed by Khanna (1993) in the river Ganga at Haridwar, Logankumar *et al.* (1989) in the river Bhavani at Sirumugai, Tamil Nadu. During the study total suspended solid was found maximum (45 mg/l) in post-autumn month and minimum (15 mg/l) in pre-autumn and autumn month and increased value was probably due to heavy rain causing soil erosion and adding more suspended or dissolved solids from the nearby area as also observed by Khanna (1993) in the river Ganga at Haridwar.

During this study it was found that turbidity was higher (26.66 J.T.U.) during postautumn month which may be due to heavy soil erosion and lower (15.33 J.T.U.) during preautumn month as also reported by Khanna(1993) in the river Ganga, Joshi and Bisht(1993) in Ganga canal at Jwalapur, Haridwar. The turbidity

and total solids were closely interrelated with one another and cause common effect upon the river and aquatic life as also stated by Verma *et al.*(1984). The maximum (8.5) pH was recorded in post-autumn month, which might be due to increased chemical load in the river or due to increased photosynthetic activities and low dilution capacity of water. The minimum pH was recorded (6.9) in pre-autumn month which was due to decreased photosynthetic activities which was due to increase in turbidity affecting the penetration of light as also reported by Badola and Singh (1981) reported similar trend in river Alakhnanda river of Garhwal Himalaya. Similar observations were reported by Sangu and Sharma (1985) in river Yamuna. Khanna (1993) in the river Ganga, Joshi and Bisht (1993) in Ganga canal at Jwalapur, Haridwar. Dissolved oxygen is usually related to ambient temperature, current velocity, rainfall and turbulence besides some biological components:-viz. planktonic blooms. Higher value (9.25 mg/l) of D.O. was observed during pre-autumn month, which permit retention of higher amount of air at lower temperature. Thus low temperature has high turbulence usually cause rise in oxygen level. Lower value (8.38 mg/l) of D.O. was observed during post-autumn month due to low O_2 retention capacity of water with the rise in temperature and higher TDS status as also observed by Badola and Singh (1981) reported similar trend in river Alakhnanda river of Garhwal Himalaya. Similar observations were reported by Sangu and Sharma (1985) in river Yamuna. Khanna (1993) in the river Ganga and Kataria *et al.* (1995) in Kubza River at Hoshangabad. The BOD was observed maximum (3.25 mg/l) in post-autumn month and minimum (2.3 mg/l) in pre-autumn month. A similar pattern has been reported by Khanna(1993) in the river Ganga, Chugh (2000) in the river Ganga at Haridwar and Kataria *et al.*(1995) in Kubza River at Hoshangabad.

The maximum value (3.16 mg/l) of COD observed during post-autumn month and minimum (2.3 mg/l) in pre-autumn month. A positive relationship has been observed between COD and water temperature Free Carbon Dioxide was observed maximum (3.31 mg/l) in post-autumn month due to high temperature, and minimum (2.56 mg/l) in pre-autumn month when temperature was low and turbidity was found lowest. Pahwa and Mehrotra (1966) have reported that the Ganga River contains maximum free carbon dioxide in rainy season at Allahabad. Charakbarty *et al.* (1959) also observed the maximum free CO2 in Yamuna during Monsoon at Allahabad.

Sulphate concentration was found to be minimum (1.65 mg/l) in pre-autumn month and maximum (2.76 mg/l) during post-autumn, also observed by Kataria(1966) in borewellsof Bhopal city. Maximum value (23.38 mg/l) of chlorides was observed in Post-autumnmonth and minimum (18.36 mg/l) in Pre-autumn month.The term alkalinity is defined as the quality if ions in water, which react to neutralize hydrogen ions. The maximum value of alkalinity was found in pre-autumn month and minimum in post-autumn month. The cause of increasing alkalinity was the decomposition of the organic water.

A total number of 36 fish species were observed in river Song while Badola and Singh (1981) observed 31 species of fish in river Alakhnanda of Garhwal Himalaya. Bhatt *et al*. (1984) reported 26 fish species in river Kosi of Kumaon Himalayas. Khanna and Badola (1991) observed 30 species of fish fauna in the river Ganga at Hardwar.

SYSTEMATIC LIST OF FISHES

Present scientific names and classification

Sub- phylum	Craniata
Super-class	Gnathostomata
Phylum	Vertibrate
Series	Pisces
Class	Teleostomi
Order	Cyprini-formes
Family	Cyprinidae
Division	Cyprini
Name of Species	**Local name**
Labeo rohita	Rohu
Labeo dero	Aragi
Labeo calbasu	Rohu
Labeo gonious	Rohu
Punitus sarena	Darahi
Punitus ticto	Shidhari
Punitus chola	Shidhari
Punitus sophore	Shidhari
Punitus conchonius	Darahi
Rasbora daniconius	Dandwa
Barilius bola	Bola
Barilius bendelisis	Bola
Barilius vagra	Bola
Danio devario	Fatukari
Brachydanio reria	-
Crossocheilus	-
Garra gotyla gotyla	-
Schizothorax sinatus	-
Schizothorax richardsoni	-
Tor putitora	Mahsheer

Tor tor	Mahsheer
Family : Cobitidae	
Botia dario	
Lepidocephalus guntea	Hakati
Neomacheilus botia	Natwa
Neomacheilus rupicala	Natwa
Family : Bagridae	
Mystus seenghala	Tengar
Mystus tengara	Tengar
Mystus vittatus	Tengar
Family : Saccobranchidae	
Heteropneustes fossils	Singhi
Family : Clariidae	
Clarius batarachus	Mangur
Order : Beloniformes	
Family : Belonidae	
Xenentodon cancila	Kauwa
Family: Channidae	
Channa striatus	Saur
Channa gachuo	Girae
Family: Anabantidae	
Colisa fasciatus	Khosti
Family: Mastacembelidae	
Mastacembelus armatus	Baam
Mastacembelus pancalus	Patya

Table-1 : Seasonal variations of different parameters of Song River at Dehradun.

Para meter	Pre-autumn	Autumn	Post-autumn	Average
Temperature ($_{o}$C)	19.50	22.83	23.16	21.16±2.02
Velocity (m/sec)	0.82	0.87	0.95	0.88±0.07
Total Solid (mg/l)	300.00	330.00	380.00	336.66±40.41
T.D.S (mg/l)	290.00	315.00	335.00	313.30±22.55
T.S.S (mg/l)	17.33	15.33	35.33	22.66±11.02
Turbidity (J.T.U.)	15.33	20.00	26.66	20.66±5.69
pH	6.90	6.90	8.56	7.45±0.96
DO (mg/l)	9.25	8.90	8.38	8.85±0.44
Free CO_2(mg/l)	2.56	2.76	3.31	2.88±0.39
BOD (mg/l)	2.30	2.80	3.25	2.78±0.47
COD (mg/l)	2.30	2.68	3.16	2.71±0.43
Sulphate (mg/l)	1.65	2.27	2.76	2.22±0.56
Alkalinity (mg/l)	180.80	158.16	141.50	160.15±19.73
Chlorides (mg/l)	18.36	22.90	23.38	21.54±2.78

References

APHA, AWWA, WPCF, 1998. *Standard methods for examination of water and waste water*, 20th Eds. American Public Health Association; 1015, Fifteen Street, New Washington., 15: 1-1134.

Badola, S.P. and Singh, H.R., 1981. Hydrobiology of the river Alakhnanda of Garhwal Himalaya*,* ***Ind. J. Eco.***, 8(2):269-276.

Bhatt, S.D., Bisht, Y.and Negi, U., 1984. Ecology of Limnoflora in river Koshi of the Kumaon Himalaya (U.P.). ***Proc. Ind. Natu.,*** S.C, 50(4).

Bhutiani, R. and Khanna, D.R., 2007. Ecological study of Suswa River: modeling DO and BOD, ***Environ. Monit. and Assesment,*** 125:1-3.

Biswas, J., 1970. Interactions and interrelations between human and water. ***Indian Journal Environ. Health.,*** 14: 297-309.

Chakrabarty, R.D., Ray, P. and Singh, S.B., 1959. A quantitative survey of Plankton and physiological conditions of the river Yamuna at Allahabad. ***Indian. J. Fish.,*** 6(1):186-203.

Chugh, Tarun, 2000. *Seasonal variation in the microbial ecology of river Ganga at Hardwar*, Ph.D Thesis, Gurukula Kangri University.

Joshi, B.D. and Bisht, R.C.S, 1993. Some aspects of physico-chemical characteristics of western Ganga canal near Jwalapur at Haridwar. ***Him. J. Env. Zool.***, 7(1):76-82.

Kataria, H.C., 1966. Sulphate content in bore well water of Bhopal city. ***Ultra. Scientist. Phyl. Sci.***, 8(1):97-100.

Kataria, H.C., Jain, O.P., Gupta, S.S., Srivastava, R.M. and Shandilya, A.K., 1995. Physicochemical analysis of water of Kubza river of Hoshangabad. ***Oriental. J. Chem.,*** 11(2):157-159.

Kaur, Surendra and Joshi, B.D., 2003. Describes seasonal variation in some physicochemical parameters of Ganga. ***Him, J. Env & Zoo.***, 17(1):45-55.

Khanna, D.R., 1993. *Ecology and Pollution of Ganga River*, Ashish publication House, Delhi:1-241.

Khanna, D.R. and Badola, S.P., 1991, *Fish fauna of the river Ganga at Hardwar. Aquatic Environment,* Ashish Publishing House. 8/81, Punjabi Bagh, New Delhi, 90-93.

Khanna, D.R. and Bhutiani, R., 2003.Worked on limnological status of Satikund pond at Hardwar, ***Indian J. Env. Sc.,*** 7(2):131-136.

Khanna, D.R. and Bhutiani, R., 2004. *Water analysis at a glance*, ASEA Publications, 1- 115.

Khanna, D.R. and Singh, S., 2002. *Published a book on pond fish ecology and economics*. Daya publishing House, Delhi: 1-81.

Khanna, D.R., Seth, T.R., Malik, D.S. and Singh, R.K.,1999. Fishes and their ecology of river Suswa at Raiwala (Dehradun), ***Sw. Eco. Sys. and Env.,*** Ed. by D.R. Khanna, A. Gautam,105-110.

Khanna, D.R., Singh, S., Gautam, A. and Singh, J.P., 2003. Study of assessment of water quality of river Ganga in distt. Bulandshahar (U.P.). ***J. Nat. Con.,*** 15(1):167-175.

Kudesia, P.R., 1988. Studied the diseases caused because of polluted water in New Delhi.***Indian J. Ecol.,*** 12(4):236-254.

Logankumar, K., Sivakumar,A.A., Logasamy, S. and Aruchami, M., 1989. Seasonal variation in the nutrients of the river Bhavani at Sirumugai, Coimbatore district, Tamil Nadu., ***Ind. J. Ecol***. 16(1): 60-63.

Pahwa, D.V. and Mehrotra, S.M., 1966. Observation on fluctuations in abundance of plankton in relation to certain hydrological conditions of river Ganga. ***Proc. Nat. Acad. Sci***., 36B(2):157-159.

Pandey, B.N., Kumar, K., Lala, A. and Das, P.K.L., 1993. A prelimary study on the physico-chemical quality of water of the river Kosi, ***J. Ecobiol.,*** 5: 237-339.

Sangu, R.R.S. and Sharma, K.D., 1985. Studies on water pollution on Yamuna river at Agra, ***Indian J. Env. Hlth.,***27(3): 257-261.

Santra, S.C., 2004. *Environmental Science*. New Central Book Agency (P) Ltd. 1-944.

Semwal, N. and Akolkar, P., 2006. Water quality assessment of sacred Himalayan Rivers of Uttarakhand. ***Current Science.,*** 91(4).

Trivedi, R.K. and Goel, P.K.,1986. *Chemical and Biological method for water pollution studies*. Karad: Environmental Publications, 1-251

Trivedy, P.K., 1990. Studied the monitoring and control of river pollution. *Water pollution and management*., 245-265.

Verma, S.R., Sharma, P., Rani. A., Gupta, A.K. and Dalela, R.G., 1984. Pollution and saprobic status of eastern Kalinadi. ***Limnologica (Berlin)*** 15(1):69-133.

Sampling Site	Pre-autumn	Autumn	Post-autumn	Avarage
Raiwala	19.0	21.0	23.5	21.16± 2.25
Chiddarwala	20.0	22.0	24.0	22.00± 2.00
Lacchiwala	19.5	19.5	22.0	20.33 ±1.44

Table - 2 The value of temperature (oC) found at different sampling stations of Song River.

Sampling Site	Pre-autumn	Autumn	Post-autumn	Avarage
Raiwala	0.90	0.95	1.00	0.95± 0.05
Chiddarwala	0.85	0.85	1.00	0.90 ±0.087
Lacchiwala	0.73	0.82	0.85	0.80 ±0.062

Table - 3 The velocity (m/sec) of water found at different sampling stations of Song River.

Sampling Site	Pre-autumn	Autumn	Post-autumn	Avarage
Raiwala	305	345	385	345±40.00
Chiddarwala	310	335	375	340±32.79
Lacchiwala	300	310	380	330±43.59

Table -4 The value of total solids (mg/) found at different sampling stations of Song River.

Sampling Site	Pre-autumn	Autumn	Post-autumn	Avarage
Raiwala	285	320	340	315±27.84
Chiddarwala	300	325	335	320±18.03
Lacchiwala	285	300	330	305±22.91

Table -5 The value of total dissolved solids (mg/l) found at different sampling stations of Song River.

Sampling Site	Pre-autumn	Autumn	Post-autumn	Avarage
Raiwala	20	25	45	30±3.61
Chiddarwala	10	10	40	20±9.17
Lacchiwala	15	10	50	24±21.79

Table -6 The value of total suspended solids (mg/l) found at different sampling stations of Song River.

Sampling Site	Pre-autumn	Autumn	Post-autumn	Avarage
Raiwala	16	20	30	22±7.21
Chiddarwala	20	25	30	25±5.00
Lacchiwala	10	15	20	15±5.00

Table -7 The value of turbidity (J.T.U.) found at different sampling stations of Song River.

Sampling Site	Pre-autumn	Autumn	Post-autumn	Avarage
Raiwala	17.60	24.23	27.65	23.16± 5.11
Chiddarwala	19.50	24.50	23.50	22.50 ±2.65
Lacchiwala	18.00	20.00	19.00	19.00 ±1.00

Table -8 The value of Chlorides (mg/l) found at different sampling stations of Song River

Sampling Site	Pre-autumn	Autumn	Post-autumn	Avarage
Raiwala	7.25	6.75	8.20	7.40±0.74
Chiddarwala	7.00	6.50	9.00	7.50 ±1.32
Lacchiwala	6.50	7.50	8.50	7.50± 1.00

Table -9 The value of pH found at different sampling stations of Song River.

Sampling Site	Pre-autumn	Autumn	Post-autumn	Avarage
Raiwala	9.25	8.75	8.40	8.80 ±0.43
Chiddarwala	9.50	9.00	8.50	9.00 ±0.50
Lacchiwala	9.00	9.00	8.50	8.83 ±0.29

Table -10 The value of Dissolved oxygen (mg/l)found at different sampling stations of Song River.

Sampling Site	Pre-autumn	Autumn	Post-autumn	Avarage
Raiwala	2.95	3.05	3.45	3.15± 0.265
Chiddarwala	2.75	2.75	3.50	3.00± 0.433
Lacchiwala	2.00	2.50	3.00	2.50 ±0.50

Table -11 The value of free carbon dioxide (mg/l) found at different sampling stations of Song River.

Sampling Site	Pre-autumn	Autumn	Post-autumn	Avarage
Raiwala	2.65	2.95	3.55	3.05± 0.46
Chiddarwala	2.25	2.95	3.50	2.90± 0.63
Lacchiwala	2.00	2.50	2.70	2.50± 0.50

Table -12 The value of biochemical oxygen demand (mg/l) found at different sampling stations of Song River.

Sampling Site	Pre-autumn	Autumn	Post-autumn	Avarage
Raiwala	2.20	2.90	3.15	2.75± 0.49
Chiddarwala	2.45	2.65	2.85	2.65± 0.20
Lacchiwala	2.25	2.50	3.50	2.75± 0.66

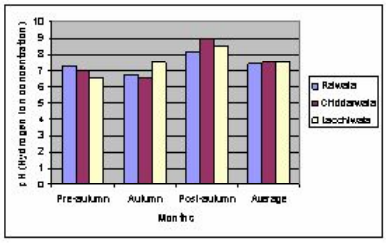
Table -13 The value of chemical oxygen demand (mg/l) found at different sampling stations of Song River.

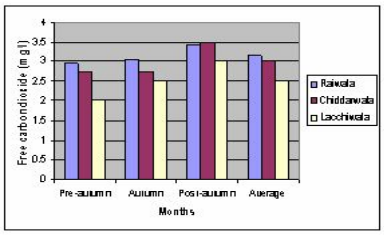
Sampling Site	Pre-autumn	Autumn	Post-autumn	Avarage
Raiwala	1.85	2.42	2.73	2.32± 0.45
Chiddarwala	1.60	2.15	2.85	2.20± 0.63
Lacchiwala	1.50	2.25	2.70	2.15± 0.61

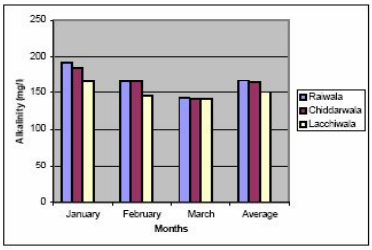
Table -14 The value of Sulphate (mg/l) found at different sampling stations of Song River.

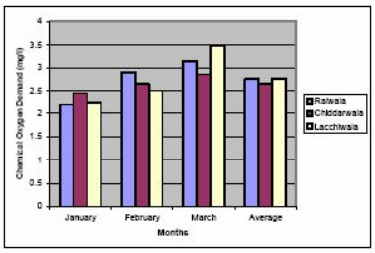
Sampling Site	Pre-autumn	Autumn	Post-autumn	Avarage
Raiwala	192.50	164.50	142.26	166.42± 25.18
Chiddarwala	185.00	165.00	140.75	163.58±22.16
Lacchiwala	165.00	145.00	141.50	150.50± 12.68

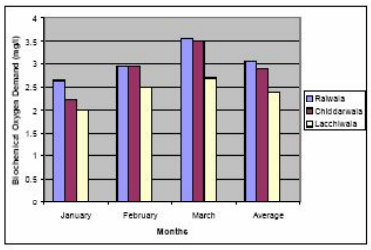
Table -15 The value of alkalinity (mg/l) found at different sampling stations of Song River

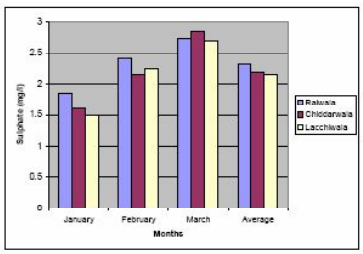

pH (Hydrogen ion concentration)
Pre-autumn
Autumn
Post-autumn
Average
Months
Raiwala
Chiddarwala
Lacchiwala

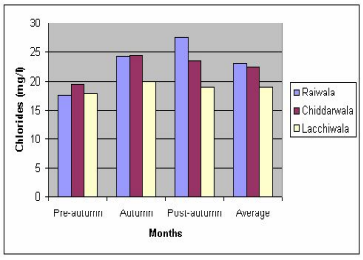

Free carbondioxide (mg/l)
Pre-autumn
Autumn
Post-autumn
Average
Months
Raiwala
Chiddarwala
Lacchiwala

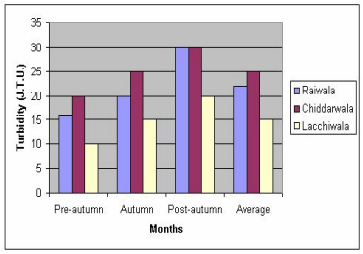

Alkalinity (mg/l)
January
February
March
Average
Months
Raiwala
Chiddarwala
Lacchiwala

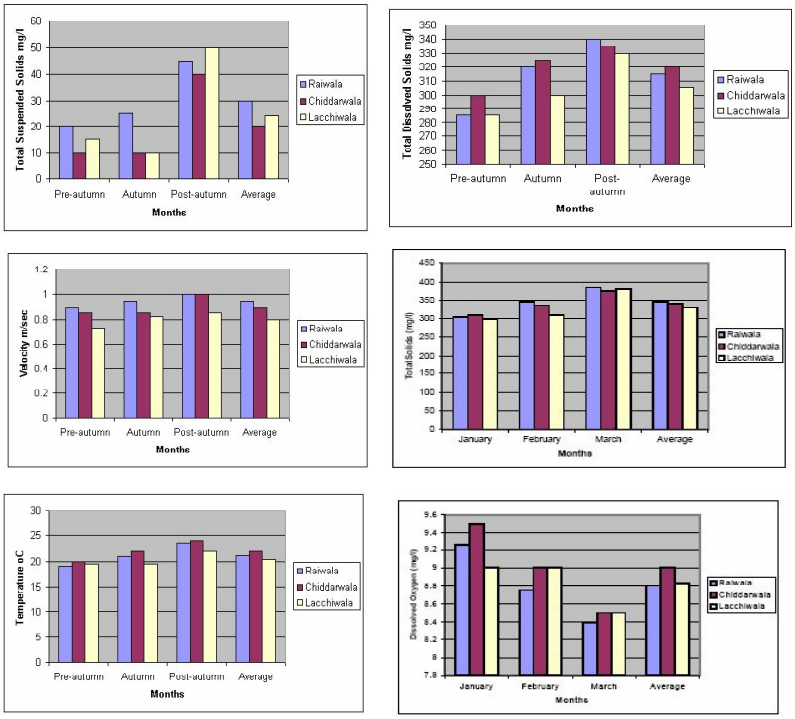

Chemical Oxygen Demand (mg/l)
January
February
March
Average
Months
Raiwala
Chiddarwala
Lacchiwala


Biochemical Oxygen Demand (mg/l)
January
February
March
Average
Months
Raiwala
Chiddarwala
Lacchiwala


Sulphate (mg/l)
January
February
March
Average
Months
Raiwala
Chiddarwala
Lacchiwala


Chlorides (mg/l)
Pre-autumn
Autumn
Post-autumn
Average
Months
Raiwala
Chiddarwala
Lacchiwala


Turbidity (J.T.U)
Pre-autumn
Autumn
Post-autumn
Average
Months
Raiwala
Chiddarwala
Lacchiwala



Graphs showing fluctuation in parameters in different seasons

Environment Conservation Journal 8 (3) 127-132, 2007
(ISSN 0972-3099)

Study of physico-chemical parameter for a reservoir at Khandwa District (M.P.)

Vivek Kesre[**], L. K. Mudgal[#], D.R. Khanna[*], Gagan Matta[*] and Dheeraj Kumar[*]
[#]Department of Zoology, Govt. Girls P.G. College, Indore, (M.P.)
[*] Deptt of Zoology & Environmental. Science, Gurukul Kangri University, Hardwar (UK).
[**] Department of Zoology, Govt. M.L.C. Girls P.G. College, Khandwa, (M.P.).

Abstract

Importance of water for the living being could not be neglected, with this view and the impact of the reservoir from the ecological and local point, this study was carried out. Reservoir studied is located at Khandwa, 3 Km. away from city, Khandwa on a local nallha named Barood nallah. It is a rain water reservoir, the primary source of water to the reservoir is a 6.4 Km long canal called Ajanti canal. Analysis of the reservoir water is carried out to observe the effect of decreasing catchment's area, due to siltation and decreasing water quantity on the physico-chemical condition of the reservoir water and its seasonal variation. Physico-chemical parameter analyzed were; temperature, pH, turbidity, transparency, TDS, silicate, free CO_2, DO, BOD, COD, total hardness, Ca hardness, Mg hardness, sulphate, fluoride, chloride and potassium form August 2006 July2007. Statistical analysis of the obtained data is carried out to draw conclusion.

Introduction

Water plays a significant role in different vital and structural activities. Water is inevitable for all living organisms as it has a great social and economical value ultimately affecting men health. It is essentially required for irrigation, industrial development, hydro electrical generations, fisheries, human life survival and domesticated animals. As the water is very important reservoirs have multidimentional approach including flood control, hydropower generation, water supply, navigation, restoration, etc (Ngo, 2006). Moghat reservoir is a tropical rain water reservoir located in Khandwa district, near Moghat village, 3 Km away from the Khandwa city. It was constructed in 1897 by the British engineers, initially to full fill the water requirement of the Khandwa city. Catchment area of the reservoir was 23.30 square kilometer and to this water is added by local nala named Ajanti canal and seasonal river, but now it has been reduced greatly due to natural and anthropogenic activity. With the time and due to improper management water holding capacity of the reservoir decreased and ultimately failed to complete the motive for which this reservoir came into existence. Till now no such limnological study has been carried out on the Moghat reservoir therefore no review on this reservoir was found. Limnological study on pond and other reservoir is carried out like Adefemi, O.S. *et al.*, (2007) worked on the physico-chemical condition of a dam in Nigeria and showed the level of significance between different physico-chemical state-variable. Limnological features of man made lakes were analysed and observed by Ayoade, *et al*. (2006). Polak, J. studied the nitrifying activities in Wloclawek dam reservoir in 2004. Van Den Bos, A.C. in 2003 released his work on the water quality of the Occoquan reservoir and its tributary watershed. Daily physico-chemical dynamics of Siemianowka reservoir lies in northeastern Poland was studied by Jekatierynczuk-Rudczyk, E., *et al*. (2002). Khanna, *et al*. (2000) analyzed the abiotic factors of a pond at hardwar.

Purpose of this study :

i. the present water reservoir is not studied so far.

ii. conduct and update water quality assessment of the Moghat reservoir.

iii. assess the present physical and physico-chemical status of reservoir.

iv. draw attention towards the problem faced by the reservoir.

Materials and Method

Study site

Moghat reservoir is located 3 kilometer away from the Khandwa city in northwest. The geographic position of this reservoir is 21 – 49' N and 76 –20' E. It is situated 1071 ft. above from mean sea level. The maximum depth 5.2 m. and mean depth 1.2 m. it has 5.36 kilometer long shoreline. Source of water to the reservoir is a canal named Ajanti canal which collect rain water from various sources and drain it to the reservoir. Since the time human activity near by to the reservoir increased problem of eutrophication and siltation to the reservoir increased.

Sampling

Monthly sampling was done from July 2006 to August 2007. Samples were taken between 7 am. to 9 am. but transparency was measured between 10 am. to 2 pm. Water samples were taken on one liter polythene bottles. Temperature, pH, fixing of DO and transparency were measured at the spot.

Analysis

Samples were analyzed according to"Standard Methods for the Examination of Water and Wastewater (APHA)" 20th edition; 1998. Published by American Public Health Association.

Results and Discussion

In the investigated physical trait of the reservoir water it is observed that water temperature was maximum during July (29.63 ^{0}C ±0.29) and minimum during December (17.93 ^{0}C ±0.19), transparency was maximum in December (8.98 cm ±3.10) and minimum in September (1.52 cm ±0.99), turbidity in August was maximum (138 JTU ±26.95) and minimum during the month of January (22.75 JTU ±3.86) and TDS maximum in the month of July (218 mg/l 9.42) and minimum during February (105.80 mg/l ±2.20). Average observed for Temperature, Transparency, Turbidity and TDS for the year 2006-07 were 25.69 ^{0}C ±4.27, 5.15 cm ±3.63, 68.04 JTU ±39.39, 166.81±33.60 mg/l respectively. Observations of physical parameter are given in table no.1. Chemical parameter analyzed for reservoir water were pH, Free CO_2, Total hardness, Ca hardness, Mg hardness, DO, BOD, COD, Sulphate, Floride, Silicate, Potassium and Chloride. Observed values are given in table no-2. The maximum and minimum value for pH was (8.82±0.02) in January and (7.72±0.17) in August respectively. Free CO_2 was maximum (3.63 mg/l±0.83) in May and minimum (1.22 mg/l ±0.08) in October, Ca

and Mg hardness found in the reservoir water maximum was (37.25 mg/ l ±1.76) in June and (26.05 mg/l ±1.69) in June respectively and the minimum value of them was (26.90 mg/l ±0.82) in February and (11.08 mg/l ±1.29) in November respectively. Total hardness found was maximum (154.33 mg/l ±1.85) in May (92.83 mg/l ±0.70) in September. Minimum and maximum value of DO found was (4.98 mg/l ±0.61) in April and (8.90 mg/l ±0.22) in December respectively. The minimum value of BOD found for the reservoir water was (2.93 mg/l ±0.15) in December and maximum value was (4.73 mg/l ±0.35) in June. COD observed was (8.73 mg/l ±0.65) in November and minimum was (11.73 mg/l ±0.46) in June. The minimum value of Sulphate, Silicate Potassium and Chloride was (16.03 mg/l ±1.07) in December, (6.75 mg/l ±0.17) in November, (0.97 mg/l ±0.01) in August, (17.13 mg/l ±2.16) in December respectively. The maximum value observed for the reservoir water for the parameter Sulphate, Silicate, Potassium and Chloride was (33.65 mg/l ±1.65) in July, (11.20 mg/ l ±0.28) in April, (1.28 mg/l ±0.03) in June, (32.30 mg/l ±2.10) in June respectively. Fluoride during the whole show no variation and its value found constant (0.30 mg/l ±00).

The average value during the whole year of study observed for pH, Free CO_2, Total hardness, Ca hardness, Mg hardness, DO, BOD, COD, Sulphate, Fluoride, Silicate, Potassium and Chloride was (8.18±0.20), (2.40 mg/l ±0.78), (121.64 mg/l ±19.23), (29.95 mg/l ±3.53), (15.91 mg/l ±4.98), (6.64 mg/l ±1.37), (3.77 mg/l ±0.59), (10.41 mg/l ± 1.00), (23.66 mg/l ±5.97), (0.30 mg/l ±5.8E-17), (1.17 mg/l ±0.09), (23.13 mg/l ±4.88) respectively. Results obtained are given in tabular form in table no.1 & 2 and their graphical representation are shown in fig. no. 5 to 8.

References

Adefemi, O.S., Asaolu, S.S. and Olaofe, O., 2007. Assessment of the Physico-chemical status of water samples from major dams in Ekiti State, Nigeria. ***Pakistan Journal of Nutrition***, 6(6): 657-659.

APHA, AWWA and WPCF, 1998. *Standard methods for the examination of water and wastewater.* American Public Health Association. Washington 20th Edition. N.York.

Ayoade, A.A., Fagade, S.O. and Adebisi, A.A., 2006. Dynamics of limnological features of two man-made lakes in relation to fish production. ***African Journal of Biotechnology,*** 5(10): 1013-1021.

Jekatierynczuk-Rudczyk, E., Gorniak, A., Zielinski, P., Dziemian, J., 2002. Daily dynamics of water chemistry in lowland olyhumic dam reservoir. Polish ***Journal of Environmental Studies***, 11(5): 521-526.

Khanna, D.R., Gautam, A., Chugh, T. and Sarkar, Praveen, 2000. Impact of abiotic factors on the phytoplanktonic population of a pond at Haridwar. ***Ennvironment Conservation Journal,*** 1(1): 41-46.

Ngo, L.L., 2006. *Optimising reservoir operation: A case study of the Hoa Binh reservoir, Vietnam*. Ph.D. thesis, Institute of Environment & Resources Technical University of Denmark.

Polak, J., 2004. Nitrification in the surface water of the Wloclawek Dam Reservoir. The Process Contribution to Biochemical Oxygen Demand (N-BOD). **Polish *Journal of Environmental Studies*,** 13(4): 415-424.

Van Den Bos, A.C., 2003. *A water quality assessment of the Occoquan reservoir and its tributary watershed: 1973-2002.* Thesis of Master of Science in Environmental Engineering. Graduate faculty of the Virginia polytechnic Institute and State University.

Moghat reservoir

Ajanti canal

Siltation effect on Moghat reservoir

Eutrophication in Moghat reservoir

Table No.1: Seasonal variation in physical parameter of Moghat reservoir water for 2006-2007.

Months	Temperature (^{0}C)	Transparency (cm)	Turbidity (JTU)	TDS (mg/l)
July	29.63±0.29	3.88±0.83	120.25±14.38	218.00±9.42
August	26.95±0.13	1.80±0.55	138.50±26.95	190.50±3.70
September	28.63±1.1	1.52±0.99	41.50±11.50	180.00±7.35
October	29.65±0.24	7.77±2.72	38.75±8.50	174.00±6.32
November	21.50±0.48	8.68±1.22	25.25±4.11	169.75±7.90
December	17.93±0.19	8.90±3.10	30.50±8.02	163.50±7.77
January	19.35±1.4	7.23±1.57	22.75±3.86	128.50±1.73
February	22.53±0.48	6.28±1.76	48.25±15.12	105.80±2.20
March	25.68±0.51	5.84±1.34	71.75±22.29	129.35±0.47
April	27.80±0.18	3.19±1.46	84.75±10.24	149.83±1.46
May	29.50±0.57	3.76±0.91	88.50±6.66	182.50±7.55
June	29.20±0.78	2.98±1.03	105.75±11.32	210.00±12.49
Average±Sd	**25.69±4.27**	**5.15±2.63**	**68.04±39.39**	**166.81±33.60**

Table No.2: Seasonal variation in chemical parameter of Moghat reservoir water for 2006-2007.

Months	pH	Free CO_2 (mg/l)	Hardness (mg/l) Total	Hardness (mg/l) Ca	Hardness (mg/l) Mg	DO (mg/l)	BOD (mg/l)	COD (mg/l)	Sulphate (mg/l)	Fluoride (mg/l)	Silicate (mg/l)	Potassium (mg/l)	Chloride (mg/l)
July	7.84±0.23	2.74±0.54	104.45±1.72	29.35±1.80	12.30±1.43	5.50±0.29	4.50±0.56	11.48±0.68	33.65±1.65	0.30±00	9.88±0.50	1.00±0.02	28.95±4.14
August	7.72±0.17	2.92±0.95	96.38±1.50	27.43±1.30	11.93±2.17	5.70±0.32	4.18±0.71	10.65±0.79	30.10±0.28	0.30±00	9.10±0.56	0.97±0.01	23.33±4.66
September	8.12±0.08	2.59±0.98	92.83±0.70	27.88±1.84	12.07±2.32	6.43±0.29	3.85±0.66	10.18±0.71	25.45±1.77	0.30±00	8.33±0.34	1.20±0.03	22.05±3.64
October	8.27±0.02	2.22±1.02	122.45±1.07	28.78±1.68	12.73±1.34	6.48±0.43	3.28±0.28	9.48±0.50	22.65±1.31	0.30±00	7.38±0.26	1.23±0.04	18.85±1.53
November	8.24±0.02	2.81±0.76	118.28±0.98	28.33±0.92	11.08±1.29	6.43±0.17	3.13±0.21	8.73±0.65	22.60±1.97	0.30±00	6.75±0.17	1.23±0.05	17.15±1.33
December	8.23±0.03	1.22±0.08	120.48±0.93	27.50±0.75	14.25±1.44	8.90±0.22	2.93±0.15	8.98±1.10	16.03±1.07	0.30±00	7.23±0.24	1.15±0.03	17.13±2.16
January	8.82±0.02	1.37±0.20	121.50±2.27	27.43±1.03	14.53±1.31	8.25±0.31	3.18±0.15	9.83±0.40	16.78±0.87	0.30±00	7.83±0.13	1.15±0.04	19.05±3.51
February	8.22±0.03	1.38±0.19	122.38±1.11	26.90±0.82	16.28±1.47	7.70±0.71	3.45±0.13	10.43±0.25	17.68±0.67	0.30±00	9.58±0.28	1.17±0.05	21.30±3.45
March	8.32±0.06	1.92±0.69	127.10±1.78	29.55±0.70	16.79±1.25	6.63±0.61	3.73±0.15	10.90±0.27	19.28±0.46	0.30±00	10.30±0.23	1.21±0.05	23.58±4.30
April	8.37±0.16	2.81±0.83	134.85±1.61	32.98±1.40	18.05±1.26	5.55±0.37	4.05±0.26	10.90±0.29	20.78±0.82	0.30±00	11.20±0.28	1.23±0.03	25.64±3.50
May	8.34±0.04	3.63±0.83	154.33±1.85	36.10±1.56	24.98±1.48	4.98±0.61	4.28±0.22	11.40±0.28	27.33±0.98	0.30±00	10.83±0.15	1.25±0.02	25.64±1.70
June	8.28±0.03	2.79±0.60	153.65±1.70	37.25±1.76	26.05±1.69	5.13±0.43	4.73±0.35	11.73±0.46	31.63±1.42	0.30±00	10.60±0.52	1.28±0.03	32.30±2017
Average±Sd	**8.18±0.20**	**2.37±0.75**	**121.64±18.01**	**29.95±3.53**	**15.91±4.98**	**6.64±1.37**	**3.77±0.59**	**10.41±1.00**	**23.66±5.97**	**0.30±5.8E-17**	**9.08±1.54**	**1.17±0.09**	**23.13±4.88**

Fig.5: Variation between Turbidity, Total hardness, Ca hardness and Mg hardness

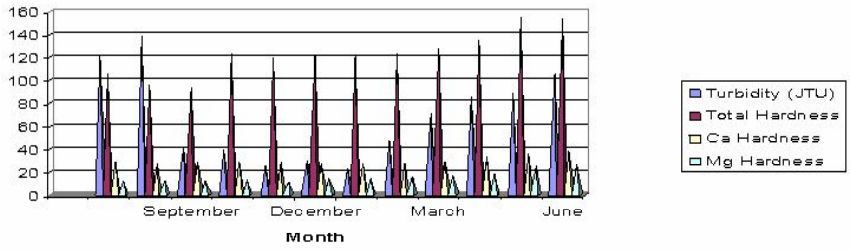


Fig.6: Comparision between Free CO2, DO, BOD and COD

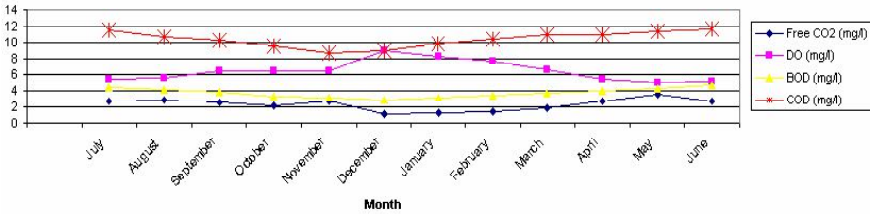


Fig.7: Comparative study between Ca, Mg, DO, Sulphate, Floride, Potassium and Chloride

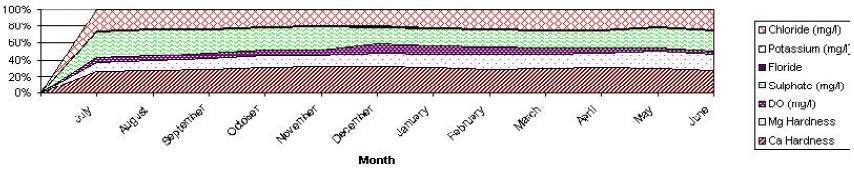
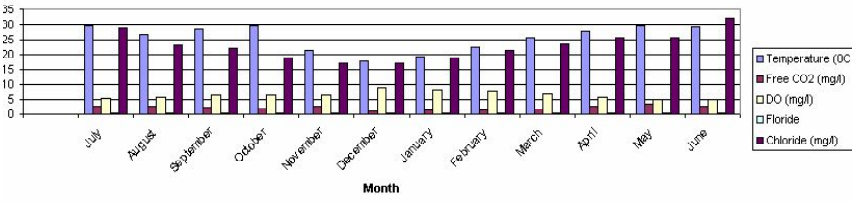


Fig.8: Comparative study between Temperature, Free CO2, DO, Floride and Chloride



Environment Conservation Journal 8 (3) 133-153, 2007
(ISSN 0972-3099)

Seasonal variation in physico-chemical and biological properties of river Panar (Bihar)

B. N.Pandey, O. P.Ambasta* and A.K. Jha, Shambhu, K.

Eco-Genetical Research Labora, P.G. department of Zoology

Purnia College, Purnia -854301*Department of Botany

R . L . College , Madhav Nagar, Purnia-854204.

**P.G. Department of Zoology, T.P.College , Madhepura-852113

Abstract

A base line study was conducted to determine the impact of anthropogenic activities on the physico-chemical and biological factors of the river Panar. The result revealed well defined seasonal variation .On the basis of physico-chemical and biological parameters the river appears to be polluted. On the basis of Moyle's classification, the river water appeared to be hard type. Likewise on the basis of phosphorous and nitrogen , the investigated water body may be categorized as moderate trophic level . The bulk of phytoplankton was shared by Chlorophyceae (9), Myxophyceae (8), Bacillariophyceae (9) and Euglenophyceae (1). Many of algal species out of the total 27 reported from the river like *Euglena, Microcystis, Anabaena,Chlamydomonas* , and *Spirulina* were recognized as pollution indicator . The zooplankton population comprised of Rotifera (19), Cladocera (5) and Copepoda (3). The zooplankton also comprised some pollution tolerant species like *Brachionus, Keratella, Moina, Mesocyclops , Cypris , Ceriodaphnia , Polyarthra* etc. The study clearly revealed that the aquatic environment of the river has undergone degradation and is not suitable for human use. The main sources of river pollution in the present study were recognized as:

a) discharge of domestic sewage from near by villages

b) agricultural run off

c) burning of corpses on the bank of river

d) bathing habits of human as well as cattles

e) washing of clothes and utensils

f) soil erosion

g) retting of Jute .

Proper remedial measures should be taken immediately in order to restore it from further deterioration. There must be alternate waste disposal system away from the river and disposal of solid and liquid waste must be stopped forth with. Indiscriminate fishing practices and retting of jute should be stopped, Planting of some toxicant reducing macrophytes should be done on both sides of the river. There is urgent need to take up widespread conservation and education programme in this area to highlight the problem of pollution.

Key Words *Seasonal Variation, Physico-Chemical Characteristics, Phytoplankton, Zooplankton, Water Quality.*

Introduction

Fresh water is the most precious resource on the earth, which is becoming scarce. Rivers, streams, ponds and lakes have been the major source of water. But these days, due to industrialization, urbanization and anthropogenic activity, most of the rivers have become a matter of great concern over period of last few decades because of their vital importance in several human uses, all over the world. Due to the unplanned industrialization and population explosion of the country, the rivers have become today one of the most

heavily polluted water sources of India .

Of all the earth's ecosystems, rivers are the most dynamic having as their primary function the transportation water. They also carry the load of the dissolved and particulate output of crystal weathering and erosion from land to the sea. Rivers have been studied for many years with inputs from many disciplines of science and humanity. Engineering hydrologists, geographers, economists, biologists, chemists, geologists and social scientists have produced a vast body of literature on regional, hydrographical, chemical and historical aspects (Livingstone, 1963; Barnes and Mann, 1980). From data available with UNESCO 1979 and UN 1981 on twenty-nine of the larger rivers of the world, the inter annual variance of discharge is found to be between 6 and 33 percent.

In most of the developing countries, the disposal of sewage and industrial wastes is often conducted without critical appraisal of the impact upon their receiving waters . There are numerous sources of domestic and industrial effluents leading to heavy metal enrichment of water and sediments. The rapid urbanization and industrialization, which are, advanced tool and tips of modern civilization have cultivated pollution problems into water, air and land.

The quality of water resources is usually described according to its physical, chemical and biological characteristics. The use of water in any region for different purposes like domestic, industrial, agriculture and fish culture depends on its physico-chemical and biological characteristics. Hence the present work was undertaken which deals with the seasonal variation in physico-chemical and biological properties of river Panar.

Materials and Method

The present investigation was carried out in the river Panar at five sampling stations selected in the stretch of the 15 km.(Fig-1) The water samples were collected at the monthly intervals between Jan'2003 to Dec'2003 from each sampling station in a polythene bottle of 3 ltrs capacity . Water temperature was recorded with an ordinary mercury thermometer graduated from 0^0 to 50^0 C. The analysis of p^H , dissolved oxygen , free carbon dioxide, BOD,COD, carbonate ,bicarbonate , chloride ,nitrate, phosphate and sulphate was done according to the methods of APHA (1975) and Trivedy and Goel (1984) .

For the planktons, 50 ltrs of river water was taken and filtered through the boilting silk plankton net (No.30) with 77mesh/sq cm. The samples were taken from different areas of the stations regularly. The plankton concentrate on the plankton net was preserved with 5% formalin. Separation and counting the plankton was done by taking 1 ml of sub-samples into a Sedgwick Rafter Plankton Counting chamber of 1 ml capacity. All organisms were counted according to the procedure described by Welch (1952).

Results and Discussion

Temperature :

It is well known fact that the water temperature exerts direct as well as indirect influence on many abiotic and biotic compositions of aquatic ecosystem. Temperature has variable effects, it may kill some organisms and may stimulate the growth of the other (Kotpal and Bali, 1989). The water temperature regulates various

physico-chemical as well as biological activities (Raney and Menzel,1969) and its values and variations have a great bearing upon its productivity (Jhingran, 1982). It also reflects on the dynamics of living organisms (Chandler, 1942). All organisms posses well defined limits of temperature tolerance. All metabolic and physiological activities are greatly influenced by water temperature. Temperature also affects the speed of chemical changes in soil and water. Temperature showed diurnal as well as seasonal variations. In the present investigation, the water temperature followed more or less similar trend of the air temperature. The water temperature varied between 18.9 to 36.9^{0}c (Table-1). Dale and Gillsspic (1977) have reported the influence of macrophytes on the water temperature.

pH:

pH is a general physico-chemical parameters and indicates the fate of chemical constituents. It is one of the most important environmental factor of natural water. pH is also reported to play an important role in the formation of algal bloom (Anderson,1961 and King, 1972). Decreasing volume of water often accompanied by progressive change in pH (Adoni, 1975). The variation of pH is often linked with the species compositions and life processes of animal and plant communities inhabiting them. In the present investigation, the pH varied between 7.3 - 8.6.(Table-1). Thus the river water was alkaline throughout the year. The highest pH value during winter appeared to be influenced by water level, large number of phytoplanktons and highest value of dissolved oxygen (Sunder, 1988 and Pandey *et al.,* 1992a). The pH is associated with high photosynthetic activity (Roy,1955). The low p^H value during monsoon might be due to high turbidity and elevated water temperature, which stop photosynthetic activity leading to accumulation of free CO_2 which lowers the pH of water during monsoon (Adebisi, 1980).

Transparency

Turbidity restricts the penetration of sunlight and hence reduces photosynthetic activity which in turn is related to the productivity of water mass. The suspended particles causing turbidity may also absorb considerable amount of nutrient element like phosphorus, nitrogen and potassium in their ionic forms making them unavailable for planktonic production. Turbidity makes the water unfit for domestic purpose. In the present study the turbidity varied from 31.5 to 72.8 cm (Table-1). The high turbidity during rainy season may be attributed to the land drainage contributing to increase in particulate suspended matter; Roy (1955) reporting on the hydrology of an irrigation tank from Banglore, Karnataka opines that high turbidity adversely affects primary production . The highest transparency during winter season was due to close competition between macrophytic vegetation and phytoplanktons. Kaul *et al.,* (1972) and Wetzel (1975) found that macrophytes were capable of storing nutrients, suspended in water in more quantity that the phytoplankton could do. Zutchi and Vass(1973) have similar observations while studying the limnology of Kashmir lakes.

Dissolved Oxygen

The dissolved oxygen content plays a vital role in supporting aquatic life in running waters and is susceptible to environmental changes (Jameson and Rana,1996). Dissolved oxygen affects the solubility and availability of the nutrients and the productivity of the ecosystem (Wetzel,1975). Dissolved oxygen is one of the most important parameters in the water quality assessment and reflects the physical and biological process prevailing in the water. The volume of oxygen dissolved in water is dependent upon (i) Its temperature (ii) the partial pressure of oxygen in the air in contact with the water at the surface, and (iii) the concentration of dissolved salts . The water receives oxygen mainly through two sources (i) by absorption from the atmosphere at the surface, and (ii) by the photosynthesis of chlorophyll bearing organisms inhabiting the water body. Any water polluted by organic wastes suffers from decline in dissolved oxygen (Butcher , 1947). In the present investigation the dissolved oxygen varied from 6.8 - 9.9 mg/L 9 Table-1). The higher value of oxygen was observed during winter season when temperature was low. It supports findings of Rao (1975), Bharti and Kori (1975) , Mishra and Yadav (1978), Singhal et al .,(1985), Saxena and Mishra (1991). The low value of oxygen during rainy season might be due to higher growth of bacteria which utilizes oxygen for metabolic activities. However, Madhyastha et al . , (1999) have repotted increased level of dissolved oxygen during monsoon leading to super saturation , which may be due to rainwater .Higher value of O_2 during summer has been reported by Vijaykumar (1992,99) due to increased solar radiation . There should be adequate dissolved oxygen in all the seasons . The river with self-purification capacity could assimilate the exhisting load (Lester, 1967).

BOD

The Biochemical Oxygen demand (BOD) is a parameter which enables the determination of relative oxygen requirements especially of waste waters, polluted waters and effluents. BOD in water showed a very critical situation .The value ranged from 19.6 — 29.8 mg/l (Table-1) Higher value were observed and presented seasonal fluctuation in monsoon and lower values in post monsoon . The overall increase in BOD values can be attributed to the discharge of organic wastes and animal excreta in to the water from domestic sources and animals of the villages located near the rivers. Kaur *et al.,* (1996) have reported increase in BOD value in river water due to deposition of animal excretory wastes.

COD

COD values were also very high in the river water, which ranged from 59.5 – 92.8 mg/l (Table 1) . High COD values were due to algal biomass and other organic matter (Patel and Sinha , (1998). The peak of COD was observed in monsoon . The highest value of BOD and COD in rainy season are due to higher concentration of dissolved solid (Jameel, 1998). High COD value show that a large amount of chemically oxidizable matter is present.

Free CO_2

Free carbon-dioxide is an extremely necessary constituent in an aquatic ecosystem (Welch , 1952) . The

respiratory activity by aquatic organisms produce considerable amount of CO_2 in the water, which remains dissolved partly in water as carbonic acid and part of it diffuses to atmosphere . The free CO_2 value of the river ranges from 0.8 – 1.2 mg/l (Table-1). The low value of CO_2 during winter season might be due to increased photosynthetic activity by phytoplanktons. The high value of CO_2 during summer season suggests active decomposition of organic matter. High carbon dioxide content is indicative of high organic pollution (Todda , 1970 and Cole , 1979) .

Vyas and Kumar (1968) showed a direct relationship of free carbon dioxide with transparency, temperature and pH, while an inverse relation with dissolved O_2 . According to Bohra and Bharagava (1977) high concentration of CO_2 results in to low pH and high carbonate values . Present observation of high CO_2 in summer are in line with similar studies done earlier by Vyas and Kumar (1968). In summer with an increase in atmospheric temperature there was corresponding rise in water temperature and subsequent increase in biological oxidation of organic matter that might have caused and elevation in the level of CO_2 (Singh and Srivastava, 1988 Michael , 1966).

Chloride

Natural water normally contains low chloride than bicarbonate and sulphates. Large contents of chloride in fresh water is an indication of organic pollution (Thrash *et al.,* 1944). Chloride is generally undertaken as major factor to equalize cation - anion balance of ecosystem . The most important source of chloride in the water is the discharge of domestic sewage. Man and other animals excrete very high quantities of chloride together with nitrogenous compounds . The chloride contents in the river under investigation was found highest during summer and lowest during winter season (Table-1). The higher value of chloride during summer months may be due to the gradual decrease in the amount of water. Mishra and Yadav (1978) have also reported increased values of chloride in summer months and have correlated this with gradual decrease in the amount of water. Moreover, the increased amount of excreta laid by various aquatic fauna may also account for the increased values of chloride during summer months. The finding of Cole, 1979; Pandey and Mishra , 1990 and Swarnalatha , 1994 are also similar with the observations made in the present study in this regard . Munawar (1970) has suggested that high value of chloride is an indication of pollution of animal origin. It has been also suggested that chloride contents also increased with degree of eutrophication (Sinha.1986).

Alkalinity

Alkalinity of water is the capacity to neutralize a strong acid and is characterized by the presence of all hydroxyl ions capable of combining with hydrogen ion. The role of alkalinity in the determination of productive capacity of aquatic environment has been described by Philipose (1959), according to whom inland waters are categorized into three types, further according to the same author waters with low alkalinity are comparatively low in production. The alkalinity in natural waters is mainly due to the presence of bicarbonates and carbonates. Rai (1980) has reported that waters rich in free CO_2 are comparatively less alkaline whereas waters deficient in this gas are more alkaline . Similar observations have been made by

Roy (1955), Zafar (1964) and Munawar (1970). But on the contrary , Singh (1965) has claimed that the alkalinity of water does not seem to be affected either by oxygen or carbon dioxide alkalinity below 500 mg/l indicate low photosynthetic rate (Das, 2002).

In the present investigation carbonate alkalinity was absent throughout the year . Bicarbonate alkalinity ranged from 50.1 - 99.0 mg/l (Table-1). Bicarbonate alkalinity was highest during summer and lowest during rainy season. On the basis of alkalinity values the river water can be classified under high category of nutrient type after the classification of Philipose (1959) as the alkalinity value is > 100 mg/L. On the basis of Moyle's (1946) classification, the river may be termed as hard water type . The low value of alkalinity during monsoon indicated degradation of water quality due to flooding from intensive agricultural zones. The effect of alkalinity in river water is responsible for the increased algal productivity. On the basis of pH, free CO_2 and alkalinity , the river water may be considered moderately alkaline giving support to the observations of Vass *et al.,* (1977) of river Jhelum .

Nitrate

Nitrogen occurs in natural waters in elemental state and as organic as well as inorganic nitrogenous compounds. The elemental nitrogen in water is derived mostly from the atmosphere. The other source is the bacterial denitrification of nitrates, nitrites and ammonia. Nitrate parameter is an excellent parameter to judge organic pollution. Thrash *et al.,* (1944) have attributed the nitrogen richness of fresh water body to the pollution of animal origin. In aquatic system nitrogen level is regulated through precipitation, atmosphere solution and volatilization under meteorological process; sedimentation influence effluent and ground water movement under geologic process, nitrogen fixation, denitrification, uptake, growth, decay, hydrophytes pumping and fish and weed removal under biological process (Toetz, 1976). The level of the total nitrogen concentration in an index of carbon budget of fresh water body (Munawar, 1970:Pillai and Sreenivasan, 1975). In the present study the nitrate value ranged from 0.38 to 0.64 mg/l . The low value of nitrate during winter season might be due to high macrophytic and phytoplankton production. Lee *et al.,*(1975) have indicated that during winter, the decrease in nitrogen is probably associated with entire uptake of this element by these plant communities. The high value of nitrate during rainy season night be attributed to rain showers, decomposition of organic matters and influx of flood water (Rao and Govind, 1966).

Phosphate

The phosphate in natural water occurs in very small quantities. It is necessary for fertility and is generally recognized as a key nutrient in the productivity. The phosphate more than 2 mg/l in open water gives a sign of organic pollution (Pomeroy *et at.,* 1965). Among the various micro-nutrients phosphorous is found to play an important role in governing the primary productivity of any ecosystems (Hutchinson, 1957). The primary concern to phosphorous lies in its ability to increase the growth of nuisance algal and eutrophication. Butler and Liss (1972) stated that any change in phosphate content may affect the plankton community.

Phosphate is the main nutrient responsible for eutrophication in water bodies. Excess of phosphate is

reported to be present in the domestic sewage. According to Arceivala (1981) raw domestic water may contain an average of 10mg/l of phosphate.

Phosphorus is available in water combined with a number of ions. Phosphate or iron and calcium are very common . In the present investigation the phosphate value was usually low, the minimum being 0.08 mg/ l (Table-1). The minimum value of phosphate during winter may be due to advance phytoplanktons which utilizes it . Such findings have also been reported by Kataria *et al.,* (1996) . The maximum value of phosphorous during rainy season might be due to agricultural run off which brings phosphate from the catchment areas. Cattle dung and night soil also add to the phosphorous content of water.

Sulphate

Sulphate, a common anion has a very important role in the soft water systems where certain organic chelate or complex metal ions prevent those ions reacting with other substances (Hutchinson, 1957 and Wetzel, 1975). The increased value of sulphate during monsoon (Table-1) might be due to surface run off which brings more suspended solids along with organic and soluble salts (Sinha, 1986). The low value of sulphate during winter might be due to higher phytoplankton population. Sulphate is ecologically important for growth of plants and its short supply may inhibit the development of plankton. Sulphur is also important in protein metabolism.

Phytoplankton

Phytoplankton is an important aquatic flora. They play a key role in maintaining proper equilibrium between abiotic and biotic components of the aquatic ecosystem. Phytoplankton have been regarded as the chief primary producers of natural ecosystems. Being an index of trophic status, phytoplankton reflects the over all environmental condition of the system and its potentiality (Agarwal *et al.,* 1993). Phytoplankton are the fundamental components of aquatic ecosystem as they are the major source of biologically important and labile organic carbon, located at the base of food chain. The magnitude and dynamics of phytoplankton population have became an essential tool to assess the general health of an aquatic eco-system. Phytoplankton can be used in the treatment of waste water and either heavy scale deposition of corrosiveness of water and making it potable (Mahadev and Hosmani, 2002). Their density have been reported to be effected by the quality of water (Bilgrami and Dutta, 1979: 1985).

The phytoplankton communities of the river were presented mainly by four groups comprising 38.71% species of Chlorophyceae , 38.96% Myxophyceae , 15.06% Bacillariophyceae and 7.27% Euglenophyceae (Table-2 and Fig 2).

Chlorophyceae

This group was represented by *Spirogyra sp., Volvox sp,. Ulothrix sp,. Closteridium sp,. Chara sp,. Pandorina sp., Zygnema sp., Chlorella sp. and Chlamydomonas sp.*

Myxophyceae

This group was represented *by Anabaena spheical, Oscillatoria limnetica, Microcystis robusta, M.*

aeruginosa, Spirulina sp., Merisomopedia sp., Nostoc sp. and Collastrum sp.

Bacillariophyceae

This group was represented by *Cymbela, Melosira , Navicula Nitzschia sp., Diatoma Syndera, Fragilaria, Pinnularia and Cyclotella.*

Euglenophyceae

This group was represented by *Euglena viridis.*

Davis (1955) pointed out that various physical, chemical and biological circumstances must be simultaneously taken into consideration for understanding the fluctuation of plankton population. Temperature, pH, alkalinity and phosphate have been emphasized to be significant factors controlling distribution of Cyanophyceae (Singh,1965). George (1976) also reported temperature and pH correlation with phytoplankton . In the present investigation pH, DO and transparency showed a positive relationship with Chlorophyceae. Jackson (1971) has reported alkalinity range of 50 to 110 mg/l as optimum for the Myxopycean where as Sreenivasan (1965) observed 50 mg /l alkalinity for the growth of Myxopyceae. The present study agree with them. The rate of production are closely dependent upon temperature conditions of water body (Mc Camby, 1953). According to Roy (1955) low temperature in Hoogly was favorable for the growth of diatoms resulting in highest plankton peak in the year. The present study shown highest phytoplanktons in winter, when water temperature was low. There was decline in number with increase in temperature suggesting that phytoplankton preferred moderate temperature. Rainfall and high turbidity produced by high wind velocity during rainy season had a direct bearing on phytoplankton population reducing them to minimum numbers.

The river harbours many allergenic algae such as *Chorella vulgaris, Anabaena, Microcystis, Nostoc sp.,* and *Oscillatoria sp.* Allergenic problems caused due to such algal are rhinitis, bronchial asthma, hypersensitivity in fish, cattle and animals couple with symptoms of partial paralysis , loss of balance, hard stool, reduced milk yield , general weakness and photosensitization of skin (Shukla, 1991).

During recent years algae have acquired place of problem organism in eutrophic waters (Trainer, 1978). Toxic characteristic exhibited by certain species *Microcysts acruginosa, Anabaena flosagual* and *Aphanizomenon flosaguae* are the best offenders. Water fowl , fish and livestock are the most frequently affected organism though human deaths have also been reported. *Ulothrix sp*. and *Diatoms* are some of the more troublesome forms (Evans, 1960 and Edmondson, 1974).

The study made on phytoplankton of water bodies all over the world have shown marked differences in the floriotic composition with different levels of pollution which have promoted several workers to use algal composition as the indicator of the level of pollution Hasle, 1947; Rawson, 1956; Hutchinson, 1967 and Palmer, 1969).

Palmer (1969) on the basis of studies carried out at different places in the world has given a list of 60 algal genera and 80 species most tolerant to pollution. The use of diatoms as indicators of pollution has been emphasized by Davis (1964); Patrick (1973); Reynold (1973); Stockner and Benson(1967);Stoermer *et al.,*

(1978); Rai and Kumar (1976) and Verma *et al .,* (1978) have reported *Nitzschia* from highly polluted water in India. Geevarghese and Chandrasekharan (1985) while studying the impact of newsprint factory on Moovattepuzha river found that the diatoms *Nitzschia, Melosira, Diatoma, Pinnularia* and *Navicula* were quite dominating in polluted zone . Some other studies like Raina *et al.,* (1982) on river Jhelum, Gunale (1991) on river Mula. Mutha and Adhola (1988) on river Betwa have also reported certain characteristic diatoms in polluted conditions. These authors have also encountered several members of Chlorophyceae, Cyanophyceae and Euglenophyceae like *Pandorina, Scenedesmus, Coelastrum, Chlorella, Chalmydomonas Oocystis, Pediastrm, Microcystis, Oscillatoria, Anabaena, Ankistrodesmus* and *Euglena* in polluted conditions. Goel and Autade (1995) have reported 61 species of algae during their studies on river Panchganga. Out of these 61 species, 21 are pollution tolerant species . Wani (1998) have reported 91 species of phytoplankton in the lakes of Kashmir. Prasad and Singh (2003) have reported 20 taxa of algae in a tropical water body of Motihari. In the present investigation,27 species of phytoplanktons were found of which many were pollution tolerant. Algal species can also be used as good indicators of heavy metal pollution in fresh water ecosystems (Forstner and Wittmann, 1979). *Euglena* and *Nitzschia* have been regarded as indicators of Cr and Cu pollution in water (Palmer, 1980). Ramaswamy *et al.,* (1982) reported luxuriant growth of *Syndera* and *Nitzschia* and Euglenophyceae in water having high concentration of Cu. However, in present study no such correlation was observed. Franklin (1972) suggested that blue green algae are general indicators of eutrophication of water. Rama Rao *et al.,* (1978) have also designated green algae to be the indicators of highly polluted waters.

Zooplankton

Zooplankton forms the vital link between autotorphs and heterotrophs in an aquatic ecosystem. Zooplankton occupy an intermediate position in the food web. Zooplankton, the primary consumers, which play an important role in fish production are being adversely affected. These organisms are highly variable in nature from one water bodies to the other and acts as bioindicators of pollution (Arora, 1966; Sampath *et al.,* 1978; Sharma, 1986 and Saksena, 1987). The Zooplankton forms a link between phytoplankton and macroinvertebrates, which inturn provides food to fishes and aquatic bird . The knowledge of their seasonal qualitative and quantitative fluctuation has been considered always essential for proper understanding of the factors influencing biological productivity and fisheries development. Really, planktonic animals in fresh water are dominated by Rotifers, Cladocera and Copepods. Rotifers are the most sensitive bio-indicators of water quality and their presence may be used as a reference to the physico-chemical characteristics of their habitat. Several zooplankton species have been classified as indicator of polluted conditions. The zooplankton community mainly comprises of Rotifers (46.83%), Cladocera (36.46) and Copepods (16.71%) (Table 3 and Fig .3) . The three groups of zooplankton were:

A. Rotifera

Brachionus rubens, B.falcatus, B. calyciflorus, B. plicatilis, B .angularis,. B. forticula, B. caudatum, Keratella tropica, K. vulga, K. eanadensei, Monostyla lunaris M. bulla, Horaella sp., Lepadella sp.,

Cephalodella forticula, Rotaria sp., Polyarthra sp., Ophryoxus sp. and Chydorus gibbus.

B. Cladocera

Moina micrura, M. brachiata, Macrothrix sp., Daphnia sp., and *Ceriodaphnia sp.*

C. Copepods

Nauplius sp., Mesocyclops sp. and *Heliodaptomus vidunus.*

Species richness is a good indication of the dynamic balance of the communities. The rotifers constitute from 33.33% to 53.84 % in total zooplanktonic communities in various waters (Kaushik, 1992) . In the present investigation , the percentage of rotifers in total zooplankton is 46.83 % The difference in rotifer community structure in the river can be attributed to intense variability in physico-chemical and geographical condition . Other factors responsible can be nutrients, organic matter and phytoplanktonic growth .

Lakshminarayana (1965), Chourasia and Adoni (1985) have found a direct relationship between pH and zooplankton production . It is quite evident from the present study that the pH range of 7.3 to 8.2 favoured the growth of zooplankton . Nasar (1977) noted that pH between 7.6 to 7.7 is quite suitable for development of zooplankton. Low value of nutrients act as limiting factor for zooplankton development despite good illumination (Sreenivasan, 1970).

The structure of zooplankton community is characteristic and is the product of the environmental conditions prevailing there. Presence of maximum zooplankton population in summer might be due to the presence of higher population of bacteria. According to Singh (1991), Pandey *et al.,* (1995) optimal thermal and nutritional condition and higher concentration of oxygen might be responsible for the higher rotifer population during summer. The lower density of zooplankton during rainy season might be due to flood and fast current of river water (Pandey *et al.,* 1995,2004). The abundance of zooplankton in the ecosystem in comparison to other group is an indication of eutrophication (George, 1966).

Dominance of rotifers in the seasonal data of zooplankton as observed in the present study is in accordance with the findings of Michael (1968); Saha *et al.,* (1971); Bahura *et al.,* (1993), Pandey *et al.,* (1992b, 1994, 1995, 2004) and Hosmani (2002).

The species composition of zooplankton indicated that rotifers occur more predominantly than cladocerans and copepods. Dominance of rotifers in other groups has also been reported in other water bodies of the world (Pennak, 1994; Alikuhni, 1957; Michael 1968 and Singh and Sahai, 1978). However , Patra and Dutta (2004) have reported copepodans as the largest group . The sequence of dominance of various groups was Rotifera > Cladocera > Copepods. Rotifers form an important componcent of zooplankton community involved in the trophodynamics of an aquatic ecosystem.

The Cladocerans were succeeded by the Copepods, which in turn indicates that Copepods build up their population taking more time than Rotifers and Cladocerans. However, once they become dominant, they continue to dominate the habitat till hydrological conditions favour their existence. The phytoplankton bloom physical and chemical characteristic of water are stated to be greatly responsible for the Copepods population (Patalas, 1975). Copepods were abundant during rainy season followed by winter peak . Winter

and rainy peaks have been reported by Maruthanayagm *et al.,* (2003) and Pandey *et al.,* (2004). Comita and Anderson (1959) found that copepods multiply when that phytoplankton population was abundant. Such an observation was not found in the present investigation. This supports finding of Hosmani (2002). The cladocerans population was scanty in comparison to the rotifers. The main cladoceran peak was observed during summer and rainy seasons. According to Wright (1965) the density of cladocerans is primarily determined by the food supply but in the present investigation decline in the number of cladocerans in the presence of sufficient food may due to fish predation and the active competition between cladocerans and other groups.

The zooplanktonic species have been recognized as pollution indictors by their usual absence or presence in water body. Sampath *et al.,* (1978), Verma *et al.,* (1984) , Sharma (1986), Mishra and Saksena (1990) have commented on the basis of study of zooplankton communities that *Arcella discoides Difflugia cornata D. muriformes, Brachionus angularis, B. rubens, B. caudatus, B. falcatus, B. calyciflorus, B. diversicornis, Keratella lenzi, K. tropica, Moina sp., Daphnia carinata, D. lumkoltz, Cypris sp. Cyprinotus* and *Mesocyclops* are present in mesotrophic waters. *Arcella sp., Diffugia sp. Centropyxis sp., Brachionus angularis, B. calyciflorus, B. rubens, B. caudatus, B. quadridentatus, B. budapestinensis, B. petrodinoides, B. sessilis, Keratella tropica, K. cohlearis, Anuracopysis fissa, Platyias quadricornis, Lecane crenata, L.cornuta, L. lunaris, L. decipience L. pyriformis, L. closterocerca, Colurella bicuspidate, Filinia longiseta, F. terminalis, Asplanchna sp., Rotaria neptunia, Cephalodella sp., Conchilus sp., Polyarthra sp., Daphnia parvula, Cerodaphina lacustaris, Chydrous sphaericus, Daphanosoma leuchtenbergianum, Moina sp., Mesocyclops edax* and *Diaptomus busiciloides* are representative of eutrophic waters (David and Roy, 1966; Arora, 1966; Sharma, 1986; Bhatti and Rana, 1987; Cap, 1980; Janicki *et al* ., 1979 and Saksena, 1987). In the present study, *B. calyciflorus , sp*., *B. falcatus, B.forticula, B. angularis, Cephalodela sp., Polyarthra sp, Moina, Mesocyclops sp.,* Cypris sp., Ceriodaphnia sp. were present in the river and they are suggestive of pollution.

All forms of organic matters are basically undesirable in the water though to a certain level of is tolerable. This may lead by to serious trouble like eutrophication and depletion of the oxygen content of the system and thus impairing its health. Indian standards set 3 mg /l of DO as the limit. The DO level throughout the year was more than 3 mg/l. This perhaps indicates that the self purification capacity of the river can assimilate the existing load.

The results of physico-chemical study of water quality of the river depict a very critical level of pollution. An over all nutrients status, a low level of dissolved oxygen , high BOD,COD, solids and low oxygen are some of the positive factors favouring the growth of phytoplankton (Palmer, 1969). The growth of algae causes eutrophication, which may enhance the fish production (Lund, 1972).

It is clear from the present findings that the aquatic environment of the river has under gone degradation. The main sources of river pollution in the present study were recognized as:

a) Discharge of domestic sewage from near by villages as well as industrial wastes

b) Agricultural run off

c) Burning of corpses on the bank of river
d) Bathing habits of human as well as cattles.
e) Washing of clothes and utensils and
f) Soil erosion
g) Jute retting

Proper remedial measures should be taken immediately in order to restore it from further deterioration. There must be alternate waste disposal system away from the river and the disposal of solid and liquid wastes must stopped forthwith . Planting some macrophytes like *Polygonum amphibium. Bacopa momiesi Alternanthera sessilis* and *Leonots nepataefolia* on both sides of the river has been reported to reduce toxicants from the polluted river water (Gupta, 2000).

References :

Adoni, A.D.,1975. Studies on micro-biology of Sagar lake. Ph. D. thesis, Sagar University, Sagar, M.P.

Anderson , G.C., 1961. Recent change in the trophic nature of lake, Washington. A review in algae and metro politancinnati, Ohio, TRW, 61(3):27-33.

Adebisi,A.A., 1980. The physico-chemical hydrology of tropical seasonal upper Ogum river. *Hydrobiolo.,* 79:157-165 .

Agarwal, R., Bahura, C.K. and Saxena, M.M., 1933. Planktonic productivity of sewage fish pond and adjoninig oxidation pond at Vallabh Gardens, Bikaner. ***Acata. Ecol,***. 15(1):58-61 .

Alikuhni, K .H., 1957. *Fish culture in the India* . Farm Bulletin no. 20: ICAR , New Delhi .

APHA (America Public Helath Association) American Water Works Association and pollution Control Federation, 1975. *Standard methods of examination of water and wastewater,* 14th edition . APHA, Washington, USA.

Arceivala, A. J., 1981. *Waste water treatment and disposal.* Marcel Dekker, New York .

Arora, H.C., 1966. Studies on Indian Rotifera Part III . ***J. Zool. Soc.,*** 16(1&2):1-6

Bahura, C.K., Bahura, P. and Saxena, M.M., 1993. Zooplanktonic community of Shivbari temple tank Bikaner. ***J. Ecobiol .,*** 5(1):5-8.

Barnes, R.K. and Mann, K.H., 1980. Fundamental of Aquatic Ecosystems . Blackwell Scientific Pub. Oxford : 1-229 .

Bharti, S.G . and Kori . A.P., 1975. Limn logical studies in ponds and lakes of Dharwad : Diurnal variation in Saydapur Keri Part I Kanrnataka Univ. ***J.Sci .,*** 20:157-167 .

Bhatti, D.P.S. and Rana, K.S., 1987. Zooplankoton in relation to abiotic componets in the fort moat of Bharatpur, Proc.Nat .Acad . Sci. India 57 (B):237-242 .

Bilgrami, K.S. and Dutta Munshi , J.S., 1979. Limnological Survey and lmpacg of Human Activites on the River Ganga (Barauni to FaraKKa). Allied press, Bhagalpur, India .

Bilgramni ,K.S. and Dutta Munshi , J.S., 1985. Ecology of river Ganges . Impact of Human and Conservation of Aquatic Biota . (Patna to Farkka .) Allied press , Bhagalpur,India .

Bohra , O.P. and Bhargava , D.S.(1977) : Abiotic factors chlorophyll pigments and primary production in

two lakes of Jodhpur . Geobios , 4:215-216 .

Butcher, R.W., 1947. Studies on Ecology of river VII. The algae of enriched water. ***J. Ecology,*** 35:186-191.

Cap, R.K., 1980. Limnological studieds of Western lake Erie. 111 phytoplankton and physical – chemicaldata from –November 1939 to Nomver 1940. ***Ohilo J.Sci .,***42:24-44.

Chandler, D.C., 1942. Lmnological studies of Western lake Erie. III Phytoplankton and physical – chemical data from- November 1940 .***Ohico. J. Sci.,*** 80:114-118.

Chourasia , S.K. and Adoni, A.D., 1985. Zooplankton dynamics in a shallow eutrophic lake. In Proc. Nat . Symp. Pure and Appl. Limnology .(Ed .A.D. Adoni). Bull. Bot. Soc. Sagar, 32:30-39.

Cole, G.R., 1979. *A Text Book of Limnology*. 2nd Ed . New York . The E.V. Mosley Co., London.

Comita and Anderson, 1959. Cited from phyto;lankton zooplankton relationship in four fresh water bodies of Dharwar . Hosmani. S.P. (2002). ***Ind. J. Env. & Ecoplan .,*** 6(1):23-28.

Butler, E.T. and Liss, S., 1972.Chemical survey of tamar estyary. ***J. Mar. Biol.,*** 52:681-699.

Dale, H.M. and Gillsspic, T. J., 1977. The Influence of submerged Aquatic Plants on temperature Gradients in shallow water bodies. ***Canadian J. Bot.,*** 55(16):2216 – 2225 .

Das. A.K., 2002. Phytoplankton primary Production in some selected Reservoirs of A.P. ***Geobios***, 29:52-57.

David, A . and Roy. P., 1966. Studies on the pollution the river Daha (N. Bihar) by sugar and distillery wastes. ***Environ . Hlth .,*** 8(1):6-35.

Davis, C.C., 1955. *The marine and fres water plankton Michigan State*. Uni. Press. East Lausing , 562 p .

Edmondson, W.T., 1974. *A simplified method for counting phytoplankton, in R.A. Vollenweider*. A manual on methods for measuring primary productivity in aquatic environment Blackwell Sci. Pub. Oxford .

Evans, G.H., 1960. Algological studies in Ann. Rep. of East African fresh water fisheries. Res. Org. jinga, Uganda.

Forstner, V. and Wittman, G.T.W., 1979. *Metal pollution in the Aquatic Environment*. Spring-berlage. New york

Franklin, T., 1972. First internat .Symp on taxonomy and biology of blue green algae Univ . Madras, 442.

Geevarghese, C.and Chandrashekharan. M.P., 1985. Studies on the ecological aspect of rectory waste on river ecosystem. ***Poll. Res.,*** 4(1):21-24.

George , M.C., 1966. Comparative plankton ecology of five fish tanks in Delhi, India. *Hydrobiol.,* 27:81-10.

George. J.P., 1976. Hydrobiological studies on lower lake of Bhopal with special reference to productivity of economic fishes Ph. D.Thesis, Bhopal University .

Goel, P.K. and Autade, V.B., 1995. *Ecological studies on the river panchganga at Kolhapur with emphasis on biological components*. Recent Researches in Aquatic Environment. PP. 25-46 Ed . Gautam,A.and Agarwal., N.K. Daya publishing House, New Delhi .

Gunale ,V.R.,1991. Algal communities as indicators of pollution. ***J. Environ. Biol.,*** 233-232.

Gupta, A.K., 2000. Sustainable strategies for restoration of degraded Varuna river corridor. ***J. Env. & Poll.,*** 7(1):43-46.

Hasler, A.D., 1947. Eutrophication of lades by domestic drainage. *Ecology.,* 28:288-295.

Hosmani, S.P., 2002. Phytoplankton – zooplankton relationship in four fresh water bodies of Dharwar Ind. ***J. Env. & Ecoplan.,*** 6(1):23-28.

Hutchinson, G.E., 1957. *Treatise on Limnology*. John Wiley and Sons, New York.

Hutchinson, G.E., 1967. *A Treatise on Limnology , Vol . III. Introduction to lake biology and limnoplankton.* J. Wiley and Son. N.Y.

Jackson, D.F., 1971. Comparative studies on phytoplankton photosynthesis in relation to totel alkalinity ***Ver. Limnol.,***14:125-133.

Jameel, A.A., 1998. Physico-chemical studies in Vyyakondan channel water of River Cauvery. ***Poll. Res.,*** 17:110-114.

Jameson, J. and Rana, B.C., 1996. Pollution status of river complex Sabarmati at Kheda region of Gujarat I. J. Physico- chemical characters. ***Poll. Res.,*** 15(1):53 – 55.

Janicki. A.K., Decosta, J. and Davis, J., 1979. Midsummer crustacean – planktonic communities of seven small compoundments. ***Hydrobiol.,*** 64:123-129.

Jhihgran, V.G., 1982. *Fish and Fisheries of India* (1st and 2nd Ed .) Hindustan Publishing Corporation. Delhi, India.

Kataria, H.C., Quereshi, H.A., Iqubal, S.A. and Shandilya, A.K., 1996. Assessment of water quality of Kolar Reservoir in Bhopal, M.P. ***Poll.,*** 15 (2):191-193.

Kaul, V., Zutshi and Vass, K.K., 1972. Biomass productivity of some macrophytes in Srinagar lakas. In P.M. Colley and F.B. Golley (Eds.). Tropical Ecology Emphasizing Organic production. Pp. 295-311.

Kaur, H., Dhillon, S.S., Bath, K.S. and Mander, G., 1996. Analysis of the elements polluting River Ghaggara in the region of Punjab. ***J.Env.& poll.,*** 3 (2): 65-68.

Kaushik, S., 1992. Ecological studies of some water bodies at Gwalior, Madhya Pradesh, Ph.D. Thesis, Jiwaji University, Gwalior.

King, D.L., 1972. Carbon limitation in sevage lagoons. In Nutrients and Eutrophication.Am. Soc Limnol. Oceanogr , Kanari, 98:112.

Kotpal, R.L . and Bali, N.P., 1989. Concept of Ecology 4th Edn.Vishal Pub. Jalender, India.

Lakshminarayana, J.S.S., 1965. Studies in the phytoplankton of river Ganges, Varanasi, India. I.Physico-chemical characteristics of river Ganges II. The seasonal algae in the river Ganges. ***Hydrobiol***., 25:19-165 .

Lee, G.F., Bentley, E. and Amundson, R., 1975. Effects of marshes on water quality. In coupling of land Water system". ed-A. D Hasler. 105-126, spinger – Verlag Berlin : heidelber : New york.

Lester, W.F., 1967. Management of River quality. In: River Management P.C. G.lsaac (Ed.) Maclaren and Son Ltd, London.

Livingstone, D.A., 1963. Chemical composition of rivers and lakes U.S. G.S.Geological Survey Prof . Pop .440G 1-64.

Lund, J.W.J., 1972. Eutrophication Proceedings of the Royal Society of London. ***Bio. Sci.,*** 180:371-382.

Mahadev, J. and Hosmani, S.P., 2002. Langlers index and is velation to phytoplankton in two lakes of

Mysore city. ***Nature Env. & Poll. Tech.,*** 1(1) : 19-21.

Maruthanayagam, M., Sasikumar, M., and Senthikumar, G.C., 2003. Studies on Zooplankton population in Thirukkulum pond during summer and rainy seasons. ***Nature Env. & Pol. Tech.,*** 2(1):13 - 19.

Madhyastha, P.D., Rekha, P.D. and Shashikumar, K.C., 1999. Impact of anthropogenic activities on the river quality along pilgrims centres at Dakshina Knnada. ***J. Hum. Ecol.,*** 10(1):29 -34 .

Mc. Camby, A.M., 1953. Factors influencing the growth of phytoplankton. ***J. Fish Res. Board. Can.,*** 10: 253-282 .

Michael, R.G., 1966. Diurnal variation in chemical factors and zooplankton in the surface layers of three freshwater fishponds, Ind. ***J. Fish.,*** 13(1 & 2):48-42.

Michael, R.G., 1968. Studies on zooplankton o a tropical fish pond. Hydrobiol, 2(1-2)Mahadev, J. and Hosmani, S.P., 2002. Langlers index and is velation to phytoplankton in two lakes of Mysore city. ***Nature Env. & Poll. Tech.,*** 1 (1):19-21.

Maruthanayagam, M., Sasikumar, M., and Senthikumar, G.C., 2003. Studies on Zooplankton population in Thirukkulum pond during summer and rainy seasons. ***Nature Env. & Poll.Tech.,*** 2(1):13 - 19:47-60.

Mishra ,G.P. and Yadav. A.K., 1978. A comparative study of physico-chemical characteristics of river and lake water in Central India. ***Hydrobiol .,*** 59(3):275-278.

Mishra, S.R. and Saksena, D.N., 1990. Seasonal abundance of the zooplankton of waste Water from the industrial complex at Birla Nagar (Gwalior), India.Acta. Hydrochem . ***Hydrobiol.,*** 18:215-220.

Nasar, S.A.K., 1977. Investigations on the seasonal periodicity of zooplankton in freshwater pond in Bhagalpur, India. ***Acat. Hydrohem. Hydrobiol.,*** 5 (6):577-584.

Palmer, C.M., 1969. Composites rating of algal tolerating organc pollution. ***J. phycol.,*** 5:78-82

Palmer, C.M., 1980. *Algae and Water Pollution*. Castle House Publication Ltd., U.S.A.

Pandey, B.N., Jha, A.K, Das P.K.L. and Pandey, K., 1994. Zooplanktonic community in relation to certain Physico-chemical factors of konnwamps, Purnea, Biahr. ***Env. & Ecol.,*** 12(3):563 -567.

Pandey, B.N., Lal, R.N., Mishra, P.K. and Jha, A.K., 1992a. Seasonal rhythms in the physico-chemical properties of river Mahananda (Katihar), Bihar. ***Env. & Eco.,*** 10(2):354 – 357.

Pandey, B.N. and Mishra, R.D., 1990. Hydrobiological features of river Saura . ***Bio. J.,*** 2(2):354- 342.

Pandey, B.N., Mishra, A.K., Jha, A.K., and Lal, R.N., 1992 b. Studies on qualitative composition and seasonal fluctuation in plankton composition of river Mahananda,Katihar (Bihar). ***J. Ecotoxicol. Environ. Monit.,*** 2(2): 93-97.

Pandey, B.N., Mishra, A.K., Das, P.K.L and Jha, A.K., 1995. *Studies on hydrobiological condition of river Saura in relation to its impact on biological health.* Recent Researches in Aquatic Environment, (Eds.Ashutosh Gautam and N.K. Agrawal) Daya publishing House, New Delhi.

Pandey, B.N., Hussain, S., Jha, A.K. and Shyamanand, 2004. Seasonal fluctuation of zooplanktonic community in relation to certain physico-chemical parameters of river Ramjan of Kishanganj , Bihar ., Nature . Env.& Poll . Tech.,3 : 325 - 330.

Patel , N.K. and Sinha, B.K., 1998. Study of the pollution load in the ponds of Burla area near Hirakund Dam

of Orissa. ***J.Env. & Poll.,*** 5(2): 57-160.

Patalas, R., 1975. The crustacean plankton communities of fourteen North American great lakes., Ver. Intern. ***Ver. Limnol.,*** 19:504 – 511.

Patra, S.B., and Datta, N.C., 2004. Seasonal fluctuation of different zooplanktonc groups of a rainfed wetland in relation to some abiotic factors. Insd. ***J. Environ .& Ecoplan.,*** 8(1):7-12.

Patrick, R., 1973. Use of Algae, especially diatoms in assessment of water quality. (In); Biologicl method for assessment of water quality, 76-95 ASIM/STP.

Pennak, R.W., 1944. Diurnal movements of zooplankton organisms in some Colorado mountain lakes. ***Ecology,*** 25:387 – 403.

Philipose, M.T., 1959. Fresh water phytoplankton of inland fisheries. Proc. Symp. Algology, 4:275–291

Pillai, K.V. and Sreenivasan, A., 1975.A note on the carbon and nitrogen status of some lakes, reservoir and pond of Tamilnadu. ***J. Inland. Fish. Soc.,*** 2(195) :65–97.

Pomeroy, L.R., Smith, E.E. and Grant., C.M., 1965. The exchange of phosphate between estuarine water and sediments. ***Limnol. Oceanoor.,*** 10(2):167-172.

Prasad, B.B. and Singh, R.B., 2003. Composition abundance and distribution of phytoplankton and zoobenthos in a tropical water body. ***Nature Environ. and Poll. The.,*** 2(3) :255-258.

Rai, D.N., 1980. Ecological structures of certain Swamps of Darbhanga (Bihar) Ph. D. Thesis, Bhagalpur University, Bhagalpur.

Rai, L.C. and Kumar, H.D., 1976. Systematic and ecological studies on algae of some habitats polluted with fertilizer factory effluents near Shapuri, Varanasi, India, Nova Hedwigia, 27:805-811.

Rama Rao, S. Singh, U.P. and Mail, L.P., 1978. Pollution of river Kaun (Indore). India. I. Biological assessment of Pollution, Water 12:555-559.

Ramaswamy, S.N., Somashekar, R.K. and Areka, G.D., 1982. Ecological studies on algae in waste water from rubber tyre factory. ***Indian J. Environ, Hlth.,*** 24:1-7.

Raina, R., Subla, B.A . and Zutchi, D.P., 1982. Water quality and Plankton of Jhelum River. ***Int. J. Ecol. Environ. Sci.,*** 8:11-17.

Raney, E.D. and Menzel, B.W., 1969. Icthyological Association Bull. Ithaca. BYZ.

Rao, C.B., 1955. On the distribution of algae in a group of six small ponds. II. Algal periodicity. ***J. Ecol.,*** 43:291-308.

Rao, D.S. and Govind, B.V., 1966. Hydro-biological studies of Tungbhadra reservoir. ***Indian J. Fish,*** 11:321-344.

Rawson, O.S., 1956. Algal indicators of trophic lake types. ***Limnol. Oceanoger.,*** 1:18-25.

Roy, H., 1955. Plankton Ecology of River Hooglly (West Bengal). ***Ecology,*** 36:169-175.

Reynolds , C.S. (1973) : The seasonal periodicity of planktonic diatoms in a shallow eutrophic lake. Freshwater Biol., 3 : 89-100.

Saha, G.N., Sehgal , K.L., Mitra, E.and Nandy , A.C. (1971) : Studies on the seasonal and diurnal variation in phsico-chemical and bilogicl conditions of a perennial fresh water pond . J.Inland . Soc . India.,

3: 79-102.

Sampath, V., Sreenivasan , A. and Ananathanarayanam , R.(1978) : Rotifers as biological indicators of water quality in Cauvery river. Abst. Symp Environ.Biol., P.5.

Saksena , D.N. (1987) : Rotifers as indicator of water quality . Acta Hydrochem., Hydrobiol., 15:169-175.

Saxena, D.N. and Mishra, B.R (1991) : The water quality index self purification capacity of sewage collecting channel , Morar (Kalpi) River at Gwalior , Madhaya Pradesh J. Fresh Water Biol ., 3 (2) : 169-175.

Sharma, B.K. (1986) : Assessment of pollution indicators in Indian Rotatoria . J.Meghalaya. Sci. Soc., 47-49.

Syuam Sunder (1988) : Monitoring the water quality in a stretch of river Jhelum , Kashmir,Ecology and Pollution of Indian Ricers . Ed. U.P. 131 -162. Ashish Publishing House , New Delhi.

Shukla , A.C. (1991) : Biological studies of the Ganga Eco-system betwwn Kannauj and Shuklaganj . Tge Ganga , A Scientific study . Northern Book Centre , New Delhi.

Singh, V.P. (1965) Phytoplankton periodicity in a small lake near Delhi J.Phykos, 4 : 61-68.

Singh , R. (1991) : Rotifer fauna of Jmalpur , Munger , Bihar. J.Curr . Bio.Sci., 8 : 45-48.

Singh, S.B. and Sahay , R. (1978) : Seasonal fluctuation of zooplankton population in relation to certain physico-chemical factors of a pond . Geobios , 5 : 228-230.

Sinha , M.P (1986) : Limno biotic study of trophic status of a polluted freshwater reservoir of coal field area poll . Res ., 5:13-17.

Singh , S.R. and Srivastava , V.K. (1988) : Variation of water quality of Ganga river between Buxer and Ballia Poll. Res ., 7 (3-4) : 85-92.

Singhal, R.N., Jeet,S. and Deviesh, R.W. (1985) : The relationship among physical, chemical and plankton characteristics of unregulated rural ponds in Haryana, India, Trop. Eco ., 26: 43-53.

Sreenivasan, A. (1965) : Limnology of tropical Impoundments . III Limnology and productivity of Amaravati reservoir (Madras state) India . Hydrobiol., 26: 501-516.

Sreenivasan, A . (1970) : Limnology of tropical impoundment , A comparative study of the major reservoirs in Madras state (India). Hydrobiol., 36:443-469.

Swarnalatha, N. (1994) : Seasonal rhytms of various physico-chemicl characteristics of a lake . J.Mendel ., 11 (1) : 65-66.

Stoermer , E.L. Ladonski, B.G.and Schelske , C.L. (1978) : Population response of lake Michigon phytoplankton to nitrogen and phosphorous enrichment . Hydrobiol., 57: 249-265.

Stockner , J.G. and Benson , W.W. (1967) : The succession of diatom assemblages in the recent sediments of lake Washington . Limnol . Oceanoger . , 12 (5) : 513-532.

Thrash, J.C., Beale, J.F. and Suckling , E.V., 1944. *The examination of water supplies.* Ed. Taylor, E.W. 1949.

Todda, B.K ., 1970. Water Encyclopedia. Water Information Centre. Port Washington, New York.

Toetz, D.W., 1976. Mineral cycling in reservoirs. ***Ann. Okla. Acad. Sci.,*** 5:21-28.

Trainer, F.R., 1978. *Inductory phycology*. Jhon Wiley & Sons; 1-525.

Trivedy, R.K. and Goel, P.K., 1984. *Chemical and Biological Methods for Water Pollution Studies*. Environmental Publications.

UNITED NATIONS, 1981. *River Inputs to Ocean systems*. New York, 384 pp.

UNESCO, 1979. *Discharge of selected rivers of the world*. UNESCO, Paris.

Vass, K.K., Raina, H.S., Zutchi, D.P. and Khan, M.A., 1977. Hydrobiological studies of river Jhelum. *Geobios,* 4:238–242.

Verma, S.R., Shukla, G.R. and Ahuja, S.R., 1978. Pollution studies of few rivers of western Uttar Pradesh with reference to biological indicators. ***Ind. J. Env. Health,*** 20:87-99.

Verma, A.M., Dudani, V.K., Kumar, B., Kumar, S. and Pandey, S., 1988. Proc . Nat . Acad . Sci India, 58 (B) : 11-259.

Verma, S.R., Sharma, P., Tyagi, A., Rani, S., Gupta, A.K . and Dalela, R.C., 1984. Pollution and saprobic status of eastern Kalnadi. ***Limonologica (Berlin) .,*** 15:69-133.

Vijay Kumar, K., 1992. Limnological studies of perennial and seasonal standing water bodies of Gulbarga area. Ph. D. Thesis. Gulbarag University, Gulbarga.

Vijay Kumar, K., Holkar, D. and Kaur, D., 1999. Limonological studies on Chandrampalli reservoir, Gulbarga. Fresh Water Ecosystem (Ed., K. Vijay Kumar). Daya Publishing House Delhi .

Vyas, L. N. and Kumar, H.D., 1968. studies on the phytoplankton and other algae of India Sagar tank , Udaypur , India. ***Hydrobiol.,*** 31:421-434.

Wani, I.A., 1998. *Lentic aquatic resources of Himalaya. The case of Kashmir himalaya, India*. Conservation and Management of Aquatic Resources. Daya Publishing House. Delhi-35.

Welch , P.S., 1952. *Limnology*. Mc. Graw Hill Book Company, New York. Tronto and London (2nd ed).

Wetzel, R.G., 1975. *Limnology*. W.B. Sunders Co. Philadelphia, U.S.A.: 742.

Wright, J.C., 1965. The population dynamics and production of Daphnia in Canyon Ferry Reservior, Mentana. ***Limnol, Oceanoger.,*** 10:583-590.

Zafar, A.R., 1964. On the ecology of algae in certain fish ponds of Hyderabad , India,II. Distribution of unicellular and colonial forms. ***Hydrobiol .,*** 24 (4):556-566.

Zutchi, D.P. and Vass, K.K., 1973. Variation in the water quality of some Kashmir lakes. ***Trop . Ecol.,*** 14 (2): 182-196.

Table – 1 : Physico-chemical characteristics of the river water . (All values are expressed in mg/L except pH and transparency (cm)

Months	Temp ^{0}C		pH	Trans.	COD	DO	BOD	Free CO_2	CO_3	HCO_3	PO_4	NO_3	Cl	Sulphate
	Air	Water												
Jan	20.1	18.9	8.6	72.8	66.8	9.9	19.9	0.9	0	90.8	0.09	0.38	25.6	55.6
Feb	22.4	19.5	8.4	70.3	64.7	9.5	20.4	0.8	0	90.5	0.08	0.41	23.2	66.4
Mar	30.5	27.9	8.2	58.6	59.5	9.3	20.6	1.1	0	88.4	0.09	0.43	28.5	73.1
April	34.8	32.5	7.9	50.9	71.6	8.5	21.9	1.9	0	92.1	0.12	0.49	29.4	77.6
May	37.4	35.1	7.5	48.7	74.2	8.3	24.2	1.14	0	99.9	0.14	0.54	32.4	72.9
June	38.2	36.8	7.3	45.1	78.2	8.1	25.4	1.19	0	80.4	0.16	0.56	33.5	71.4
July	38.9	36.9	7.4	38.9	90.4	7.8	25.1	1.04	0	64.6	0.16	0.58	33.9	80.5
Aug	37.4	35.8	7.3	34.1	92.8	7.6	29.8	1.08	0	55.8	0.18	0.61	32.6	74.2
Sept	35.9	28.2	7.6	31.5	76.5	6.8	22.9	1.09	0	50.1	0.18	0.64	29.7	81.9
Oct	33.5	25.4	7.9	35.5	69.8	6.4	21.8	1.04	0	55.2	0.15	0.47	28.2	63.5
Nov	29.1	22.2	8.0	46.5	66.5	7.9	21.4	1.1	0	59.6	0.12	0.42	26.1	58.3
Dec	24.5	20.1	8.4	60.1	65.3	8.1	19.6	1.0	0	70.4	0.11	0.40	25.2	60.4

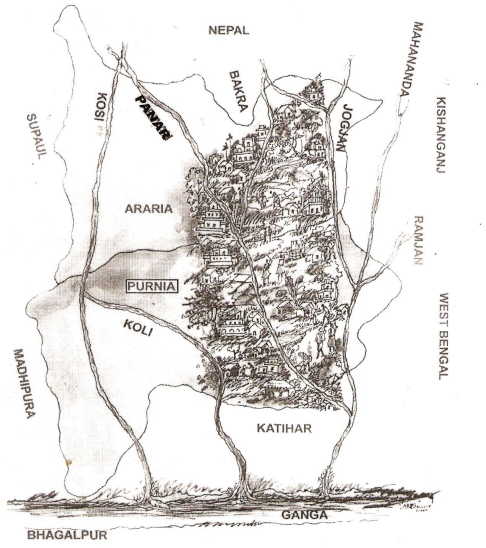
Table-2: Monthwise distribution of phytoplankton groups in river water .

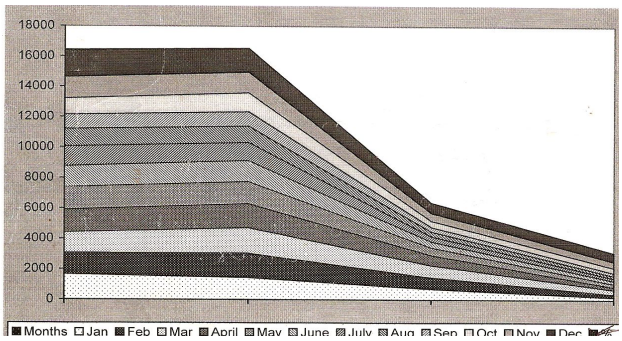
Months	Chlorophyceae	Myxophyceae	Bacillariophyceae	Euglenophyceae
Jan	1680	1450	720	178
Feb	1388	1595	758	202
Mar	1350	1680	790	295
April	1485	1588	670	188
May	1498	1450	498	205
June	1370	1378	390	198
July	1295	1198	340	178
Aug	1145	1078	320	155
Sept	950	945	305	195
Oct	1058	1250	405	325
Nov	1425	1356	520	395
Dec	1795	1580	680	575
%	**16439(38.71)**	**16542(38.96)**	**6396(15.06)**	**3089(7.27)**

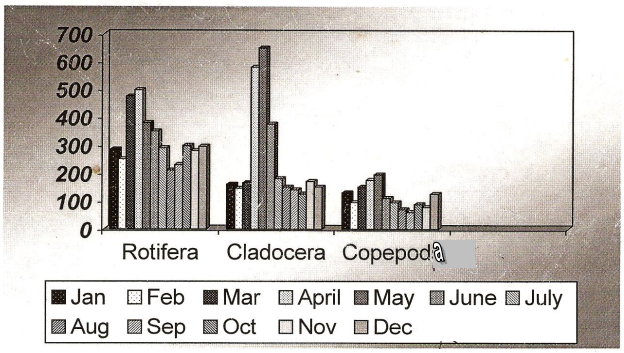
Table – 3: Month wise distribution of zooplankton & group in river water

Months	Rotifera	Cladocera	Copepods
Jan	285	160	130
Feb	250	145	95
Mar	475	165	150
April	498	580	175
May	380	650	195
June	350	375	110
July	290	180	95
Aug	210	150	70
Sep	230	140	60
Oct	298	125	88
Nov	280	170	78
Dec	295	150	125
%	3841 (46.83)	2990 (36.46)	1371(16.71)

Fig. 1: River Panar showing sampling sites.




18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Months Jan Feb Mar April May June July Aug Sep Oct Nov Dec


700
600
500
400
300
200
100
0
Rotifera
Cladocera
Copepoda
Jan
Feb
Mar
April
May
June
July
Aug
Sep
Oct
Nov
Dec