

# *Report and Opinion*

ISSN 1553-9873

**Volume 1 - Issue 3 (Cumulated No. 3), June 15, 2009**



Marsland Press, New York, the United States

# Report and Opinion

ISSN: 1553-9873

The **Report and Opinion** is an international journal with a purpose to enhance our natural and scientific knowledge dissemination in the world under the free publication principle. Papers submitted could be reviews, objective descriptions, research reports, opinions/debates, news, letters, and other types of writings that are nature and science related. All manuscripts submitted will be peer reviewed and the valuable papers will be considered for the publication after the peer review. The Authors are responsible to the contents of their articles.

**Editor-in-Chief:** Hongbao Ma

**Associate Editors-in-Chief:** Shen Cherng, Jingjing Z Edmondson

**Editors:** George Chen, Qiang Fu, Mark Hansen, Mary Herbert, Deng-Nan Horng, Wayne Jiang, Chuan Liang, Mark Lindley, Margaret D. Ma, Mike Ma, Yongsheng Ma, Da Ouyang, Xiaofeng Ren, Ajaya Kumar Sahoo, Shufang Shi, Tracy X Qiao, Pankaj Sah, George Warren, Qing Xia, Yonggang Xie, Lijian Yang, Jenny Young, Tina Zhang, Ruanbao Zhou, Yi Zhu

**Web Design:** Jenny Young

## Introductions to Authors

### 1. General Information

**(1) Goals:** As an international journal published both in print and on internet, this journal is dedicated to the dissemination of fundamental knowledge in all areas of nature and science. The main purpose of the journal is to enhance our knowledge spreading in the world under the free publication principle. It publishes full-length papers (original contributions), reviews, rapid communications, and any debates and opinions in all the fields of nature and science.

**(2) What to Do:** This journal provides a place for discussion of scientific news, research, theory, philosophy, profession and technology - that will drive scientific progress. Research reports and regular manuscripts that contain new and significant information of general interest are welcome.

**(3) Who:** All people are welcome to submit manuscripts in any fields of nature and science.

**(4) Distributions:** Web version of the journal is freely opened to the world, without any payment or registration. The journal will be distributed to the selected libraries and institutions for free. For the subscription of other readers please contact with: [sciencepub@gmail.com](mailto:sciencepub@gmail.com).

**(5) Advertisements:** The price will be calculated as US\$400/page, i.e. US\$200/a half page, US\$100/a quarter page, etc. Any size of the advertisement is welcome.

### 2. Manuscripts Submission

**(1) Submission Methods:** Electronic submission through email is encouraged and hard copies plus an IBM formatted computer diskette would also be accepted.

**(2) Software:** The Microsoft Word file will be preferred.

**(3) Font:** Normal, Times New Roman, 10 pt, single space.

**(4) Indent:** Type 4 spaces in the beginning of each new paragraph.

**(5) Manuscript:** Don't use "Footnote" or "Header and Footer".

**(6) Cover Page:** Put detail information of authors and a short title in the cover page.

**(7) Title:** Use Title Case in the title and subtitles, e.g. "Debt and Agency Costs".

**(8) Figures and Tables:** Use full word of figure and table, e.g. "Figure 1. Annual Income of Different Groups", Table 1. Annual Increase of Investment".

**(9) References:** Cite references by "last name, year", e.g. "(Smith, 2003)". References should include all the authors' last names and initials, title, journal, year, volume, issue, and pages etc.

#### **Reference Examples:**

**Journal Article:** Hacker J, Hentschel U, Dobrindt U. Prokaryotic chromosomes and disease. *Science* 2003;301(34):790-3.

**Book:** Berkowitz BA, Katzung BG. Basic and clinical evaluation of new drugs. In: Katzung BG, ed. *Basic and clinical pharmacology*. Appleton & Lange Publisher. Norwalk, Connecticut, USA. 1995:60-9.

**(10) Submission Address:** [sciencepub@gmail.com](mailto:sciencepub@gmail.com), Marsland Press, 525 Rockaway PKWY, #B44, Brooklyn, New York 11212, the United States, 718-404-5362.

**(11) Reviewers:** Authors are encouraged to suggest 2-8 competent reviewers with their name and email.

### 2. Manuscript Preparation

Each manuscript is suggested to include the following components but authors can do their own ways:

**(1) Title page:** including the complete article title; each author's full name; institution(s) with which each author is affiliated, with city, state/province, zip code, and country; and the name, complete mailing address, telephone number, facsimile number (if available), and e-mail address for all correspondence.

**(2) Abstract:** including Background, Materials and Methods, Results, and Discussions.

**(3) Key Words.**

**(4) Introduction.**

**(5) Materials and Methods.**

**(6) Results.**

**(7) Discussions.**

**(8) Acknowledgments.**

**(9) Correspondence to.**

**(10) Submission date**

**(11) References.**

#### **Journal Address:**

Marsland Press,  
525 Rockaway PKWY, #B44,  
Brooklyn, New York 11212, the United States,  
718-404-5362.

[sciencepub@gmail.com](mailto:sciencepub@gmail.com)

<http://www.sciencepub.org>; <http://www.sciencepub.org>

# ***Report and Opinion***

Volume 1 - Issue 3, 2009, ISSN 1553-9873

[Cover Page](#), [Introduction](#), [Contents](#), [Call for Papers](#), [All papers in one file](#)

## **CONTENTS**

<b>No. / Titles / Authors</b>	<b>page</b>
<a href="#">1. Antioxidant and Estrogen Like Activity of the Seed of <i>Phoenix dactylifera</i> L. Palm Growing in Egyptian Oases</a> Nagwa M. Ammar, Sahar Y. Al-Okbi, Doha A. Mohamed and Lamia T. Abou El-Kassem	1-8
<a href="#">2. Effect Of Mold Infested Feeds On The Growth And Survival Of <i>Heterobranchus longifilis</i> Fingerlings</a> Effiong, B.N. And Alatise, S. P	9-14
<a href="#">3. Studies on Municipal Solid Waste Management in Mysore City- A case study</a> Yadav Ishwar Chandra and N.Linthoingambi Devi	15-21
<a href="#">4. Recent Status of Arsenic Contamination in Groundwater of Northeastern India – A Review</a> N.Linthoingambi Devi, yadav Ishwar Chandra, QI Shihua	22-32
<a href="#">5. Improving The Teaching And Learning Of Mathematics In Second Circle Institutions In Ghana: Paper Ii</a> Adetunde, I. A.	33-35
<a href="#">6. Conservation status of the endemic orchid, <i>Peristylus kumaonensis</i> Renz. (Orchidaceae) of Western Himalaya, India</a> Jeewan Singh Jalal, Pankaj Kumar, Lalit M. Tewari and Y.P.S.Pangtey	36-40
<a href="#">7. Treatment of <i>Dracunculus medinensis</i> infection with Cotrimoxazole in endemic populations of Ebonyi, South Eastern Nigeria</a> Jude C. Aiosike; Emmanuel S. Miri; Charles I. Okoli; Bertram K.NWokc; Celestine O. K. Omkuliri; Ezekiel G. Ajnyi and Joe E. Asor	41-46
<a href="#">8. Diversity Of Orchids In Uttarakhand And Their Conservation Strategy With Special Reference To Their Medicinal Importance</a> G.C.Joshi, Lalit M. Tewari, Nidhi Lohani, Kanchan Upreti, Jeevan S. Jalal, Geeta Tewar	47-52
<a href="#">9. Treatment Of Waste Water From Food Industry Using Snail Shell</a> E.O Jatto, I.O Asia, E.E Egbon, J.O Otutu, M.E Chukwuedo, C.J Ewansiha	53-57
<a href="#">10. Reflect the Space-time Relations Again</a> Yang Fa-cheng	58-63
<a href="#">11. School Violence And Guidelines For Establishing Disciplinary Committee In Schools</a> DR. ALABI, AMOS OYETUNDE	64-68
<a href="#">12. Microtuber: A Source of Germplasm Conservation</a> Anoop Badoni and J. S. Chauhan	69-71
<a href="#">13. A debate on assessment system: responsibility of scientist</a>	72-75

Ashish K. Chaturvedi

14. Effect of partial replacement of fishmeal with duckweed (*Lemna paucicostata*) meal on the growth performance of *Heterobranchus longifilis* fingerlings

Effiong, B.N; Sanni, A. and Fakunle, J.O

76-81

15. Gymnosperms of Nainital

Poonam Tripathi, Lalit M. Tewari, Ashish Tewari, Sanjay Kumar, Y.P.S. Pangtey and Geeta Tewari

82-104

Marsland Press, 525 Rockaway PKWY, Brooklyn, New York 11212, The United States; (347) 321-7172; [editor@sciencepub.net](mailto:editor@sciencepub.net)

<http://www.sciencepub.org>

[editor@sciencepub.net](mailto:editor@sciencepub.net)

---

**Emails:** [editor@sciencepub.net](mailto:editor@sciencepub.net); [sciencepub@gmail.com](mailto:sciencepub@gmail.com)

---

|

|

|

© 2009. Marsland Press

## Antioxidant and Estrogen Like Activity of the Seed of *Phoenix dactylifera* L. Palm Growing in Egyptian Oases

Nagwa M. Ammar<sup>1</sup>, Sahar Y. Al-Okbi<sup>2</sup>, Doha A. Mohamed<sup>3</sup> and Lamia T. Abou El-Kassem<sup>4</sup>

<sup>1, 4</sup> Pharmacognosy Department, <sup>2, 3</sup> Food Sciences and Nutrition Department  
National Research centre, El-Tahreer Street, Dokki, Cairo, Egypt.

e-mail: [S\\_Y\\_alokbi@hotmail.com](mailto:S_Y_alokbi@hotmail.com)

**Abstract:** Developing the Egyptian desert, especially the Egyptian Oases, is considered as one of the most important National goals. Thousands species of medicinal, aromatic and food plants grow in the Egyptian desert, creating a base of raw materials to be explored for drug and nutraceutical production. This work focused on an important biologically active plant growing in the Egyptian Oases which is *Phoenix dactylifera* L. Family Palmae. The non-polar and polar successive extracts of the seeds of *Phoenix dactylifera* L. which is widely distributed in El-Dakhla Oases were tested for the antioxidant activity by an in-vitro bioassay technique according to the  $\beta$ -carotene bleaching method, as well as for the estrogen-like-activity. The effect of the extracts on nutritional parameters was also assessed. Acute toxicity test of the non-polar and polar extracts was carried out. The results showed that both extracts have antioxidant and estrogen like activity with different degrees. Variable significant changes in the nutritional parameters were noticed. The non-polar and polar extracts showed complete safety. The bioactive fractions were subjected to a phytochemical examination and the biologically active compounds were identified by using different chromatographic techniques. **Conclusion:** Both non-polar and polar extracts of the seeds of the studied seeds of *Phoenix dactylifera* showed antioxidant and estrogen like activity with different degrees which may be attributed to the presence of sterols, tannins and flavonoids. Both extracts showed complete safety. [Report and Opinion. 2009;1(3):1-8]. (ISSN: 1553-9873).

**Key words:** Palmae, *Phoenix dactylifera* L., Antioxidant, Estrogen like activity, Bioactive fractions.

### Introduction

Egypt is characterized by the presence of a great number of palms abundantly distributed all over the country. Palms in general possess many economic uses, the fruits of some species can be considered as an important crop used as nutrient, other species are used in the production of sugar, starch, fiber, wax, timber and oil which can be used in many pharmaceutical and food products. Palms have become increasingly important in commercial horticulture. It is important to note that Palmae, an ancient Family of 3400 species, its classification being based largely on morphological and anatomical characters of the leaf and fruit. A recent study on gross morphological characteristics classified and reorganized six subfamilies within the Palmae (Bolombery and Tony, 1982; Uhl and Dransfield, 1987).

Rare publications have been reported for the Family concerning its phytocjemical studies, probably because of the difficulty of collecting fresh material and getting it authenticated. Most work has been carried out on economically important plants such as *Phoenix dactylifera*, *Cocos nucifera* and other plams cultivated for food and oils (Al-Shabib and Marshall, 2003).

*Phoenix dactylifera* L. Family Palmae is known in Arabic as Nakl; fruit as Balah and Tamr; in English as Date palm, in French as Dattier. The plant grows in Egyptian desert, especially in Egyptian Oases.

Reviewing the folk medicine as well as the literature, some species of Palms have been reported to possess many important biological effects such as *Phoenix dactylifera* which is one of the most important economic plants of Palmae. The edible fruit of this species are cited as the most important products (Vayalil, 2002). Dates are cooling, tonic, diuretic, fattening, aphrodisiac, alexeteric and are useful in leprosy thirst, asthma, bronchitis, fatigue, tuberculosis, abdominal complains, fever, vomiting, wanderering of the mind and loss of consciousness. In addition, dates have demulcent, expectorant and laxative effect. Dates are also used internally to clear enigmatic or to regulate the urine and in vaginal pessaries with other ingredient to enhance fertility. Kernels of dates are used for healing ulcers of genital organs. Date Palm pollen grains have gonadotrophic activity.

The aim of the present work is to study the antioxidant and estrogen like activity of the non-polar and polar successive extracts of *Phoenix dactylifera* seeds as well as the phytochemical constituents of the bioactive fractions. The safety of the biologically active fractions was also determined.

## MATERIALS AND METHODS

### MATERIALS

#### Plant materials:

Samples of the seeds of *Phoenix dactylifera* L. Family Palmae were collected from plants growing in El Dakala Oases, dried and then powdered to No. 26 scieve and kept in dark well closed container. Voucher specimens are deposited in the herbarium of the National Research Centre, Giza, Egypt.

#### Animals:

**Rats:** Twenty-four female immature white albino rats with average body weight of  $45.5 \pm 0.3$  g were obtained from the animal house of National Research Centre, Giza, Egypt. The animals were kept individually in stainless steel cages at room temperature. Water and food were given ad-libitum.

**Mice:** Adult normal male and female albino mice of 21-25 g body weight were used in acute toxicity test.

#### Diets:

A balanced diet composed of 10% protein, 10% corn oil, 23.5% sucrose, 47% maize starch, 5% fiber, 3.5% salt mixture (Briggs & Williams, 1963), and 1% vitamin mixture (Morcos, 1967) was prepared for feeding the rats all over the experimental period.

## METHODS

**Phytochemical screening of the seeds under investigation:** The powdered seed was screened for carbohydrates and/or glycosides, reducing sugars, tannins, flavonoids, alkaloids and/or nitrogenous bases, saponins, unsaturated sterols and/or triterpenes and coumarins using chemical and chromatographic techniques (Harborne, 1984).

**Preparation of the successive extracts with selective organic solvents:** The air-dried powdered seeds under investigation were extracted successively in a continuous extraction apparatus until exhaustion with petroleum ether (40-60 °C), ether, methanol and 50% aqueous methanol. The solvents were stripped off under reduced pressure and dried to constant weight in vacuum desiccator over anhydrous calcium chloride. The extracts of both methanol and 50% anhydrous methanol were pooled together as polar extract. Those of petroleum ether and ether were mixed to be the non-polar fraction.

**Determination of antioxidant activity:** Antioxidant activity of non-polar and polar extracts was determined according to the β-carotene bleaching method using D,L α-tocopherol as standard (Velioglu *et al.*, 1998). 1 ml of β-carotene solution (0.2 mg/ml in chloroform) was transferred to different round bottom flasks (100 ml) containing 0.02 ml of linoleic acid and 0.2 ml Tween 20. Each mixture was then dosed with 0.2 ml of 80% MeOH (as control), or 50 mg/L of D,L α-Tocopherol (as standard) or corresponding plant extracts. After evaporation to dryness under vacuum at room temperature, 50 ml of oxygenated distilled water was added and the mixtures were shaken to form a liposome solution. The mixtures were then subjected to thermal auto-oxidation at 50 °C for 2h. The absorbance of the solution was measured immediately at 470 nm after their preparation ( $t = 0$  min) and at the end of the experiment ( $t = 120$  min) using UVPC spectrophotometer. All samples were assayed in triplicate. Antioxidant activity (AA) was calculated as percent inhibition relative to control using the following equation (Al-Saikhan *et al.*, 1995).

$$AA = (R_{control} - R_{sample} / R_{control}) \times 100$$

Where  $R_{control}$  and  $R_{sample}$  were the bleaching rates of β-carotene in reactant mixture without antioxidant and with plant extract, respectively.

**Studying the estrogen like activity and safety of the extracts:** The estrogen like activity was determined according to Ali *et al.* (1998). Rats were divided into four groups (6 rats/group). Rats of first and second group were given daily oral dose of non-polar and polar extracts respectively (500mg/kg rat body weight for 10 days). Rats of the third group were daily subcutaneously injected with estradiol benzoate (2mg/kg rat body weight) for 10 days and served as reference group. Rats of the fourth group were run as control where no medication or extract was given. During the experimental period rats were fed on balanced diet. All rats were examined daily for opening of vagina as one parameter of estrogenic activity. Body weight and food intake were recorded once weekly. At the end of the experiment (10 days); total food intake, body weight gain and food efficiency ratio were calculated. Blood samples were withdrawn on heparin from eye vein orbital after an overnight fast. Blood samples were centrifuged for 10 min at 3500 rpm for separation of plasma for determination of 17- $\beta$  estradiol using ELISA technique (as second parameter of estrogenic activity) and glucose (Tinder, 1969), cholesterol (Watson, 1960), total protein (Rheinhold, 1953), urea (Fawcett and Scott, 1960), creatinine (Houot, 1985) and activity of alanine transaminase (ALT) (Reitman and Frankel, 1957) and aspartate transaminase (AST) (Reitman and Frankel, 1957) adopting colorimetric assay. The uteri of the rats were excised and weighed. Uteri were dried to a constant weight in an oven at 100 °C and their dry weights were determined (as third parameter of estrogenic activity). The results obtained were expressed as the Mean  $\pm$  SE and the significance of the results was analyzed statistically adopting Student's t-test.

**Acute toxicity test:** Acute lethal toxicity test of non-polar and polar extracts was carried out according to Goodman *et al.*, (1980). The 24 h mortality counts among equal sized groups of mice (8 animals/group) receiving progressively increasing oral dose levels of the different extracts were recorded.

**Identification of the bioactive constituents of non-polar fraction:** Three grams of the non-polar extract was saponified by refluxing with alcoholic potassium hydroxide 10%, after dilution with water, the unsaponifiable fraction was extracted with ether. The ether was evaporated; the unsaponifiable fraction was kept for TLC and GLC analysis. The aqueous mother liquor was acidified with 10% hydrochloric acid and the liberated fatty acids were extracted with ether. Ether was evaporated and the residue was kept for studying the total fatty acids (EL-Said and Amer, 1965).

**The unsaponifiable matter was analyzed by both TLC and GLC:** For analysis through TLC, silica gel "G" plate was used as adsorbent and Benzene : Ethyl acetate (86:4) (v/v) as solvent system. The developed chromatoplates were detected with vanillin-sulphuric acid reagents, and heated at 100 °C for 5 minutes (Stahl, 1969).

The unsaponifiable fraction was analyzed by GLC adopting the following conditions: Column: 10% OV-101 packed column; Stationary phase: Chromosorb W-HP; Detector temperature: 290°C; Injector temperature, 28°C; Carrier gas N<sub>2</sub>; flow-rate 30 ml/min; air flow-rate: 300ml/min; H<sub>2</sub> Flow-rate 30ml/min; Detector FID; Chart speed: 0.5 cm/min; Oven program: Initial temperature, 70°C; Final temperature, 270°C; total time, 85 min. Identification of hydrocarbons and sterols contents of the unsaponifiable matter was carried out by comparison of their retention times with co-injected authentic reference compounds. Quantification was based on peak area integration.

**Analysis of fatty acids:** The fatty acid fraction previously prepared was subjected to methylation (Vogel, 1961) and analysis by GLC of the methyl ester adopting the following conditions: Stationary phase, 10% diethylene glycosuccinate packed column; oven temperature, 170°C; detector temperature, 300°C; injector temperature, 250°C; Carrier gas, N<sub>2</sub>; flow-rate, 30ml/min; air flow-rate, 350ml/min; H<sub>2</sub> flow-rate, 350ml/min; detector, FID; Chart speed, 2cm/min. Identification of the fatty acid methyl ester was carried out by direct comparison of retention times of each of the separated compounds with authentic samples of the fatty acid methyl esters analyzed under the same conditions. Quantification was based on peak area integration.

## Results and Discussion

Developing the Egyptian Oases through the use, as well as protection and conservation of its endogenous medicinal and food plants is a National and International goal. This work focused on the biological and phytochemical study of the seed of *Phoenix dactylifera* palm growing in these areas, with the aim of discovering novel therapeutic agents or functional food ingredients.

Phytochemical screening of seed revealed the presence of carbohydrates, and/or glycosides, sterols and/or triterpenes, tannins, flavonoids, alkaloids and/or nitrogenous bases.

The antioxidant activity of the non-polar and polar extracts of the seeds of *Phoenix dactylifera* L. are shown in table (1). The synthetic antioxidant D,L  $\alpha$ -tocopherol showed the highest antioxidant activity (92%). The non-polar extract showed higher antioxidant activity (57.8%) than the polar extract (53.9%).

In the estrogen like activity experiment, the biochemical parameters of the different experimental groups are shown in table (2). The treatment of immature female rats with date seed extracts or estradiol showed significant increased in the plasma level of estrogen compared to control. The maximum elevation was due to estradiol treatment (97%,  $p < 0.001$ ), followed by the polar extracts (46%,  $p < 0.001$ ), while the non-polar extracts showed the lowest elevation (35%,  $p < 0.001$ ). This result indicated that both extracts have estrogen like activity but still below the estradiol effect. Rats treated with estradiol produced significant increase in plasma creatinine, urea and plasma activity of AST compared to control, while the biologically active extracts produced no changes in these parameters. Estradiol and the extracts did not produce any significant change in plasma glucose, total cholesterol, total protein and activity of ALT. These results reflect the safety of administration of date seed bioactive extracts compared to estradiol.

**Table1:** Antioxidant activity of the studied extracts and tocopherol as standard.

Extract type	Percentage antioxidant activity
Non-polar extract	57.8
Polar extract	53.9
DL $\alpha$ -tocopherol	92

**Table (2): Biochemical parameters of different experimental groups of the estrogenic test.**

Plasma parameters	Group (Mean $\pm$ SE)			
	Control	Estradiol	Non-polar extract	Polar extract
Glucose (mg/dl)	51.5 $\pm$ 1.839	57.2 $\pm$ 1.782	55.8 $\pm$ 0.946	52.5 $\pm$ 1.384
% Change		2	8	0.4
Total Cholesterol (mg/dl)	63.7 $\pm$ 1.782	65.8 $\pm$ 1.992	64.8 $\pm$ 1.621	61.3 $\pm$ 1.819
% Change		3	2	-4
Total protein (g/dl)	6.9 $\pm$ 0.087	6.7 $\pm$ 0.097	6.6 $\pm$ 0.198	6.7 $\pm$ 0.108
% Change		-3	-4	3
Creatinine (mg/dl)	0.58 $\pm$ 0.014	0.66* $\pm$ 0.032	0.61 $\pm$ 0.008	0.61 $\pm$ 0.009
% Change		14	-4	5
Urea (mg/dl)	24 $\pm$ 1.183	29.8** $\pm$ 0.946	26.7 $\pm$ 1.054	26.3 $\pm$ 1.115
% Change		24	11	10
AST (IU/l)	137.5 $\pm$ 1.258	148** $\pm$ 1.064	139 $\pm$ 1.712	139.5 $\pm$ 1.607
% Change		8	1	2
ALT (IU/l)	56.3 $\pm$ 1.475	60.3 $\pm$ 1.744	58.2 $\pm$ 1.514	58.2 $\pm$ 1.661
% Change		7	3.4	3
17- $\beta$ Estradiol (pg/ml)	34.8 $\pm$ 1.621	68.5*** $\pm$ 1.543	47*** $\pm$ 1.154	50.8*** $\pm$ 0.946
% Change		97	35	46

Values significantly differ from control:

\*:  $p < 0.05$ , \*\*:  $p < 0.010$ , \*\*\*:  $p < 0.001$ .

The effect of administration of the date seed extracts or estradiol on uterine weight and opening of vagina are shown in table (3). The administration of non-polar and polar extracts or estradiol to immature femal rats produced significant increase in uterine weight ( $p < 0.001$ ) compared to control. Estradiol administration produced the maximum increase (99%), while the non-polar extract produced the lowest

increase (34%). Estradiol treatment produced the maximum increase in the rate of opening of vaginal orifice followed by the polar extract, while the non-polar extract produced the lowest effect. These results clarified the estrogen like activity of both date seed extracts, which was below the estradiol effect.

**Table (3): The effect of administration of date seeds extracts or estradiol on uterine weight and opening of vagina.**

Parameters	Control	Estradiol	Non-polar extract	Polar extract
<b>Uterine weight (mg) (Mean±SE)</b>	20.5 ± 0.764	40.7* ± 1.358 99	27.5* ± 0.764 34	31.8* ± 0.946 55
<b>% Change</b>	0/6	4/6	2/6	3/6
<b>Degree of opening vagina</b>				

Values significantly differ from control: \*: p < 0.001.

Nutritional parameters of the different experimental groups are seen in table (4). The administration of the date seed extracts or estradiol showed significant lower values of the final body weight and food efficiency ratio ( $p < 0.001$ ) in spite of the significant increase in total food intake in the group given estradiol and polar extract ( $p < 0.005$  and  $p < 0.025$  respectively) compared to control. The worst effect on nutritional parameters was attributed to the non-polar extract. The reduction in nutritional parameters may be a bad effect in growing stage however it may have beneficial use in obese subjects, especially that the safety of the extracts have been proven on both liver and kidney function in the present study. The polar extract may increase the energy expenditure thereby reducing the body weight in spite of the significant increase of food intake.

The acute lethal toxicity test revealed that both non-polar and polar extracts were very safe up to 12g/kg mice body weight which corresponds to 93g/70kg man body weight for human when the dose of mice was extrapolated to corresponding estimates in human adopting interspecies dosage conversion scheme (Paget and Barnes, 1974). This reflects the highest safety of the bioactive extracts.

**Table (4): Nutritional parameters of different experimental groups of the estrogenic test.**

Parameters	Group (Mean + SE)			
	Control	Estradiol	Non-polar extract	Polar extract
<b>Initial body weight (g)</b>	45.8 ± 1.077	45.3 ± 0.843	45.4 ± 0.615	45.2 ± 0.703
<b>Final body weight (g)</b>	74.2 ± 0.654	58.2*** ± 0.654	53.3*** ± 1.174	67.7*** ± 1.022
<b>Body weight gain (g)</b>	28.3 ± 0.843	12.8*** ± 0.703	8*** ± 1.291	22.5*** ± 0.764
<b>Total food intake (g)</b>	47.9 ± 1.538	55.5** ± 1.875	44.5 ± 3.929	52.8* ± 1.352
<b>Food intake (g/day)</b>	4.8 ± 0.154	5.6** ± 0.187	4.5 ± 0.393	5.3* ± 0.135
<b>Food efficiency ratio</b>	0.592 ± 0.015	0.231*** ± 0.007	0.178*** ± 0.022	0.426*** ± 0.009

Values significantly differ from control:

\*: p < 0.025, \*\*: p < 0.005, \*\*\*: p < 0.001.

Chromatographic investigation of the non-polar extract of the seeds of *Phoenix dactylifera* revealed that the unsaponifiable fraction contains 66% hydrocarbons and 15.6% of terpenoidal compounds which are cholesterol,  $\beta$ -sitosterol, campasterol, stigmasterol and  $\beta$ -amyrin (in a percentage of 3.2%, 3.2%, 2.8%, 2.6%, 3.8% respectively). The fatty acids fraction after methylation and analysis by GLC revealed the presence of lauric, tridecanoic, myristic, pentadecanoic, palmitic, margaric, stearic and oleic acid as 20%, 2.7%, 10.3%, 3.2%, 6.8%, 3.3%, 32.8% and 10% respectively. The results also revealed that the percentage of saturated fatty acids was 79.1 and that of unsaturated fatty acids was 10.

In the present study, the non-polar extract of the seed of *Phoenix dactylifera* which exhibited a remarkable antioxidant and estrogen like activity contains different sterols such as; campasterol, stigmasterol,  $\beta$ -amyrin and  $\beta$ -sitosterol. So, the antioxidant and estrogen like activity of the non-polar extract may be attributed to the presence of the fore-mentioned sterols. Some of the oxidation products of stigmasterol have been reported previously to have estrogenic activity (Newill *et al.*, 2007). Phytosterols such as campasterol,  $\beta$ -sitosterol and  $\beta$ -amyrin have been shown previously to possess estrogenic activity (Nakari, 2005 and Nieminen *et al.*, 2004). Antioxidant activity of  $\beta$ -sitosterol has been confirmed

previously in experimental cancer model (Jayaprakasha *et al.*, 2007). Also plant sterols have been shown to reduce oxidative stress during hyperlipidemia (Fuhrman *et al.*, 2007). Phytosterols may have antioxidant activity through acting as hydrogen donor (Gordan and Magos, 1983 and Oomah and Mazza, 1999). Previously we have proved that petroleum ether extract of the seeds of *Phoenix dactylifera*, Zaghloul, possess low in-vitro antioxidant activity (8%) (Mohamed and Al-Okbi, 2005). In the present study, polar extract of the seeds exhibited an antioxidant activity slightly lower than the non-polar extract and a remarkable significant estrogen like activity. These effects may be ascribed to the presence of flavonoidal compounds and tannins which were shown from the phytochemical screening of the powdered seeds. Several flavonoids (eg, isoflavones) are known as phytoestrogens, based on their ability to mimic estrogen in mammals (Girppo *et al.*, 2007). Also Wong *et al.* (2007) showed that certain flavonoids possess estrogenic activity. Also phenolic compounds possess an antioxidant activity due to their redox properties which allow them to act as reducing agents, hydrogen donators and metal chelator thereby reduce lipid oxidation (Duthie *et al.*, 2000 and Kluth *et al.*, 2006), quench reactive oxygen species and protect from pro-oxidative damage (Kaindl *et al.*, 2007). It was also cited that the antioxidant capacity of phytochemicals are related to total phenolics compounds including flavonoids (Wolfe and Liu, 2007 and Soobrattee *et al.*, 2008). Tannins have reported to possess antioxidant activity (Tzulker *et al.*, 2007 and Ito *et al.*, 2008). As a matter of fact the antioxidant extracts may possess a protective effect towards diseases in which free radicals are involved such as cancer, diabetes, chronic inflammation, cardiovascular and cerebrovascular diseases (Rice-Evan and Diplock, 1993).

**Conclusion:** Both non-polar and polar successive extracts of the seeds of the studied date, *Phoenix dactylifera* showed an antioxidant and estrogen like activity with different degrees which may be attributed to the presence of sterols, tannins and flavonoids. Both extracts showed complete safety. Significant decrease in body weight gain and food efficiency ratio was noticed on administration of both bioactive extracts.

## References

- Ali BH., Bashir AK. and Alhadrami G. (1998): Reproductive hormonal status of rat treated with date pits. Food Chem. 66: 437-441.
- Al-Saikhan MS., Howard LR. and Miller JC. (1995): Antioxidant activity and total phenolics in different genotypes of potato (*Solanum tuberosum*, L.). J. Food Sci. 60, 341-343.
- Al-Shabib W. and Marshall RJ. (2003): The fruit of the date palm: its possible use as the best food for the future. Int. J. Food Sci. Nutr. 54 (4): 249-259.
- Bolombery A. and Tony R. (1982): Palms, Angus and Robertson Pub Australia.
- Bornkamm R. and Kehl H. (1990): The plant communities of the western desert of Egypt. Phytocoenologia 19 (2): 149-231.
- Briggs G.M. and Williams M.A. (1963): A new mineral mixture for experimental rat diets and evaluation of other mineral mixtures. Fed. Proc. 22: 261.
- Duthie G.G., Duthie S.J., Kyle J.A.M. (2000): Plant polyphenols in cancer and heart disease: Implications as nutritional antioxidants. Nutr Res Rev. 13: 79-106.
- El-Ashry M. (1999): 21<sup>st</sup> Century Challenge to the Global Environment-Within Our Reach. Second General Assembly and International Conference of Women, Science and Technology for Sustainable Development 8-11 February, Cap Town, South Africa.
- El-Said M.E. and Amer M.M. (1965): "Oils, Fats, Waxes and Surfactants"; Anglo-Egyptian Bookshop, Cairo, P. 130-132.
- ElSheikh R. and Shehata M. (1991): Hydrochemical relationship between deep and shallow aquifers in Bahariya and Farafra oases. Egypt Bulletin of Faculty of Science, Zagazig University 13 (2): 206-225.
- Fawcett JK. and Scott JE. (1960): A rapid and precise method for the determination of urea. J. Clin. Pathol. 13: 156-159.
- Fuhrmn B., Plat D., Herzog Y. and Aviran M. (2007): Conimption of a novel dietary formula of plant sterol esters of canola oil fatty acids, in a canola oil matrix containing 1,3-diacylglycerol, reduces oxidative stress in atherosclerotic apolipoprotein E-deficient mice. J. Agric. Food Chem. 55 (5): 2028-33.

- Goodman A. G. and Goodman L. S. (1980): Gilman A., Principles of toxicology, In: The Pharmacological Basis of Therapeutics, (eds. Goodman and Gilman). 6<sup>th</sup> ed. Macmillan, New York, p.1602 - 1615.
- Gordan M. H. and Magos P. (1983): The effect of sterols on the oxidation of edible oils. Food Chem. 10, 141.
- Grippo AA., Caps K., Rougeau B. and Gurley BJ. (2007): Analysis of flavonoids phytoestrogens in botanical and ephedra-containing dietary supplements. Ann. Pharmacother. 41 (9): 1375-82.
- Harborne J.B., Phytochemical Methods. A Guide to Modern Technique of Plant Analysis, Second Edition, Published in the USA by Chapman and Hall (1984).
- Houot O. (1985): Interpretation of clinical laboratory tests. Edit. Siest G., Henny J., Schiele F., Young D. S. Biomedical publications.
- Ito H., Iguchi A. and Hatano T. (2008): Identification of urinary and intestinal bacterial metabolites of ellagitannin geraniin in rats. J. Agric. Food Chem. 56 (2): 393-400.
- Jayaprakasha GK., Madadi KK., Poulose M., Jadegoud Y., Nagana Gowda GA. and Patil BS. (2007): Inhibition of colon cancer cell growth and antioxidant activity of bioactive compounds from *Poncirus trifoliata* (L.) Raf. Bioorg. Med. Chem. 15 (14): 4923-32.
- Kaindl U., Evberg I., Rohr-Udilov N., Heinzle C. and Marian B. (2007): The dietary antioxidants reveratrol and quercetin protect cells from exogenous pro-oxidative damage. Food Chem. Toxicol. (In press).
- Kluth D., Banning A., Paur I., Blomhoff R., Brigelius-Flohe R. (2006): Modulation of pregnane X receptor- and electrophile responsive element-mediated gene expression by dietary polyphenolic compounds. Free Radic Biol Med. 42 (3):315-25.
- Kobbia IA. and Shabana EF. (1978): Studies of the soil algae flora of Egyptian Bahariya oasis. Egyptian J. of Botany 31: 23-34.
- Loutfy B. (1983): Medicinal Plants of North Africa. Reference Publications, Inc.
- Mohamed D. A., Al-Okbi S. Y. (2004): In vitro evaluation of antioxidant activity of different extracts of *Phoenix dactylifera* L. fruits as functional foods. Deutsche Lebensmittel-Rundschau 101: 305-308.
- Morcos S. R. (1967): The effect of protein value of the diet on the neurological manifestations produced in rats by  $\beta$ -immodipropionitrile. Br. J. Nutr. 21: 269.
- Nakari T (2005): Estrogenicity of phytosterol evaluated in vitro and in vivo. Environ Sci 12:87-97.
- Newill H., Loske R., Wagner J., Johannes C., Lorenz RL. and Lehmann L. (2007): Oxidation products of stigmasterol interfere with the action of the female sex hormone 16-beta-estradiol in cultured human breast and endometrium cell lines. Mol. Nutr. Food Res. 51 (7): 888-89.
- Odebiyi A. and Sofowora G. (1999): Health benefits of phytochemicals from selected cadian crops. Trends. Food Sci. Technol. 10, 193.
- Oomah B. D. and Mazza G. (1999): Health benefits of phytochemicals from selected candian crops. Trends Food Sci. Technol. 10, 193 (1999).
- Paget P. and Barnes T. (1974): Evaluation of drug activities Pharmacometrics, Vol. (1), (eds. D. R. Laurrence, A.L. Bacharach). Academic Press, London and New York, p.135 - 140.
- Reitman S. and Frankel S. (1957): Calorimetric methods for aspartate and alanine aminotransferase. Am. J. Clin. Path. 28: 55.
- Rheinhold J. G. (1953): Total protein, albumin and globulin in standard methods of clinical chemistry. D. Seligron, Ed. New York, Academic press, Inc. Vol. I. p. 88.
- Rice-Evans C. A., Miller N. J. and Paganga G. (1996): Structure-antioxidant activit yrelationships of flavonoids and phenolic acids. Free Radical Biol.Med. 20, 933.
- Soobrattee MA., Bahorun T., Neergheen VS., Googoolye K. and Aruoma OI. (2008): Assessment of the content of phenolics and antioxidant actions of the Rubiaceae, Ebenaceae, Celastraceae, Erthoxylaceae and Sterculaceae families of Mautritian endemic plants. Toxicol. In Vitro. 22 (1): 45-56.
- Stahl E. (1969): Thin layer chromatography. Springer Verlag, Berlin, Heidelberg, New York.
- Trinder P. (1969): Determination of glucose in blood using glucose oxidase with an alternative oxygen acceptor. Ann. Clin. Biochem. 6: 24.

- Tzulker R., Glazer I., Bar-Ilan I., Holland D., Aviram M. and Amir R. (2007): Antioxidant activity, polyphenol content, and related compounds in different fruit juices and homogenates prepared from 29 different pomegranate accessions. *J. Agric. Food Chem.* 55 (23): 9559-70.
- Uhl NW. and Dransfield J. (1987): *Genera Palmarum*, Allen Press: Lawrence, Kansas.
- Vayalil PK. (2002): Antioxidant and antimutagenic properties of aqueous extract of date fruit (*Phoenix dactylifera* L. Arecaceae). *J. Agric. Food Chem.* 50 (3): 610.
- Velioglu YS., Mazza G., Gao L. and Oomah BD. (1998): Antioxidant activity and total phenolics in selected fruits, vegetables, and grain products. *J. Agric. Food Chem.* 46: 4113-4117.
- Vogel A.I. (1961): "Practical Organic Chemistry"; 3<sup>rd</sup> edition; Longmans Private LTD, Calcutta, Bombay, Madras.
- Watson D. (1960): A simple method for the determination of serum cholesterol. *Clin. Chem. Acta.*, 5: 637.
- Wolfe KL. and Liu RH. (2007): Cellular antioxidant activity (CAA) assay for assessing antioxidants, foods and dietary supplements. *J. Agric. Food Chem.* 55 (22): 8896-906.
- Wong SP., Li J., Shen P., Gong Y., Yap SP. and Yong EL. (2007): Ultra sensitive cell-based bioassay for the measurement of global estrogenic activity of flavonoid mixtures revealing additive, restrictive and enhanced actions in binary and higher order combinations. *Assay Drug Dev. Technol.* 5 (3): 355-62.

## Effect Of Mold Infested Feeds On The Growth And Survival Of *Heterobranchus longifilis* Fingerlings

\*Effiong, B.N. And Alatise, S. P.

Department of Fisheries Technology,  
Federal College of Freshwater Fisheries Technology,  
P.M.B. 1500, New Bussa.Nigeria.  
[bartheffiong@yahoo.com](mailto:bartheffiong@yahoo.com)

### ABSTRACT

The effect of mould infested feeds on the growth and survival of *Heterobranchus longifilis* fingerlings in aquaria tanks system was studied. *Heterobranchus longifilis* fingerlings ( $0.90\text{g} \pm 0.01$ ) were fed with three nitrogenous feeds (25.86%, 45.03% and 30.67% crude proteins). The feeds were I (mold infested feeds), II (mold non-infested feeds), and III (50% mixture of mold infested and non-infested feeds). The fish were fed to satiation at 5% body weight twice per day for 6 weeks (42 days) and the fish growth parameters measured. There was an increase in mean weight gain (MWG) of non-mold infested feeds under treatment II. The fish fed the non-mold infested feed (45.03%CP) under treatment II were observed to have the best mean final weight of 1.38g; best mean weight gain of 0.51g; best mean daily weight of 0.012g/day; best specific growth rate of 0.93% per day and best mean survival rate of 70% respectively and the best feed conversion ratio (FCR) of 5.49. There was a significant difference ( $P<0.05$ ) in the mean weight gain and feed conversion ratio of the fish between the feeds. [Report and Opinion. 2009;1(3):9-14]. (ISSN: 1553-9873).

---

**Key words:** mold infested feeds, growth and survival, *Heterobranchus longifilis*, aquaria tanks.

### INTRODUCTION

The activities of insects, microorganisms and animals as well as improper handling, physical and chemical changes due to change in temperature and humidity pose serious problem of deterioration in stored fish feeds. Although, these activities are inter-related, the effect of microbial activities in stored feeds is by far the most detrimental. Mold infestation in stored feeds reduces nutritional value owing to the loss of dietary lipids, amino acids and vitamins by enzymatic digestion (Jones, 1987; Lim et al., 2008). It may also assist in the development of lipid ketonic rancidity and non-enzymatic browning (Cockerel et al., 1971). In addition, Chow (1980) reported that mold infestation also produce poorer flavour and appearance making feed lumps and less palatable (Chow, 1980).

Adventitious storage fungi grow at moisture content of about 20 percent in equilibrium with a relative humidity of 70-90 percent and are considered the principal spoilers of feed in storage. When the relative humidity falls below 65 percent, no growth occurs (Chow, 1980; Effiong, 1997). Under favourable conditions, fungi can raise the temperature in their immediate environment to  $55^\circ\text{C}$  with concomitant increase in moisture content of the affected feed to as much as 20%, when this occurs; secondary spoilage by bacteria takes place. The most common fungi involved in the spoilage of feeds belong to the *Aspergillus* species and *Penicillium* species. They are most destructive when temperature exceeds  $25^\circ\text{C}$  and relative humidity exceeds 85 percent.

The choice of *Heterobranchus longifilis* is necessary in this study because of its remarkable fast growth rate. It is highly esteemed in Nigeria and command very high commercial value in our markets due to its ability to adapt readily to poor conditions, fast growth rate, acceptability and high conversion of artificial feeds, tolerance to crowded conditions and high quality of its flesh. (Madu and Olurebi, 1987; Ofor, 2001; Ayinla et al., 1994).

Having considered the above facts, this study was carried out therefore; to assess the effect of mold infested feeds on the growth and survival of *Heterobranchus longifilis* fingerlings.

### MATERIALS AND METHODS

#### Experimental Site

The study was carried out in the Fish Processing Laboratory of the Federal College of Freshwater Fisheries Technology, New Bussa, Nigeria.

#### Experimental System and Fish

The feeding trial was conducted in glass aquaria ( $30\text{x}30\text{x}60\text{cm}^3$ ). The glass aquaria tanks were properly washed and rinsed with clean water. They were filled with borehole water and aerated using air

pumps to ensure proper oxygenation and continual aeration. The experimental fish, *Heterobranchus longifilis* were procured from the genetic improvement laboratory of the National Institute for Freshwater Fisheries Research, New Bussa, Nigeria. They were acclimatized for three (3) days before the commencement of the experiment. This was done in order for the fingerlings to empty their stomach content and to force them to adjust to the new diet.

#### **Diet Formulation and Preparation**

Duckweed were harvested from the Green House of the National Institute for Freshwater Fisheries Technology, New Bussa and brought to the Federal College Freshwater Fisheries Technology feed mill where they were sun-dried for three (3) days before use and thereafter ground into fine powder using the hammer mill. All the other feed ingredients were milled using locally fabricated hammer mill and sieved through a 595µm sieve to remove stones and dirt to ensure homogenous size profile before being analysed for proximate composition (Table 1).

**Table 1: Proximate composition of feed ingredients**

Feed ingredients	Crude protein (%)	Ether extract (%)	Crude fibre	Ash
Fish meal	67.70	4.10	1.31	14.80
Groundnut cake	40.60	23.90	6.00	4.52
Duckweed meal	45.50	4.00	8.00	13.40
Yellow maize meal	10.80	5.50	1.45	1.46

A 40% CP feed was formulated from yellow maize, fishmeal, groundnut cake and formulation was based on the proximate composition of the ingredients (Table 1). The diet was fortified with vitamin premix, and vegetable oil. The fishmeal was replaced by duckweed meal at 30% inclusion level. The feed was thoroughly mixed in a bowl and pelletized in an improvised Pelleting machine using 1% starch as binder.

**Table 2: Percentage Composition (%) of the experimental feed**

Ingredients	Percentage Composition (%)
Yellow maize	13.8
Fish meal	18.9
Duckweed meal	8.1
Groundnut cake	54.2
Vegetable oil	2.0
Vitamin premix	2.0
Starch	1.0
<b>Total</b>	<b>100.0</b>

#### **Experimental Procedure**

For the purpose of this study the formulated diet was divided into two portions designated feed 1 & 2. Feed I was kept until visible signs of moldiness while Feed II had no moldiness. The six aquaria tanks of 3 replicates were used as follows for the experiment. Feed 1: mold-infested feed, Feed II: non- mold infested feed and Feed III: 50% mixture of the mold infested and non-mold infested diets.

The fish, *Heterobranchus longifilis* fingerlings were randomly distributed at a stocking density of 20 fish per aquarium tank. They were fed at 5% body weight twice daily morning and afternoon at equal ration. Sampling was done weekly using a sensitive electronic balance (OHAS-LS-400g model) to determine the average weight of the fish and adjust the feed accordingly.

The experiment was run for 42 days all analyses for proximate composition were determined according to the methods of AOAC. (2000). Water temperature, dissolved oxygen and pH were monitored daily with a standardized mercury thermometer while dissolved oxygen concentration was determined using Jenway Automatic pH meter (Jenway 3015).

#### **Measurement of growth parameters**

The growth parameters were measured according to the methods described by Oleva- Novoa *et al.*, (1990). Mean weight gain (MWG) was calculated as the difference between the initial and final weight divided by the number of the surviving fish at the end of the culture period.

$$\text{MWG} = \frac{\text{Final body weight} - \text{Initial body weight}}{\text{Number of surviving fish}} \times 100$$

**Specific growth rate (SGR) (%/day):** This is the relationship of the difference in the weight of the fish within the experimental period.

$$\text{SGR} = \frac{(\text{In Wf} - \text{In Wo}) \times 100}{\text{Time}}$$

Feed conversion ratio (FCR) was determined by dividing the total weight of the food given by the total increase in weight gained by the fish over a period of time while feed intake (FI) was calculated as the addition of daily mean feed intake of the fish during the period. Average daily growth (ADG) was calculated as the difference between the final weight and the initial weight divided by the number of days i.e. the experimental period

$$\text{ADG} = \frac{\text{Final weight} - \text{Initial weight}}{\text{Number of days}}$$

#### Statistical analysis

Data were subjected to analysis of variance (ANOVA) and Duncan's multiple range tests was used to compare differences among individual means (Duncan, 1955).

#### RESULTS AND DISCUSSION

Growth pattern of *Heterobranchus longifilis* fingerlings fed the experimental feeds for 42 days is presented in Table 1. During the period of study, experimental fish accepted all the feeds readily and appeared healthy. Fish survival was not very high in all the dietary treatment. It ranged from 30 to 70% (Table 3) and there were observable adverse effects of mold-infested feeds on the fish and water quality in the aquaria tanks. Fish mortality due to mold-infested treatment was high (Feed I). This could be attributed to the effect of the infestation on the nutrient content of the feed as well as the poor water quality, which was not within the recommended limits for Catfishes. (Boyd and Tucker (1998).

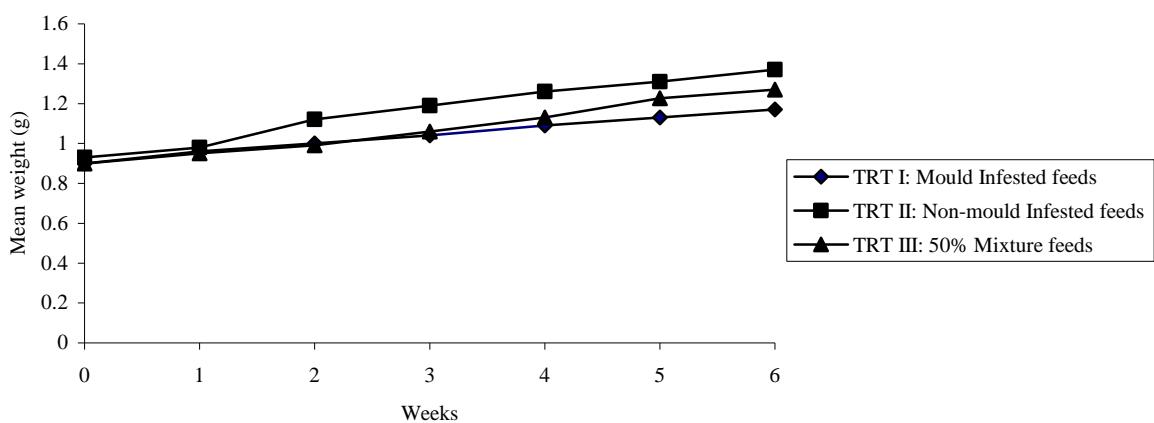


Figure 1: Growth pattern of *Heterobranchus longifilis* fingerlings fed the experimental feeds for 42 days

Russo and Yanong (2002) stated that species of *Aspergillus flavus* and *A. parasiticus* produced aflatoxins in feeds containing oilseed components such as soybean meal, groundnut cake, peanut meal and cottonseed oil. Such feeds when fed to fish usually results in poor growth performance high mortality rates.

Studies on the Nile tilapia, (*Orechromis niloticus*) showed reduced growth rates when fed diets containing 1.8mg of aflatoxin (AFB1) per one kilogram of feed for 75 days (Tuan et al., 2002). Jantrarotai and Lovell (1990) also reported that channel catfish fed mold infested feed for 10 weeks, exhibited decreased growth rates and moderate internal lesions. Although no visible lesions were observed on the experimental fish fed mold infested feed within the period of this experiment, it is possible that the poor growth and survival could be due to reduced nutritional value in the feed sample (Jones, 1987; Chow, 1980; Russo and Yanong, 2002).

Summary of results of *Heterobranchus longifilis* fingerlings fed different experimental diets for 42 days is presented in Table 3. The mean values of all the growth parameters among the treatment were significantly different ( $P<0.05$ ). The fish fed the non-mold infested feed (45.03%CP, table 4) in treatment II were observed to have the best mean final weight of 1.38g; best mean weight gain of 0.51g; best mean daily weight of 0.012g/day; best specific growth rate of 0.93% per day and best mean survival rate of 70%. This could be attributed to the high nutrient content of the feed, with a high protein value (about 45%) (Hillman and Cully, 1978; Falaye, 1992). The fish fed the 50% mixture of mold infested and non-mold infested feeds (30.67%CP, table 4) in treatment III had 50% mean survival rate and was the second best to treatment II in all other growth parameters while fish in treatment I: mould infested feed (25.86%CP, table 4) was least (worst). Non-mold infested feed (treatment II) undoubtedly proved to be very reliable and efficient for the experimental fish as a result of the faster growth rate (0.012g/d) observed from the feed during this experiment. This result is very promising since a mean final weight of 1.38g per fish is quite an ideal size for commercial catfish fingerling production under a 6-week culture period.

The higher crude protein content of 45.03% of the non- mold infested feed compared to the 30.67% in the 50% mixture of mold infested and non-mold infested feeds, and then the 25.86% of the mold infested feed indicates the adverse effect of mold infestation on the nutritional value of the feed which in turn affected the growth and survival of the experimental fish.

**Table 3: Summary of results of *Heterobranchus longifilis* fingerlings receiving different Experimental diets for 42 days**

Treatments	Average Initial weight (g)	Average Final weight (g)	Average daily wt gain (g/day)	SGR (%/day)	FCR	Survival Rate
I: Mould infested Feed	0.91	1.19	0.01	0.64	7.64	35
	0.90	1.16	0.01	0.60	8.27	25
	0.89	1.15	0.01	0.61	6.80	30
	<b>0.90</b>	<b>1.17</b>	<b>0.01</b>	<b>0.62</b>	<b>7.57</b>	<b>30</b>
II: Non-mould infested feed	0.90	1.41	0.01	1.07	4.65	70
	1.00	1.36	0.01	0.73	6.83	60
	0.90	1.37	0.01	1.00	4.98	80
	<b>0.93</b>	<b>1.38</b>	<b>0.01</b>	<b>0.93</b>	<b>5.49</b>	<b>70</b>
III: 50% mixture feed	0.90	1.24	0.01	0.76	6.41	60
	0.91	1.29	0.01	0.83	5.81	50
	0.91	1.28	0.01	0.81	5.92	40
	<b>0.91</b>	<b>1.27</b>	<b>0.01</b>	<b>0.80</b>	<b>6.05</b>	<b>50</b>

The result of the proximate composition of the experimental feed is shown in Table 4. Mold infested feed contained the lowest amount of total nitrogen while non-mold infested feeds had the highest. The 50% mixture of mold infested and non-mold infested feeds contained 30.67% CP. The protein levels of the experimental feeds 111 and I are lower than that found in feed II. Effiong and Eyo (1999) reported low crude protein content in mold infested feed samples. Their findings is similar to that of this experiment

**Table 4: Proximate Composition of the Experimental feeds (Dry matter basis)**

Samples	Crude protein	Ether Extract	Crude Ash	Moisture content	Crude fibre
Mold infested feeds	25.86	7.08	10.52	8.11	6.74

Non-mold infested feeds	45.03	11.06	13.29	2.00	4.90
50% mixture of mold infested and non-mold infested feeds	30.67	8.89	11.90	2.80	4.50

### CONCLUSION

This study was carried out to determine the effect of mold-infested feeds on the growth and survival of *Heterobranchus longifilis* fingerlings. The study was monitored for 42 days in glass aquaria tanks. Some physico-chemical parameters such as temperature, dissolved oxygen and pH were monitored and found to be within the tolerable range. The fish fed the non-mold infested feed (45.03% CP, table 4) in treatment II gave the highest mean weight gain (MWG); best specific growth rate (SGR) and feed conversion ratio (FCR). It could be concluded from the findings of this experiment that mold infested feeds have profound adverse effect on the growth and survival of *Heterobranchus longifilis* fingerlings.

### REFERENCES

- AOAC (2000). *Association of Official Analytical Chemist Official methods of analysis* 15th edition. Washington, DC.
- Boyd, C.E and Tucker, C.S (1998). *Pond Aquaculture water Quality management*. Kluwer Academic Publishers, Boston, M.A., USA. 700pp.
- Chow, K.W. (1980) *Storage problems of feedstuff in Fish Feed Technology* Chap. 13.pp.216-244.
- Cockerell, I. Francis B. and Halliday, D (1971) Changes in the nutritive value of concentrate feedstuffs during storage. *Proceedings of Conference of Feed Resources and improvement of Animal feeding methods in the CENTO Region countries*, Tropical products Institute, London, pp.181-192.
- Duncan D. B. (1995). Multiple range tests and multiple F – test. *Biometrics*, 1:1-42.
- Effiong, B.N and A. A. Eyo (1997) Control of mould infestation in stored pelleted feed. *NIFFR Annual Report*, pp.128-134.
- Effiong, B.N and A. A. Eyo (1999) Control of mould infestation in stored pelleted feed. *Proceedings of the 12th Annual Conference of Biotechnology Society of Nigeria (BSN) Pp. 115-117*. (A.A. Eyo, P.O. Aluko, S.A. Garba, U.D. Ali, S.E. Lamai and S.O. Olufeagba eds.) New Bussa, Nigeria. April 13-17, 1999.
- Eyo, A.A. (2001). Chemical composition and amino acid content of the commonly available feedstuffs used in fish feeds in Nigeria. *Fish nutrition and fish feed Tech.* (A.A. Eyo ed.). pp 14- 25.
- Falaye, A. E. (1992). Utilization of agro-industrial wastes as feedstuffs in Nigeria. *Proceedings of the 10th Annual conference of Fisheries Society of Nigeria (FISON)*, pp
- Hillman, W.S and Cully, D. D. (1978). The uses of duckweed. *American Scientist* 66(July/August): 442-451.
- Jones, F. (1987) Controlling mould growth in feeds. *Feeds International* 8:20-29.
- Juli-Anne Royes Russo and Roy P.E. Yanong (2006) Molds in fish feeds and Aflatoxicosis. Tropical Aquaculture Laboratory, *Florida Cooperative Extension Service*, Institute of Food and Agricultural Sciences, University of Florida.64:502-510.
- Jantrarotai,W and R.T.Lovell (1990) subchronic toxicity of dietary aflatoxin B1 to Channel catfish. *Journal of Aquatic Animal Health* 2:248-251.

Lim,H.A;W.K.Ng;S.L Lim and C.O Ibrahim (2008) Contamination of palm kernel meal with *Aspergillus flavus* affects its nutritive value I pelleted feed for tilapia, *Oreochromis mossambicus*.*Aquaculture Research*. Vol.32 Issue 11:895-905.

Madu, C.T and Olurebi S.O (1987) Effect of varying dietary protein levels on growth and food utilization of fish (*Clarias gariepinus*) fingerlings. NIFFR Annual Report, pp.46-49.

Ofor, C.O (2001) Production and gonad development of Heterobranchus longifilis (Teleostei: Clariidae, Val.1843) in tropical indoor ponds. *Journal of Aquaculture in the tropics*.16 (2): 121-130.

Tuan, N.A; J.M. Grizzle, R.T.Lovell; B.B. Manning and G.E. Rottinghaus (2002). Growth and hepatic lesions of Nile Tilapia (*Oreochromis niloticus*) fed diets containing aflatoxin B1.*Aquaculture*.212:311-319.

Oleva-Novoa, M.E., Campos, G.S., Sabido, G.M. and Martinez-palacios C. A. (1990). The use of alfalfa leaf Protein concentrates as a protein source in diets for Tilapia (*Oreochromis mossambicus*). *Aquaculture* 90: 291-302.

4/1/2009

## **Studies on Municipal Solid Waste Management in Mysore City- A case study**

Yadav Ishwar Chandra and N.Linthoingambi Devi\*

Department of Environmental Science, University of Mysore, Mysore-570006, India

\*School of Environmental Studies, China University of Geosciences, 388, Lumo Road, Wuhan, Hubei, 430074 P.R. China.

Email: ashok\_ishwar@yahoo.com, Phone no: +919873453116

**Abstract:** Solid waste management is a worldwide phenomenon. It is a big challenge all over the world for human beings. The problem of municipal solid waste management (MSWM) is also prevailing in the urban environment of Mysore. Therefore the present study was taken to find out the problems and prospects of Municipal solid waste in Mysore city. A detailed investigation was made regarding the methods of practices associated with sources, quantity generated, collection, transportation, storage, treatment and disposal of Municipal solid waste in Mysore city. The data concerning to SWM in Mysore was obtained through questionnaire, individual field visit, interacting with people and authentic record of municipal corporation. Photographic evidences were also made about generation, storage, collection, transportation, treatment and disposal of MSW. This study reveals that the present system of MSWM in Mysore city is not satisfactory based on Municipal Solid Waste (Management & Handling) Rules 2000. [Report and Opinion. 2009;1(3):15-21]. (ISSN: 1553-9873).

**Key words:** Municipal solid waste, Mysore city cooperation (MCC), Composting, Municipal solid waste (Management and Handling) Rule 2000

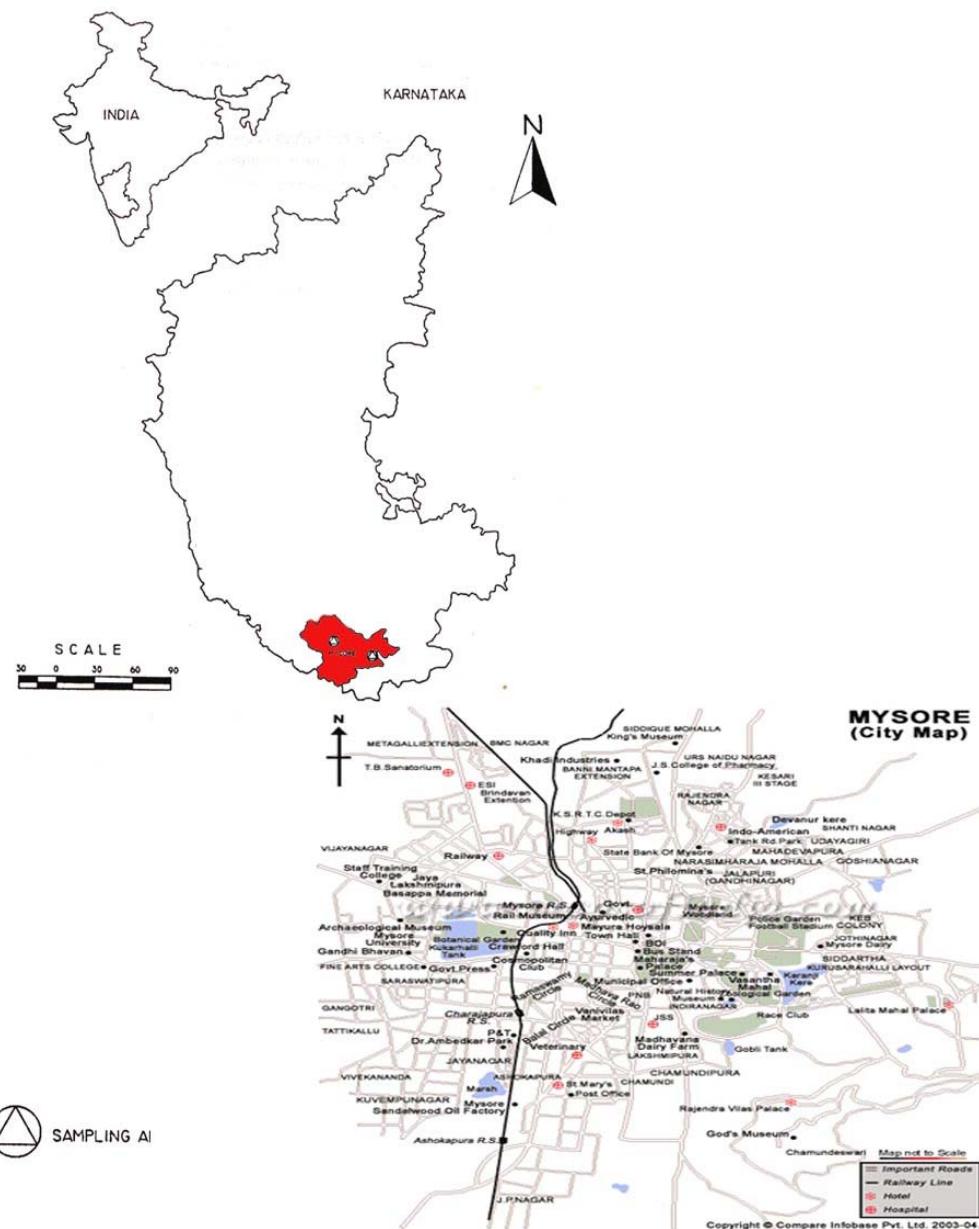
### **INTRODUCTION**

Mysore is the second largest city in Karnataka after Bangalore .Mysore was the capital of Mysore state until 1956, when the capital was shifted from Mysore to Bangalore. Mysore is spread over an area of about 128 sq. km with the growing population (0.65 millions in 1991 to 0.76 millions in 2001) at faster rate due to influx of many service industry activities, the generation of municipal waste both garbage and sewage has been on the rise .Anthropogenic activities in society generate large quantities of wastes posing a problem for their disposal. Improper disposal leads to spreading of diseases and unhygienic condition besides spoiling the aesthetics. The city has several major and small industries present in Nanjangud 20 Km away from the Mysore city together with many educational and commercial establishments. In India, every year 30.3 millions tons of Municipal solid waste is generated .This equate to about 350 gm of waste per person on average (Mazumdar ,1994)

Solid waste management is a integral part of urban and environmental management of each city with more than 65% of India's 250 million population living in class I town (population over 0.1 million ) and 23 cities getting distinction of being metropolises (population over 1million)(Asnani et al; 1992, Bhide and Sudarshan, 1976) Municipal solid waste management, like most of other infrastructural services has come under great stress, consider low priority areas, solid waste management was never taken up seriously either by public or by concerned agency or authorities and now the piled up waste is threatening our heath, environment and well being (Chouhan and Reddy 1996, Mazumdar 1994). Mysore City Corporation (MCC) is responsible for community solid waste management in city .The present study has been carried out in the urban environment of Mysore in the year 2006 to understand the problems and perspective associated with solid waste management in the city.

### **MATERIALS AND METHODS**

The solid waste from the different sector of society was collected, mixed and one Kg sample was prepared by using quartering method. The waste was then characterized and the percentage of each constituent was calculated .Secondary data regarding solid waste generation, collection system and disposal methods were collected from Mysore City Corporation.



**Fig. Study area**

## RESULTS AND DISCUSSION

### Solid Waste Management

MCC is responsible for the management of solid waste generated in the city. The city administration has been decentralized in 8 zones. There are in all 65 wards in the city. The chief Health Officer is the overall incharge of solid waste management in the city. According to MCC, around 259.14 TPD solid waste is generated every day .Major sources of solid waste is given in table 1

**Table 1: Major sources of solid waste generation.**

SN	Sources of waste generation	Quantity(TPD)
1.	Non Slum Households	160.7
2.	Slum Households	10.3
3.	Shops and establishment, schools, temples etc	20.5
4.	Hotels ,Choultries etc	26.7
5.	Market ,Vegetable shops & meat shops	28.8
6.	Hospitals & Clinics	5.9
7.	Industries	1.4
8.	Others	5.1
	<b>Total</b>	<b>259.4</b>

Waste generation rates works out to be 0.35 Kg per capita per day. Approximately 170 TPD waste is generated from the residential sources. The hotels, Choultry and markets account for 55 TPD and the rest is from others sources. The various waste generating places in Mysore city are –

Shops	20067
Choultries	124
Hotels	410
Industries	133
Meats shops	387
Hospitals & Clinics	599
Temples	430

### **Collection System**

The solid waste is collected from different sources/establishment by various methods. The solid waste management activity n Mysore consists of wastes generator throwing the waste into the round RCC bins and masonry bins. The pourakarmika sweeps the road and drains and transfer the waste into small heaps on the road or into the bins .Mysore being a tourist city, there are many location within the city and occasion especially during Dasara where special effort for cleaningness are required .Special contingents of staff are dedicated for these operation.

There are 2879 dust bins are placed in Mysore city. Two types of dust bins are used. These are cylindrical bottomless cement concrete of 0.45-0.8 m<sup>3</sup> capacity and rectangular bins with bottom made of masonry of 2-10 m<sup>3</sup> capacity. The collection of waste from these dust bins is planned in accordance with frequency of container becoming full. The present location of dust bins and the waste collection point have been classified into daily collection (A type), weekly twice collection (B type) and weekly once collection (C type) as part of Nirmal Nagara Programme. In addition, there are 20 dumper placer containers used as primary collection containers in commercial areas and bulk generator. Around 30 wards are managed on contract by private contractor authorized by MCC. The contracts involves sweeping of the wards , transfer of waste to the bins and others collection point ,collection of waste from these point and transporting them to the Waste Processing Facility (WPF) or any other designated disposal point. The number of staff engaged in solid waste management in the city corporation is shown in table 2

**Table: 2 Distribution of staff for SWM**

SN	Category Staff	Numbers
1.	Health Officer	1
2.	Deputy Health Officer	1
3.	Senior Health Inspector	4
4.	Junior Health Inspector	18
5.	Conservancy Dafedar	42
6.	Pourakarmika (Sweepers)	787
7.	Porakarmika on time scale & Gram Panchayat	16
8.	Drivers	23

The city has various government hospitals, private hospitals, nursing homes and clinics .MCC has contracted private agency that has set up a Biomedical Waste Processing Facility (BWPF) on T.Narsipura road .The infectious waste from 599 hospitals are collected by agency at cost and being treated .The industrials waste from small unit get mixed in the municipal stream while the larger industries manage their own waste.

### **Transportation**

Transportation of solid waste is carried out partially by MCC and partially by private contractor. Out of 65 wards, MCC is responsible for transportation of about 50-55 % of solid waste generated, while private contractor are responsible for the rest 40-45 % of the waste in the city. The solid waste is stored temporarily in the dust bins and then transported to the disposal site. Types of vehicles used for transportation of solid waste are as follows:

Tractor tipper 5  
Tractor trailer 17  
Dumper 2

One tipper and four tractors are more than 15 years old. Another 2 tippers and 6 tractors are over 10 years old. Lifting of garbage is done manually. The waste collected from the roads and bins is directly transported to the final dumping site .The refuse vehicles have to travel about 6 Km distance through the city to carry waste up to the dumping site. The tractors and dumpers carrying waste are not covered or partially covered during the journey and waste tends to spill on the roads. Most often workers are not provided with protective hand gloves and shoes so they are directly expose to the waste. Protective measures are necessary to avoid contracting skin allergies and respiratory diseases .The loading and unloading of waste is done through mechanical system reducing direct contact of worker with the wastes.

### **Disposal of Wastes**

Considering quantity and composition of Municipal solid waste generation in Mysore city, a composting plant was set up under the ADB assisted Karnataka Urban Infrastructure Development Project at Vidayanya Puram to generate compost from the city refuse. The plant is located about 6 Km from the Mysore city within an areas of 12.5 acres The plant was set up by the Excel Industries and was being operated by M/S Vennar Organics till June 2005. The plant has been operational at sub optimal levels and as of then the agency stopped operation. Now MCC is operating the Excel plant itself. The plant has the capacity to handle 200 tons of waste per day. The remaining waste is being dumped besides the Excel plant. The city doesn't have disposal sites. Management of biomedical waste (BMW) is taken care by a private agency that has set up a biomedical waste processing facility on T.Narsipura road. There is also a small vermin-composting is operational in Mysore Zoo.

### **Characteristics of Solid Waste**

The quantity and characteristics of solid waste vary from place to place .factors that influence the quantity and composition are the average income level, the sources, the population, social behavior, climate, industrial production and the market for waste materials. The waste generation and economics level of the society have been related by studying the quantity of domestic solid waste generated from three socioeconomic groups' i.e. Low income group (LIG), middle income group (MIG) and high income group (HIG) and a positive correlation between the high income and waste generation has been noted. The HIG people throw away more plastic, metallic and glass waste and also hazardous waste. Plastics, metals and glass account for 11 % in the Mysore city solid waste.

The study reveals that the composition of solid waste in Mysore city has 40 % organic matter followed by 45 % earthen materials and 1.5 % as wooden materials. This shows that municipal solid waste of Mysore city has a fair amount of biodegradable materials. The percentage of non biodegradable waste like metals and plastics is not very high but substantial percentage of concrete /pebbles/silts/sands etc was observed, which is indicative of large scale building construction and other development activities. The typical composition of municipal solid waste of Mysore city is given in table 3

**Table 3:Composition of municipal solid waste of Mysore city.**

<b>SN</b>	<b>Components</b>	<b>Approx.value (%)</b>
1.	Organic components	
2.	Straw ,bagasses ,& banana leaves	40
3.	Wooden materials	1.5
4.	Plastics	10
5.	Stones /pebbles/silts/sands	45
6.	Cloths /rags	1.5
7.	Metals	0.2
8.	Rubber/leather	1
9.	Glass /ceramics	0.8

### **IEC Activities in Mysore City**

IEC activities in Mysore are entrusted to People Science Forum (PSF) , a part of Karnataka Rajay Vigyan Parishat(KRVP) since Jan 2005.Before Nirmal Nagar was implemented ,there were Jatha's workshops, signature campaign on solid waste management were held. After the implementation of Nirmal Nagar project, house to house campaign on SWM is being held since Oct 2001till date, consecutively for 196 weeks. School children Eco club has been formed; training for MCC staff and two workshops have been organized for Residence Welfare Association (RWA) formation. At Dasara exhibition 2004, public dialogue, street plays were held. As of now about 40 RWAs is active in the city.

### **CONCLUSION**

The solid waste management in Mysore city appears to be inadequate and needs up gradation. The solid waste has to be disposed off scientifically through sanitary landfill and recyclable portion of the waste should be salvaged. Segregation of recyclable material would also leads to reduction in quantity of solid waste for final disposal. Higher priority needs to be assigned to the management of municipal solid waste by the local authority and a system approach needs to be adopted for optimizing the entire operation of SWM encompassing segregation at source, timely and proper collection, transportation routes and types of vehicles and development and proper operation of sanitary landfill site .Mysore city might need to look for better solution of waste disposal considering unavailability of landfill and disposal site.

The present system of MSWM in Mysore city is not satisfactory based on MSW(M & H) Rule 2000. There is need to implement MSW (M & H) Rule 2000 in an integrated manner. More emphasis needs to be laid on segregation and collection of waste at door step. Segregation of recyclable material from mixed waste not only is tedious but also wasteful, therefore the residents should be sensitized towards the importance of segregation of wastes at source. Rather than considering the municipal solid waste simply as residue to be thrown away, it should be recognized as resource materials for the production of energy, compost and fuel depending upon the techno-economical viability, local condition and sustainability of the project on long term basis.

**Correspondence to:**

Mr. Yadav Ishwar Chandra, Department of Environmental Science, University of Mysore, Mysore-570006, India.

**Email: ashok\_ishwar@yahoo.com, Phone no: +919873453116**

Miss.N.Linthoingambi Devi, School of Environmental Studies, China University of Geosciences.Key Laboratory of Bio and Environmental Geology of Ministry of Education, Wuhan Hubei 430074, P.R.China  
**Email: n.linthoi.devi@gmail.com**

**Submission date:** 30<sup>th</sup> March 2009

**REFERENCES**

1. Asnani, P.U , SR Shukla and PS Rajvanshi (1992) Solid waste management all India.
2. Bhide A.D and Sudarshan (1976) Solid waste management in developing countries.
3. Chouhan B.M and B.K Reddy (1996) Bio-energy scenario in India. IREDA News. 7(1):20-27
4. Dhande A.D. Ingle sopan T, Attarde Sanjay B and Wagh Nilesh D : (2005) ,Ecofriendly approach of urban solid waste management - A Case Study of Jalgaon city, Maharastra, J. Environ. Biols 26 (4): 747-752.
5. G.P. Shivashankara, H.B Rekha (2005) Solid waste management in suburban areas of Bangalore. Nature Environment and Pollution Technology 4(4): 495-500.
6. Indian standards Institution IS – 10158 (1992).Method of Analysis of solid waste.
7. Jha MK, Sondhi OAK and Pansare M (2003) Solid waste Management - A case study IJEP, 23 (11): 1153 – 1160
8. Macwan J.E.M, Jay Shukla, Perita Patel and Bhumika Shah (2003) Metropolitan Domestic Solid waste Generation Analysis in Indian context” Journal of Indian Association Env.al Management Vol. 30:158-161.
9. Malvia R, Choudhary R and Budhia Dharam (2002) Study on solid waste assessment and management. Indore city. IJEP 22(8): 841-846.
10. Mazumdar,N.B (1994) Municipal solid waste management the Indian perspectives.

Environment Monitor, 12(2): 257-269.

11. Renjini RL and Prakasam V.R, (2005) An evaluation of Municipal solid waste management in Tripunithura Municipality of Kerala ,IJEP; 25 (7) :652-656.
12. Shannigrahi A.S. Chatterjee N and Olamiya M.S (1997) Physicochemical characteristics of Municipal solid waste in to mega city, Indian journal of Env.al Portection Vol. 17: 527 – 529.
13. Shekdar, A.V. (1999) Municipal solid waste management. The Italian Perspective Journal of MEM, 27: 100-108.
14. Tambekar D.H. and Kale S.A (2005) A study on physicochemical characteristics of Municipal solid waste of Amravati city, Maharashtra, Nature Env. And Pollution Tech. Vol. 4, No. 3:459 - 462
15. Tehabanoglu G et al, Theisen H and Eliassen R, (1993) Solid waste Engineering principle and management , MG-Graw Hill, New York.
16. Yishu Chiu, Joan Eryrter and George W. Gipe, (1976) Solid Waste Generation. Rates of a University Community. Journal of Env.al Engg Divison ASCE vol 102 –, PP: 340 – 345

4/1/2009

## Recent Status of Arsenic Contamination in Groundwater of Northeastern India – A Review

N.Linthoingambi Devi<sup>1</sup>, yadav Ishwar Chandra<sup>2</sup>, QI Shihua<sup>1</sup>

<sup>1</sup>*School of Environmental Studies, China University of Geosciences, 388, Lumo Road, Wuhan, Hubei, 430074, P.R. China.*

<sup>2</sup>*Department of Environmental Science, University of Mysore, Mysore-570006, India*

n.linthoi.devi@gmail.com

**Abstract:** High concentration of arsenic (As) in groundwater in the northeastern states of India has become a major cause of concern in recent years. Arsenic in groundwater has been detected in some parts of Assam, Tripura, Manipur, Nagaland and Arunachal Pradesh. The ground water in the past was considered to be safe for drinking purpose but now it came to be known that many shallow tube wells contain arsenic at concentrations higher than the safe limit set for drinking purpose by WHO 1993. It is becoming an emerging issue in the water supply and health sectors of Northeastern India. This paper reviews the recent status of arsenic in ground water of northeastern states of India and recommends proper research methods to be adopted in mitigating the effects of it to human health. [Report and Opinion. 2009;1(3):22-32]. (ISSN: 1553-9873).

**Keywords:** Arsenic, Arsenic in ground water, contaminated tube wells, drinking water in northeastern states of India.

### Introduction

Arsenic contamination of drinking water is a worldwide problem due to its detrimental effects on health. These effects range from skin ailments through to serious diseases such as Cancer and to death. Arsenic contamination of ground water has been reported from many countries including Bangladesh, Vietnam, Argentina, China and parts of USA and now in India. The provisional limit of Arsenic in drinking water as recommended by WHO is 10 microgram per liter. Arsenic is a chemical that is widely distributed in nature and principally occurs in the form of inorganic or organic compounds. Inorganic compounds consist of arsenite, the most toxic forms and arsenate the less toxic forms. Exposure to inorganic compounds may occur in a variety of ways through certain industrial effluents, chemical alloys, pesticides, wood preservative agents, combustion of fossil fuels, occupational hazards in mining and dissolution in drinking water. The most commonly found arsenic compounds in drinking water are trivalent arsenite or pentavalent arsenate. However, groundwater is notoriously prone to chemical and other types of contamination from natural sources or by anthropogenic activities. Reliable data on exposure and health effects are rarely available, but it is clear that there are many countries in the world where arsenic in drinking water has been detected at concentrations greater than the WHO Guideline Value, 0.01 mg/l or the prevailing national standards. The major issue of arsenic contaminated water is to find out the level of contamination of arsenic and it is not so easy because of no color, no odor and no taste even in the highly contaminated water. Arsenite is more toxic (about ten times) than the arsenate due to former ability to react with sulphydryl groups thereby increasing the residence time (Nagarnaik et al., 2002). Although there is no widely accepted mechanism of the release of arsenic in ground water, but it has been accepted that most of all including in northeastern states of India is of natural, geological origin. The arsenic is thought to be closely associated with oxidation-reduction process of iron oxides and pyrite.

A study has revealed that thousands of underground water sources in India's northeast are unfit for consumption due to highly toxic contamination of arsenic (Sujit Chakraborty, 2007). 28,181 water sources located in Assam have been contaminated with arsenic, iron and fluoride inorganic materials, followed by 2,931 in Tripura, 566 in Arunachal Pradesh, 136 in Nagaland, 124 in Meghalaya, 76 in Sikkim, 37 in Manipur and 26 in Mizoram. Due to the withdrawal of excessive amounts of groundwater, problems of increased iron, fluoride and arsenic (As) contamination have been reported in different parts of India (Khan, H. R., 1994, Singh, A. K., 2004). A study on cancer risks from As in drinking water indicates that it could cause liver, lung and kidney/bladder cancer besides skin cancer (Smith, A. H. et al., 1992). The most

important remedial measure is prevention of further exposure by providing safe drinking water. From this point of view, several ideas have been highlighted in this article to control and remove As from groundwater used for household activities as well as irrigation.

### **Distribution of arsenic in groundwater in northeastern states**

The presence of As in groundwater in West Bengal is the most serious health hazard India has ever faced. According to the North Eastern Regional Institute of Water and Land Management (NERIWALM), a staggering 32,077 water sources have been contaminated with naturally occurring inorganic materials like arsenic, iron and fluoride (Sujit Chakraborty,2007).A recent study shows that out of three blocks of Gplaghat district of Assam, Podumoni shows maximum 67.57% groundwater contamination by Arsenic followed by Kathalguri block 44.45% (Mridul Chetia, 2008).

Many areas within the northeastern states with As concentration greater than 0.05 mg/l, implying that millions of people are at serious risk of As poisoning (Singh, 2004) . According to a report, the concentration of As generally varies from 0.02 to 0.9 mg/l (exceeding the WHO standard of 0.01 mg/l and Bureau of Indian Standard (BIS) of 0.05 mg/l). While As and iron pose individual problems in the aqueous environment, their association in groundwater have the potential of providing a simple means of removing As by co-precipitation and adsorption. About 95% of the area of the northeastern region contains dissolved iron in excess of 2 mg/l, and the iron concentration is as high as 15 mg/l in many areas (Singh ,2004) The North Eastern Regional Institute of Water and Land Management (NERIWALM) report 2007 said arsenic levels in Assam, Manipur, Tripura and Arunachal Pradesh were above 300 parts per billion (ppb). According to the World Health Organisation (WHO), consumption of water contaminated with arsenic levels of over 50 ppb can cause skin lesions and even cancer.

Maximum arsenic concentration content of 490  $\mu\text{g/l}$  was observed in Jorhat (Titabor, Dhakgorah, Selenghat and Moriani blocks), Dhemaji (Sissiborgoan and Dhemaji blocks), Golaghat district (Podumani block) and Lakhimpur (Boginodi and Lakhimpur blocks), Assam (Chakraborti, D. et al , 2004).In Thoubal district of Manipur, about 25% of the collected samples had As in the range 798–986  $\mu\text{g/l}$ . The sediment in the northern region contains a high percentage of clay and organic compounds (Acharyya ,1999) , which may retain and release As in the groundwater aquifers. A study (Baruah, 2003) on As in carbonaceous matter in Arunachal Pradesh, Assam, Nagaland and Meghalaya, indicated that the mean As concentration of samples from the four regions was 95.1 mg/kg. It is believed that the weathering of sulphide associated with carbonaceous matter may have produced As-rich iron oxyhydroxides, which in turn released As (after reduction) to the existing sedimentary environment (Khan 1994, Nickson 1998) . Results indicated increased As enrichment from east to west in Northeast India. The distribution of arsenic in northeastern India is presented in Figure 1.

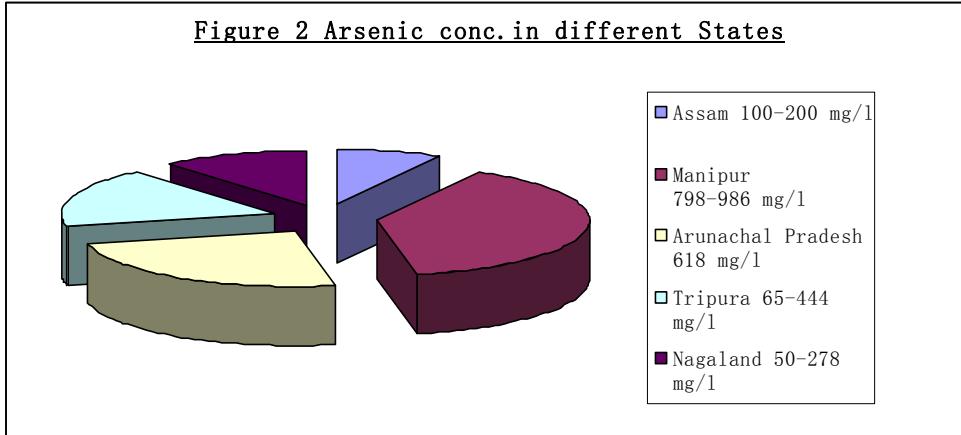


**Figure 1.** Distribution of arsenic in groundwater of northeastern India.

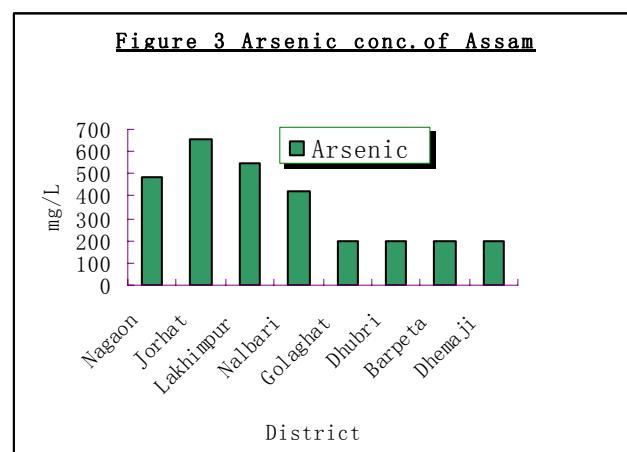
**Table 1: Arsenic contaminated areas of different northeast states in India Source:( Singh, 2004)**

States	District	Arsenic range
Assam	Barpeta, Dhemaji, Dhubari, Darrang, and Golaghat,	100-200 ( $\mu\text{g/l}$ )
Manipur	Thoubal	798-986 ( $\mu\text{g/l}$ )
Arunachal Pradesh	Papum Pare, West Kameng , East Kameng, Lower Subansiri, Dibang Valley, Tirap	618 ( $\mu\text{g/l}$ )
Tripura	West Tripura, North Tripura and Dhalai	65-444 ( $\mu\text{g/l}$ )
Nagaland	Mokok chong, Mon	50-278 ( $\mu\text{g/l}$ )

**Figure 2 Arsenic conc. in different States**



According to the Agartala news reports 2007, arsenic was found in Jirania and Bishalgarh in West Tripura district, Salema, Halahali, Kamalpur, Joynagar in Dhalai district, Sanitala, Rajbari, Dharmanagar, Kailishahar, Kanchanpur and Jampui in North Tripura district. After observing from table 1 and recent publications, news we can find out that the distribution of arsenic in northeast regions is increasing rapidly. The NERIWALM report said arsenic levels in Assam, Manipur, Tripura and Arunachal Pradesh were above 300 parts per billion (ppb). According to the World Health Organisation (WHO), consumption of water contaminated with arsenic levels of over 50 ppb can cause skin lesions and even cancer (Sujit Chakraborty, 2007). Most of the district and blocks of Assam were affected by arsenic and its spreading. The concentration of arsenic in affected districts as shown fig 3.



### **Arsenic sources**

Arsenic is a natural constituent of the earth's crust and is the 20th most abundant element. The average concentration (NAS 1977, Taylor 1985) of As in the continental crust is 1–2 mg/kg. Arsenic is released in the environment through natural processes such as weathering and volcanic eruptions, and may be transported over long distances as suspended particulates and aerosols through water or air. Arsenic emission from industrial activity also accounts for widespread contamination of soil and groundwater environment (Jacks, G. 1998, Juillot, F. 1999), Many authors have reported As emissions to the atmosphere on global, regional and local scales (Nriagu, J. O. 1988, Pacyna, J. M. 2001). Once introduced into the atmosphere, As may circulate in natural ecosystems for a long time depending on the prevailing geochemical environments (Boyle, R. W. 1973, Yan Chu, H., 1994)

### **Toxicity and health effects of arsenic:**

The United States Environment Protection Agency (USEPA) and International Agency for Research on Cancer (IARC) have specified arsenic as known human carcinogen. According to EPA weight of evidence classification for carcinogens, arsenic is categorized as Group A Carcinogen. Its classification indicates that there is sufficient evidence from epidemiological studies to support a case effects relationship between the substance and cancer. As is virulent poison on acute ingestion, 76 mg As (3+) is considered to be lethal to adults and extremely toxic on long-term exposure to a very low concentration (Azcue and Narjagu, 1994 in Sharma 1999). Extremely toxic arsenic oxide former use as a poison for vermin has been vastly reduced on account of concerns over its accumulation in the food chain. Arsenic enters the human body through ingestion, inhalation, or skin absorption. Significant route of As ingestion is drinking water. The amount of As species in urine is often considered an indication of chronic As exposure. The species are the result of the biotransformation of inorganic As (Table 2)

**Table 2: Arsenic speciation in human urine: (Smith,T.J. 1977)%**

Species	Average values	Mg/L
As(III)	1.3	1.9
As(V)	1.3	3.9
Methylarsonic acid	3.4	1.8
Dimethyl arsenic acid	11.5	15.0
Total As	21.2±2.04	22.5±8.5

The discovery of arsenic in drinking water in many areas of the world has caused widespread public health concern. Close to 100 million people in the world, including about 13 million in the United States, are chronically exposed to inorganic As [International Agency for Research on Cancer (IARC) 2004]. Inorganic As is an established potent human carcinogen (IARC 2004). In addition, ingestion of As through drinking water has been implicated in several noncancer diseases, for example, peripheral vascular disease; hypertension; respiratory, neurologic, and liver disorders; and diabetes mellitus [IARC 2004; National Research Council (NRC) 2001; WHO/IPCS (International Programme on Chemical Safety) 2001]. Early effects of exposure to As in drinking water include pigmentation changes and hyperkeratosis (IARC 2004; Smith et al. 2000), which reportedly appear after 5–10 years of exposure (Guha Mazumder et al. 1998). There may be some degree of skin absorption in contact of trivalent oxide, because of its rapid solubility. Most ingested and inhaled arsenic is well absorbed through the gastrointestinal tract and lungs into blood stream. It is distributed in large number of organs including the liver, lung, kidney and skin. About 70 % of the arsenic is excreted mainly through the urine. Most arsenic absorbed into the body is converted by liver to less toxic methylated arsenic then efficiently excreted in the urine (Saha, 1999, in Nagarnaik 2002). In the initial stage of chronic exposure of arsenic for more than five years, skin colour becomes black (melanosis), rough and tough (keratosis), eyes become red (conjunctivitis). Also in some cases there will be pain in inhaling (Bronchitis) and Vomiting and Diarrhea (Gastroenteritis). The manifestations of arsenicosis are clearer in the second stage with black and white spots on the skin (leukomelanosis), palms and soles are affected by hard nodules (Hyperkeratosis), swelling of legs, Peripheral Neuropathy and complications of kidney and liver. Finally it also turns to cancer in skin, lungs, kidneys, liver and other organs.

#### **Guideline value for arsenic in drinking water**

The first version of International standards for drinking water included arsenic in the category of toxic substances and established 200 ppb as the allowable concentration in drinking water (WHO, 1958). In updated standards of 1963, WHO lowered the allowable concentration to 50 ppb (WHO, 1963). The WHO continued its review work to lower the guideline value for arsenic in drinking water by establishing a guideline value (provisional) of 10 ppb in 1993 (WHO 1993). This provisional Guideline Value (GV) of 10 ppb has been adopted as the national standards for drinking water by a number of countries. However many developing countries have retained the previous WHO GV of 50 ppb as their national standards.

**Table 3: Currently accepted national standards for arsenic in drinking water in some selected countries.**

S.No.	Countries	National Standards for As in drinking water (ppb)	Year since when it has been accepted
1	Australia	7	1996
2	Jordan	10	1991
3	Japan	10	1993
4	EC	10	1998
5	Mongolia	10	1998
6	Laos	10	1999
7	USA	10	2001
8	Canada	25	1999
9	Philippines	50	1978
10	Sri Lanka	50	1983
11	Vietnam	50	1989
12	India	50	NA
13	Bangladesh	50	NA
14	China	50	NA
15	Nepal	50	2003

**Testing for arsenic****Field methods**

The most important characteristic of the field-testing method is that the testing can be carried out in field, where the sample is taken. In this method relatively very simple testing field-kits are used. When any metal arsenide reacts with strong acids, arsine gas is formed. Most arsenic test kits rely on the reduction of inorganic arsenic to arsine gas ( $\text{AsH}_3$ ) using zinc metal and hydrochloric acid. This gas is allowed to pass through the mercury bromide ( $\text{HgBr}_2$ ) indicator paper and the intensity of colour indicates the concentration of arsenic.

Many field kits, including only one India kit are available in listed as follows;

- AAN Kit (Japan)
- E-Merck Kit (Germany)
- NIPSOM Kit (Bangladesh)
- AIIHPH Kit (India)
- ENPHO Kit (Nepal)
- Modified AAN Kit (Nepal)
- Hach EZ (USA)
- Wagtech Arsenator (UK)

**Analytical Methods**

Numerous methods are described in the literature, for the analysis of total arsenic in water. Many analytical methods essentially employ the same principles, but apply different reagents or concentrations.

The possibilities for total arsenic determination include:

1. Atomic absorption spectrometry (AAS)
  - a. Hydride Generation System (AAS-HG)
  - b. Graphite furnace (AAS-GF) for atomization,
2. Inductively coupled plasma
  - a. With atomic emission spectrometry (ICP-AES)
  - b. With mass spectrometry (ICP-MS)
3. Atomic fluorescence spectrometry (AFS)

4. Anodic stripping voltammetry (ASV) or
5. Spectrophotometry.

Both atomic absorption spectrometry and atomic fluorescence spectrometry, a relatively new and sensitive technique, are single element specific techniques with known and controllable interferences. The inductively coupled plasma techniques offer the possibility of examining a number of contaminants, as they are multi-element techniques, again with known and controllable interferences. Anodic stripping voltammetry is a useful technique for samples containing only free dissolved arsenic, while the spectrophotometric method, which is also a single element technique, has the advantage of being relatively inexpensive in terms of equipment. The mostly used in Indian laboratories AAS-HG technique is based on the atomic absorption measurement of arsenic generated by thermal decomposition of arsenic (3+) hydride. As (3+) is reduced to arsine gas by reaction with sodium tetrahydloborate in a hydrochloric acid medium (ISO 11969:1996; SM 3114:1999). Arsenate and Arsenite have different sensitivities using this technique so any arsenate must be reduced to trivalent arsenic prior to the determination and done by using a solution of hydrochloric acid, potassium iodide and ascorbic acid. In India the silver diethyldithiocarbamate spectrometric method (SDDC) and spectrophotometry have been also used as alternate to AAS-HG. The key points of each of the above techniques are summarized below in Table 4

**Table 4: Summary of analytical methods for Arsenic test:**

Method	Detection Limit (ppb)	Sample Size (ml)	Equipment Cost (USS in '000)	Daily Through put	Remarks	Selected References
AAS-HG	0.05	50	20-100	30-60	Single element	ISO,11969 (1996); SM 3114(1999)
AAS-GF	1-5	1-2	40-100	50-100	Single element	ISO/CD 15586 (2000); SM 3113 (1999)
ICP-AES	35-50	10-20	60-100	50-100	Multi element	ISO/CD 11885 (1996); SM 3120 (1999)
ICP-MS	0.02-1	10-20	150-400	20-100	Multi element	SM 3125 (1999)
HGAFS	0.01	40-50	20-25	30-60	Single element	CEN/TC/230/ WGI/TG, 12 N3 (1999)
ASV	0.1	25-50	10-20	25-50	Only free Dissolved arsenic	USEPA 7063
SDDC	1-10	100	2-10	20-30	Limited to water sample	SM 3500 (1999) ISO 6595 (1982)

#### Global situation of arsenic in groundwater

Active groundwater contributes about 0.274 percent of total water budget and is the major source as fresh water for drinking water proposes. Arsenic contamination in groundwater has been reported in 20 different countries of the world. Four major calamities in order of magnitude are in Asia and these are Bangladesh, India (West-Bengal), China (including Inner Mongolia) and Taiwan. In terms of population exposed, arsenic problems in ground water from the alluvial deltaic aquifers of Bangladesh and West Bengal represent the most serious occurrences identified globally. The southwest coastal zone of Taiwan was perhaps the first area to be identified as a problem area for health effects arising from chronic arsenic exposure. Awareness of the arsenic problem began during the 1960s (Smedley et al., 2003) and

arsenic-related health problems were documented. Well-known black-foot dieses in Taiwan had been identified science then. The Chaco-Pampeon Plain of central Argentina perhaps is the largest region of high-arsenic groundwaters known, covering around one million km<sup>2</sup>.

**Table 5. Naturally-occurring As problems in world ground waters: (In Smedley et al., 2003)**

S.No.	Country/Region	Population exposed (million)	Area (Km <sup>2</sup> )	Max Conc. Range (ppb)
1	Bangladesh	30	150000	2500
2	India/West Bengal	6	23000	3200
3	China	5.6	NA	NA
4	Argentina	2	1000000	5300(7800 in some pore waters)
5	Nepal	0.46-0.75	30000	600(2620 in one case)
6	Chile(North)	0.5	125000	1000
7	Mexico	0.4	32000	620
8	USA(South west)	0.35	206300	2600
9	Taiwan	0.1	4000	
10	Mongolia (Huhhot Basin)	0.1	4300	2400

#### **Discussion:**

Despite limited studies and information, a significant segment of the rural Indian population residing in the northeastern has been exposed to an elevated level of arsenic. An accurate figure of the exposed population may be much higher than presently believed, and requires the majority of the tube wells to be examined. The North Eastern Regional Institute of Water and Land Management (NERIWALM) report said people in the northeastern region use water from tube wells for drinking, cooking and agricultural purposes and this way arsenic enters the food chain. This could cause chronic arsenic toxicity in the course of time, resulting in arsenical skin lesions and dermatitis in the initial stages and cancer and death if patients are exposed to high concentration over prolonged periods. According to another study, more than 15 million people face arsenic contamination in the five states bordering Bangladesh - West Bengal, Tripura, Assam, Mizoram, and Meghalaya (Sujit Chakraborty, 2007). In recent study, Assam deep well arsenic concentration is very high, peoples not yet identified the some places which are affected but in future the problem of arsenicosis may arise (Mridul Chetia, 2008). So along term environmental planning is required to get rid of the ensuring danger of this pollution of groundwater.

One of the ways to mitigate this arsenic problem is to change the source (uncontaminated groundwater), which brings up other issues of privacy and ownership. Some field tests suggested that water from deeper tube wells (>30 m) contains a low level of arsenic (World Bank, 2005); therefore pumping water from deep tube wells for supply is another option. However, this requires a thorough investigation of the aquifers and a detailed cost analysis. And again, it may need some sort of treatment depending on the arsenic level. The rural people should aware about the arsenic pollution and uses of field kids, does at least rural people can mitigate the arsenic pollution and less arsinocosis. Therefore, government should take seriously of these rural places and need to do further monitoring.

Many technologies have been developed for the removal of As. All the technologies for As removal rely on a few basic chemical processes. Oxidation/reduction reactions reduce (add electrons to) or oxidize (remove electrons from) chemicals, altering their chemical form. These reactions do not remove As from solution, but are often used to optimize other processes. Precipitation causing dissolved As to form a low-solubility solid mineral, such as calcium arsenate. This solid can then be removed through sedimentation and filtration. When coagulants are added and form flocs, other dissolved compounds such as As can become insoluble and form solids. This is known as co-precipitation. The solids formed may remain suspended, and require removal through solid/liquid separation processes, typically coagulation and filtration. In adsorption and ion exchange, various solid materials, including iron and aluminum hydroxide flocs have a strong affinity for dissolved As. As is strongly attracted to sorption sites on the surfaces of these solids, and is effectively removed from solution. Ion exchange can be considered as a special form of adsorption. From several studies, it is already known that coagulation precipitation is an effective and most frequently applied technique in As removal (Edwards, M., 1994, Jekel, M. R., 1994, Hering, J. G., 1996). In this technique, addition of coagulant facilitates the conversion of soluble As species into insoluble

products through co-precipitation and adsorption. Adsorption of As on preformed  $\text{Fe(OH)}_3$  has also been shown to be an effective method for removing As (Driehaus, W., 1998). However As removal during coagulation with  $\text{FeCl}_3$  is more efficient than As adsorption onto preformed hydrous ferric oxide (Hering, J. G., 1997). It is suggested that where As removal depends on iron precipitation, the settling time must exert a major influence on the removal process. Some simple household As-removal systems have also been developed based on traditional-sand filtration water purification along with wood charcoal or rusted iron nails as an adsorption medium. These As-removal filters have been used in As-affected areas of Bangladesh and Nepal.

Therefore, Arsenic could be removed by co-precipitation as well as by adsorption on ferric hydroxide surfaces if the groundwater contains an appreciable concentration of dissolved iron. Oxidation of iron (II) chemically or biologically to ferric hydroxide is essential. About 95% of the area of the northeastern region contains dissolved iron in excess of 2 mg/l, and the iron concentration is as high as 15 mg/l in many areas (Singh, 2004); therefore, a simple iron assisted biological sand filter may be applicable to remove arsenic to an acceptable level. The household filters currently distributed in the arsenic affected districts contain rusted iron nails (ferric hydroxides) as the sink for arsenic adsorption by a surface complexation mechanism. The soluble iron ( $\text{Fe}^{2+}$ ) already present in the groundwater oxidizes in the form of ferric hydroxide, and the elemental iron (iron nails) oxidizes to ferric hydroxide chemically (air) and biologically, especially by air and iron bacteria, respectively.

The arsenic loaded iron particulates are retained on the sand filter by mechanical straining. The advantages of this kind of filter are that the iron bacteria, which thrive on iron and organic matter, develop on the filter. The outer cell of these bacteria provides a large surface area for arsenic loaded iron oxide adsorption (Katsogiannis and Zouboulis, 2004). The pitcher filter unit can remove 90–98% As-bearing water when As bearing groundwater was passed through wood charcoal and sand. This technology is effective at household level in removing As, but the system may be quickly clogged as groundwater of the northeastern region contains excessive iron. Risk of bacterial contamination may also to be checked by sterilizing the medium before filter-construction. (Murcott,Lukacs 2002) conducted a technological evaluation of the biosand filter and the possible mechanism of arsenic, iron, and pathogen removal. A recent study by Jin and Chiu (2007) at the University of Delaware stated that zero-valent iron based filters were effective in removing pathogenic bacteria and viruses (99.999%) from drinking water. The mechanism of virus removal was not clear, but the researchers believe that viruses might have been inactivated chemically by iron oxide or due to the adsorption of viruses on the iron oxide surfaces; E. coli, Hepatitis A, Norovirus and Rotavirus were also removed by zero-valent iron assisted filters (Jin and Chiu, 2007). The filters currently introduced in the northeast region are a good arsenic mitigation alternative. A long-term plan should be formulated by the government for the treatment and sustainable use of northeast groundwater. Every field kits should be checked for their performances. For this purpose establishment of a reference laboratory is urgent. Every new tube well should be constructed only after the test for arsenic.

### **Conclusion:**

This review has attempted to summarize the incidents of arsenic contamination in groundwater in the northeastern states of India. It poses a significant risk to public health in the northeast region of India. Therefore, the first priority to remediate the crisis should be early identification of the affected sources, and the next hurdle is to provide arsenic-safe water to the affected masses. It is necessary to seal the highly contaminated tube wells to protect the non-contaminated aquifers and provide the good biosand filters to the rural northeast regions.

### **Acknowledgements**

The authors would like to thank the reviewers for their constructive comments.

### **Corresponding to:**

**Miss.N.Linthoingambi Devi**, School of Environmental Studies, Key Laboratory of Bio and Environmental Geology of Ministry of Education, China University of Geosciences, 388, Lumo Road, Wuhan, Hubei, 430074, P.R. China.

Email: n.linthoi.devi@gmail.com phone no: 008613098823940

Submission date: 1<sup>st</sup> April 2009

**Reference:**

1. Acharyya, S. K., Chatraborty, P., Lahiri, S., Raymahashay, B. C., Guha, S. and Bhowmik, A., (1999) Arsenic poisoning in the Ganges delta. *Nature*, 401: 545–546.
2. Baruah, M. K., Kotoky, P., Baruah, J., Borah, G. C. and Bora, P. K. (2003) Arsenic association and distribution in carbonaceous materials in northeastern India. *Curr. Res.*, 85: 204–208.
3. British Geological Survey/Department of Public Health Engineering. (2001). Arsenic contamination of groundwater in Bangladesh. Technical Report, Key worth, UK.
4. Boyle, R. W. and Jonasson, I. R., (1973) The geochemistry of arsenic and its use as an indicator element for geochemical prospecting. *J. Geochem. Explor.*, 2: 252–296.
5. Chakraborti, D. et al., (2004) Groundwater arsenic contamination and its health effects in the Ganga–Meghna–Brahmaputra plain. *J. Environ. Monit.* 6:74N–83N.
6. Chowdhury, U. K., (2001) Groundwater arsenic-contamination status at four geo-morphological areas in Bangladesh (special reference to arsenic in biological samples and agricultural crop). Ph D dissertation, Jadavpur University, Kolkata.
7. CEN/TC/230/WG1/TG 12 N 3 (1999) Water quality – Determination of arsenic in drinking, surface, ground, saline and industrial and domestic waste waters.
8. Edwards, M., (1994) Chemistry of arsenic removal during coagulation and Fe–Mn oxidation. *J. Am. Water Works Assoc.*, 86, 64–78.
9. Gleick PH (1996) Basic water requirements for human activities: meeting basic needs. *Water Int.*;21(2):83–92.
10. Guha Mazumder DN, Haque R, Ghosh N, De BK, Santra A, Chakraborty D, et al. (1998). Arsenic levels in drinking water and the prevalence of skin lesions in West Bengal, India. *Int J Epidemiol* 27(5):871–877.
11. Hering, J. G., Chen, P.-Y., Wilkie, J. A. and Elimelech, M., (1997) Arsenic removal during coagulation. *J. Environ. Eng., ASCE*, , 123, 800–807.
12. IARC (International Agency for Research on Cancer),(2004) Some Drinking-Water Disinfectants and Contaminants, Including Arsenic. IARC Monogr Eval Carcinog Risks Hum 84.
13. ISO 11885,(1996) Water quality – Determination of 33 elements by inductively coupled plasma atomic emission spectrometry.
14. ISO 11969, (1996) Water quality – Determination of arsenic – Atom absorption spectrometric method (hydride technique).
15. ISO 6595(1982) Water quality – Determination of total arsenic – silver diethyldithiocarbamate spectrophotometric method.
16. ISO/CD 15586, (2000) Water quality – Determination of trace elements by atomic absorption spectrometry with graphite furnace.
17. Jacks, G. and Bhattacharya, P. (1998) Arsenic contamination in the environment due to the use of CCA-wood preservatives. In Arsenic in Wood Preservatives: Part I, Kemi Report, vol.3/98:. 7–75.
18. Jin Y, Chiu P. (2007) New technology removes viruses from water; 2007. [http://www.terrardaily.com/reports/New\\_Technology\\_Removes\\_Viruses\\_From\\_Drinking\\_Water\\_999.html](http://www.terrardaily.com/reports/New_Technology_Removes_Viruses_From_Drinking_Water_999.html) (Accessed April 29, 2007).
19. Juillot, F., Ildefonse, P. H., Morin, G., Calas, G., de Kersabie, A. M. and Benedetti, M., (1999) Remobilization of arsenic from buried wastes at an industrial site: mineralogical and geochemical control. *Appl. Geochem.*, 14:1031–1048.
20. Katsoyiannis IA, Zouboulis AI.(2004) Application of biological processes for the removal of arsenic from groundwaters. *Water Res.*;38(7):17–26.
21. Khan, H. R., (1994) Management of groundwater resources for irrigation in Bangladesh, FAO
22. M 3500-As B, (1999) Standard Methods for the Examination of Water and Wastewater, Silver Diethyldithiocarbamate method.
23. Murcott S, Lukacs H. Household water treatment in Nepal; (2002). [http://thinkcycle.mle.ie/thinkcycle/main/development\\_by\\_design\\_2002/publication\\_household](http://thinkcycle.mle.ie/thinkcycle/main/development_by_design_2002/publication_household)

- d\_water\_treatment\_in\_nepal/Lukacs\_Murcott2.pdf (accessed April 27, 2007).
24. Maharjan M, Watanabe C, Ahmad A, Ohtsuka R(2005) Arsenic contamination in drinking water and skin manifestations in lowland Nepal: the first community-based survey. Am J Trop Med Hyg; 73:477–9.
25. Nagarnaik P. B. , Bhole A.G. and Natarajan G.S. (2002) Arsenic removal of ground water – a state of art, Water Resources Journal, December: 51-66.
26. NRC (National Research Council). (2001) Arsenic in Drinking Water: 2001 Update. Washington, DC: National Academy Press.
27. NAS, (1977) Medical and biologic effects of environmental pollutants: arsenic. National Academy of Sciences, Washington DC
28. Ngai T, Dangol B, Murcott S, Shrestha RR. (2006) A simple arsenic solution for the arsenic problem, Kanchan Arsenic Filter. Environment and Public Health Organization;
29. Nickson, R. T., McArthur, J. M., Burgess, W. G., Ahmed, K. M., Ravenscroft, P. and Rahaman, M., (1998) Arsenic poisoning of Bangladesh groundwater. Nature, 395–338.
30. Nriagu, J. O. and Pacyna, J. M., (1988) Quantitative assessment of worldwide contamination of air, water and soils with trace metals. Nature, 333: 134–139
31. Pacyna, J. M. and Pacyna, E. G., (2001) An assessment of global and regional emissions of trace metals to the atmosphere from anthropogenic sources worldwide. Environ. Rev. 9:269–298.
32. Saha J.C., Dixit A.K., Bandyopadhyay M., Saha K.C. (1999) A review of arsenic poisoning and its effects on human health”, Critical reviews in Environmental Science and Technology, Vol. 29, No3:281-313.
33. Singh, A. K., (2004) Arsenic contamination in groundwater of North Eastern India. In Proceedings of 11th National Symposium on Hydrology with Focal Theme on Water Quality, National Institute of Hydrology, Roorkee, pp. 255–262.
34. Sharma, R.M. (1999) Research study on possible contamination of groundwater with Arsenic in Jhapa, Morang, and Sunsari districts of Eastern Terai of Nepal. Report of the WHO Project, DWSS, Govt of Nepal.
35. Smith, A. H. et al. (1992) Cancer risks from arsenic in drinking water. Environ. Health Perspect., 97: 259–267.
36. SM 3113(1999) Standard Methods for the Examination of Water and Wastewater. Metals by electrothermal atomic absorption spectrometry.
37. SM 3114 :(1999) Standard Methods for the Examination of Water and Wastewater. Arsenic and selenium by hydride generation/atomic absorption spectrometry.
38. SM 3120 :(1999),Standard Methods for the Examination of Water and Wastewater. Metals by plasma emission spectrometry.
39. Smedley P.L. and David G K. (2003), Source and behaviour of arsenic in natural waters, chapter 1, Arsenic report, WHO.
40. Smith AH, Lingas EO, Rahman M. (2000)Contamination of drinking water by arsenic in Bangladesh: a public health emergency. Bull W H O;78(9):1093–103.
41. Taylor, S. R. and McLennan, S. M., (1985) The Continental Crust: Its Composition and Evolution, Blackwell Scientific, London,
42. USEPA 7063 (1996) Arsenic in aqueous samples and extracts by anodic stripping voltammetry (AVS), method 7063. U.S. Environmental Protection Agency.
43. WHO, (1958). International Standards for Drinking-water
44. WHO, (1963). International Standards for Drinking-water, Second edition, vol. 3
45. WHO, (1993). Guidelines for drinking-water quality, second edition, vol. 1.
46. WHO/International Programme on Chemical Safety. (2001). Arsenic and Arsenic Compounds. Environmental Health Criteria 224. 2nd ed. Geneva: World Health Organization
47. www.medindia.net/news/view\_news\_main.asp
48. Yan Chu, H., (1994) Arsenic distribution in soils. In Arsenic in the Environment, Part I: Cycling and Characterization (ed. Nriagu, J.O.), John Wiley, New York, pp. 17–49.

## Improving The Teaching And Learning Of Mathematics In Second Circle Institutions In Ghana: Paper II

Adetunde, I. A.  
Department Of Mathematics  
University Of Mines And Technology  
Tarkwa.  
Ghana.

Email: [iadetunde@umat.edu.gh](mailto:iadetunde@umat.edu.gh)  
[adetunde@gmail.com](mailto:adetunde@gmail.com)

**ABSTRACT:** Mathematics subject had seriously become problematic and is posing limitations to our children/wards in seeking admission into the tertiary institution of learning. The paper II is a follow up to paper I and continues the ways of improving the teaching and learning of mathematics in second circle institutions in Ghana. [Report and Opinion. 2009;1(3):33-35]. (ISSN: 1553-9873).

**Keywords:** Mathematics, Second Cycle Institutions, SSCE, Teaching and Learning, Mathematics Association of Ghana (MAG), Ghana Mathematical Society (GMS), National Mathematics Institute (NMI).

### INTRODUCTION

"The old slogan of fail in Mathematics, fail in all other subjects" is back on the stage because no applicant can gain admission to higher/tertiary institutions without a credit pass in mathematics. It has now been the awareness that "mathematics" is the key to all subjects be it the Sciences, Technology Accounting and Social Sciences or even law. Not only these, the overall national development of any nation and building of a healthy happy and prosperous society or nation can not be successfully achieved without mathematics. The pursuit of mathematics is therefore, vital and imperative for any society, or community or nation in order to maintain its independence and ensure increased prosperity and keep its place amongst the civilized nations (society) of the world is this era of technology. The rich and more advanced country of the world have attained their affluence through advanced which they made in mathematics which links sciences and technology. This implies that mathematics education is a very important input in the scientific and technological development of any society. It is now obvious that mathematics subject is a tool for science and technology.

Mathematics has now entered into the field of studies which were thought to be non-mathematics in the past. Mathematics is now seen as the pivot on which all other subjects revolve. As a result, the poor performance of students in the subject cannot be allowed to go unattended to. Right from childhood, in nursery classes, mathematics is one of the basic skills impressed. This shows how mathematics forms the foundation of any solid education. In the paper I, we looked into the probable causes of student's poor performance in the subject with recipes to the problems, the paper II, is an extension of paper I.

There is awareness of Our students' poor performance in Mathematics as evidenced by the results of trends in International Mathematics and Science Study (TIMSS), which was conducted in 2003, when the results were ranked from the highest to the lowest in performance, Ghana occupied the 44<sup>th</sup> position out of the 45 participating Countries. The results are very painful to those of us who brag about the Ghanaian's academic prowess. Brooding over the results is of no use though; rather concrete steps must be taken to stop the downward trend of performance in Mathematics, stabilize the situation and then gradually move the whole Nation towards understanding and appreciating the beauty and utility of Mathematics in today's World (1 and 3)

## METHODS OF IMPROVING THE TEACHING AND LEARNING OF MATHEMATICS

It is worthy to mention that government of Ghana alone count shoulder the enormous responsibility to better and improve the quality as well as standard of education at all levels. It is therefore imperative that other agencies, organization of private individual, NGOs etc. should assist in improving the standard of education in the country; this can be done by organizing workshop so as to positively support the efforts of government.

Train-the-trainers workshop: this is another method of improving the teaching and learning of mathematics. By train-the trainers we means, a situation where we have two teachers, i.e. one from junior and another from senior schools need to be selected to train each others. They will be expected to impact knowledge to each other and to other teachers on their return to schools after the workshop when a teacher has adequate knowledge of what is expected of him/her, imparting the knowledge in such field will not be a problem and our students will not end by being drop outs after failing their terminal examination.

- Our Association (MAG) Mathematical Association Ghana, Ghana Mathematical Society (GMS) and National Mathematics Institute (NMI) should be powering mathematics workshop to every schools within some jurisdictions, this may lead to improvement in the teaching and learning of mathematics
- Provision of mathematical laboratory to the second circle institutions. If our second circle students can see some of what they are being taught in laboratory, that means we move from abstract to reality, this can bring out improvement in the teaching and learning of mathematics.
- Provision of mathematics models, film strips will also help in improving the teaching and learning of mathematics in our second circle institutions.
- The Mathematical Association of Ghana (MAG), Ghana Mathematical Society (GMS) and National Mathematics Institute (NMI) should be organizing mathematics competition between/among the second circle institution with in a jurisdiction and any school came first should be rewarded specifically. If this is done, there will be improvement in the teaching and learning of mathematics.
- The member of the Mathematical Association of Ghana should be going round the second circle institution in Ghana, to give Maths funfair, lectures or symposia etc. this will also aid in the teaching and learning of Mathematics.
- Mathematics Teachers' through Mathematical Association of Ghana (MAG) need to be supported to attend International Conferences this will bring in exposure to what Mathematics is everyday. MAG, GMS, NMI needs to be organizing International Conferences for its members by inviting other international mathematics association.
- MAG should expand its membership to include those who are not classroom teachers of mathematics. MAG members can gain valuable knowledge by interacting with such people and this can bring about improvement in the teaching and learning of mathematics.
- MAG and GMS leadership need to open up to new ideas that will make MAG and GMS a truly professional body that will spearhead mathematics education in Ghana and it could bring about improvement in teaching and learning of mathematics.
- Mathematics teachers' should encourage their students and however change the wrong notion developed by our Society over many years which some of the teachers have transferred to Children and Pupils that Mathematics is difficult.
- Mathematics teachers should try to do their best to create a friendly classroom atmosphere where teaching is easier and learning is easy and even enjoyable; not a place of war where criticism is rampant and teaching and learning is difficult. So teachers should use to praise instead of threats to get students to learn.
- Teacher should plan carefully their work and spend part of their holidays for planning on how to cover their syllabus before the school reopens. The problem of teaching and learning mathematics is as a result of the fact that some of the basic topics/foundation

topics were untaught and that has created “holes” in the minds of our students or pupils. Teacher should remedy it and not add to the problem by skipping some topics.

- Teachers of Mathematics subjects should always use concrete objects to teach children because children learn from concrete to abstract.
- Teachers of Mathematics subjects should be endeavour to the use of continuous assessment to assess the work and progress of their pupil, this could bring improvement to the teaching and leaning of Mathematics.
- Teachers of Mathematics should stop attempting to “pour” knowledge into the “empty” heads of students rather than providing them the opportunity to study and understand Mathematics.

#### **REFERENCES**

1. S.E. Anku (2006) :“Wake up mathematical association of Ghana”. Address delivered by Professor S.E. Anku at the 32<sup>nd</sup> annual conference workshop at Addisadel College Cape Coast on 29<sup>th</sup> August 2006.
2. Beatrice Osafo (2006): “Presidential Address delivered by Mrs. Beatrice Osafo Affum” at the 32<sup>nd</sup> annual conference workshop at Addisadel College Cape Coast on 29<sup>th</sup> August 2006.
3. S. E. Anku (2006): MEAGASA EDUCATION (Center for Excellency in Mathematics Education – Meceme) Vision, Mission, Philosophy and Goal. “Will Ghana be ready for TIMSS 2007”.
4. Adetunde I. A. (2007): “Improving the teaching and learning of Mathematics in second cycle Institutions in Ghana (Paper 1)”. Pakistan Journal of the Social Sciences. Vol 4(3): 340 – 344.

4/4/2009

**Conservation status of the endemic orchid, *Peristylus kumaonensis* Renz. (Orchidaceae) of Western Himalaya, India**

**Jeewan Singh Jalal\*** **Pankaj Kumar, \*\* Lalit M. Tewari\*** and **Y.P.S.Pangtey\***

\* Department of Botany, Kumaun University, Nainital, Uttarakhand

\*\* Habitat Ecology Department, Wildlife Institute of India, Dehradun, Uttarakhand (India)

Name of Author	E-mail address
Jeewan Singh Jalal	: <a href="mailto:jeewansinghjalal@rediffmail.com">jeewansinghjalal@rediffmail.com</a>
Pankaj Kumar	: <a href="mailto:pankajsahani@rediffmail.com">pankajsahani@rediffmail.com</a>
Lalit M. Tewari	: <a href="mailto:l_tewari@rediffmail.com">l_tewari@rediffmail.com</a>
Y.P.S.Pangtey	: <a href="mailto:y_pangtey@yahoo.com">y_pangtey@yahoo.com</a>

**ABSTRACT**

*Peristylus kumaonensis* Renz is an endemic taxon of Western Himalayas. It is found in the outer fringe of the Kumaun Himalayas 5 km away from Nainital towards Ratighat. The orchid species appears to be restricted to this area according to past and the present surveys. Major threats to the existence of this species are due to habitat fragmentation, forest fire and might be the invasion of a fern species *Phytopteryx oxyloba*. This species is of conservation concern because of the low numbers of individuals and restricted distribution in the western Himalayas. [Report and Opinion. 2009;1(3):36-40]. (ISSN: 1553-9873).

**Keywords:** Kumaun Himalayas, endemic, *P. kumaonensis* Renz, Western Himalayas.

**INTRODUCTION**

Peristylus is an Indo-Malaysian genus of about 60-70 species of terrestrial orchids. The genus is distributed in the tropical and sub-tropical parts of Asia, New Guinea, Australia and some Pacific Islands. The generic name is derived from Greek peri= around and stylus=column, referring to the shape of the column. The genus *Peristylus* have convex stigmas that are entirely united to the base of the labellum and to the auricles of the column. All species are multi-flowered, dull coloured, small and held close to the short-lived flower stem. All the species are deciduous terrestrials with fleshy, subterranean tubers and closely related to *Habenaria*. *Peristylus* is represented in India by 28 species of which eight species are found in Western Himalayas. Kumaun Himalaya occupies the central sector of Indian Himalaya and lies between 28°44' - 30°49' N Lat. and 78°45' - 81° and 01' E long. Broadly the area consists of three parallel mountain ranges. The outermost range rises steeply above the plains to more than 2000 m above msl, reaching 2600 m in some peaks near Nainital. Rainfall is heaviest on the southern slopes of this range and can vary between 1981 cm and 3048 cm annually. This area receives the major part of its annual precipitation during the southwest monsoon from June to September. Altogether 192 species of orchids under 61 genera were recorded so far from Kumaun Himalaya (Pangtey et. al., 1991). *Peristylus kumaonensis* Renz was reported for the first time by Dr. J. Renz in 1983 from the locality 5 km from Nainital, towards North on the way of Ratighat at an altitude of 2178 m and it is restricted to this area in the whole of Western Himalayas (**Fig. 1 & 2**). During that period almost 130 individuals were counted at this particular locality (Pangtey, personal communication). On our orchid study tours in Kumaun region since 2002 we have been continuously observing the population of this species. Now the scenario of the whole area has been changed due to habitat changes and anthropogenic pressures. The population has drastically decreased and only 30 individuals were observed in this locality in a recent count. The species generally grows on rocks covered by thick mats of moss. The mossy bed basically holds moisture and soil which is sufficient for the growth of the species. During our survey we tried to locate other areas where this might also occur, but we could not find this species in other parts of Kumaun Himalayas. It is therefore very important to conserve this interesting endemic orchid species and its habitat.

## SPECIES DESCRIPTION

*Peristylus kumaonensis* Renz., J. Orchid Soc. India 1: 23. fig. 1. A-H (1987); Pangtey et. al., Orchids Kumaun Him. 77 (1991); Jalal, Sys. Phyt. Hab. Eco. Orch. Utt.: 149 (2005).

Erect, terrestrial herbs bearing 2 unequal basal leaves, that are somewhat clasping. Leaves erect and unequal in size and shape. Lower leaves longer, narrowly oblong, acute, 9 x 1.5 cm. Upper leaves lanceolate to linear-lanceolate, reduced in size. Inflorescence very narrow, rather laxly sub-secund. Bracts lanceolate, acuminate, as long as the ovary or little shorter or longer. Flowers minute, greenish and glabrous. Sepals converging; dorsal sepal elliptic, obtuse, upto 1.7 mm long; lateral sepals obliquely ovate-elliptical, acute, slightly longer than the dorsal. Petals obliquely rhomboid-elliptical, upto 1.5 mm long. Lip as long as the petals, trilobed near the middle, with small triangular side-lobes and a longer, obovate to oblong mid-lobe. Spur much shorter than the ovary (**Fig. 2**).

**Flowering:** This taxon flowers from late July through August.

**Geographical Distribution:** It is only known from specimens seen on the way to Ratighat near Nainital, Western Himalaya.

**Specimen Examined:** Wildlife Institute of India herbarium (WII) - *J.S.Jalal 13993*.

**Habitat:** *Peristylus kumaonensis* has been found at elevations of 2178 m (7145 ft) on the moist rocky surface covered by thick mossy patches. This particular habitat is a transition zone of Banj-oak (*Quercus leucotrichophora*) forest and Chir-pine (*Pinus roxburghii*) forest. Apart for this a fern species *Phytopterys oxyloba* is the main associate species.

## THREATS

This species is threatened as the result of its low numbers and restricted distribution in Kumaun Himalayas. The plants are small and fragile and cannot tolerate the direct impacts of anthropogenic pressures, canopy exposure and forest fire. Chir-pine forest is also prone to fire. This forest also changes the hydrology of the area and soil chemistry which impacts many rare herbs including orchids. The soil becomes more acidic under chir-pine forest which can have negative effect on the germination of orchid seeds. Another major threat is the road side location. This particular species is found growing on the roadside verges on the main Nainital-Ratighat road and frequently used by local community for their daily needs. During rainy season, that is also the peak flowering season of *Peristylus kumaonensis* Renz, the local villagers clean the tall herbs and bushes on the roadside and because of this activity most of the time the *Peristylus kumaonensis* Renz species is also damaged. In past few years it was observed that *Phytopterys oxyloba*, a lithophytic fern is also overtaking the habitat. For conservation of this endemic orchid further survey is required to relocate this species and establish its vulnerability to the threatening processes in the area. Recovery actions such as monitoring the habitat during the flowering time, raising the seeds artificially and replenishing the habitat artificially and fire management may need to be implemented. It is also recommended that this interesting species be included in the list of national threatened species of orchids.



**Figure 1: Showing location of *Peristylus kumaonensis* Renz in Western Himalaya**



**Figure 2:** Habitat of *Peristylus kumaonensis* Renz.



**Figure 3:** *Peristylus kumaonensis* Renz: 1. Plant in habit; 2. Closeup of Inflorescence.



**Figure 4: Close-up of Inflorescence**

#### **ACKNOWLEDGEMENTS**

Authors are grateful to the Department Science and Technology, Government of India for financial support to carry out this work. Authors are also thankful to Director, Wildlife Institute of India, Dehradun for providing necessary support and facility.

**Correspondence to**

Dr. Jeewan Singh Jalal  
Young Scientist (DST)  
Department of Botany  
D.S.B.Campus  
Kumaun University, Nainital,  
Uttarakhand, India  
Tel: 09412348q46  
E-mail: jeewansinghjalal@rediffmail.com  
Alternate e-mail: jeewan.orchid@gmail.com

**REFERENCES**

- Pangtey YPS, Samant, SS, GS Rawat. Orchids of Kumaun Himalaya. Bishen Singh Mahendra Pal Singh, Dehradun, India: 1991.
- Jalal JS. Systematics, Phytoogeography and Habitat Ecology of Orchids in Uttarakhand. Ph.D. thesis, Kumaun University, Nainital: 2005.
- Renz J. *Peristylus kumaonensis* Renz., Journal of The Orchid Society of India, 1987; 1 (23) fig. 1. A-H.

**4/10/2009**

## Treatment of *Dracunculus medinensis* infection with cotrimoxazole in endemic populations of Ebonyi, South Eastern Nigeria

Jude C. Anosike<sup>1\*</sup>; Emmanuel S. Miri<sup>2</sup>; Charles I. Okoli<sup>3</sup>; Bertram E. B. Nwok<sup>4</sup>; Celestine O. E. Onwuliri<sup>5</sup>; Ezekiel G. Ajayi<sup>6</sup>  
INS Dozie<sup>5</sup> and Joe E. Asor<sup>6</sup>

<sup>1</sup>Global 2000 Nigeria Guinea worm Eradication Programme, Box 256 Abakaliki, Ebonyi State, Nigeria

<sup>2</sup>Global 2000 Nigeria National Office, Jos, Nigeria

<sup>3</sup>Tropical Animal Health and Production Research Lab., Department of Animal Science and Technology, Federal University of Technology Owerri, Nigeria

<sup>4</sup>Tropical Disease Research Unit, Department of Animal and Environmental Biology, Imo State University, P.M.B 2000 Owerri, Nigeria

<sup>5</sup> Office of the Vice Chancellor, Federal University of Technology Owerri, Nigeria  
Department of Zoology, University of Calabar, Cross River State, Nigeria

**Corresponding author:** Dr. I.C. Okoli, [dr\\_charleso@yahoo.com](mailto:dr_charleso@yahoo.com)

**\*Professor Jude C. Anosike:** This paper is published posthumously in memory of Professor Jude C Anosike, who died in late 2008. He was formally of the Tropical Disease Research Unit, Department of Animal and Environmental Biology, Imo State University, P.M.B 2000 Owerri, Nigeria and a consultant to the Global 2000 Nigeria Guinea worm Eradication Programme, Box 256 Abakaliki, Ebonyi State, Nigeria.

### ABSTRACT

**Background:** The aim of this study was to determine the effectiveness of cotrimoxazole (Septrin®, Wellcome, England) on *Dracunculus medinensis* and the response of infected persons on mass cotrimoxazole therapy in an endemic rural farming population. **Method:** During the peak transmission season of 1998/1999 epidemiological years, 12,158 persons were examined for guinea worm infections in endemic populations of Ebonyi state, southeastern Nigeria. Eight hundred and sixty-four (864) active cases as well as persons with painful non-emergent worms were systematically treated with cotrimoxazole. Dosage was adjusted according to body weight given in tablets at 20 mg/kg in 2 divided doses for 5 days. **Results:** Of the 864 treated cases, 539 and 125 were females and males respectively. Eight hundred and twelve (812) patients had 1-3 worms, while 52 patients showed poly-parasitism of up to 28 worms per person. Inflammation signs subsided within the first 2-4 days of treatment with cotrimoxazole. Specifically, symptoms were more in the untreated than in the treated group. The drug enhanced healing of septic wounds, reduced both swollen legs and pains in over 67% of the cases. **Conclusion:** Cotrimoxazole appears to be effective without serious adverse effects in the treatment of dracunculiasis. Its efficacy in the amelioration of symptoms and cure of the disease is encouraging and should prove a useful weapon against dracunculiasis in Nigeria. [Report and Opinion. 2009; 1(3):41-46]. (ISSN: 1553-9873).

**Keywords:** Dracunculiasis, guinea worm, cotrimoxazole, prodromal signs, Nigeria

### INTRODUCTION

Treatment of dracunculiasis in endemic foci may involve either surgery or chemotherapy. Surgical removal of dracunculus is widely practiced in several endemic areas, when the outline of a worm can be seen or palpated. This approach is however not effective if the worm has burst in the tissue or has broken the skin more than a few days previously (1, 2). It is also difficult to remove the worm when it is embedded in deep fascia (1). Over the years, a number of therapeutic substances have been employed in the treatment of dracunculiasis. Among the earliest trial substances used in West Africa and India were palm oil, kerosene and concoction of leaves placed over the ulcer (4). In most endemic areas, various oral portions such as raw sugar and tartar emetics have also been recommended (5, 6). Most of these concoctions, though with deep bearing in local beliefs are not of much value in the treatment of dracunculiasis. Although other medicaments like diethylcarbamazine (DEC) appear to be without action on the adult worms, Rousset (7) presented circumstantial evidence that DEC kills the developing stages of *D. medinensis* including

larval stages inside cyclops (8).

Chemotherapy of dracunculiasis received a boast with the discovery of niridazole, thiabendazole, metronidazole and mebendazole in the mid 20<sup>th</sup> century. Trial/ field treatments with these drugs have continued to yield varying results (1, 10, 11, 12). Metronidazole for example, was useful but also requires 7 days of application to achieve appreciable result (10).

Mass chemotherapy against dracunculiasis has not received much attention in Nigeria, probably because of general lack of effective cure with the drugs currently in use (13, 12.4). More so, these drugs have been shown to be toxic and relatively expensive for peasants, who constitute majority of clinical cases (14). In southeastern Nigeria, information on the treatment of the disease is non-existent (15, 16, 17). We present our findings on Ebonyi state, which was the most endemic state in Nigeria by 1998/99 epidemiological year. In an area of renewed outbreak reported in previous studies (17, 2) trial doses of cotrimoxazole (Septrin®) were therefore administered to infected subjects following parasitological and clinical examinations. Earlier point trial with cotrimoxazole had yielded some encouraging results amongst patients on its effectiveness in ameliorating pains and improving worm expulsion/extraction (18). The objective of the present study is to determine the effectiveness of the cotrimoxazole on *D. medinensis* and the responses of infected patients to mass therapy with the drug during an outbreak of infection in four most endemic local Government Areas of Ebonyi State, Nigeria.

## MATERIAL AND METHODS

Volunteers with obvious acute manifestations of dracunculiasis such as abscess, itching, erythema, blister, bleb formation, pain and cellulitis were randomly selected for the study from the four most endemic local Government Areas (LGA) of Ebonyi State, Nigeria. These included Ikwo, Ozibo, Ebonyi and Ezza North LGAs. A total of 12,158 persons were examined, and of these, 864 persons including active cases of dracunculiasis as well as persons with non-emergent worms and village based health workers (VBHWs) were treated with cotrimoxazole (Septrin®, Wellcome, England). Cotrimoxazole is a combination of trimethoprim and sulphonamides. Trimethoprim is a diaminopyrimidine derivative, which inhibits the conversion of dihydrofolate to trihydrofolate by inhibiting the enzyme dihydrofolate reductase in bacteria and protozoa (19, 20). Used alone, it is not particularly effective against bacteria and resistance develops easily (21, 22). However, in combination with sulphonamides, a synergistic action, which results in a segmental blockage of microbial enzyme systems through the blocking of different reactions in the same pathway occur with broad spectrum bactericidal consequence (20). Although an old drug, it still finds useful application in the management of numerous bacterial infections (23, 24, 25, 26).

The drug was administered orally in tablet form according to manufacturer's instruction, which was translated to 20 mg/kg body weight in two divided doses daily for five days. The efficacy in the amelioration of symptoms as well as cure of the infection was monitored. The clinical course of the disease in other patients not administered the Septrin® was equally monitored.

The clinical signs such as exudation, pain, redness and swelling were ranked using the method of Sastry et al (27) as follows: 0 = nil; 1 = mild; 2 = moderate; 3 = severe and 4 = incapacitating (very severe). The effect of the cotrimoxazole on *D. medinensis* was also scored using the method of Sastry et al (27) in classifying response to treatment as poor= no response, fair = slow, or delayed response, good = easy extractability of worms, with relief of inflammation and very good = spontaneous extrusion of worms and dramatic subsistence of inflammation. In subjects with multiple lesions, maximum grading of clinical manifestation was noted, while reports of prodromal symptoms and signs were recorded.

The patients progress was noted on the 3rd, 6<sup>th</sup>, 9<sup>th</sup>, 12<sup>th</sup> and 15<sup>th</sup> days. These intervals were necessary to the team for appropriate case management, while the lesion usually would have shown reasonable response and healing. Adverse reactions to the drug in treated subjects and their intensity were equally scored on a 0-3 basis as follows: 0= absent; 1 = mild or occasionally present; 2 = severe and continuous; 3 = stop treatment. Data generated from the study were analyzed using simple descriptive statistics such as simple averages and percentages.

## RESULTS

Table 1 showed that of the 12,158 persons examined, 864 (7.1%) were infected with guinea worm. This included active cases as well as persons with painful non-emergent worms. Treated subjects varied across

the study area with Ikwo LGA (30%) as the highest and Ozibo as the least (17.1%). Of the 864 patients treated with Septrin®, 529 were females and the rest males, with the number of persons infected reaching a peak in the 11-20 years-age bracket before a gradual decrease with increase in age of patients (Table 2).

Majority of the clinical manifestations were moderate (Table 3), while over 70% of the predilection sites of worm emergence were the lower limbs (Table 4). Three cases of lesions each were observed on the scrotum, chin and breast respectively. The treated subjects showed good tolerance to the drugs, with many reporting relief of pain, while the clinical course of the disease in the untreated group extended up to 13 weeks before subsidence of acute manifestations. Inflammatory manifestations disappeared in the treated group within 2-3 days of treatment.

In 864 cases, there was spontaneous extrusion of the worm or the worm could be extracted manually without any resistance (Table 5). Abscess formation or encystment was not observed after drug therapy. Worms which were previously palpable could not be felt as a cord presumably due perhaps, to migrations of the worms to deeper fascia or lyses. There were reports of prodromal symptoms and signs in most patients prior to the emergence of adult fertilized female worms. These were observed in both treated and control groups.

Table 1: Distribution of guinea worm patients in relation to sampled areas

Local Government Area*	Number infected (%)
Ikwo	267(30.9)
Ozibo	148(17.1)
Ebonyi	202(23.4)
Ezza North	247 (28.6)
Number Infected	= 864

\*These are the most endemic Local Government Areas in South eastern Nigeria during the 1998/1999 transmission season.

Table 2: The age and sex distribution of the patients

Ages in years	1-10	11-20	21-30	31-40	41-50	51-60	61-70	Total
Females	86	192	117	46	39	31	28	529
Males	49	78	60	51	45	23	19	325

Table 3: Ranking of clinical manifestations

Clinical Manifestation	Grading						Total
	0	1	2	3	4		
Swelling	•25	42	373	364	60		864
Pain	13	49	398	339	65		864
Redness	34	220	305	211	94		864
Exudation	105	52	401	219	87		864

Table 4: Predilection sites of worm emergence

Predilection Site of lesion	Lower limb	Upper limb	Other sites	Total
No of lesion	715	134	88	937

**Table 5: Observations on clinical response**

Response to treatment	No of Cases	Percentage
Poor	61	7.1
Fair	53	6.1
Good	86	9.9
Very good	664	76.9
n	=	864

## DISCUSSION

Numerous traditional remedies abound in the study area indicating absence of effective modern management of the condition in the area (28). These rural communities had neither functional hospitals nor medical centers. Thus ulcers arising from guinea worm infection were treated according to the subject's level of belief and understanding. Some sufferers superstitiously attributed the disease to the wrath of the gods or to witch craft and could not readily appreciate any link between it and drinking cyclops-infested water (28). Systematic health education in these communities on the treatment of dracunculiasis has been successful, but must be sustained.

About 67% of the infected subjects, with emerging adult female worms complained of prodromal symptoms a few days or hours before the emergence of the worms. Kale (14) similarly reported that 80% of patients had prodromal signs in dracunculiasis endemic area in western Nigeria. The prodromata usually lasts for less than 24 hours and consists of one or more of generalized urticarial rash accompanied by erythema, mild to moderate itching, fever and giddiness, dyspnoea, nausea, vomiting, diarrhoea and infrequently intra-orbital oedema and syncope. These symptoms were observed more in the control group than in those treated with Septrin®. Prodromata of dracunculiasis are allergenic in nature and results from the release of histamine-like substances triggered off by the presence of the worms (11).

Most antibiotics so far employed in the management of dracunculiasis have beneficial effects on the patients in that they relieve symptoms, speed up the expulsion of the worms from the body and promote the healing of illness. Because they have not been shown to affect the worm in any discernible way, Muller (1) has suggested that their beneficial action in the treatment of dracunculiasis derives from their anti-inflammatory properties. Again, significant amount of an intra-cellular bacterium and endosymbiont wolbachia has been observed in the body of some parasitic nematodes (29, 30, 31). Further studies are urgently needed to elucidate the possible involvement of wolbachia in *D. medinensis* infection vis-a-vis the effect of those antibiotics on the parasites and wolbachia when present.

The Septrin® equally enhanced healing of septic wounds, reduced both swollen legs and pains in over 67% of the cases. Some of the worms that could not be extracted due to loss of cuticle, atrophied and died within 4-6 days in 664 cases, as revealed by spontaneous extrusion of the dead worms or ease of manual extraction. Simple treatment regime, availability, good tolerance and the dramatic effectiveness makes Septrin® a possible candidate drug for mass treatment of dracunculiasis in the study area. Since Septrin® brand of cotrimoxazole is relatively costly when compared with other brands in the Nigerian market, there is need to repeat the study with other cheaper brands in order to determine their effectiveness and use by poor rural farmers, who constitute the major sufferers of dracunculiasis in Nigeria (18). Cotrimoxazole could prove a useful weapon for agencies mandated with the eradication of dracunculiasis in Nigeria.

## ACKNOWLEDGEMENTS

This investigation received logistic support from the Global 2000 Nigerian Program. They also made available all the free drugs used for this study. The group thanks Dr. Ernesto-Ruiz of Global 2000 Carter Centre, Atlanta for the initial encouragement and support prior to the commencement of this study. We are also grateful to our numerous field managers, LGA Guinea worm coordinators, village heads, Village Based Health Workers and Ebonyi state Ministry of Health. Encouragement received from Dr. Okwoli Amali of the Department of Biological Sciences, University of Agriculture Makurdi, Benue state and Dr Johan P. Velema of the Carter Center, Atlanta is highly appreciated.

## REFERENCES

1. Muller, K: *Drciciinailux* and dracunculiasis. Adv. Parasitol. (1971) 9, 73-151.
2. Anosike, JC, Nwoke, BEB, Dozie, INS, Thofern, UAR, Okere, AN, Tony-Njoku, K, Nwosu, DC, Oguwuikc, UT, Ajayi, LG: Control of endemic dracunculiasis in Ebonyi State, South-eastern Nigeria. Int. J. Hyg. Environ. Health. (2003) 206, 1-6.
3. Johnson, MF: Guinea worm arthritis of knee Joint Br. Med.1. (1968) I., 314 (Corr.). Kale, GO: A controlled field trial of the treatment of dracunculiasis with metronidazole and niridazole. Ann. Trop. Med. Parasitol. (1974) 68, 91-95.
4. Fairley, NH and Liston, WG: Studies in dracontiasis III. A note on various local Indian remedies. Indian J. Med. Res. (1924) 12, 93-103.
5. Macfie, JWS: Intravenous injection of tartar emetic in guinea worm infections. Lancet, (1920) 1, 654-656.
6. Richards, WG: Note on *Dracunculus medinensis*. Parasitology. (1972) 14, 307-308.
7. Roussa, P: Essai de prophylaxie et de traitement de la dracunculose per la notezine en Adrar. Bull. Soc. Med. Afr. Occ. Franc. (1952) 9, 351.
8. Onabamiro, SD: The geographical distribution and clinical features of *Dracunculus medinensis* in south west Nigeria. W. Afr. Med. J. (1952) 1, 159.
9. Oduntan, SO.; Lucas, A.O. and Gilles, H.M: Treatment of dracunculiasis with niridazole. Lancet , 1967) 2, 73-75.
10. Lucas, AO; Oduntan, SO. and Gilles. HM: Niridazole in guinea worm infection. Ann. N.Y. Acad. Sci. (1969) 160, 729-739.
11. Kale, OO: Clinical evaluation of drugs for dracontiasis. Imp. Doc. (1974) 7, 15-16.
12. Kale, OO: Fall in incidence of guinea worm infection in western Nigeria after periodic treatment of infected persons. Bull. Wld. Hlth. Org. (1983) 60, 951-957.
13. Onabamiro. SD: The effects of hexazon (Banocide) diethylcabamazine on the larval form of *Dracunculiasis medinensis*. W. Afr. Med. J. (1956) 5, 64.
14. Kale, OO: Clinical and therapeutic aspects of guinea worm disease. In Proc. First Nat. Conf. Dracunculiasis in Nigeria. Kwara State Nigeria (1985). PP. 30-42. ,
15. Nwosu, ABC: Ifezulike, EO, Anya, AO: Endemic Dracontiasis in Anambra State of Nigeria: Geographical distribution, clinical features, epidemiology and socio-economic impact of the disease. Ann. Trop. Med. Parasitol. (1982) 76, 187-200.
16. Anosike, JC, Njoku, A.I, Nwoke, BEB, Ukaga, CN, Okoro, OU and Amadi, ANC: The status of dracunculiasis in parts of Isieke community in Ebonyi Local Government Area of Ebonyi State, Nigeria. Trop. Ecol. (2000) 41, 183-193.
17. Anosike, JC, Azoro, VA, Nwoke, BEB, Keke, IR. Okere, AN, Oku, HH, Ogbulie, JN. Tony-Njoku, RF, Okoro, OU and Nwosu, DC: Dracunculiasis in the north eastern border of Ebonyi state, south eastern Nigeria. Int. J. Hyg. Environ. Health. (2002) 205, 1-7.
18. Anosike, JC, Nwoke, BEB, Dozie, INS, Oku, HH, Asor, JH, Nzeoma, A.I, Ameh, I.G. Ogbusu, FI, Adeiyongo, CM, Osunwa, CO and Ikpeama, CA: Endemicity of dracunculiasis transmission pattern and ecology of cyclopoid copepods in the northwestern part of Ebonyi state, Nigeria. Int. J. Nat. Appl. Sci. (2005) \*1. 57-67.
19. Bushby, SRM and Hitchings, GH: Trimethoprim. a sulphonamide potentiator. Br. J. Pharmacol., (1968) 33,72-78.
20. Singleton, P. *Bacteria in biology, biotechnology and medicine*. 4<sup>th</sup> ed. John Wiley and Sons. Ltd, New York, Toronto (1997).
21. Aiello, SH and Mays, A (ed): *The Merck veterinary Manual 8<sup>th</sup> edition*, Merck and Co. Inc.. While-house Station. N.J. USA (1998).
22. Okoli, I.C. Studies on anti-microbial resistance among *E. coli* isolates from feeds and poultry production units. PhD Thesis, Federal University of Technology. Owerri, Nigeria (2004).
23. Waller, MT, Birgit, L, Dierk, B: *Stenotrophomonas (Xanthomonas) maltophilia*: In vitro susceptibility to selected antimicrobial drugs, single and combined, with and without defibrinated human blood. *Chemotherapy* (1998) 44: 293-304.
24. Maggioli, F, C'apra, R, Bottura, P. Pravettoni, G, Mighorino, Suter, F: In-vitro activity of moxifloxacin combined with other antibacterials against methicillin resistant *Staphylococcus aureus* Inter. J. Kxper. Clin. Chemother. (2000) 12, 195-108.
25. Manfredi, R, Nanetti, A, Valentini, R, Chiodo: *Acinetobacter* infections in patients with human

- immunodeficiency virus infection: Microbiological and clinical epidemiology. *Chemotherapy*, (2001)47:19-28.
- 26. Koleno, A, Doezo, A, Beno, P, Lisko, A, Stano, A, Kremery, V: Comparison of antimicrobial resistance profile between children in Cambodia and in Kenya, both with AIDS, on cotrimoxazole. *Inter. J. Exper. Clin. Cheimother.* (2005) 17, 139 (Abstract).
  - 27. Sastry, SC, Taya Kimor, J, Lakshminarayana, V: The Treatment dracontiasis with thiabendazole. *J. Trop. Med. Hyg.* (1978) 81, 32-35.
  - 28. Amadi, ANC, Anosike, JC, Asor, JE, Okoli, CG and Iwuala. MOE: Studies on the knowledge, attitude and perceptions of dracunculiasis in Ebonyi State, Nigeria. *Inter J. Nat. Appl. Sci.* (2005)1, 46-52.
  - 29. Townson, S, Hutton, D, Siemienksa .J, Hollick, L, Scanlon, T and Tagboto, SK: Antibiotics and *Wolbachia* in filarial nematodes: antifilaria activity of rifampicin, oxtetracycline and chloramphenicol against *Onchocerca lienalis* and *Brugia pahangi*. *Ann. Trop. Med. Parasitol.* (2000) 94: 801-816.
  - 30. Nwoke, BEB, Anosike, JC and Dozie, INS: *Wolbachia* in filarial parasites: An appraisal of its involvement in the pathogenesis of filariasis. 27<sup>th</sup> Ann. Conf. NSP. 24<sup>th</sup>- 27<sup>th</sup> Sept. Abstr. No. 25. (2003).
  - 31. Fairley, NH: Studies in dracontiasis V: Observations and reflections on intravenous medication with special reference lo tartar emetic. *Indian J. Med. Res.* (1924) 12. 369-374.

4/5/2009

## Diversity Of Orchids In Uttarakhand And Their Conservation Strategy With Special Reference To Their Medicinal Importance

G.C.Joshi<sup>1\*</sup>, Lalit M. Tewari<sup>2</sup>, Nidhi Lohani<sup>3</sup>, Kanchan Upreti<sup>4</sup>, Jeevan S. Jalal<sup>5</sup>,  
Geeta Tewari<sup>6</sup>

<sup>\*1</sup>Regional Research Institute (Ayurveda), C.C.R.A.S., Tarikhet , Ranikhet -263663 Uttarakhand,  
<sup>2,3,4,5</sup>Department of Botany, <sup>6</sup>Department of Chemistry, D.S.B. Campus Kumaun University,Nainital,  
(Uttarakhand)

[l\\_tewari@rediffmail.com](mailto:l_tewari@rediffmail.com)

[geeta\\_k@rediffmail.com](mailto:geeta_k@rediffmail.com)

[g\\_joshi2006@yahoo.com](mailto:g_joshi2006@yahoo.com)

[jeewansinghjalal@rediffmail.com](mailto:jeewansinghjalal@rediffmail.com)

[idhi.lohani@yahoo.co.in](mailto:idhi.lohani@yahoo.co.in)

### Abstract

Orchids are under duress species. These are becoming a rarity, losing out to human greed. These species are not only important for their aesthetic value but also because they work as ecological indicators. Their disappearance indicates a change in the quality of soil and air of the region. In the present communication diversity of orchids in Uttarakhand has been studied. 72 genera with 236 species of orchids are recorded from Uttarakhand. Among them 17 species are found medicinally important. 12 Taxa are recorded in red data book of Indian plants. Rapid depletion of orchid species requires urgent conservation measures. There is a need for educational programmes on importance of orchids and their role as essential components of state biodiversity. [Report and Opinion. 2009;1(3):47-52]. (ISSN: 1553-9873).

**Key words:** Orchids, uttarakhand, conservation, medicinal plant

### Introduction

Uttarakhand lies between 28-41' and 31-28' N latitude and 77-35' and 81-01' E longitude. The region has 53,483 sq.km. total geographical area and about 64.8% of its area under forest cover (FSI, 1999). The varied topography and climatic conditions met within the state are conterminous with a very rich biodiversity.

The vegetation of the State ranges from tropical deciduous to alpine vegetation and is broadly categorized into

1. Subtropical in the lower altitude region up to 800 m. It comprises moist tropical and dry deciduous vegetation.
2. Temperate-found at an altitude ranging from 700-1400 m.
3. Sub alpine and Alpine- found above 3000 m.. An area of about 1000 sq. km. In the Northwestern part of Uttarkashi district of the state falls in the cold desert represent alpine scrubs.

The altitudinal variations and climatic changes in the state have shown the great diversity in the habit, which resulted in luxuriant and varied floristic composition.

Beautiful flower orchids are becoming a rarity, losing out to human greed. Orchids are not only important for their aesthetic value but also because they work as ecological indicators. Their disappearance indicates a change in the quality of soil and air of the region. The ubiquitous "Blue vanda" of cheerapunjee has disappeared due to the degradation of the environment. Orchids are mainly shade loving; therefore, they have no chance of survival, once forests are cleared. While clearing forests for cultivation, many trees, bearing orchids die.

Orchids are mysterious in many ways. These are increasingly being cultivated throughout the world. The incredible shapes and colours of their flowers and their long vase-life have attracted many generations' of mankind. There are over 17,000 species of orchids the world over. This is one of the largest, families of flowering plants and found abundantly in tropics. Even though all of them are perennial herbs, they may be land-plant, lithophytes, epiphytes, saprophytes, etc and show a great diversity in their floral structure, developed mainly as a result of their adaptation to pollination by a wide variety of insects. 1141 species of orchids in 166 genera are recorded from India. Of these, 657 species in 86 genera are

epiphytes and 484 species in 82 genera are terrestrial. The genera *Cymbidium* and *Liparis* have both epiphytic and terrestrial species (Arora, 1980; Bhattacharya, 1969; Das and Jain, 1980; Hajra, 1983; Kothari, 1983; Issar and Uniyal, 1967, Kummar and Lal, 1994; Malhotra and Balodi, 1984; Balodi and Malhotra, 1985).

In uttarakhand 72 genera with 236 species of orchids are recorded. Taking all the monocotyledonous families into account Orchidaceae is the 2nd largest family after Poaceae in Uttarakhand. Genus *Habenaria* with maximum-17 species followed by *Dendrobium*-16 species and *Bulbophyllum* with-II species.

Orchids are popular for their healing properties too, *Vanda parviflora* is said to have antiviral and anti cancerous properties (Pangtey and Kalakoti, 1983; Rawat and Pangtey, 1983, 1985).

### **Methodology**

Extensive survey of Uttarakhand state was carried out under plant exploration programme from 1980-2005. Identification of orchid was made with the help of floristic literature and specimens lodged in herbarium of Regional Research Institute (Ay), CCRAS, Tarikhel, Ranikhet, Uttarakhand. The herbarium of B.S.I. (BSD) and FRI (DO), Dehradun Uttarakhand were also consulted.

### **Constraints and opportunities**

Orchids are protected species under the convention on International Trade in Endangered species (CITES) under schedule VI of the wild life protection Act (1972), all the nine species of "Lady's slipper" can only be sold if they are grown in registered nursery. Among Indian orchid species *Cymbidium*, *Dendrobium* and *Vandas* are endangered.

Orchids are also threatened by over grazing of livestock, construction of roads, dams, bridges, natural factors like forest fires, over extraction etc. The changing pattern of rainfall and decrease in the forest cover has contributed to their decrease. Rainfall is decreasing every year. This affects the growth of orchids that thrive in regions with regular rainfall.

Creation of public awareness and promotion of conservation strategies is essential. The orchids also have a good market because of their medicinal property. The tuber of 'Salampunja' (*Dactylorhiza*) is a valuable medicine. However businessman are apprehensive about investing in the regions because of insurgency and poor infrastructure. In spite of the diversity many species are yet to be discovered because of difficult terrain in this region. With more and more wild places being opened up for tourism, the beautiful orchids have been the most affected. Every tourist wants to take home these exotic beauties. Awareness among tourist with special informative posters can certainly help to check this vandalism. There are several more plant species waiting to be discovered, but they may disappear even before we come to know about their existence. This will be a permanent loss to mankind.

Botanical excursion students in their misguided enthusiasm collect bag full of specimen. Such wasteful activity needs to be regulated or even banned, often batches after batches of students come to collect certain plant group that are not common. This has already resulted in the disappearance of several plant populations. More than the students, it is the teaching fraternity that needs to be reoriented in such practices. Backed by vigorous conservation awareness programmes, students should be encouraged not to pick, not to up root.

The time has come to study plant communities as living ecological components and not just as dried herbarium. There is a need for educational programmes on importance of orchid and their role as essential components of the state biodiversity.

### **Conclusion and discussions**

Orchids are mostly collected from the wild using non sustainable, destructive method like collecting the entire plant, rhizome, tuber, roots other reproductive parts like fruit and seeds. Such destructive collection methods are the major factors influencing orchid population. Further, low regeneration rate and loss of habitat add to the serious threat to orchid population. Such rapid depletion from the wild requires urgent conservation measures. Fore seeing the fate of some commercially important orchids, efforts have been initiated to cultivate these species.

The seed germination is erratic in orchids therefore tissue culture technique should be applied for their cultivation. Cultivation for sustainable utilization has been recommended as one of the most urgent task. However, propagation techniques are yet to be perfected or no attempt at all has been made to cultivate the orchid. For this reason, husbandry research, limitation factor research and life history studies

have been recommended. Many of them because of their small population size and restricted distribution, require intensive care and habitat management and may survive only with human support. One has to take into consideration that a commercial need for such resources is actually the need of the people and unless alternatives provided through cultivation, wild species will not be secure.

### Orchids genera & species in Uttarakhand

SI	Genera	Species
1.	<i>Acampe</i> Lindl	2
2.	<i>Aerides</i> Lour	2
3.	<i>Anoectochilus</i> Blume	1
4.	<i>Aorchis</i> Vermeulen	2
5.	<i>Aphyllorchis</i> Blume	2
6.	<i>Archineottia</i> Chen	1
7.	<i>Arundina</i> Blume	1
8.	<i>Ascocentrum</i> Schltr. ex J.J. Sm.-	1
9.	<i>Brachycorthis</i> Lindl	1
10.	<i>Bulbophyllum</i> Thouars	11
11.	<i>Calanthe</i> Ker- Gawl	8
12.	<i>Cephalanthera</i> Rich	1
13.	<i>Cheirostylis</i> Blume	1
14.	<i>Chiloschista</i> Lindl	1
15.	<i>Cleisostoma</i> Blume	1
16.	<i>Coelogyné</i> Lindl	5
17.	<i>Corallorrhiza</i> Gagnebin	1
18.	<i>Cryptochilus</i> Wall.	1
19.	<i>Cymbidium</i> Swartz	9
20.	<i>Cypripedium</i> Linn.	4
21.	<i>Dactylorhiza</i> Necker ex Neuski	1
22.	<i>Dendrobium</i> Swartz	16
23.	<i>Didiccia</i> king & Prain ex King & Pantl	1
24.	<i>Diphylax</i> Hook f.	1
25.	<i>Diplomeris</i> D.Don	1
26.	<i>Epipactis</i> Zinno	3
27.	<i>Epipogium</i> Gmelin ex Borkhaussen	2
28.	<i>Eria</i> Lindl	9
29.	<i>Eulophia</i> R.Br. ex. Lindl	9
30.	<i>Flickingeria</i> Hawkes	2
31.	<i>Galeala</i> Lour.	1
32.	<i>Gastrochilus</i> D.Don	4
33.	<i>Gastrodia</i> R.Br.	1
34.	<i>Geodorum</i> G. Jackson	1
35.	<i>Goodyera</i> R.Br.	6
36.	<i>Gymnadenia</i> R.Br.	1
37.	<i>Habenaria</i> Willd.	17
38.	<i>Hemivilia</i> Lindl	1
39.	<i>Herminium</i> Linn	8
40.	<i>Kinidium</i> P.F. Hunt	2
41.	<i>Livaris</i> L.C. Rich	10
42.	<i>Listera</i> R.Br.	4
43.	<i>Luisia</i> Gaud	3
44.	<i>Malaxis</i> Soland ex Swartz.	7
45.	<i>Neottia</i> Guettard	2
46.	<i>Neottianthe</i> (Reichb.)Schltr	2

47.	<i>Nervilia</i> Comers.ex Gaud.	7
48.	<i>Oberonia</i> Lindl	9
49.	<i>Oreorchis</i> Lindl	3
50.	<i>Ornitho chillus</i> (Lindl) Wall ex Benth.	1
51.	<i>Otochilus</i> Lindl	1
52.	<i>Pachystoma</i> Blume	1
53.	<i>Pecteilis</i> Rafin	2
54.	<i>Pelatantheria</i> Ridl	1
55.	<i>Peristylus</i> Blume	9
56.	<i>Phaius</i> Lour	1
57.	<i>Pholidota</i> Lindl ex Hook	2
58.	<i>Platanthera</i> Rich	2
59.	<i>Pleione</i> D.Don	4
60.	<i>Ponerorchis</i> Reichb.f.	
61.	<i>Pteroceras</i> Hasselt ex Hassk	1
62.	<i>Rhynchostylis</i> Blume	1
63.	<i>Satyrium</i> Swartz.	1
64.	<i>Smitinandia</i> Holtt.	1
65.	<i>Svirianthes</i> Rich	2
66.	<i>Sunivia</i> Lindl	1
67.	<i>Thelasis</i> Bhime	1
68.	<i>Thunia</i> Reichb.f.	1
69.	<i>Tropidia</i> Lindl	1
70.	<i>Vanda</i> W.Jones ex R.Br.	5
71.	<i>Vandopsis</i> P fitz.	1
72.	<i>Zeuxine</i> Lindl	3
	Genera- 72	Species 236

### Medicinal orchids of Uttarakhand

1. *Aerides multiflorum* Roxb.  
Vern. – Maana  
Epiphytic on miscellaneous forest of Siwalik ranges and sub montane Himalaya  
Fl. & Fr.: Jun-Aug  
Uses: Leaf paste applied as poultice on cuts and wounds.
2. *Calanthe tricarinata* Lindley Terrestrial grassy localities of montane forests in Vern- Syoru damp and shady places Fl.&Fr. March-Sept  
Uses: Leaf paste applied on sores and eczema. Leaves and pseudo bulbs believed as an aphrodisiac by locals
3. *Coelogynne cristata* Lindley Vern- Gondya, Harjojan Usually epiphytic on rocks or epiphyte on montane forests, Fls & Fr.-March-June.  
Uses: Infusion of pseudobulbs given in constipation as also as an aphrodisiac.
4. *Epipactis helleborine* (L.) Crantz Terrestrial, montane forests under damp shady Vem.- Trindrya places Fls.& Fr.-July-Oct.  
Uses: Infusion of leaves given in intermittent fever. Rhizome regarded as an aphrodisiac.
5. *Eulophia dabia* (D.Don) Hoch.  
Vern- Misri, Salip,  
Salam mishri, Munjatak Terrestrial, rare, associated with dense forest floor, Submontane to montane Himalaya,  
Fl.&Fr. March-May  
Uses: Tubers are given to infants in cough and cold.
6. *Goodyera repens* (L.) R.Br.  
Vern: Girwara Terrestrial, in shaded oak forest floor, in montane and alpine Himalaya, Fls Fruit-Aug-Oct.

Uses: Plant paste externally applied in syphilis, extract is taken as a blood purifier.

### All the species of *Habenaria* generally exploited as the trade name Riddhi/Viridhi

7. *Habenaria intermedia* D.Don. In moist shady places of montane forest,  
Vern: RidhilViriddhi (Sans) generally in open grass land. Fl & Fr. July- Sept.  
Uses: The One of the ingredient of Astavarga of Ayurveda, used as tonic.
8. *Habenaria marginata* Colebr. Terrestrial on grassy slopes, forest  
Vern- Haldya-Jari cover submontane to montaneHimalaya, Fl. & Fr. - July  
Uses: Thoroughly boiled plant extract taken in flatulence.
9. *Herminium lanceum* Terrestrial, common in shaded and wet  
(Thunb. ex Susartz) Vuijk. Forest, rock shelters in montane and alpine  
Himalaya. Fl. &Fr.- July-Sept.
- Uses: Extract of plant given in suppressed  
urination.
10. *Malaxis acuminata* D. Don. Terrestrial, damp and shady forest  
Sanskrit name-Jeevak, submontane to alpine Himalaya Fls. & Fr.-  
Rishbhak, Munjatak Aug-Oct.  
Vern.- Lasuni  
Uses: One of the ingredient of "Astavarga"  
medicine of Ayurveda. Locally the bulbs are  
used in bronchitis as well as given as a tonic.
11. *Habenaria intermedia* D.Don. In moist shady places of montane forest,  
Vern: RidhilViriddhi (Sans) generally in open grass land. Fl &Fr. July-  
Sept.  
Uses: The One of the ingredient of Astavarga of  
Ayurveda, used as tonic.
12. *Malaxis muscifera* (Lindley) Kuntze Terrestrial in moist shady forest grassy  
Sansk- Rishbhak / jeevak slopes of montane zone. Rare fis & Fr.  
July-Sept.  
Uses: One of the ingredient of "Astavarga" medicine.  
The under ground parts used as tonic.
13. *Pholidota articulata* Lindley. Epiphytic on rock and trees in submontane  
Sanskrit - Jeevanti to montaneHimalayaFls.&Fr. -Apr.-May.  
Uses: Whole plant used as tonic.
14. *Satyrium nepalense* D. Don. Terrestrial, in open grassy slopes in montane to  
salam mishri alpine slopes. Fls. & Fr. - July- Oct. Vem-Saleep,  
Uses- Root used as tonic and also used in diarrhoea,  
tubers edible.
15. *Spiranthes sinensis* (Persoon) Ames Terrestrial in open grassy slopes  
Vem-Phirtya submontane to montane Himalaya Fl. &  
Fr. -May-July.  
Uses: Decoction of plant given in intermittent fever,  
tubers used as tonic.
16. *Vanda cristata* Linn. Epiphytic in montane zone. Fls & Fr.-May-July.  
Sans-Rasna  
Uses: Stem and leaf extract used as a tonic.
17. *Dactylorhiza hatagirea* (D.Don) Terrestrial,Tubers palmate in subalpine  
Vem-Hathajari, Salampunja and alpine Himalaya in open moist  
localities. Fl. & Fr.-June-Oct.  
Uses: Used as general tonic, as aphrodisiac and  
in bronchitis.

(Abbreviation used: Vern-Vernacular name, Sans.-Sanskrit name)

### Rare endangered Orchid of Uttarnakhand

Rare endangered Orchid of Uttarnakhand recorded in Red Data book of Indian Plants (Nair and Shastry, 1987, 1988, 1990):

TAXA	RDB Status
1. <i>Aphyllorchis gallani</i> Duthie	Endangered
2. <i>Archinottia microglottis</i> (Duthie) Chen	Rare
3. <i>Cyperipedium elegans</i> Reichb.f.	Rare
4. <i>Cyperipedium himalaicum</i> Rolfe	Rare
5. <i>Diplomeris hirsuta</i> (Lindl.) Lindl	Vulnerable
6. <i>Eria occidentalis</i> Seid	Rare
7. <i>Eulophia mackinnonii</i> Duthie	Rare
8. <i>Flickingeria hesperis</i> Seid	Endangered
9. <i>Aphyllorchis parviflora</i> King & Pant!	Rare
10. <i>Calanthe alpina</i> Hookf.ex.Lindl.	Rare
11. <i>Calanthe pachystalix</i> Reichb.f. ex. Hook f.	Endangered
12. <i>Cypripedium cordigerum</i> D. Don	Rare

### Acknowledgement

Authors are grateful to Director, CCRAS, New Delhi and Head, Botany Department, Kumaun University, Nainital for the facilities provided for this work. We are thankful to Prof. Y.P.S. Pangtey, FNASC for encouragement.

### References

- Arora, C.M. (1980) New record of some orchids from N.W. Himalaya VI-*Ind. J.For* 3:78-79.  
Bhattacharya, U.C. (1969) New distributional records of orchids for West Himalaya. *Bull. Bot Soc. Bengal* 23:161-165.  
Das, S. and Jain , S.K. (1980) Orchidaceae, Genus Coelogyne. *Fasc. Fl. India* 5: 1-33  
Hajra, P.K. (1983) New Species of Lister a from Nandadevi National Park,Chamoli, District, Uttar Pradesh. *Bull.Bot-Surv India*, 25: 181-182.  
M.J. Kothari (1983) P.F. Hunt *Vandopsis undulata* (Lindl.) Smith (Orchidaceae) in Pithoragarh District. *Ind. J.for.* 6:160-161  
Issar, R.K. and Uniyal, M.R. (1967) Orchid of Uttarakhand Himalayas *Ind.forester* 93:713-716.  
Kumar, C. Satish and Lal, Mani (1994) A catalogue of Indian orchids Bishen Singh Mahendra Pal Singh, Dehradun.  
Malhotra, C.L and Balodi, Bipin (1984) A New species of Corallorrhiza gagnebin from Gori Valley. *Bull. Bot. Sarv. India* 26 (1-2): 108-109.  
Bipin Balodi and Malhotra, C.L. (1985) Herminium mackinnoni Duthie An overlooked species from Kumaun. *J.Eco. Taxon.Bot* 6:465-466.  
Nair, M.P. and Shastry, A.R.K.(eds) (1987) (vol-I), (1988)(Vol-II), (1990) (Vol-III)- Red Data Book of Indian Plants, Botanical Survey of India Calcutta.  
Pangtey, Y.P.S. and Kalakati, B.S. (1983) A note on the occurrence of Cheirostylis griffithii Lindl. (orchidaceae) from Western Himalaya. *Ind. J. for* 6:170.  
Rawat, G.S. and Pangtey, Y.P.S. (1983) Herminium Josephii Rchb.f.chidaceu a new record for Western Himalaya *Ind.J.For* 6:171  
Rawat, G.S. and Pangtey, Y.P.S. (1985) Neottianthe calcico1a (W.W. Sm.) Schlt. (Orchidaceoe) New to the flora of India *Curr.Sci.* 54 (19): 1005-1006

4/7/2009

## Treatment Of Waste Water From Food Industry Using Snail Shell

E.O Jatto<sup>1\*</sup>, I.O Asia<sup>1</sup>, E.E Egbon<sup>1</sup>, J.O Otutu<sup>2</sup>, M.E Chukwuedo<sup>1</sup>, C.J Ewansiha<sup>3</sup>

1. Department of chemistry, Ambrose Alli University, Ekpoma

2. Department of chemistry, Delta State University, Abraka.

3. Department of chemistry, college of education, Igueben.

(E-mail: [obynwenyi@yahoo.com](mailto:obynwenyi@yahoo.com))

\* Corresponding author.

**ABSTRACT:** Waste water from a food- factory was characterized and treated using snail shell. The aim was to find out the effectiveness of snail shell as a coagulant in waste water treatment. The result of the parameter studied before and after treatment, shows a change in color from dark brown before treatment to light brown after treatment, there was reduction in turbidity values from 332 - 133NTU, conductivity 0.294 - 0.164mscm<sup>-1</sup>, total suspended solids 0.814- 0.184mg/l, total dissolved solids, total solids from 15600-15200mg/l and 15600.2-15200.2mg/l respectively. There was decrease in BOD and COD values from 29.27-19.77mg/l and 872- 215mg/l respectively while the DO value increase from 1.14 - 2.16mg/l. Phosphate was completely removed. From the results, it shows that snail shell is effective in the treatment of waste water treatment. [Report and Opinion. 2009;1(3):53-57]. (ISSN: 1553-9873).

### INTRODUCTION

Snails belong to the phylum molluscs and to the class gastropods; this class includes the gastropods, slugs and snails.

Most gastropods have a single usually spirally coiled shell into which the body can withdraw.

Gastropods are characterized by ‘torsion’ a process that results in the rotation of the visceral mass and mantle on the foot [1].

The mantle cavity of the gastropod (including anus) lies in the anterior body. When the snail’s body is drawn in to the shell, it is sealed by a Horney plate called the operculum.

The typical gastropod shell is a cone, coiled round a central axis as a spiral geometrically. The simple reason for this coiled shell is because an uncoiled shell would be impossible to carry its massive body because of its high centre of gravity [3].

Most shell coiled to right (dextral), although a few coiled to left (sinistral) [2]. The central axis of coiling is called the columella and at the anterior end of the shell forms the inner lip of the mouth opening called the aperture [4].

The group of snails that is common in this part of the world belongs to the family of the achatinidae, also known as the achatine snails. The family members include (i) achatina achatina (ii) achatina marginata (iii) achatina fulica (iv) linicolarial species [5].

The achatine snails are the largest terrestrial snails on earth. The largest achatina achatina may grow to a body size of more than 12 inches and length of the shell to 10 inches.

The shell has a brownish color with a characteristic stripe pattern.

The main constituent of the shell is calcium carbonates which are either of two crystalline forms calcite and aragonite. The remainder is organic matrixes which constitute a protein known as conchiolin that usually make up to 5% of the shell. The fine structure of mollusks shells has been studied by using various techniques including scanning electron microscope of broken surfaces. In each of them, blocks or stripe of calcium carbonate are separated by a thin layer of conchiolin.

The shell consists of long stripes of aragonite laid down in groups. It has a lot of several uses which could be as result of the hard nature of the shell. The shell protects the snail from physical damage and from predators; they are also used in the manufacture of buttons, jewels and art collections.

As a result of the chemical composition of the shell, it can be used in waste water treatment either as a coagulant or adsorbent.

As a coagulant, it helps to neutralize fine particles of suspended and dissolve matter in a water supply or sample to form flocs that settles and can be filtered out. The choice and dose rate of the coagulant will depend on the characteristics of the waste water to be treated.

Calcium the main composition of snail shell when in solution dissociates into calcium (ii) ion ( $\text{Ca}^{2+}$ ) and various calcium complexes such as calcium hydroxide ion  $\text{Ca}[\text{OH}]^{2+}$ , the various positive

species which are formed may combine with negative charges and form the colloidal particles, example  $\text{Ca}^{2+} + 2(\text{colloid}) \rightarrow [\text{Ca}(\text{colloid})_2]$ .

During coagulation, the colloidal materials will come together and become incorporated or adhere into the masses that can readily be precipitated.

Achatina snails are hermaphrodites, they can proliferate very fast, they usually reproduce several times per year under natural conditions, hence they are found every where in this part of the world and it serves as food. The shells are not consumed and deposited or it's allowed to litter the environment, it becomes undesirable and pollutes the environment as waste which can be converted to wealth by using it for water treatment among many other applications or uses [6].

Waste water (effluent) can be described as water generated along process operation in any industry. Waste water is sometimes used to describe liquid waste [7], the nature of the waste water produced depends on the activities and process technology which gives each industry a distinct profile of waste water or effluent. It ranges from saline water, run off, wash water, alkaline and acid waste neutralization water [8].

An effluent may contain a great variety of chemicals whose nature, quantity and mix depends on the activities of the industries, such as its process technology, their concentrations through utility use, contaminants added in the process operation, nature of raw materials and process methodology [7].

The objective of this research is to study the suitability of snail shell as an adsorbent or coagulant in waste water treatment. To do this, the stability of the snail shell at different pH was studied, followed by the optimum dosage of the shell using turbidity and COD as the parameter and treating waste water from food industry.

#### MATERIALS AND METHODS

Snails (*achatina achatina*) shells were collected from various locations around Ekpoma, due to its naturally occurring and low cost.

The shells collected was washed, dried properly and homogenized to fine powder to ensure a large surface area. The grind snail shell was sieved using 0.1mm diameter sieve.

The stability of the snail shell in different pH was studied to know whether the snail shell will go into solution at any pH.

The pH of the snail shell was determined using the electrometric method.

The surface area was also studied using the iodine thiosulphate method; this was followed by the determination of optimum dosage using turbidity and COD analysis as parameters.

Waste water samples were collected from a food industry located in Edo state. The company specializes in the production of corn flakes and agricultural feeds.

Representative samples were insured by adequately flushing a service unit line; composite sampling was done by collecting samples obtained from a particular place on hourly basis over a period of 24 hours.

The waste water was analyzed before and after treatment with snail shell as described in the standard methods for waste water and effluent analysis [8].

Where analysis was not immediately possible the sample was preserved in a refrigerator at 4<sup>o</sup>C at this temperature, bacterial are in active and biodegradation is inhibited [7].

The analysis carried out on waste water sample before and after treatment were pH, using the electrometric method with the aid of a laboratory ph meter (Jenway model 3150) [7]. The temperature of the water was determined using the mercury in glass thermometer.

Electrical conductivity was measured by using HACH, TDS conductivity meter.

Nitrate was determined using the Brucine method [8]. Phosphate analysis was carried out using Kjeldahl method, sulphate ion was analyzed by turbidmetric method [10].

Dissolve oxygen (DO) was determined by alkaline -azide modification of Winkler' method [11]. Using dichromate reflux method [12], chemical oxygen demand (COD) was determined. Biochemical oxygen demand (BOD) was measured using dilution method [3].

Nitrogen and turbidity were determined using different standard methods.

## RESULTS AND DISCUSSIONS

### RESULTS

pH of snail shell (*achatina maginata*) =8.48.

Surface area =40.29.

Table I: Result of optimum dosage of coagulant using COD.

S/No	Mass of snail shell in grams.	Volume of sample used ml	COD mg/l	% reduction of COD
1	RAW	10	872	
2	3.1	10	392	53
3	3.2	10	408	55
4	3.3	10	403	50
5	3.4	10	312	64
6	3.5	10	448	48

Table II: Result of waste water analysis before treatment with optimum doses of snail shell.

S/No	PARAMETERS	RESULT	UNIT
1	pH	5.42	
2	Color	Dark brown	
3	Turbidity	332	NTU
4	Temperature	20	°C
5	Conductivity	0.294	Mscm <sup>-1</sup>
6	Total suspended solid	0.814	Mg/l
7	Total dissolved solids	15600	Mg/l
8	Total solids	15600.8	Mg/l
9	Nitrogen (ammonium-nitrogen)	0.085	Mg/l
10	Nitrate	41.01	Mg/l
11	Sulphate	58.11	Mg/l
12	Phosphate	0.173	Mg/l
13	BOD	29.27	Mg/l
14	COD	872	Mg/l
15	DO	1.14	Mg/l

TABLE III: Results of waste water analysis after treatment with optimum doses of snail shell.

S/No	PARAMETER	RESULTS	UNITS
1	pH	6.42	
2	Color	Light brown	
3	Turbidity	133	NTU
4	Temperature	20	°C
5	Conductivity	0.164	Mscm <sup>-1</sup>
6	Total suspended solids	0.184	Mg/l
7	Total dissolved solids	15200	Mg/l
8	Total solids	15200.2	Mg/l
9	Nitrogen(ammonium-nitrogen)	0.015	Mg/l
10	Nitrate	13.52	Mg/l
11	Sulphate	15.46	Mg/l
12	Phosphate	0.00	Mg/l
13	BOD	19.77	Mg/l
14	COD	215	Mg/l
15	DO	2.16	Mg/l

From the results of the analysis performed or carried out on the snail shell, the pH and surface area have values of 8.48 and 40.29 respectively.

The pH value shows that the solution of snail shell is slightly alkaline, this as a result of the presence of calcium carbonate and protein present in the shell [2]. It has a large surface area [4]. It was easy to homogenize the snail shell into fine powder, due to this, there is a large surface area for reaction, and hence it serves as a good coagulant for the treatment of waste water.

The stability studies carried out on the snail shell shows that it was very stable in all pH values, only about 0.02g went into solution, hence it is very suitable for the treatment of waste water at any pH or medium.

Optimum dosage measurement using turbidity and COD as an index for measurement show that between the values of 3.4g per 100ml of the shell can coagulate or treat waste water effectively, that is a better result was obtained when 3.3g- 3.4g per 100ml of the shell was applied. However, the optimum dosage of 3.4g per 100ml of the shell was used because COD as a parameter has been found to have a high degree of relationship with other parameters such as BOD, DO, conductivity, turbidity etc.[8].

Analysis carried out on waste water sample before and after treatment showed that the values of the total solids (T.S), total suspended solids (TSS) and total dissolved solids (TDS) were 15600.8, 0.814 and 15660 mg/l respectively. This shows that the raw sample contains high solid concentrations, most of which are in the dissolve forms while some were in the suspended form. This is a result of the production processes or activities of the industry.

The conductivity and turbidity whose values were  $0.294\text{mscm}^{-1}$  and 332NTU respectively is an indication that the raw sample (waste water) contains high amount of dissolved and suspended particles and ions.

The temperature of the waste water sample is 20<sup>o</sup>c and the dissolved oxygen (DO), biochemical oxygen demand (BOD) and chemical oxygen demand (COD) have values of 1.14, 29.27 and 872 mg/l respectively. The low value of dissolved oxygen and high values BOD and COD show that there is a high competition for the DO at 20oc by the suspended, dissolved substances and micro organism in the waste water, this is an indication of pollution [7].

Nitrate, sulphate, ammonia-nitrogen and phosphate values were 42.01, 58.11, 0.085 and 0.173mg/l respectively.

Nitrate ion in water is undesirable, this is because it can cause methaemoglobinmea in infants, the high amount of sulphate gives the waste water an offensive odor, the concentration of phosphate present in the raw waste water sample can cause algae growth and eutrophication when discharged into the environment and water bodies (rivers), this indicate strong pollution and therefore calls for treatment before disposal [7].

The results of the parameters studied after treatment of the waste water with snail shell, shows that for total solids (TS), total suspended solids (TSS) and total dissolved solids (TDS) were 15200.2, 0.184 and 15200mg/l respectively; there was a substantial reduction of these values in comparison to the values before treatment.

The dissolved oxygen (DO), Biochemical oxygen demand (BOD) and chemical oxygen demand (COD), values were 2.16, 19.77 and 215mg/l respectively. The increase in the value of dissolved oxygen and decrease in Biochemical and chemical oxygen demand is an indication of the improved quality of the water after treatment.

The quality of any water is high when there is increase in dissolved oxygen (DO) and decrease in Biochemical oxygen demand (BOD) after treatment [7]. This improved quality of the water sample after treatment indicates the effectiveness of snail shell for waste water treatment [8].

Dissolved and suspended substances contribute to the high conductivity and turbidity values of any waste water, after treatment of waste water with snail shell, there was a drastic reduction in conductivity and turbidity values, these values were  $0.164\text{mscm}^{-1}$  and 133NTU respectively, this correlates with the reduction in dissolved substances of the waste water.

Phosphate was completely removed. It was completely absent from the waste water sample after treatment. This is a result of the presence of calcium ion in the shell. Calcium has the ability to react with phosphate ion resulting in the formation of calcium phosphate and calcium hydrogen phosphate which can be removed by filtration.

The nitrate, sulphate, Ammonium-Nitrogen and phosphate values were 13.52, 15.46, and 0.00mg/l respectively. The reduction of values indicates that there is improvement in the quality of the water: hence it is safe for disposal.

The odor was removed after treatment due to the reduction in sulphate.

## CONCLUSION

Snail shell as a coagulant is very effective in the treatment of waste water at any pH. A high level of success was achieved in reducing the dissolved solids, Nitrates, sulphate, and of removal phosphate completely from the waste water.

There was a reduction in COD, BOD, conductivity, turbidity values and increase in DO values after treatment, an indication that the snail shell is an effective coagulant and is economic viable in the treatment of waste water.

## REFERENCES

1. Brunt. J, Engel B, Rapp G (1999), Giant African snail plant protection services; secretariat of the pacific community. Fiji pp4.
2. Aboua F.(1995). Proximate analysis and mineral contents of two giant African snails consumed iv Ivory Coast, Tropical science England pp:220-222
3. Mc-Graw- Hill (1987). "Encyclopedia of science and technology" vol15, Mc Graw Hill book coy. New York.
4. Linsley R.K, Franzi Y.B (1977): Water resources and environmental engineering.
5. Mark J. (2004): Environmental science 5<sup>th</sup> edition, John Wiley and sons pp57-70
6. Gaman P.M and Sherington K.B (1977): Pergamon press ltd. London.Pp.62-65, 76-79, 80-87, 92-95, 134-139.
7. Ademoroti C.M.A (1996): "Environmental chemistry and toxicology" Foludex press ltd. Ibadan.
8. Ademoroti C.M.A (1996) "standard methods for waste and effluent analysis" Foludex press ltd. Ibadan.
9. Asia I.O, Oladoja N. A. Determination of optimum dosage of chemical coagulants/ flocculants needed for sludge treatment. Journal of science, engineering and technology(2003) Vol10 No.3 pp5031-5043
10. Sheen R.T, Kahler H.L and Ross E.M (1935). Turbidimetric determination of sulphate in water. Ind.engng.chem.anal.ed: pp7,262.
11. Winkler, L.W.(1888): Thye determination of dissolved oxygen in water. Ber.Dtsch.chem.ges 21.pp2843-2854
12. Dobbs R.A and Williams R.T (1963) "elimination of chloride interference in chemical oxygen demand test" Analytical chemistry:pp1064
13. Hanson N.W (1973) Official standardized and recommended methods of analysis: The society of analytical chemistry. London.

4/12/2009

# Think of the Relationship Between Time and Space Again

Yang Fa-cheng

Company of Ruida Centre in Xinjiang  
15 Hongxing Street, Kalamayi, Xingjiang 834000, CHINA  
e-mail: [yangfacheng2006@163.com](mailto:yangfacheng2006@163.com)

## ABSTRACT

In this paper, the author puts forward a mathematical model, this model can give a clear relationship between time and space . The authors put forward from the objective reality, the new ideas and mathematical formula, let people know along the correct road of law reflects reality. [Report and Opinion .2009;(3): 58-63].(ISSN:1553-9873)

**Key words:** light spherical , wave-front , instantaneous space-time , transmission time

## 1. INTRODUCTION

Time this concept has been Newtonian in Philosophic Natural is Principle Mathematical in. Time clock is used for measuring "real" time of a kind of instrument (timing is used to measure time clock of an instrument.). Authors assume two reference frame ,  $S$  and  $S'$  , in reference frame  $S$  (except the source point) have arbitrary spatial point light  $P$ , when the movement of the reference frame  $S'$  coincides with static system  $S$  completely moments, point  $P$  to launch a flash . In each of the origin of the observer and timing starts, each frame of reference in different time to receive a pulse respectively. The author after careful consideration, and try to establish a new relationship between time and space.

## 2. RELATIONSHIP BETWEEN TIME AND SPACE

In the past has put forward the theory of the light- speed invariance, the speed and not say invariability of the photon with any reference point . It refers to the meaning itself : From the point light shining a pulse, the flash to spread around the geometry is a sphere. The spherical surface in the vacuum diffusion speed remain unchanged. We obtained the spherical equation that each reference frame.

### 2.1 Using Algebraic Equations is Obtained

As Fig.1 shown , authors assume two reference frame ,  $S$  and  $S'$  , along the  $X$ -axial movement speed reference frame  $S'$  for  $V$  , moves from point  $J$  to  $A$  and presently coincides with the reference frame  $S$  completely . At this moment , from the light-source point  $P$  shining a pulse, in their respective reference frame origin at the observer timing starts, the flash to spread around the geometry is a sphere. Point  $P$  is always the center of spherical array, ball spherical surface(or wave-front)spread to the source of reference frame  $S$ , point  $O$  . Timer values  $t$  for reading. The space location in reference frame  $S$  point  $P$  for  $(x, y, z)$  , instant space-time as  $(x, y, z, t)$  . In time  $T = 0$  to  $T = t$  , pulse propagation distance is the radius of the ball[1]. According to the Pythagorean theorem , we obtain spherical equation in the reference frame  $S$  :

$$x^2 + y^2 + z^2 = (ct)^2$$

(1)

Move along the  $X$ -axis reference frame  $S$  , spherical surface continued to spread in, the ball on the pursuit of diffusion in face of reference frame  $S$  observer. At this moment, in reference frame  $S$  to read the clock is  $t$  , the space location in reference frame  $S$  point  $P$  for  $(x, y, z)$  , instant space-time as  $(x, y, z, t)$  . Figure 1 in analysis,

obviously ,  $t > t'$  . Light spherical diffusion speed relative to the center from point of origin for finding  $C$  .

Due to the point  $P$  is fixed in the reference frame  $S$  , it is relative to the movement of reference frame  $S$  vary with time. So , instant space-time as ( $x$  ,  $y$  ,  $z$  ,  $t$  ).

In time  $T = 0$  to  $T = t$  , pulse propagation distance is the radius of the ball. According to the Pythagorean theorem , we obtain spherical equation in the reference frame  $S$  :

$$x'^2 + y'^2 + z'^2 = (ct')^2$$

(2)

The  $x$  -shaft and  $X$  axle load , reference frame  $S$  along the  $X$ -axis movement, around the  $X$ - axis rotation does not. That is ,  $y = y$  ,  $z = z$  .  $y = y$  ,  $z = z$  ,  $x = x - vt$  . With formula (1) and (2) joint solution formula we have :

$$y^2 + z^2 = (ct)^2 - x^2 \quad , \quad (x')^2 + [(ct)^2 - x^2] - (ct')^2 = 0 \quad ;$$

$$(x - vt')^2 + [(ct)^2 - x^2] - (ct')^2 = 0 \quad , \quad (c^2 - v^2)(t')^2 + 2vxt' - (ct)^2 = 0 \quad .$$

Decomposition of the unary quadratic equations

$$(1 - v^2/c^2)t'^2 + (2vx/c^2)t' - t^2 = 0$$

(3)

In order to facilitate the process with ( $V/C = \beta$ ) .

Take equation is root, we must :

$$t' = \frac{\sqrt{(1 - \beta^2)t^2 + \beta^2 x^2/c^2} - \beta x/c}{1 - \beta^2}$$

(4)

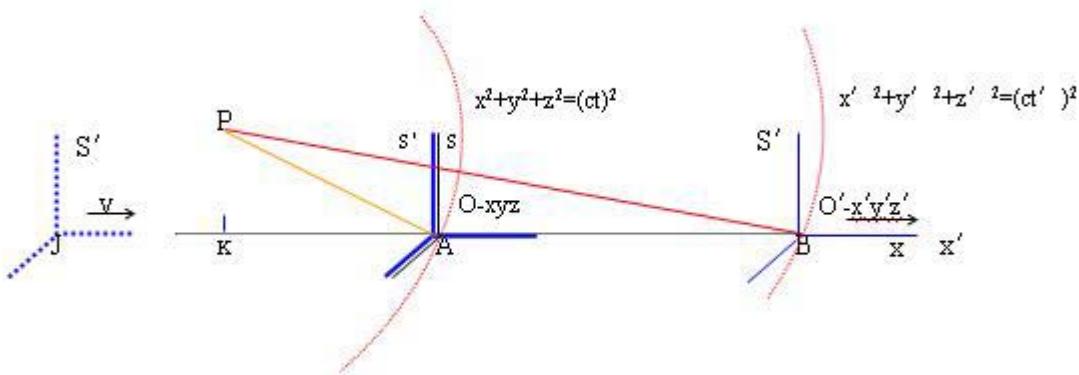


Fig.1 The reference frame  $S$  spherical equation is Eq.(1). The reference frame  $S'$  spherical equation is Eq.(2).

## 2.2 Derived Using the Geometric Equations

The  $x$  -shaft and  $X$  axle load [2] , and  $y$  -axis parallel axis with  $y$  ,  $z$  -axis parallel axis with  $z$  . Therefore , point  $P$  on reference frame ,  $S$  and  $S'$  ,  $y = y$  ,  $z = z$  . In the equation (1),  $t$  say flash signal transmission time value , from point  $P$  to  $O$  . In the equation (2),  $t'$  say flash signal transmission time value , from point  $P$  to  $O'$  . Obviously, in Fig.1,  $t > t'$  . Is the

signal propagation delay effect [3].

In another way, the same results. When the movement of the reference frame  $S$  coincides with static system  $S$  moment. Completely. A flash point  $P$ , light balls for reference frame  $S$  in pursuit of the movement. Figure 1 of a right triangle: a right triangle  $\Delta PKO$  in  $\Delta PKO'$  plane.

$$\overline{pk}^2 + \overline{ko}^2 = \overline{po}^2 , \quad (a)$$

$$\overline{pk}^2 + \overline{ko'}^2 = \overline{po'}^2 . \quad (b)$$

Type (b) minus (a) is  $\overline{po'}^2 - \overline{po}^2 = \overline{ko'}^2 - \overline{ko}^2$ .  $\overline{ko'} = |x - vt|$ ,  $\overline{ko} = -x$ ,  $\overline{po'} = \overline{ct}$  and

$\overline{po} = \overline{ct}$  generation of the sorting get  $(x - vt')^2 + [(ct)^2 - x^2] = (ct')^2$ . In order to get on the same after the equation  $(x - vt')^2 + [(ct)^2 - x^2] = (ct')^2$ . In Fig. 1, if the negative direction along the  $X$  axis reference frame  $S$  movement, results with the same formula (3).

From the perspective of geometry discuss the advantages of: Along the  $X$ - axis movement, reference frame  $S$  around the  $X$  axis rotation may, don't assume  $y = y$ ,  $z = z$ , that is  $y = y$ ,  $z = z$ . If the variable is along the  $X$  axis reference frame  $S$  movement, known as reference frame  $S$  speed changing with time, the function that can use the definite integral to answer [4].

### 3. DISCUSS AND REVIEW

Light source point  $P$  is a hypothesis in the  $y$ - axis, by equation (4) that same time dilation and Einstein formula. Light source point  $P$  is a hypothesis in the  $X$  axis, assume the light source is on the  $X$  axis, two kinds of circumstances, is in the positive direction of the  $X$  axis and the opposition upward, we have a series of formulas.

#### 3.1 Light Source Point $P$ In $y$ - $z$ Plane

Use the formula (3) and Fig.1 analysis: will be light source point  $P$  moves to  $(y - z)$  plane, in the formula (3),  $x = 0$ , we obtain :

$$t' = \frac{t \cdot \sqrt{1 - \beta^2}}{1 - \beta^2} = \frac{t \cdot \sqrt{1 - \beta^2}}{\sqrt{1 - \beta^2} \cdot \sqrt{1 - \beta^2}} = \frac{t}{\sqrt{1 - \beta^2}}$$

(5)

This formula is similar with Einstein type.

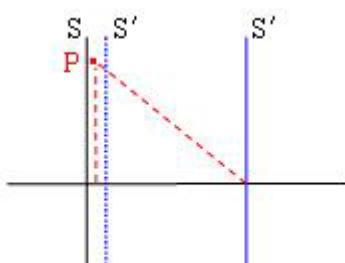


Fig.2 Light source point  $P$  in  $y$  -  $z$  plane ,  $Y$  and  $z$  at the same time is not zero.

### 3.2 Light Source Point In the X- axis

Will light source point  $P$  moves to the  $X$ - axis, that is in Fig.1  $X$ - axis of negative direction ,

$$x < 0, \quad x \neq 0, \quad y = 0, \quad z = 0, \quad \text{then we have:} \quad ct = -x, \quad t = -x/c$$

Substitute these values into formula (4) obtained :

$$t' = \frac{\sqrt{x^2/c^2} - \beta \cdot x/c}{1 - \beta^2} = \frac{\pm x/c - vx/c^2}{1 - \beta^2}$$

(6)

If the light source point  $P$  is moving to the  $X$ -axis direction, ( $x > 0$ ) ,

$$t'_1 = \frac{\frac{x}{c}(1 - \frac{v}{c})}{(1 - \beta)(1 + \beta)} = \frac{x}{c + v}$$

(7)

Point  $P$  on the  $X$  axis of the opposition , ( $x < 0$ )

$$t'_2 = \frac{-\frac{x}{c}(1 + \frac{v}{c})}{(1 - \beta)(1 + \beta)} = \frac{-x}{c - v}$$

(8)

### 3.3 The Relationship Between Moving Photonic and Reference Frame

Assuming the  $X$  axis symmetric point  $O$  on two point light source of  $P_1$  and  $P_2$ , as Fig.3 shown . When the movement of the reference frame  $S$  coincides with static systems  $S$  completely moments, two point light also issued flash light , reference frame  $S$  to two point light source of  $P_1$  and  $P_2$  , clock with  $t_1$  respectively  $t_2$  . According to the formula (7) and (8) available :

Reference frame  $S$  movement toward the light source point :  $c + V = x/t'_1$

$$\text{That is : } U'_1 = c + V = x/t'_1$$

(9)

Reference frame  $S$  movement away from light point :  $c - V = -x/t'_2$

$$\text{That is : } U'_2 = c - V = -x/t'_2$$

(10)

Analysis the formula (9) and (10) . Source:  $P$  is in reference frame  $S$  on the movement direction, that said, inertial systems  $S$  is along the photon trajectory line movement . Therefore , the photons movement speed by Galileo transformation (relative reference frame  $S$  ) . From the formula (9) and (10), movement speed of reference frame  $S$  for any value .

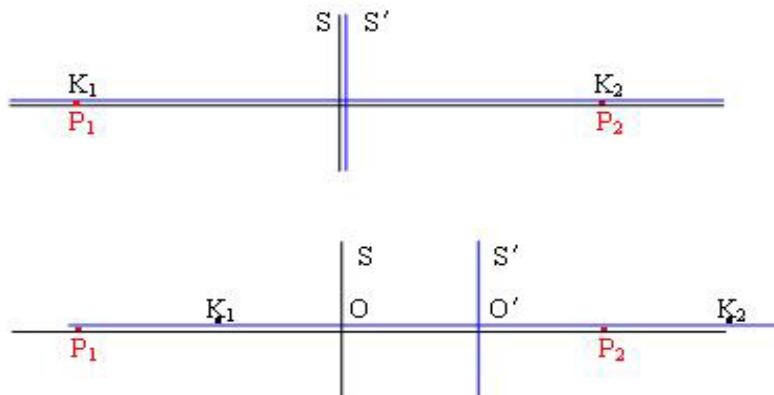


Fig.3 Along the  $X$ -axis movement reference frame  $S$  , light source point is fixed on the  $X$ -axis.

#### 4. UNDER THE LIGHT OF THE RELATIONSHIP BETWEEN TIME AND SPACE MOVEMENT

In a little light in reference frame , relative to their source of photon speed isotropic for  $C$ . As Fig.4 shown , source:  $P$  is spherical of center, but the relative to their reference frame outside the inertial system is anisotropic . When along the  $X$ -axis movement systems  $S_a$  and stillness reference frame  $S$  completely coincidence moments, send a flash point  $P$  . In their respective reference frame origin at the observer timing starts, when the inertia light point  $P$  speed is  $V$  ( $0 < V < C$ ) movement to point  $E$  , ball spherical surface (or wave-form) spread to the source of reference frame  $S_a$  point  $O_a$  , timer values  $t_a$  for reading . The space location in reference frame  $S$  point  $P$  for  $[ (x_a + Vt_a) , y_a , z_a ]$  , instant space-time as  $[ (x_a + Vt_a) , y_a , z_a , t_a ]$  . From point  $A$  to  $B$  distance is  $Vt_a$  . According to the Pythagorean theorem , we obtain spherical surface equation in the reference frame  $S_a$  :

$$x_a^2 + y_a^2 + z_a^2 = (ct_a)^2$$

(11)

Light spherical continued to spread , in the moment  $t$  , spherical surface diffuse to point  $A$  battle. Inertial system point  $P$  with static reference frame  $S$  point  $G$  of superposition , at the time  $t$  , in the reference frame  $S$  point  $P$  space-time is the center of the ball in . According to the Pythagorean theorem , we obtain :

$$(x_a + Vt)^2 + y^2 + z^2 = (ct)^2$$

(12)

Suppose  $y_a = y$  ,  $z_a = z$  ,  $y_a = y$  ,  $z_a = z$  and  $= V/c$  combined the formula (11) with the formula (12) to form a simultaneous equations and to solve this equations. We obtained , the one-element quadratic equation of an unknown number  $t$  :

$$(1 - V^2 / c^2)t^2 - (2Vx_a / c^2)t - t_a^2 = 0$$

(13)

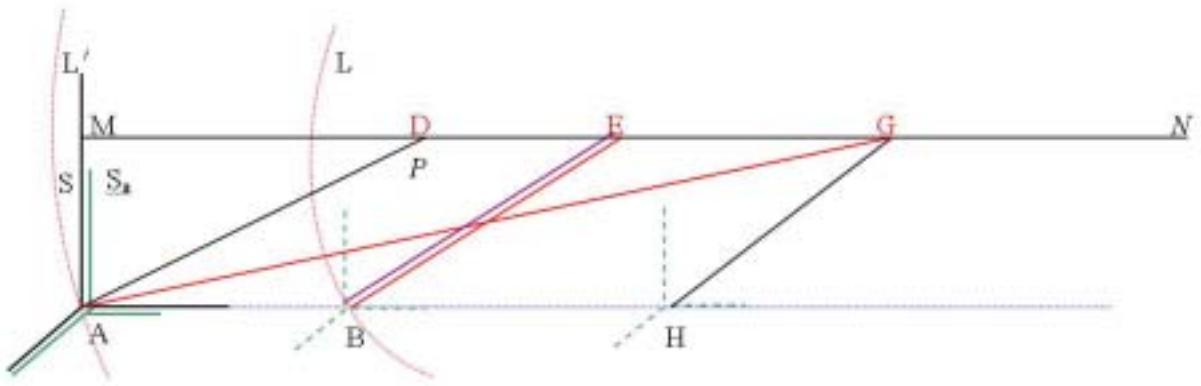
We chose the positive root of such a quadratic equation as follows:

$$t = \frac{\sqrt{(1 - \beta^2)t_a^2 + \beta^2 x_a^2 / c^2} + \beta x_a / c}{1 - \beta^2}$$

(14)

If we like this "discussion and reviews" analytical formula ( 14 ) , will get the same result with . In Fig.4 , if the negative direction along the X axis reference frame  $S_a$  movement , results with the same formula (13).

If the variable is along the X axis reference frame  $S_a$  movement , known as reference frame  $S_a$  speed changing with time, the function that can use the definite integral to answer [4,5].



$$(x_a + Vt)^2 + y^2 + z^2 = (ct)^2$$

$$x_a^2 + y_a^2 + z_a^2 = (ct_a)^2$$

Fig.4 The reference frame  $S_a$  spherical equation is Eq.(11). The reference frame  $S$  spherical equation is Eq.(12).

## 5. CONCLUSION

**The speed of light spherical diffusion invariant :** In the vacuum, light spherical diffusion speed relative to the center from point of origin for finding  $C$  .

**The change of photonic speed :** Inertial system is along the photon trajectory line movement , the speed of photon and inertial system state closely related . Therefore, the photons movement speed by Galileo transformation ( relatively all inertial system ) .

## REFERENCES

- [1] Zhang Chong An. Matter Regularity 2003, P.207, 2003
- [2] Yang Fa Cheng. Matter Regularity 2003, P291, Journal of Xinjiang Petroleum Education College, 2001, issue 4, P51.
- [3] C. Kittel et al. Berkeley Physics Course, Vol.1, Science Press, 1979.
- [4] Xu Shao Zhi, The Mathematical Fundation of the Special Theory of Relativity is Wrong, Invention and Innovation, 2001(1) .
- [5] Yang Fa Cheng, A New Mathematical Model to Replace the Lorentz Transformation, " the New probe of space-time Theory " , A chief Editor, Hao Jian Yu, Beijing, Geology Press,2005.

## School Violence And Guidelines For Establishing Disciplinary Committee In Schools

DR. ALABI, AMOS OYETUNDE

SCHOOL OF EDUCATION

EMMANUEL ALAYANDE COLLEGE OF EDUCATION, OYO, OYO STATE, NIGERIA

Email: [amosalabi@yahoo.com](mailto:amosalabi@yahoo.com)

### ABSTRACT

The school is an open system that influences its environment and is being influenced by it too. Thus, the existence of violence in the society culminated to its existence in the school system. This paper examines the concept of violence, cases and types of violence in schools, factors associated with it, the need for discipline in schools and the guidelines for establishing disciplinary committee in schools. It also suggests some of the expected functions of disciplinary committee in order to promote and encourage discipline among pupils and teachers thereby reducing/terminating the occurrence of violence in our schools. It concludes that violence in educational institutions poses a lot of challenges to the stake holders in education and thus all hands must be on deck to help put students on the right track of non-violent behavior so that the educational objectives would be achieved. [Report and Opinion. 2009;1(3):64-68]. (ISSN: 1553-9873).

**Key Words:** School Violence, Factors associated with violence, Disciplinary Committee, Non – Violence Behaviour, Educational Institutions.

### NOTE

### INTRODUCTION

Life is dynamic and so nothing in it is static. Dynamism of life is what makes it interesting, challenging and puzzling. Even though it is often said that nothing is new under the heaven, but it must be said that old things are usually painted in new colour, or given new name, status or appear in a new way or dimension and as such regarded as new. Every society started from the primitive state and goes on changing (improving) until it reaches full modernization (development). As such, things keep on changing until there is nothing to change but a kind of re-appearance, recoding or re-colouring of old things in the modern time.

The school life in the society is dynamic as well. It does not remain static for life. For example, in the primitive society, school life was peaceful and calm. However, in the developing society school life is not as peaceful. A lot of changes in form of acts of indiscipline such as violence are features of schools in the developing society.

### Concept of Violence

There are as many definitions of violence as the write up on violence. Protector (1980) defines violence as "very great force in action or feeling or rough treatment". Brehm, Kassin and Fein (2002) see violence as extreme act of aggression. Violence has its root in aggression, hence those authors define aggression as "behaviour that is intended to injure another person who does not want to be injured". Stanko (1999) observes "we usually associate violence and its use with individually motivated action, although a great deal of violence is committed by individuals on behalf of others".

*Roget's Thesaurus of English Words and Phrases* (1982) has a very long list of synonyms of violence. Among the list are these few ones, "vehemence, frenzy, impetuosity, destructiveness, boisterousness, turbulence, commotion, uproar, riot, row, roughness, rough handling, thuggery, terrorism, brute force, cruel

act, brutality, barbarity, savagery, terrorism," to mention but few. From this list, it can be safely inferred that violence is an act of wickedness. It is wickedness in thought and personified in human relations. It is man inhumanity to man.

### **Explanation for Violence**

Researchers have been concerned about how to account for the violence of individuals. Four broad explanations are identified. These are:

- Biological Explanation: This has to do with parental traits transmitted to their offsprings. It is natural as it is inherited through the genes of the parents.
- Psychological Explanations: This is the state of mind of an individual while some are kind others are sadistic. It is interesting to note that individual can precondition his state of mind towards what he wants it to be.
- Sociological Explanations: This is as a result of societal influence or environmental influence. The influence of society on an individual can never be overemphasized. No one exists without a society and as such the societal life (culture) becomes the individual life afterall.
- Political Explanations: This is rooted in the system of governance by the ruling class. The system of governance goes a long way to make or mar the individuals in the society. (Stanko, 1999).

### **Violence in School**

Violence is not a strange incidence in school. It is as common as any other offence. Violence is one of the acts of indiscipline found at every level of education be it tertiary, secondary and primary though at varying degrees. There is hardly any week or month when cases of violence at secondary or tertiary level of our education will not be reported in the dailies. Even though, the type we find in tertiary institutions may not be the one in primary schools but a great deal of violence is committed in primary school as well.

### **Types of Violence in Schools**

The following among others are types of violence common in schools.

- Student to Student
- School to Student
- Student to School Authority
- Student to Teacher and vice versa
- Teacher to Teacher
- Teacher to School-head and vice versa

### **Cases (examples) of Violence in Schools**

The following among others are examples of violence in primary and secondary schools.

- Assault (by choking, biting, grabbing, hitting and throwing) on mates and staff members.
- Bullying
- Fighting
- Oppression and brutality to others
- Use of profane, vulgar or abusive language
- Rioting, vandalism/destructive demonstration in school (Wolfgang, 2005)

### **Factors Associated With (Causes of) Violence**

Below are some of the factors associated with violence among students in schools.

- |                                  |   |   |
|----------------------------------|---|---|
| • Home Background                | - | Parental violence (examples), child abuse                     |
| • Hereditary                     | - | Parental traits, individual differences                       |
| • Group Size                     | - | Large/Small Groups  |
| • Physical Environmental Effects | - |   |
| • Media Effects                  | - | Scenes of violence on television, video, radio to mention few |
| • Injustice                      | - | Insult, provocation, retaliation                              |

- Embarrassment and Humiliation
- Frustration
- Alcoholic Effect

### **The need for Discipline in Schools**

A well disciplined child is a trained child and vice versa. Any training without discipline is no training in the real sense of the word. As such, formal education without adequate discipline is worthless.

Discipline is very important to life. It is a very necessary condition for any venture to be successful. Huge investment in education is not worthwhile without discipline. All investment in education will go down the drain without proper discipline of recipients.

Discipline is often thought of in term of the verb. As such, it is often thought of in term of melting out punishment to an offender. However, it is in term of noun that it is being used here. Discipline as a noun is defined as “readiness or ability to respect authority and observe conventional or established laws of society or any other organization” (Adesina, 1980). *Longman Dictionary of Contemporary English* (1980) defines discipline as “training of the mind and body to produce obedience and self-control”. Discipline can therefore be seen as means whereby individuals are trained to be law abiding, orderly and ensure peaceful coexistence within a community. It is a training which when it becomes part and parcel of a person’s life it becomes his way of life, as such, persons with that way of life are usually described as being disciplined.

Two types of discipline are identified. These are self-discipline or internal discipline and imposed or external discipline. External discipline is regimental and much feared. It has all implications of order, punishment, laws, regulations, fear and intimidation. Individuals who are under its influence usually feel deep loss of freedom. Self-discipline or internal discipline, on the other hand, accords its owner respect, self-control and self-restraint. A self-disciplined child or individual is refined, cautious, considerate and systematic in his approach to achieve goals.

### **Disciplinary Committee**

As its name implies, this is a committee set up for the maintenance of discipline in school. The committee ensures that children in school are law abiding, orderly and peaceful in the pursuant of educational objectives/goals in the school community. The need for discipline in school necessitates the setting up of disciplinary committee. The facts that indiscipline has become the order of the day in many communities also make the establishment of a disciplinary committee in school imperative. That the school children are expected to be ideal in behavior makes the establishment of school disciplinary committee a must. The need for conducive teaching and learning environment in schools makes the establishment of disciplinary committee in school a necessity. Conducive teaching and learning atmosphere is often thought of in terms of physical environment. However, no matter how appropriate and adequate the physical environment may be without conducive interpersonal relationship with a sense of security and feeling of safety, the teaching and learning will not be productive.

### **Guidelines for Establishing Disciplinary Committee in Schools**

Certain factors are necessary for consideration before constituting a disciplinary committee. These factors are guides so that the committee will be well constituted to help it perform at optimal level. The following are suggested guidelines for establishing school disciplinary committee.

#### **Membership**

This should not be too large or too small in number. It should be commensurate to the size of the school. The bigger the school, the larger the size of the committee. Membership should not be less than five (5) and not more than ten (10) as the case may be. However, the bigger the school, the larger the size of the school. The head of school should be the chairperson of the committee. Membership should include at least one or two teachers from each of the two levels of the school i.e. lower and upper classes. The senior prefects (boy and girl) and other related prefect(s) is (are) also member(s). PTA Chairman/Secretary can be ex-officio.

#### **Tenure**

The committee exists for just one year. It should be reconstituted every year to give room for new prefects and perhaps other experienced teachers being transferred from or to the school.

### **Inauguration**

The committee should be formally inaugurated at the beginning of each session in the assembly. Membership should be known to all pupils. The terms of reference, justification or need for such a committee should equally be spelt out for the students.

### **Terms of Reference**

These should also be spelt out for the committee. These should be the framework that will guide the committee in their day to day operation and performance of their duties. The terms of reference if prepared by the Ministry of Education should be used. But if there is none from the parenting ministry, the head of school and other teachers can prepare the terms of reference for the committee.

### **Constitution**

This is also necessary in order to give full details about the committee, its functions, its powers, limitations, and expectations.

### **Authorization**

There is the need for backup authority for the committee. The Ministry of Education should be contacted for this. Equally important is the fact that the Parent Teacher Association or the Community should be aware of this committee and its terms of reference.

### **Suggested Functions of Disciplinary Committee**

The following among others are suggested functions of Disciplinary Committee.

- To serve as model in terms of character training and behavior for students
- To assist the students in conforming with school rules and regulations
- To help students develop self-discipline/internal discipline
- To administer punishment commensurate with offence committed by any student.
- To liaise with the school and law enforcement agents in case of difficult student
- To set up some school rules and regulations for the students to obey
- To promote and encourage good behaviours among the teachers and students.
- To ensure peaceful coexistence among and between teachers and pupils respectively thereby creating a conducive school environment.

An elementary school in United States of America has the following regulations for students according to the Comprehensive Educational Centre (1992)

- Do not forget things
- Bring an umbrella on rainy days
- When entering or leaving the classroom, open and close the door quietly
- Use the toilet at the beginning of the break period and do not soil anything
- Don't waste drinking water and pay attention to hygiene
- When leaving your home or returning home, make appropriate greetings to your parents.
- Carry the things that you will need in the school yard before the start of classes
- Do not say or do things that will be unhelpful to you and others
- Always inform the school if you will be absent or late, or if you will return home early
- Do not buy things on your way to and from school
- Work hard to keep the school clean
- Take care of things like school property, plants in the school ground and so on.
- Do not sing vulgar and coarse songs.

It should be emphasized once again that school rules and regulations are necessary in order to reduce incidences of violence in schools. However, the rules must be understood by the children, the rules need not be too many so that students can memorize them if possible and they should not be too difficult (Draconian law) to abide by.

## **MATERIALS AND METHODS**

## **RESULTS**

## **DISCUSSION CONCLUSION**

The wave of violence across and all over the world, especially in educational institutions poses a lot of challenges to the educators or educationists and the wind blows no one any good. There is the need to rise up against the culture of violence in our schools. The existence of violence in our schools will affect negatively the values of education being transmitted to and acquired by the students.

## **REFERENCES**

- Adesina, A. (1980) *Some Aspects of School Management*. Lagos: Board Publications Ltd.
- Brehm, S. S., Kassin, S. M. and Fein, S. (2002) *Social Psychology*. New York: Houghton Mifflin Company.
- The Comprehensive Educational Centre (1992). *The History of Shizuoka Pre Culture*. Vol 1. pp. 570. USA: John Wiley and Sons sinc.
- Protector, P. (1980) (ed) *Longman Dictionary of Contemporary English: International Student Edition England*: Longman Group Ltd.
- Stanko, E. A. (1999) "Violence" in K. Adam & K. Jessic (ed, 1999). *The Social Science Encyclopedia, Second Edition*. London: Routledge. Pp 896 – 897.
- Thesaurus R. (1982). *Roget Thesaurus of English Words and Phrases*. England: Penguin Books.
- Wolfgang, C. H. (2005) *Solving Discipline and Classroom Management Problems: Methods and Models for Today's Teacher. sixth edition*. USA: John Wiley and Sons Inc.

ACKNOWLEDGMENT: The author is grateful to Prof. Adetunde Isaac of University of Mines and Technology, Tarkwa, Ghana, for making this article publishable.

4/26/2009

## **Microtuber: A Source of Germplasm Conservation**

**Anoop Badoni\* and J. S. Chauhan\*\***

Department of Seed Science and Technology

Faculty of Agriculture

H. N. B. Garhwal University, Srinagar- 246 174, Uttarakhand, India

\*Research Scholar and Young Scientist (UCOST)

\*\*Assoc. Prof. and Head of Department

For correspondence: [annabadoni@yahoo.co.in](mailto:annabadoni@yahoo.co.in)

---

### **Introduction:**

Potato can supplement the food needs of the country in a substantial way. It produces dry matter food, well-balanced protein and more calories from unit area of land and times than other major food crops. It contains practically all the essential dietary constituents like cereals, carbohydrates which are the major constituents of potato. Besides it contains essential nutrients as proteins and minerals like calcium, phosphorus, iron and vitamins: B1, B2, B6 and C (Thamburaj and Singh, 2001). The rising population and per capita income are pushing up the demand for food, which needs to be met through enhanced productivity per unit area and time. In this context, importance of potato is noteworthy for several reasons. Firstly, potato crop produces more edible energy and protein per unit area and time than other food crops. Secondly, for the small and marginal farmers, potato fits well into multiple cropping systems prevalent in tropical and subtropical agro-climatic conditions. Thirdly, the high profitability of potato as a cash crop has made it a viable commercial enterprise and lastly, rapid technological advances in varietal improvement, agro-techniques, plant protection, storage and processing and likely have led to expansion of potato production even in non-traditional environments (Pandey *et al.*, 2006). [Report and Opinion. 2009;1(3):69-71]. (ISSN: 1553-9873).

### **Problems in traditional cultivation methods:**

Conventional propagation of potato is done vegetatively using seed tubers and ensures uniformity of the crop in terms of growth and yield, but results in degeneration of the crop due to virus infection, the rate of degeneration 398 varying from place to place and from cropping season to cropping season (Biniam, 2008). The viruses are transmitted through different ways including through planting infected tubers. If the seed stock is not maintained well or frequently replaced with fresh ones, the virus infiltration can reach up to 100% in 3 - 4 successive crop seasons resulting in almost half or one third yields (Khurana *et al.*, 2001). This is the major problem faced by seed producers. Successful cultivation of seed potato depends upon the availability of disease free seed, soil, moisture, plant protection measures, low temperature, short days conditions during tuberization phase, resulting rapid bulking rate. Potato plant is very sensitive to ecological factor such as temperature, rainfall and photoperiod (Singh, 2002).

Seed tuber quality is an extremely important factor for potato yield. Since it is a vegetatively propagated plant, fungal, bacterial and, particularly viral disease, agents are easily transmitted through the tubers (Truta, 1997). Viral diseases are, for the most part, responsible for degeneration, characterized by a decrease in vigor, productivity, and resistance to diseases of potato cultivars after successive cultivation from the same lot of tubers (Silberschmidt, 1937; Sangar *et al.*, 1988).

### **New Approaches:**

In India, the systematic work on potato tissue and cell culture was initiated in 1972 at the Central Potato Research Institute, Shimla. Varietal improvement programme at CPRI over the past more than 50 years has been largely instrumental in nearly thirteen-fold increase in total production and three-fold increase in yield in the country. Further, the development of short duration varieties the Kufri Chandramukhi, K. Ashoka, K. Jawahar, K. Pukhraj and K. Lauvkar has contributed towards higher cropping intensity and higher returns to farmers. This technique was developed in 1970s to enable healthy seed potato production in sub-tropical Indian plains under low aphid period. A range of techniques, including tissue culture and *in vitro* rapid multiplication have been used by 26 national programs in Africa, Asia, and Latin America to clean, maintain, and reproduce basic stocks of seed potatoes for later

multiplication and used by farmers (Horton and Sawyer, 1985). This technique aided by biotechnological approaches for virus elimination, micropropagation and effective viral diagnostics has sustained the National Potato Seed Production Programme by producing about 2600 tonnes of breeder's seed annually. This breeder seed is needed to be multiplied to about 4, 32,000 tonnes of certified seed by the State Department of Agriculture/Horticulture to meet the seed potato requirements of our farmers (Pandey *et al.* 2006).

#### **Microtuber: A Source of Germplasm Conservation:**

Almost half a century has passed since in vitro tubers (microtubers) were first described in potato, but their adoption as a seed propagule has been uneven globally. Consensus is lacking regarding optimal production practices for microtubers and their relative productivity in relation to other propagules for minituber production. There is significant uncertainty regarding the utility of microtubers for evaluation of agronomic characters. However, the application of microtubers in germplasm conservation is widely accepted. Microtubers are produced in vitro in a plethora of different growing systems with varying environment, media constituents, and storage intervals. Many of the interactions between growth parameters in vitro and subsequent productivity appear to be genotype-specific.



Accordingly, microtubers come in different sizes, have different dormancy requirements, and differ widely in relative growth potential and productivity. Despite these differences, there is evidence for strong analogies in growth responses between field-grown tubers and microtubers. The use of microtuber technology in seed tuber production, breeding programs, germplasm conservation, and research appears to have enormous potential. Microtubers are utilized for minituber (small tubers produced from in-vitro-produced propagules) production in greenhouses or screenhouses and, less commonly, are directly field-planted. Wherever microtuber and minituber production technologies have been implemented, they have halved the field time necessary to supply commercial growers (3 or 4 years compared with 7 or more years), and greatly improved seed tuber quality (fewer viral, bacterial, fungal problems) (Donnelly, *et al.*, 2003). Production of mini-tubers as a source for seed potato was investigated by growing in soil micropropagated plants and micro-tubers produced from micropropagated plants. Micropropagated plants produced mini-tubers in glasshouse after 70–115 days of growth in soil. A large proportion of the mini-tubers produced were between 9 and 15 mm diameter. Several factors, e.g., explant number, duration of *in vitro* culture and genotype influenced mini-tubers production (Ahloowalia, 1994).

In all potato growing regions the availability of high quality clean seed tuber has been the most limiting owing to the conventional clonal propagation that favors disease build-up that drastically reduces yield. Potato seed production programmes in many countries have been boosted by using these techniques. In recent years the first multiplication steps in seed production programmes are speeded up by using in vitro plantlets, Microtubers (Bizarri and Ranalli, 1995) or mini tubers (Hussey and Stacey, 1981).

#### **References:**

- Ahloowalia B. S. 1982. Plant regeneration from callus culture in potato, *Euphytica* 31 pp. 755-759  
Biniam, T. and Tadesse, M. 2008. A survey of viral status on potatoes grown in Eritrea and in vitro virus elimination of a local variety 'Tsaeda embaba', *African Journal of Biotechnology*, 7 (4) pp. 397-403  
Bizarri, L. B. and Ranalli, P. 1995. Effect of activated charcoal on induction and development of microtubers in potatoes (*Solanum tuberosum* L.), *Annals of Applied Biology* 127 pp. 175-181

- Donnelly, Danielle J, Coleman, Warren K, Coleman, Shirlyn E. 2003. Potato microtuber production and performance: A review, *American Journal of Potato Research*.
- Horton, D. and Sawyer, R. L. 1985. The Potato as a world food crop, with special references to developing areas, in *Potato Physiology* (ed. Li, P. H.), Academic Press Inc., USA, pp. 2-32
- Hussey, G. and Stacey, N. J. 1981. *In vitro* propagation of potato (*Solanum tuberosum*), *Annals of Applied Biology* 48 pp. 175-181
- Khurana S.M.P., Thind T.S., Mohan, C. 2001. Diseases of Potato and Their Management. In: *Diseases of Fruits and Vegetables and Their Management*, (ed. Thind TS) Kalyani Publishers, Ludhiana, India.
- Pandey, S. K., Kumar, Anil and Pandey, N. K. 2006. Harbinger of rural prosperity, *The Hindu Survey of Indian Agriculture*, pp. 71-75
- Sangar, R.B.S., Agrawal, H.O., Nagaich, B.B. 1988. Studies on the translocation of potato viruses X and Y in potatoes, *Indian Phytopathology*, 41, p.327-331
- Silberschmidt, K. A. 1937. DegenerescÍncia da batatinha. O BiolÙgico, 9, p.247-254
- Singh, I. P. 2002. Seed Production of Vegetable Crops, Aman publication House, Meerut, India
- Thamburaj, S. and Singh 2001. Text book of vegetables, tuber crops and spices, Indian Council of Agriculture Research, New Delhi
- Truta, A.A.C. DetecÁ,,1997o simultanea de vÌrus em batata (*Solanum tuberosum* L.) por DAS-ELISA e determinaÁ,o do material vegetal ideal a ser utilizado nos programas de indexaÁ,o. Lavras: UFV, pp.59(DissertaÁ,o ñ Mestrado)

5/6/2009

## A Debate on Assessment System: Responsibility of Scientist

Ashish K. Chaturvedi\*

High Altitude Plant Physiology Research Centre,  
H. N. B. Garhwal University, Srinagar,  
Garhwal, Uttarakhand  
[\\*ashi\\_spc@rediffmail.com](mailto:ashi_spc@rediffmail.com)

**Abstract:** This article debates the responsibility of scientist. [Report and Opinion. 2009; 1(3):72-75]. (ISSN: 1553-9873).

**Keywords:** Publication; responsibility; scientist; debate

Publication has always been a central part of the research process, but there had, before this, been remarkably few serious investigations into its working (Rennie, 1986; Bailar and Patterson, 1985), though no shortage of opinion written in the absence of facts. The lack of information was particularly surprising given the strong discrimination being advanced for and against peer review (Rennie, 1986). Assessment of scientific quality is a dreadfully complicated problem which has no regular solution. Ideally, published scientific results should be scrutinized by true experts in the field and given scores for eminence and magnitude according to established rules. In practice, however, what is called peer review is usually performed by committees with general competence rather than with the specialist's insight that is needed to assess primary research data. Committees tend, therefore, to resort to secondary criteria like crude publication counts, journal prestige, the reputation of authors and institutions, and estimated importance and relevance of the research field, making peer review as much of a lottery as of a rational process (Cole *et al.*, 1981; Ernst *et al.*, 1993).

In order to avoid any misinterpretation I would like to append the following restrictive remarks: scientists as a rule are not exceptionally ethical or modest in their personal lives, and there is no reason to expect them to behave better than or even differently from other people. Some scientists will even behave badly towards their fellow-scientists as soon as competition, priority and sometimes even prestige come into play. While these deficiencies are not linked very much they will eventually be ignored or tolerated by the scientific community, if a new researcher in question does admirable work and has never dishonored his real reputation, which is for being absolutely honest and trustworthy in scientific matters, that is, in obtaining and handling data and in using logic. To summarize: a scientist does not have to fit into the same categories in his work and in his life, but if he does not, he must be content to exist as a dual personality, and he must be aware of this fact.

These are some of the serious facts, but let me justify my statements as the problem involves at least two aspects: complexity and beliefs. Now the complexity; we all realize that in India the certain fields of science which are concerned with very complex systems are still in their infancy. In these fields the formulation of general proposition, laws, is still a risk, if in fact it is possible at all. Let me comment briefly on the second aspect, the impact of science and ideology on our present Indian Universities. A number of fields at our universities using the term science without deserving it, and as a consequence the formerly sharp distinction between speculative and scientific statements have rapidly disappeared.

Actually, in a philosophical view, Science can be defined operationally as an endeavor of human mind which aims at genuine knowledge. Genuine scientific knowledge is expressed as a true proposition: individual proposition (by means of data or facts) and then general propositions (or laws). True general propositions are those which describe the behavior of scientific models which are satisfying. But, if you start from beginning if after peer reviewing (as much of as a lottery) a true proposition (hypothesis) is satisfying for publication, and then it get published, the framework is then started with honesty and full scientific truth; but the individual proposition (by means of data or facts) get rejected because of an unfair, unjustified reviewing system, whether that data can be useful in framing future research priorities to the new world of the young unfolded mind.

Clearly, emerging scientific authors from India having limited resources do not necessarily publish their most citable work in journals of the highest impact because of such reviewing system, nor do their articles necessarily match the impact of the journals they appear in. This may be due to the journal's subject area and its relevance to the author's specialty, the fairness and rapidity of the editorial process, the probability of acceptance, publication lag, and publication cost (page charges) (Gordon 1984). Leading

researchers in a small field may thus be at a disadvantage compared with their colleagues in larger fields, since they lack access to journals of equally high citation impact and sometimes by the peer-review process.

If new scientific authors are not detectably rewarded with a higher impact by publishing their data, why are we so adamant on doing it? The answer, of course, is that as long as there are people out there who judge our science by its wrapping relatively than by its stuffing, we cannot afford to take any chances. For evaluation of scientific quality, there seems to be no alternative to qualified experts of the same field reviewing the manuscripts. Much can be done, however, to improve and standardize the principles, procedures, and criteria used in evaluation, and the scientific neighborhood would be well served if efforts could be concentrated on this rather than on increasing ever more stylish versions of principally ineffective markers. What is the function of science and what is the responsibility of individual scientist (the Critical reviewer) with regard to this significant problem? Reviewing can advise that how to accomplish goal but can not tell whether ought to choose that goal.

In case of peer review system, anonymous review system were used by most of the leading journals but there are no evidences, however it is assumed that this is better than an open review system. [Walsh et al., 2006](#), have evaluated the feasibility of an open review system, in which they asked the reviewers of British journal of Psychiatry whether they would agree to have their name revealed to the authors whose papers they review; 408 manuscripts assigned to reviewers who agreed were randomized to signed or unsigned groups. After measuring the review quality, tone, recommendation for publication and time taken to complete each review, they came to a conclusion that a total of 245 reviewers (76%) agreed to sign. Signed reviews were of higher quality, were more courteous and took longer to complete than unsigned reviews (Table 1 and 2). Reviewers who signed were more likely to recommend publication. In overall this study supports the feasibility of an open peer review system and identifies such a system's potential drawbacks. In Indian context no such review system have been adopted or ever tried, the reason may be the same as in above case, those opposed to open peer review put forward convincing arguments in favor of maintaining their existing state of affairs. Low-ranked reviewers may hamper their career prospects by disparaging the work of powerful senior colleagues or be frightened into writing unsuitably favorable appraisal. Unwanted, inappropriate or even acrimonious dialogue may occur between author and reviewer, and professional relationships may suffer. Reviewers may become less critical, and scientific standard may decline. Some people ask why we should interfere with a system which appears to be functioning adequately without good evidences that there is a better way ([Hyams, 1996](#)). Although, these may be some of the drawbacks of the open peer-review system but Increased accountability in the reviewing process is essential, however, this is because it has become so important to publish in good journals, not only for the careers of individuals but also for research assessment exercise. From the desk of reviewer, one can say that reviewers give their valuable time free of charge and with little credit, yet they are performing an important job which plays a part in shaping our scientific future. It is critical that they do this job in the best possible way. By signing their name to a review they automatically become more accountable. Editors are forced to seek the best possible opinions for manuscripts and the editorial process is improved. Authors who are aware of the identity of their reviewer may also be less upset by hostile and discourteous comments ([McNutt et al., 1990](#)). These are some suggestions or recommendations for extrapolating the appraisal progression and construct new thoughts for framing the assessment procedures for Manuscripts of the juvenile scientists. But in short, in a free society which is necessarily pluralistic you will always find an array of goals, and for this reason any political decision is unavoidably a compromise and can never please everybody. The Logical Framework Analysis (LFA) can also be useful in this context ([LFA, NORAD, 1999](#)). Tracking progress next to cautiously defined output indicator provides a clear basis for monitoring progress; verifying rationale and purpose level progress then simplifies evaluation. But the alternatives of such distressful conditions in scientific community are still a topic of debate. To reveal these queries need internalized principles and patterns of behavior in each and every critic scientist by having three possessions: *Knowledge, Skills and Desire*. Knowledge reflects on "What to" and "Why to", Skill reveals on "How to" and the third one most important Desire means "Want to" think over it!!.

**Table 1** Review quality ratings by item in signed and unsigned groups

Quality item	Quality rating (mean (s.d.))		
	Signed group	Unsigned group	Difference (95% CI)
Importance of research question	3.02 (1.07)	2.85 (1.12)	0.16 (-0.06 to 0.39)
Originality	2.85 (1.16)	2.71 (1.18)	0.15 (-0.09 to 0.39)
Methodology	3.63 (1.00)	3.40 (0.93)	0.23 (0.02 to 0.43)*
Presentation	3.30 (1.03)	3.04 (1.01)	0.26 (0.05 to 0.48)**
Constructiveness of comments	3.75 (0.94)	3.48 (0.93)	0.27 (0.07 to 0.47)**
Substantiation of comments	3.45 (1.05)	3.25 (1.03)	0.20 (-0.01 to 0.42)
Interpretation of results	4.43 (1.16)	3.25 (1.14)	0.18 (-0.06 to 0.41)
Mean score	3.35 (0.86)	3.14 (0.86)	0.21 (0.03 to 0.39)*
Tone of review	4.51 (0.65)	4.27 (0.91)	0.25 (0.09 to 0.42)**
Time taken	2.05 (1.25)	1.65 (1.33)	-0.39 (-0.74 to 0.06)*

\*P &lt; 0.05, \*\*P &lt; 0.01.

**Table 2** Recommendation on publication in signed and unsigned groups

Recommendation for publication	Signed group (n (%))	Unsigned group (n (%))	Total (n (%))
Accept without revision	41 (25%)	36 (24%)	77 (24%)
Accept with revision	53 (31%)	35 (23%)	88 (28%)
Resubmit with revision	43 (26%)	31 (20%)	74 (23%)
Reject	30 (18%)	51 (33%)	81 (25%)
<b>Total</b>	<b>167 (100%)</b>	<b>153 (100%)</b>	<b>320 (100%)</b>

Source: Walsh *et al.* (2006) *British journal of Psychiatry*, 176, 47-51

## References

- Bailar JC, Patterson K. Journal Peer Review: The Need For Research Agenda. *N Engl J Med.*, 1985, **312**, 654-657.
- Cole S, Cole JR, Simon GA. Chance and Consensus in Peer Review. *Science*, 1981, **214**, 881-886.
- Ernst E, Saradeth T, Resch KL. Drawbacks of Peer Review. *Nature*, 1993, **363**, 296.
- Gordon MD. How Authors Select Journals: A Test of The Reward Maximization Model of Submission Behavior. *Social Studies of Science*, 1984, **14**, 27-43.
- Hyams KC. Letter. *Lancet*, 1996, **34**, 132-133.
- McNutt RA, Evans AT, Fletcher RH, *et al.* The Effects of Blinding On the Quality of Peer Review: A Randomized Trial. *Journal of the American Medical Association*, 1990, **263**, 1371-1376.
- Rennie D. Guarding the Guardians: A Conference on Editorial Peer Review. *JAMA*, 1986, **256**, 2391-2392.

The Logical Framework Approach, Handbook For Objectives-Oriented Planning, Fourth edition, Norwegian Agency for Development Cooperation NORAD, 1999, ISBN 82-7548-160-0.  
Walsh E, Rooney M, Appleby L and Wilkinson G. Open Peer Review: A Randomized Control Trial. *British journal of Psychiatry*, 2006, **176**, 47-51

5/28/2009

**Effect of partial replacement of fishmeal with duckweed (*Lemna paucicostata*) meal on the growth performance of *Heterobranchus longifilis* fingerlings.**

<sup>1</sup> Effiong, B.N; <sup>2</sup>Sanni, A. and <sup>3</sup>Fakunle, J.O

Dept of Fisheries Technology

Federal College of Freshwater Fisheries Technology,

New Bussa, Nigeria.

Dept of Microbiology, University of Ilorin, Ilorin, Nigeria.

[bartheffiong@yahoo.com](mailto:bartheffiong@yahoo.com)

**ABSTRACT:** Duckweed (*Lemna paucicostata*) meal was experimented for its ability to partially replace fishmeal in the diet of *Heterobranchus longifilis* fingerlings under aquarium culture system. Five-dry diets formulated at 40% crude protein were fed to fingerlings ( $0.92g \pm 0.01$ ) at 0%, 10%, 20%, 30% inclusion levels of duckweed meal where the 0% served as control. The experiment, which was conducted for 70 days, measured among other parameters feed conversion ratio (FCR), specific growth rate (SGR) and survival rate (S) in the fish samples. The fish were fed at 5% body weight twice daily morning and evening. Although the three inclusion levels of duckweed supported the growth of *Heterobranchus longifilis* fingerlings, growth performance and feed utilization was favored by low inclusion of duckweed meal. From the result, 10% duckweed meal inclusion gave the best final mean weight of 3.86g, mean weight gain (MWG) of 1.51g, feed conversion ratio (FCR) of 0.11, specific growth rate of 2.11% and percentage survival of 80%. There was no significant difference ( $P < 0.005$ ) in the growth parameters between 10% inclusion level and the control diet. [Report and Opinion. 2009;1(3):76-81]. (ISSN: 1553-9873).

**Key Words:** Partial replacement, growth performance, survival, *Heterobranchus longifilis*, aquaria tanks

**INTRODUCTION**

Aquaculture shares the same challenges with Agriculture in increasing food supply and this brings about competition in the use of feeds for livestock and fish farming. Shortages of major feedstuff has been on the increase in recent times in Nigeria and with the poultry and livestock industry expanding, the aquaculture industry is finding it increasingly more difficult to source for critical feed ingredients (Adikwu, 2003; Fagbenro et al., 2003; Adejinmi, 2000).

For aquaculture to supply the population's growing demand for fish as food and to fill the gap in declining yield from capture fisheries, basic but critical information should be available especially regarding feed that are less competitive and of low cost value but with replaceable capacity for fish meals with the aim of making fish to attain table size at reduced culture time and minimum production cost.

Utilization of non-conventional protein supplements of both animal and plants origin in practical fish that has been at the fore in Nigeria in recent times. It is imperative for such practical diet to contain optimum protein, required essential amino and fatty acids.

Duckweed meal has been known for its high nutritive value with as much as 40% and above crude protein depending on the culture system (Ahmmad et al., 2003; Leonard, 1995; Hassan and Edward, 1992, Robinette et al., 1980; Hanczakowski et al., 1995).

From the foregoing therefore, this experiment was conducted to assess the suitability or otherwise of duckweed meal as a partial replacement for fish meal in the diet of *Heterobranchus longifilis* fingerlings.

**MATERIALS AND METHODS.**

**Diet formation and preparation**

Freshly harvested duckweed from the Green House of the National Institute for Freshwater Fisheries Research, New Bussa, Nigeria was sun dried for three days and thereafter grounded into fine powder using the hammer mill. All the other feed ingredients were milled using locally fabricated hammer mill and sieved through a 595um sieve to remove stones and dirt as well as ensure homogeneous size profile before analysed for proximate composition.

Five dry diets were prepared in which fish meal was replaced with duckweed meal at 0%, 10%, 20% and 30% levels using the method of Akegbejo Samson (1999) at 40% crude protein level.

The diets were fortified with vitamin premix. They were thoroughly mixed in a bowl and pelletized in an improvised pelleting machine using 1% starch as binder.

**Table 1: Percentage Composition of experimental feed**

Ingredients	Percentage inclusion level of duckweed meal			
	0%	10%	20%	30%
Duckweed Meal	0	2.6	5.2	7.8
Fish Meal	26	23.4	20.8	18.2
Yellow Maize	48	48	48	48
Soybean meal	15	15	15	15
Groundnut Cake	6	6	6	6
Vitamin Premix	2	2	2	2
Bone – meal	1.5	1.5	1.5	1.5
Starch	1.0	1.0	1.0	1.0
Salt	0.5	0.5	0.5	0.5
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

## EXPERIMENTAL SITE

The study was conducted in the fish processing laboratory Federal College of Freshwater Fisheries technology, New Bussa, Nigeria.

## EXPERIMENTAL SYSTEM AND FEEDING TRIAL

The Feeding trial was conducted in glass aquaria (30 x 30 x 60cm<sup>3</sup>). The glass aquaria tanks were properly washed and rinsed with clean water. They were filled with borehole water and aerated using air pumps to ensure proper oxygenation and continual aeration. The experimental fish *Heterobranchus longifilis* fingerlings were collected from the Genetic Improvement Laboratory, National Institute for Freshwater Fisheries Research, New Bussa, Nigeria. They were acclimatized for three days before the take off of the experiment. This was necessary to enable the fingerlings empty their stomach content and to force them to adjust to the new diet.

## EXPERIMENTAL PROCEDURE

The experimental fish were randomly distributed at a stocking density of 15 fingerlings per aquarium tank in triplicates. They were fed at 5% body weight twice daily morning ad evening at equal ration. Sampling was done weekly using a sensitive electronic balance (OHAS – LS – 500g Model) to determine the average weight of the fish and adjust the feed accordingly.

The study was conducted for 70 days. All analyses for proximate composition including the carcass composition before and after the experiment were determined according to the methods of AOAC (2000). Water temperature was monitored daily with a standardized mercury thermometer while dissolved oxygen and pH were determined using Digital DO meter and Jenway Automatic pH meter (Jenway 3015) respectively.

**Table 2: Proximate composition of experimental feeds**

Duckweed Sample	% Crude Protein	% Ether Extract	% Ash	% Moisture	% Crude Fibre
0%	45.06	11.76	13.29	2.00	4.90
10%	43.35	14.02	12.30	1.00	6.50
20%	42.56	14.29	12.00	1.00	4.46
30%	41.87	12.83	11.90	2.00	5.13

## MEASUREMENT OF GROWTH PARAMETERS

Food conversion ratio (FCR), specific growth rate (SGR) and percentage survival rate were determined as follows (After Fagbenro et al., 1992).

$$\text{FCR} = \frac{\text{Dry Weight Feed Supplied}}{\text{Total Weight gain by fish (g)}}$$

$$\text{SGR (\%)} = 100 \frac{(\text{Log}^e \text{ Wt} - \text{Log}^e \text{ WO})}{\text{T (days)}}$$

$$\text{Average Daily Wt gain} = \frac{\text{Wt} - \text{Wo}}{\text{T (days)}}$$

$$\text{S (\%)} = \frac{\text{Nt} \times 100}{\text{NO}}$$

Where Wt = final body weight of fish in grams at the end of the experiment.

WO = Initial body weight of fish in grams at the beginning of experiments.

Log<sup>e</sup> = Natural Logarithm of both final and initial body weight of fish in grams.

T = Duration (time) of the feeding trial in days.

No = Number of fingerlings alive at the end of experiment.

S = % survival

**Gross Protein Value (GPV):** This is commonly used biological method for evaluating proteins. This was determined using Devendra (1988) method as.

GPV = A/AO where

$$A = \frac{\text{g increase in weight gain}}{\text{g test protein}}$$

$$AO = \frac{\text{g increase in weight gain}}{\text{g test protein}}$$

### Protein Intake (PI)

This was determined following Sveier et al., (2000) method using the formula: PI = Total feed intake x % crude protein in the diet.

### Protein efficiency ratio (PER)

This index use growth as a measure of nutritive value of dietary protein. It was determined using Wilson (1989) as

$$\text{PER} = \frac{\text{Mean weight gain (g)}}{\text{Mean protein intake (mg)}}$$

### Productive protein value (PPV)

This expresses the percentage of ingested protein that is retained by disposition in the carcass. It is usually calculated by the carcass analyses method of miller and Bender (1955). When no correction for endogenous nitrogen losses is made the results are expressed as apparent net protein utilization (ANPU)

$$\text{PPV (\%)} = \frac{(P2 - PI) \times 100}{\text{Total Protein consumed}}$$

Where PI is the protein in fish carcass (g) at the beginning of the experimental and P2 is the protein in fish carcass (g) at the end of the experiment.

### Statistical Analysis

Data were subjected to analysis of variance (ANOVA) to compare the result. Statistical tables were used to evaluate the difference between means for individual diets at 5% (0.05) significance level.

## RESULT AND DISCUSSION

The three-inclusion level of duckweed in the experimental feed supported the growth for *Heterobranchus longifilis*. However, growth performance and feed utilization was favored by low inclusion level of duckweed meal in the experimental feed.

This result is similar to the report of several authors who have demonstrated the use of several species of duckweed as a partial replacement for fishmeal in the diet of fish and other animals. Fasakin et al., (2001) reported the use of duckweed *Spirodella polyrrhiza* in the diet of the Nile Tilapia (*Oreochromis niloticus*). They stated that fish fed duckweed based diet had higher growth rates than fish fed diet containing water fern meals.

The authors indicated the possibility of partial replacement of fishmeal with duckweed in the diet of Nile Tilapia. Shireman et al., (1978) reported that grass carp performance on a duckweed diet was superior to fish maintained on catfish chow. Robinette et al., (1980) fed channel catfish on prepared diet consisting of 20% dry duckweed; the weight gain, food conversion and energy use were equal to central diets (a standard catfish feed).

Ahamad et al., (2003) reported also the replacement of sesame oil cake by duckweed in broiler diet. They stated that partial replacement of the costly oil seed by cheaper unconventional duckweed in broiler diet resulted in increase profitability.

The protein efficiency ratio in the diets at 10 to 20% inclusive levels of duckweed meal in the experimental diet showed no significant difference compared with the control diet.

Bairagi et al., (2002) reported that 30% fermented lemlna leaf meal incorporated in the diet of *Labeo rohita* gave the best performance in terms of growth response, food conversion ratio and protein efficiency. From this result, 10% duckweed meal diet had the best specific growth rate and food conversation ratio.

Fasakin et al., (1999) reported that there was no significant difference in growth performance and nutrient utilization of fish fed on diets containing up to 20% duckweed inclusion and the control. They however, stated that increase in dietary duckweed inclusion resulted in progressively reduced growth performance and nutrients utilization of fish. This report is similar to the findings of this study. Inclusion of duckweed meal in the diet of other animals to replace fishmeal or soybean has also been reported by Samnang (1999), Hang (1998) and Becerra et al., (1995).

Yilmaz et al., (2005) reported no significant difference between the growth performance of fish that were fed diets containing up to 20% duckweed and fish that were fed the control diet, while carcass lipid and carcass protein also increased except for the diet with 15% duckweed meal in the common carp, *Cyprinus carpio*, fry. These authors concluded that a diet containing up to 20% duckweed could be used as a complete replacement of fishmeal for commercial feed in the diet formulation for common carp fry.

The findings of this study revealed increase in the carcass lipid similar to the report of these authors.

**Table 3: Growth performance and feed utilization of *Heterobranchus longifilis* fingerlings fed duckweed meal based diet for 70 days.**

Parameters	0%	10%	20%	30%
Initial Total Mean	13.92	12.81	13.08	14.59
	0.93	0.85	0.87	0.97
Final Total Mean	60.08	55.97	44.07	40.17
	4.45	3.86	3.39	3.09
Total Weight gain (g)	46.16	43.79	30.99	25.58
Mean Weight gain (g/fish)	1.71	1.51	1.19	0.98
Weekly Weight gain (g)	4.62	4.38	3.10	2.56
Specific Growth rate (SGR) (% / day)	2.08	2.11	1.74	1.45
Feed Conversion Ratio (FCR)	0.13	0.11	0.14	0.17
No. Stocked	15	15	15	15
No. of Survival	13	12	10	11
% Survival	87	80	67	73

**Table 4: Nutrient utilization by experimental fish samples**

Parameters	0%	10%	20%	30%
Protein (Intake)	14.83	11.92	10.41	10.88
Protein Efficiency Ratio (PER)	0.74	0.71	0.75	0.84
Productive Protein Value (PPV)%	14.09	15.69	7.88	5.97
Conversion Efficiency	1.0	0.75	0.50	0.22
Mean Protein intake (mg/fish)	1.14	1.19	1.04	0.99

**CONCLUSION:** This study showed that duckweed (*Lemna paucicostata*) meal, which is almost costless, could be used to partially replace the very expensive fishmeal in the diet of *Heterobranchus longifilis* fingerlings at regulated inclusion levels. This will no doubt reduce cost of production and thereby further boost aquaculture development in Nigeria.

## REFERENCES

- Adejinmi, O.O. (2000). The Chemical Composition and nutritional potential of soldier fly larvae (*Hermetia elucens*) in poultry rations. University of Ibadan. Ph. D. Thesis. Pp 292.
- Adikwu, I.A (2002). A Review of aquaculture: Nutrition in aquaculture development in Nigeria. In. *Proceeding of the Joint Fisheries Society of Nigeria/ NIFFR/FAO – National special programme for food security* National Workshop on Fish Feed Development and feeding practices in Aquaculture (Eyo, A.A. Ed.) held at National Institute for Freshwater Fisheries Research, New Bussa. 15th – 19th September 2003. Pp 34 – 42.
- Akegbejo – Samson Y. (1999). Growth Response and Nutrients digestibility by *Clarias gariepinus* fed varying levels of dietary periwinkle flesh as replacement for fish meal in low cost diet. *Journal of Applied Trop. Agriculture* vol. 4. 1:37-41.
- Ahamad, M.U; Swapon, M.R.S; Yeasmin, TU; Raham, M.S; and Ali, M.S. (2003) Replacement of sesame oil cake by Duckweed (*Lemna minor*) in broiler diet. *Pakistan Journal of Biological Science* 6 (16) 1450 – 1453
- Association of Official Analytical Chemists (2000). Official methods of chemical analysis 17th Edition, Washington D.C., USA.
- Bairagi, A; Sarkarghosh, K; Sen, S.K. and Ray, A.k (2002) Duckweed (*Lemna polyrrhiza*) leaf meal as source of feedstuff in formulated diets for rohu (*Labeo rohita* Ham) fingerlings after formulation with a fish intestinal bacterium. *Bioresouce Technol* 85 (1) : 17-23
- Becerra, M; Ogle, B. and Preston, T. R (1995) Effect of replacing whole boiled soybeans with duckweed (*Lemna* sp) in the diet of growing ducks. *Livestock Research for Development* Vol. 7 (3) 56 – 62.
- Devendra, C (1988) General approaches to Animal Nutrition Research and their relevance to fish production in the Asian region. In *Finfish Nutrition Research in Asia* (Desilva, S.S. ed) Heinemann Asia, Singapore. Pp 7 – 24
- Fasakin, E.A; Balogun, A.M and Fagbenro, O.A. (2001) Evaluation of sun dried water fern *Azolla africana* and duckweed, *Spirodella polyrrhiza*, in practical diets for Nile Tilapia, *Oreochromis niloticus* fingerlings. *Journal of Applied Aquaculture*. Vol 11 (4): 83-92.
- Fasakin, E.A; Balogun, A. M and Fasuru, E (1999) Use of duckweed *Spirodella polyrrhiza* L. Schleiden, as a protein feedstuff in practical diets for Tilapia, *Oreochromis niloticus* L. *Aquaculture Research* 30 (5): 313 – 318
- Fagbenro, O.A; Balogun, A.M. and Anyanwu, C.N (1992) Optimum dietary protein level for *Heterobranchus bidorsalis* fingerlings fed compounded diets. *Nigerian Journal of Applied Fisheries & Hydrobiology* 1:41-45

- Fagbenro, O.A; Adeparusi, E.O. and Fapohunda, O.O (2003) Feedstuff and dietary substitution for farmed fish in Nigeria. In. Proceeding of the Joint Fisheries Society of Nigeria/ National Institute for Freshwater Fisheries Research/FAO-National special programme for food Society. National Workshop on Fish feed Development and feeding practices – Aquaculture (Eyo, A.A. Ed) held at National Institute for Freshwater Fisheries Research, New Bussa 15th – 19th September 2008. Pp 60 – 72.
- Hanczakowski, P; Szymczyk, B and Wawizynski, M (1995) *Animal Feed Science and Technology*. Institute of Animal Production. Balice, Poland. 53:3-4 Pp 339 – 343
- Hang, D.T. (1998) Ensiled Cassava Leaves and duckweed as protein sources for fattening pigs on farms in central Vietnam. *Livestock Research for rural Development* Vol. 10 (3) 59 – 66
- Hassan, M.S and Edwards, P (1992) Evaluation of Duckweed (*Lemna perpusilla* and *spirodella Polyrrhiza*) as feed for Nile Tilapia (*Oreochromis niloticus*). *Aquaculture*. 104:315 – 326.
- Leonard, V (1995) Are aquatic plants particularly Azolla a useful source of food fish. In: (J.J. Symoens and J.C. Micha, eds). The management of Integrated Freshwater agro – Piscicultural Ecosystems in Tropical Areas. *Proceedings Royal Academy of Overseas Science*. Brussels, Belgium. Pp. 511 – 529.
- Robinette, H.R; Brunson, M.W. and Day, E.J (1980) Use of Duckweed in diets of channel cat fish. *Mississippi Agricultural Experiment station*. Publication No. 4532 Mississippi State University Mississippi State 13pp.
- Sammang, H. (1999) Duckweed versus ground Soya beans as supplements for scavenging native chickens in an integrated farming system. *Livestock research for Development* Vol. 11 (1) Pp 113 – 122.
- Shireman, J.V.; Colle, D.E and Rottman, R.W (1978) Growth of grass carp fed natural and prepared diet under intensive culture. *Journal of Fish Biology* 12:457 -463.
- Sveier, H; Raae, A.J. and Lied, E (2000) Growth and protein turnover in – Atlantic Salmon (*Salmo saler* L.): the effect of dietary protein level and protein size. *Aquaculture* 185:10-20.
- Wilson, R.P (1989). Amino Acids and protein. In: *Fish Nutrition* (J.E Halver, Ed). Academic Press Inc., California pp. 111 – 115.
- Yilmaz, E; Akyurt, I and Gunal, G (2005) Use of duckweed, *Lemna minor* as a protein feedstuff in practical diets for common carp, *Cyprinus Carpio* fry. *Turkish Journal of Fisheries and Aquatic Sciences* 4. 105 – 109

4/16/2009

## Gymnosperms of Nainital

Poonam Tripathi<sup>1</sup>, Lalit M. Tewari<sup>\*2</sup>, Ashish Tewari<sup>3</sup>, Sanjay Kumar<sup>4</sup>, Y.P.S. Pangtey<sup>5</sup> and Geeta Tewari<sup>6</sup>

<sup>1,2\*,4,5</sup>Department of Botany, <sup>3</sup>Department of Forestry, <sup>6</sup>Department of Chemistry, D.S.B. Campus, Kumaun University, Nainital-India

\* corresponding author, e-mail: [l\\_tewari@rediffmail.com](mailto:l_tewari@rediffmail.com)

**Abstract:** The Gymnosperms (gymno=naked; sperma=seeds; the terminology coined by Theophrastus) are a group of vascular plants whose seeds are not enclosed by a ripened ovary (fruit). In 1825 the Scottish botanist Robert Brown distinguished gymnosperms from the other major group of seed plants, the angiosperms, whose seeds are surrounded by an ovary wall. In the present study, 8 families of gymnosperms were identified which includes 15 species belonging to 14 genera. Pinus is represented by two species: *Pinus roxburghii* Roxb. And *Pinus wallichiana* A. B. Jackson. *Cedrus deodara* Roxb. *Cupressus torulosa* D. Don, *Pinus roxburghii* Roxb. Occurs in wild state while all others are grown as ornamental plants. [Report and Opinion. 2009;1(3):82-104]. (ISSN: 1553-9873).

**Key words:** Gymnosperms, Nainital, naked ovule

### Introduction

The Gymnosperms have been looked at differently, and have received varying degree of attention and treatment at the hands of botanists, at progressive period of time and in diverse geographical locations. These are common in Himalaya and the mountains of South and north India. These are the intermediates of the pteridophytes and the angiosperms. The gymnosperms have their ovules freely exposed before and after fertilization and not enclosed by any ovary wall. They are preferred by the gardeners and the plant lovers due to their gregarious looks, attractive foliage, heavy trunks and typical reproductive apparatus and are the chief ornamental plants. The wood is straight-grained, light for its strength, and easily worked. Wood of gymnosperms is often called softwood to differentiate it from the hardwood angiosperms (Chamberlain 1935, Dogra 1964, Dutta 1973, sahni 1986).

These are the most ancient seed plants which are believed to be arisen during the late Paleozoic (ca 265million year ago: Uniyal & Awasthi, 2000), most of them perished in due course of time and are now represented by the orders- Cycadales (living fossil), Ginkgoales (living fossil), Taxales, Coniferales, Gnetales [4 orders in Raizada & Sahni, 1958: order Taxales (family Taxaceae) not separated from Coniferales]. About 17 genera, 60 species (Singh & Mudgal, 1997), known to occur in India and according to Uniyal & Awasthi (2000) 48 sps. (Wild) known to occur in India out of 63 genera, 750 sps.in world.

The members of the order coniferales form a conspicuous group in north west and eastern Himalaya, the few members of which occur in the southern part. Although the family ginkgoaceae, araucariaceae and taxodiaceae are purely exotic but is successfully cultivated as well as naturalized in India (Beisnner and Hooker 1862-63, Biswas 1933, Arnold 1948, Sahni 1990, Uniyal & Awasthi, 2000). The Gymnospermous flora from Uttarakhand Himalaya are described by Hooker (1888), Duthie (1906), Osmaston (1927),Raizada and Sahni (1958), Chonker and Bisht (1961), Gupta (1968), Singh & Mudgal (1997), Kalakoti (1983), Kalakoti and Pangtey (1984), Pandey & Pandey (1999) and Uniyal & Awasthi (2000).The thorough scrutiny of these literatures helped to present the census of the gymnospermous flora of the Kumaun. Although since the cretaceous period (144 to 66.4 million years ago) gymnosperms have been gradually displaced by the more recently evolved angiosperms, they are still successful in many parts of the world and occupy large areas of the earth's surface.

So main motives behind the selection of the present study are the following: -

- (1) To explore the gymnospermic flora of Nainital region.
- (2) To highlight the economic importance of gymnosperms as medicinal Plants, ornamental utility and for miscellaneous uses.
- (3) To provide constant impetus for further researches on gymnosperms.

### Profile of Nainital

Nainital is a glittering jewel in the Himalayan necklace, blessed with scenic natural splendour and varied natural resources, dotted with lakes. There lie a large number of small lakes of which Lake Nainital is the largest. It is a pear shaped lake, approximately 2 miles in circumference, and surrounded by

mountains. Other lakes (locally known as Tal) in the region are Bhimtal, Sattal, Naukuchiatal, Punatal, Khurpatal, Sukhatal, Sariatal, Malwatal and Lampokhara. Nainital has earned the epithet of 'Lake District of India'. Nainital, of the hill towns in the state of Uttarakhand, occupies a unique place known for its salubrious climate and scenic beauty. The town is a popular health resort and attracts tourists round the year. Nainital is very rich in its diversified floras including trees, shrubs, herbs and grasses. Other high altitude spots of Nainital besides being famous tourist locations also conserve variety of wild fauna and flora. These include- China peak, Snow view, Tiffon top, The cliffs, Camel's back, Cave garden, Governor house, Zoo (highest altitude zoo in Asia), Kilbury, Vinayak, Himalaya darshan, ARIES, Hanuman garhi etc.

### **Geographic location**

According to the district gazetteer Nainital is situated at 29°24'N latitude and 79°28'E longitude in a valley of the Gagar range running east and west, which is bounded on the North by the Peak of China, which rises to a height of 8,568 feet continued by Alma peak [presently known as Snow view] and the Sher ka danda to the Eastern extremity, where the ridge descends almost to the level of the lake (Fig. 1).

On the west the rugged hill of the Deopatha rises to a height of 2438.09 meter, and on the South Ayarpatta attains an elevation of 2278.07 meter diminishing gradually towards the East. While the intervening portion between these two hills is a mass of rocks piled up loosely together which goes by the name of Handibandi and is formed of the transition limestone of Mussoorie exhibiting everywhere vast rents. the eastern boundary is the lake find an exit forming the principal source of Ballia river [nala], which falls into the Gola consists of a series of gentle undulations formed by the debris of situated at a height of 1938 m from by the debris of surrounding hills. Thus Nainital is situated at a height of 1938 meters from sea level or 6360 feet above the sea level. The town has the famous lake to which it owes its name. The surface of this lake has an elevation of 1.935m above sea level. Maximum length and breadth being 1,434 m and 463 m respectively. The depth of this lake is said to range between a maximum 28 meters and a minimum of 6 meters.

### **Discovery of Nainital**

The Britishers occupied Kumaun Garhwal in 1815 and E. Gardner was appointed as the Commissioner of Kumaun division (8 may 1815) and G.W. Traill his assistant. Later, Traill, who was very popular in Kumaun, was promoted as the Commissioner of Kumaun. He worked until 1830. He conducted the second revenue settlement of Kumaon in 1817, and it was during this period that he came to Nainital. He was the first European to have visited Nainital. However, rumours of the existence of the Nainital continued to reach British travelers. One of them, Barron decided to investigate deeper, and through threats and cajolery, he persuaded a guide to lead him to Nainital. The guide claimed to have never seen the place. Barron put a big stone on his head and told him he had to carry it to Nainital where there were no stones and that he had to be careful not to let it fall and break because he required it there. The guide with the view to relieving his load, soon admitted that there was no scarcity of stones at the spot, a fact which he could not have known without having been an eyewitness to it. J.M.Clay, author of the book 'Nainital', which was published in 1928, is of the view that Barron came to Nainital in 1841. His visit was popularized through the newspapers '*Englishman*' and '*Agra Ukhbar*'. He has given a beautiful description of the lake and the surrounding area. His next visit was a year later in December 1842. By then about half a dozen sites had already either been applied for or granted, and Lushington, then Commissioner of Kumaon, had started to build a small house. Moreover the Commissioner had already planned out a bazaar on the site of the present Mallital. In 1842, Barron constructed a house, pilgrim lodge, for himself just above the present Nainital club. Nainital's peripheral tourist zone extends up to Mulwa Tal to the East where Bhimtal, Sattal and Naukuchiatal have recently developed as tourist centers.

### **Mythology**

Nainital is referred to in the "Manas Khanda" of the 'Skanda Purana' as the Tri-Rishi Sarovar, the lake of the three sages, Atri, Pulastya and Pulaha who were reputed to have arrived here on a penitential pilgrimage, and, finding no water to quench their thirst dug a hole and siphoned water into it from Mansarovar, the sacred lake in Tibet. The ancient Hindus believed that a dip in lake Nainital, is not lesser than Mansarovar and earned merit similar to a dip in the sacred lake. The second important mythological reference to Nainital is as one of the 64 'Shakti peeths', i.e. centres of powers of the shakti cult. These centers were created wherever parts of the body of sati fell, when Lord Shiva was carrying around her

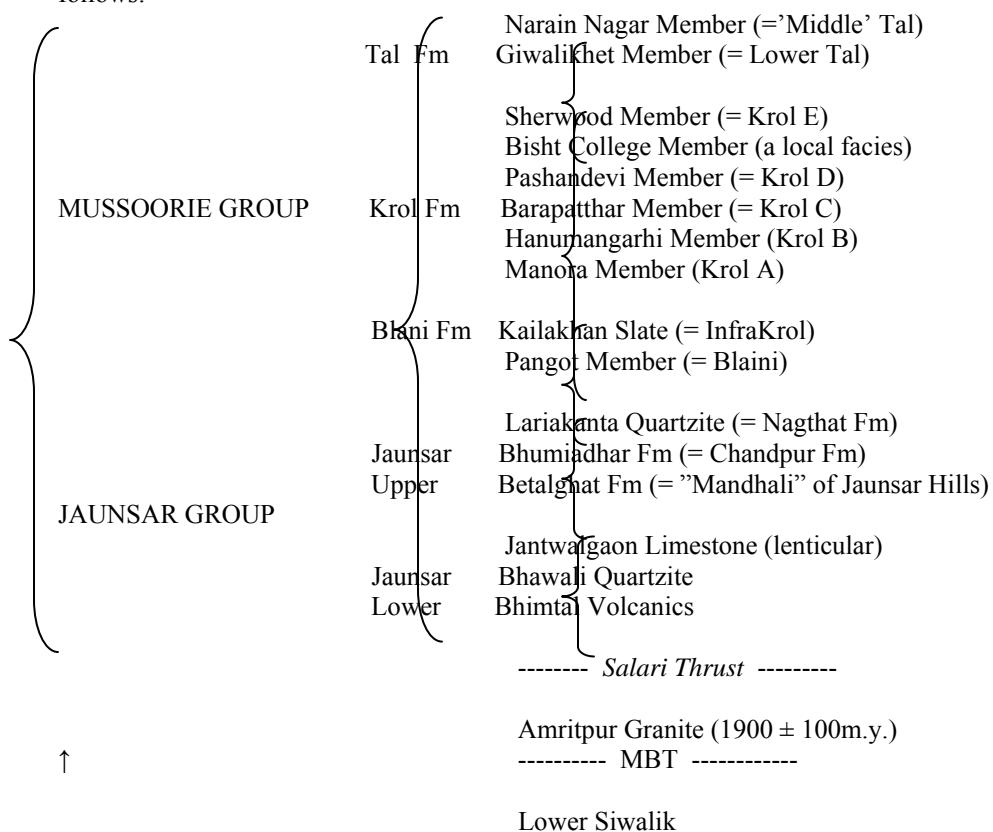
## Geology

Physiographically, the Kumaun Himalaya is divisible into-

- Outer Himalaya or Siwalik Hills (750 to 1200m altitude),
- Lower or lesser Himalaya which rise somewhat abruptly above the Siwalik hills (upto 4500m altitude),
- Main or great Himalaya (highest peak Nanda devi-7817m).

The great succession of the Nainital massif is divisible into lower Jaunsar group and upper Munsyari group (K.S. Valdia, 1980).

Lithostratigraphic succession of the Nainital hills of the Krol belt, outer lesser Himalaya, Kumaon is as follows:-



**Rock:** The different rock types occurring in the Nainital forest division could be classified in the following types:-

**[1] Sedimentary rocks:** As the name implies, are those rocks, which have been derived from the consolidation of sediments. These sediments are the products of erosion both mechanical and chemical from some pre-existing rock masses.

**[2] Metasedimentary rocks:** These rocks are formed when sedimentary rocks get metamorphosed.

**[3] Igneous rocks:** These rocks are formed from the solidification of very hot molten rock material called 'magma'. Such rocks originate generally at depth but sometimes are formed on the crust of the earth.

Igneous rocks are categorized on the basis of percentage of silica present i.e.; acidic (>65%), intermediate (50-65%), basic (45-50%) & ultra basic (<45%).

**Soil:** It is either micaceous, sandy or red clayey depending on the rock type from which it has been derived. The schist, granite, phyllites have given rise to micaceous soils. The arenaceous i.e. sandy soil is characteristic of quartzite or sandstone.

At the riverbeds some terraces have a sandy soil. Terrace deposits are well developed in the banks of Kosi, west of Betalghat to the west of Khairna and also along the banks of Gola River.

**Climatic conditions:** With a range in altitude from about 305 meter [1000'] to over 2611 meter [8,000'] very diverse climatic conditions are naturally met. Winters are very severe at the higher elevations and snowfalls down to 1,524 meters [5000'] and occasionally lower but melts rapidly below. About 2,134 meters [7,000'] and even above this snow seldom stays long on sunny slopes.

**Temperature:** Nainital has temperate summers, maximum temp. +33°C [99F] and minimum temp. +10°C [50F]. During winter Nainital receives snowfall between December and February with the temperatures varying between a maximum of 15°C [59F] and a minimum of -3°C [27F]. Severe frosts are usual from December to February and occur even in the lower valleys, which are frequently shrouded in mist in mornings.

In May and June the break of the monsoon the lower valleys are very hot and hot days experienced even up to 1,524 meters [5,000'] or more. The higher ridges are pleasantly cool even in June. The more pleasant time of the year, from the climatic point of view, is in October and November, when the air is clear, and there are no extremes of temperature at ordinary elevations.

**Rainfall:** The monsoon usually comes to an end about the middle of the September. November is the driest month. Winter rain usually being in the last week of December and continue off and on until February but may last longer in wet years. During April and May, thunderstorms often accompanied by hail, are fairly frequent. The monsoon generally begins during June, though it is uncertain and may start before the end of May or delayed until July. There is often considerable rain before the monsoon properly sets in.

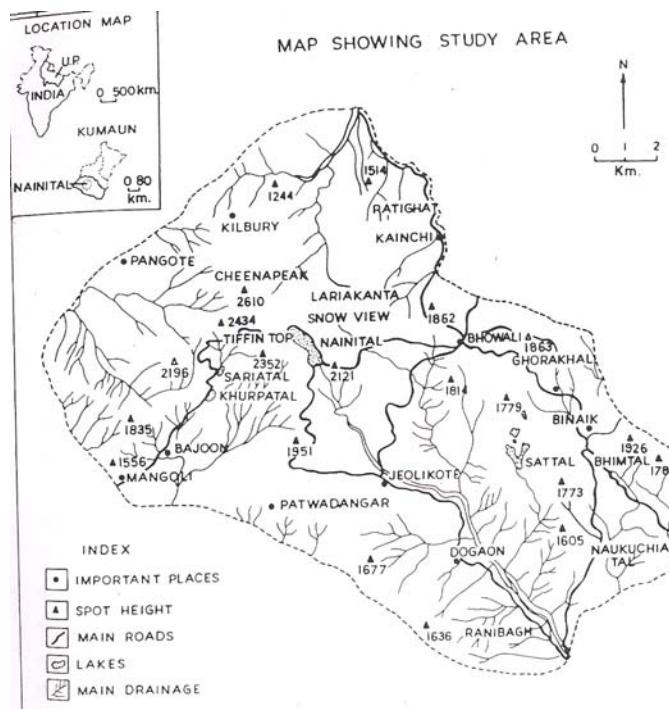


Fig. 1 Location map of Nainital

### Forest vegetation

Forest in Naini Lake catchment shows a great deal of variation. It is composed of temperate genera. This is largely attributed to the differences in topography and changes in climatic conditions that prevail in this region. Predominantly composed of temperate genera, such as oaks: - *Quercus leucotrichophora* A. Camus (banj oak), *Quercus floribunda* Lindl. Ex A.Camus (telonj), *Quercus semicarpifolia* Smith (kharsu), *Cupressus torulosa* D.Don (Cypress), *Rhododendron arboreum* Smith, (burans), *Acer oblongum* Wall. Ex DC. (Maple), *Fraxinus micrantha* Lingelsh. (Ash) and *Cedrus deodara* Roxb. (cedar), but in catchments of lower lakes at 1200-1400m altitudes tropical and subtropical plants such as species of *Bauhinia variegata* (Linn.)Benth. and *Butea* Roxb. And *Pinus roxburghii* Roxb. occur. *Quercus Leucotrichophora* A.Camus (banj oak) forests are usually confined between 1500- 2400 m but also seen running down as low elevation as 1100 m in moist ravines and form a more or less distinct altitudinal zones. The soil is usually moist and has a high degree of atmospheric humidity throughout the monsoon period from mid June to mid September. All the oaks are good fodder and continuous unregulated lopping has converted or is still converting the more accessible forests into scrub. Depending on the local conditions, the scrub is either passing into grassland or giving place to a bushy secondary growth which usually consists of largely by the shrubs like *Berberis aristata* DC. *B.asiatica* Roxb., *B.chitria* Lindl. ,*Spiraea canescens* D.Don, *Prinsepia utilis* Royle , *Pyracantha crenulata* (D.Don)Roem and *Rubus ellipticus* banj oak forests are usually confined between 1500- 2400 m but also seen running down as low elevation as 1100 m in moist ravines. Some of the common associates of banj oak forests are *Rhododendron arboreum* Smith, *Lyonia ovalifolia* (Wall.)Drude, and *Ilex dipyrena* Wall. . The commonest shrubs which are usually found associated with banj oak forests are *Berberis chitria* Lindl., *B. asiatica* Roxb. ,*Desmodium elegans* A.DC.,*Indigofera heterantha* Wall.ex Brandis. Besides *Chimnobaumbusa falcata* (Nees.)Nakai. is often very abundant .*Q. floribunda* Lindl. Ex A.Camus (Telonj oak forests) lie between 2100 -2500m and occupy an intermediate zone between banj oak and kharshu oak forests to a large extent. It attains its maximum development on deep moist soils and especially where subsoil is limestone. The canopy is usually dense and there is a thick second storey consisting of partly evergreen and partly deciduous trees and shrubs of varying sizes.the commonest associates are: *Quercus leucotrichophora* A. Camus, *Betula alnoides* Buch.Ham.ex D.Don., *Carpinus viminea* Wall. Ex Lindl. and *Acer caesium* Wall., while other common associates are *Ilex dipyrena* Wall., *Euonymus pendulus* and *Symplocos ramosissima* Wallich ex G.Don,Gen. Hist. Shrubs commonly found in these forests are: *Berberis asiatica* Roxb ,*B. aristata* DC. , *B. chitria* Lindl. , *Spiraea canescens* D.Don, *Prinsepia utilis* Royle, *Pyracantha crenulata* (D.Don)Roem and *Boenninghausenia albiflora* Hook. Kharshu oak forests occupy the highest zone among the oaks and found between 2400-2611m in hills area . the forests are usually dense .The common associates of kharsu oak forests are ; *Rhododendron arboreum* Smith, *Ilex dipyrena* Wall., *Acer caesium* Wall and *A.mono*.Maxim.Some of the shrubs found in the forests are: *Rosa macrophylla* Lindl., *Salix babylonica* Linn., *Viburnum stellatum* Wall and *V. cotinifolium* D.Don. With these some other species like banj oak forests are usually confined between 1500-2400m but also seen running down as low elevation as 1100m in moist ravines. Common associates of banj oak forests are: *Rhododendron arboreum* Smith, *Lyonia ovalifolia*(Wall.)Drude and *Ilex dipyrena* Wall. . In fact Nainital is the part of the region where populations of these oaks are, centered. *Rhododendron arboreum* Smith, dominates the under canopy of these oak forests, but in moist pockets lauraceous species, such as *Litsea umbrosa* Nees. are common. *Pinus roxburghii* Roxb. forms almost pure crops on hill slopes, above 1000m, replacing oaks where fire, harvest of biomass and erosion are frequent. The pure pine forest is single layered, while in other forests at least two layers within tree canopy are distinguishable.

All these broad-leaved species and pine are evergreen with one-year leaf life span and constitute more than 70% of tree importance. Such broad-leaved evergreen forests do not show extensive domination anywhere else in the world. Deciduous species occur in the same number as broad-leaved evergreen species but seldom dominant. *Cupressus torulosa* D.Don, an evergreen cypress of several years of leaf-life span forms a stand on the steep and dry slope below china peak in Nainital. *Bauhinia variegata* Linn.(Benth.) species, a chief associate of *Quercus leucotrichophora* A. Camus in Sattal catchment represents a transition stage between the winter deciduous species and evergreen species of this region, as this species bears some leaves during most of the winter season.



Profile of Nainital

### **Characteristic of gymnosperms**

Gymnosperms are not in such an advanced position as angiosperms because:-

- (1) They lack vegetative means of reproduction by means of cuttings, layering, etc., and are slow growers.
- (2) Limited means of dispersal (only wind and by man) and their failure to grow in varied habitats (water).
- (3) Absence of bisexuality which reduces the chances of self fertilization and more pollen is wasted as wind pollination is the main source of carriage of pollen grains
- (4) Unprotected ovules and seeds.
- (5) Absence of vessels (a few exceptions are there) in xylem and of companion cells in the phloem.

### **General features**

#### **Diversity in size and structure**

Among the gymnosperms are plants with stems that may barely project above the ground and others that develop into the largest of trees. Cycads resemble palm trees, with fleshy stems and leathery, featherlike leaves. The tallest cycads reach 19 meters (62 feet). *Zamia pygmaea* Sims., a cycad native to Cuba, has a trunk less than 10 centimeters (four inches) in height. Of the gnetophytes, *Ephedra* Teurn.ex.L. (Joint fir) is a shrub and some species of *Gnetum Linn.* are vines, while the unusual *Welwitschia* Hooker has a massive, squat stem that rises a short distance above the ground. The apex is about 60 centimeters in diameter. From the edge of the disk-shaped stem apex arise two leathery, straps like leaves that grow from the base and survive for the life of the plant. Most gymnosperms, however, are trees. The conifers, redwoods (*Sequoia*) exceed 100 meters in height and, while *Sequoiadendron* (giant redwood) is not as tall, the trunk is more massive.

#### **Importance of gymnosperms**

Gymnosperms include mainly evergreen trees and shrubs, which are extremely captivating because of their graceful habit and attractive shapes. The conifers are greatly valued by garden lovers.

Their wide range of shapes, colours, textures, and simple cultivation, make them pre-eminent specimens offering an all the year round appeal. They form the major component of any temperate forest of the world. Economically, gymnosperms are highly important particularly in forestry and horticulture, yielding timber, resins, essential oils, drugs and edible nuts.

Gymnospermous plants are widely used as ornamentals. Conifers are often featured in formal gardens and are used for bonsai. Yews and junipers are often low-growing plants cultivated for ground cover. Conifers are effective windbreaks, especially those that are evergreen. Cycads are used as garden plants in warmer latitudes, and some may even thrive indoors. Their leathery green foliage and sometimes-colorful cones are striking. Ginkgo is a hardy tree, and although it once approached extinction, it is now cultivated extensively and survives such challenging habitats as the streets of New York City. Some gymnosperms are weedy in that they invade disturbed areas or abandoned agricultural land. Pines and junipers are notorious invaders, making the land unusable.

*Araucaria*, and *Podocarpus* are important conifers of the Southern Hemisphere used for lumber. Aromatic wood of cedar is frequently used in the construction of closets or clothes chests and apparently repels cloth-eating moths. Most plywood is gymnospermous. Fibers of conifers make up paper pulp and may occasionally be used for creating artificial silk or other textiles. Conifers are frequently planted in reforestation projects. Conifer bark is often the source of compounds involved in the leather tanning industry. Bark is also used extensively as garden mulch. From conifer resins are derived turpentine and resin. Resins may also have medicinal uses. Many types of amber are derived from fossilized resin of conifers. Commercially useful oils are derived from such conifers as junipers, pines, hemlock, fir, spruces, and aborvitae. These oils serve as air fresheners, disinfectants, and scents in soaps and cosmetics. Seeds are often food sources. Pine seeds are a delicacy eaten plain or used as a garnish on bakery products

### Synopsis of families

1. **Araucariaceae:** Trees with spirally arranged narrow or broad leaves with parallel veins. Dioecious or monoecious. Male strobilli dense, cylindrical with numerous sporophylls. Cones sub globose to ovoid, generally large; with woody one seeded scales, without distinct bracts, falling when the seeds are ripe.
2. **Cephalotaxaceae:** Evergreen trees or shrubs. Branches opposite or whorled. Leaves spirally arranged, often spreading in two ranks, linear, pointed. Usually dioecious. Male strobilli axillary, sub-globose, sporophylls. With 3-8 pollen-sacs. Ovules in pairs, only one ovule developing into an olive-like fruit (seed), long stalked, with a fleshy outer coat.
3. **Cupressaceae:** Trees or shrubs, adult leaves usually small, scale like, appressed, in opposite pairs, sometimes in threes, rarely linear. Buds not scaly. Cones small their scales mostly confluent with the bracts, somewhat fleshy but generally woody when ripe, each bearing a number of erect ovules.
4. **Cycadaceae:** Trunk cylindric sometimes branched, with terminal tufts of rigid, pinnate leaves. Male and female reproductive organs on separate plants, at the apex of trunk among the leaves, male in erect massive cones with thick scales. Female megasporophylls densely woolly in crowded whorls around the top of the trunk, each with pairs of large ovules on its edge.
5. **Ginkgoaceae:** Monotypic trees. Leaves deciduous, fan shaped, with parallel veins. Dioecious. Male strobillus catkin like; antherozoids motile. Female axis a long stalk with usually 2 terminal ovules. Fruit drupe like, orange yellow, woody shell of the seed surrounded by a fetid, pulpy coat.
6. **Pinaceae:** Trees. Leaves linear, flat or needle like, spirally arranged sometimes in 2 or more rows, or in tufts. Buds scaly. Monoecious. Cones mostly woody, with spirally arranged scales. Bracts separate from the scales. Seeds generally winged.
7. **Taxaceae:** Evergreen trees. Leaves spirally arranged, rarely opposite, flattened, needle like, linear, often in two ranks, male strobilli catkin-like. Female not cone like, with a single erect ovule or seed, partly or wholly covered by a fleshy, coloured aril. Foliage and seeds poisonous, but not the aril.
8. **Taxodiaceae:** Trees with narrow, linear or awl shaped leaves, spirally arranged, sometimes apparently 2 ranked. Buds not scaly. Monoecious cones mostly globose. Scales spirally arranged, leathery or woody, persistent, more or less fused with bracts. Seeds 2-6 to each scale, erect or inverted, winged or wingless.

### Material and method

During the study whole area is surveyed thoroughly during 2007-08 and all the specimens are collected, identified and arranged to classification. The Herbarium was prepared following the method of Jain and Rao (1976). The literature was also studied for their characteristics and economic importance.

### ARAUCARIACEAE (MONKEY PUZZLE FAMILY)

GENERA- ARAUCARIA Jussieu

*Araucaria cunninghamii* Sweet

English name- Hoop Pine

Hindi name- Bunya Tree

**Distribution in Nainital:** Around Govt. house, D.S.B. Campus, High court compound as cultivated.

**General distribution and habitat:** Australia, India (Nilgiri hills), New Caledonia, pacific islands to New Guinea, Polynesia, South America. These trees occur on drier sites in rainforests, in places that are rocky or have soils with relatively low fertility it is an emergent species in subtropical and tropical rainforest.

**General description:** *A.cunninghamii* Sweet is a tall tree growing 30-50 meters in height, with a straight, rough-barked trunk with circular "hoop" markings which give rise to the common name. Evergreen tree, Dioecious or monoecious, with relatively large pith in trunk and resin in cortex.

**Bark:** Gray-brown or dark grey rough, transversely split; crown tower-shaped when young, becoming flat topped with age; lateral branchlets dense, drooping, and almost pinnately arranged.

**Leaves:** Dimorphic spirally arranged or decussate, sessile, decurrent.

**Cones:** Unisexual. Ovoid, Male cones cylindrical, to 5 cm long, terminal, solitary, spirally arranged, sessile; microsporangia 4-20. Female cones ovoid, can 10 cm long on long peduncles, solitary, terminal on branchlets, maturing in 2nd or 3rd year; the cone scales samara-like, thinly winged, bracts numerous, spirally arranged; ovulate scales degenerate or ligulate.

**Seeds:** With a narrow membranous wing on each side.

**Uses:** Cultivated for ornamental purposes in the garden. The wood is a pale yellow-brown colour with a fine texture and a straight grain making it useful for furniture, flooring, and panelling and, in the past, matchsticks and boxes.

**Seed:** Raw, cooked or ground into a powder. Starchy and delicious, it has the texture of a waxy boiled potato with the flavour of chestnuts. Large, it is an important food.



*Araucaria cunninghamii* sweet

### CEPHALOTAXACEAE

GENERA: CEPHALOTAXUS Siebold & Zucc.ex Endl

*Cephalotaxus griffithi* Hook.f.

English name: Plum Yew or Cow Tail Pin

Hindi name: Tinya

**Distribution in Nainital:** D.S.B. Campus, as cultivated.

**General distribution and habitat:** Korea, China, Japan, Burma, Laos, Vietnam and India. Its center of distribution is in China, which holds portions of the native range of seven species. All species are highly shade tolerant, typically growing as understory trees or shrubs in humid temperate to subtropical broadleaf forests. Especially in limestone regions. Mixed with coniferous and broad-leaved forests, thickets and roadsides at elevations of 2000 - 3700 meters.

**General description:** Evergreen dioecious, rarely monoecious trees or shrubs about 20m tall, with a trunk to 20 cm cbh; usually multistemmed, with an open, loosely rounded crown.

**Branches:** Branches, shoots slightly pendant. Leafy branchlets obovate, obtriangular, or rectangular in outline, plane.

**Bark:** Bark dark red-brown, peeling in strips.

**Leaves:** Buds small, covered with pointed, glossy, red-brown scale-like leaves. Leaves almost horizontally spreading; blade deep green and glossy adaxially, linear-lanceolate, base cuneate or shortly attenuate, asymmetric, margin flat or very narrowly revolute when dry.

**Cones:** Pollen-cone capitula of 6-14 cones, distinctly pedunculate (peduncle 2-5 mm), or sessile to sub sessile (peduncle 0-2 mm), globose, 6-10 mm, bracts ovate, microsporophylls 6-16, each with 3 or 4 pollen sacs. Female cones borne 3-6 together; peduncle 3-12 mm and 1.5 mm. Aril yellow or green initially, turning purple when ripe. Mature into drupe-like structure with the single large nut-like seed.

**Seeds:** 3.7cm. long, borne 3-4 together sometimes longer with a short apical point.

**EdibleUses:**

Edible Parts: Fruit; Seed.

Fruit- Fairly large, it is about 30mm x 15mm. The fruit is edible raw if fully ripe.

**Medicinal Uses**

**Cancer:**

Substances from the plant have shown anticancer activity.

**Other Uses:**

Ground cover; Hedge.

Some forms of this species are procumbent in habit and can be used as ground cover in shady places. Very tolerant of pruning, this plant makes a very good hedge in shady positions.



*Cephalotaxus griffithii* Hook.f.

**CUPRESSACEAE (CYPRESS FAMILY)**

**GENERA-Biota (Linn.) Endlicher**

*Biota orientalis* (Linn.) Endt.

**English name- Green Giant {Biota}**

**Hindi name-Morpankhi**

**Distribution in Nainital:** Cultivated as an ornamental plant in gardens and roadsides at many places in Nainital.

**General distribution and habitat:** North America, north Asia, India (planted commonly in gardens), eastern China. Grow in steep dry rocky valley slopes.

**General description:** The **Biota Green Giant** is the fastest growing evergreen shrub or small bushy tree, 15-25 feet high, often with several trunks to 6 inches in diameter, much branched with dense cylindrical crown becoming thin and irregular at maturity, resinous and aromatic.

**Bark:** Brown to dark reddish brown, finely fissured, fibrous and becoming shreddy. Inner bark whitish, fibrous, with slightly resinous taste.

**Branches:** Short, brown, slender, becoming slightly rough, resinous.

**Leaves:** Paired or opposite in 4 rows, scalelike, short-pointed and pressed against twig.

**Flowers:** Monoecious.

**Cones:** Borne at ends of short twigs, male catkin ovoid with 3-6 pairs of stamens, Pollen is produced in small yellowish male cones 3/16 inch long on different twigs of the same plant. Female cones ovoid or oblong.

**Scales:** 8-12 thickened upwards.

**Seeds:** Winged or wingless.

**Uses: edible uses:** Seed: after removing the bitterness they can be eaten.

Medicinal uses: Antiasthmatic; Antibacterial; Antipyretic; Antitussive; Aperient; Astringent; Diuretic; Emmenagogue; Emollient; Expectorant; Haemostatic; Lenitive; Parasiticide; Sedative; Skin; Stomachic.

The leaves are antibacterial, antipyretic, antitussive, astringent, and diuretic, emmenagogue, emollient, expectorant, febrifuge, haemostatic, refrigerant and stomachic. Their use is said to improve the growth of hair. They are used internally in the treatment of coughs, haemorrhages, excessive menstruation, bronchitis, asthma, skin infections, mumps, bacterial dysentery, arthritic pain and premature baldness. The seed is Aperient, lenitive and sedative. The root bark is used in the treatment of burns and scalds. The stems are used in the treatment of coughs, colds, dysentery, rheumatism and parasitic skin diseases.



*Biota orientalis* (Linn.) Endt.

**Genera: Cupressus Linn.**

***Cupressus torulosa* D.Don**

**Common name:Himalayan Cypress**

**English name:Cypress**

**Hindi name :Surai**

**Distribution in Nainital:** Kilbury road, Naina (Cheena peak) area, Hanumangarh area (planted) on degraded area, eastern slope of Govt. house, Snow view.

**General distribution and habitat:** China: in arid areas at 1500-2500 m, India (Kashmir to Arunanchal Pradesh), Nepal, Tibet, Pakistan, Bhutan. W. Himalaya at 1800-300 m on limestone substrates. It is a shade intolerant species, thriving in tropical and subtropical rainforests, where it prefers calcareous substrates.

**General description:** A large evergreen tree commonly 3.6 m in girth and 45m in height, with a pyramidal crown with horizontal or drooping branches.

**Bark:** Thick, grey brown or brown, peeling off in long thin strips.

**Leaves:** scale-like, triangular closely appressed, obtuse, dark green, often with a small dorsal furrow.

**Flowers:** Monoecious, male catkins 5-6mm long, often tinged purple, solitary at the tips of the branchlets.cones globose, woody, male cone sub globular, 5-6mm long. Female cones globose or elliptic, grouped on very short stalks, 10-20 mm across, green or purple when young, later turning dark brown, composed of 6-8(10) scales, with a small central depression and a small, triangular.

**Scales:** Woody and 6-10.

**Seeds:** Compressed 6-8 on each scale, pale brownish.

**Uses:** The plant is burnt as incense. The leaves are used. Wood - moderately hard, very durable. Used for general construction.



*Cupressus torulosa D.Don*

**Genera: Juniperus Linn.**

***Juniperus communis* Linn.**

**English: Common or Ground Juniper** **Hindi: Jhora, Billa, Bhitaru**

**Distribution in Nainital-** D.S.B. Campus, Govt. house, cultivated.

**General distribution and habitat:** Afghanistan, India (north-west Himalaya), temperate and sub arctic Asia, Europe, North Africa, North America. This is the most widespread conifer in the world. The plant prefers light (sandy), medium (loamy) and heavy (clay) soils, requires well-drained soil and can grow in heavy clay and nutritionally poor soils. The plant prefers acid, neutral and basic (alkaline) soils. It can grow in semi-shade (light woodland) or no shade.

**General description:** It is a shrub or small tree, very variable and often a low spreading shrub, but occasionally reaching 10 m tall, Dioecious, multistemmed, decumbent or rarely upright; crown generally depressed.

**Bark:** reddish brown, fibrous, exfoliating in thin strips that of small branchlets (5-10 mm diam.) smooth, that of larger branchlets exfoliating in strips and plates.

**Branches:** spreading or ascending; branchlets erect, terete.

**Leaves:** Needle-like to narrowly lance-shaped, 5 - 12 mm long (sometimes to 15 mm), jointed at base, very prickly; whitish above, dark green below; in 3's but sometimes appearing silver when glaucous, spreading.

**Flowers:** dioecious, with male and female cones on separate plants, which are wind pollinated.

**Fruit:** female cones berry-like green ripening in 18 months to purple-black with a blue waxy coating; they are spherical, 4–12 mm diameter, and usually have three (occasionally six) fused scales, each scale with a single seed. The male cones are yellow, 2–3 mm long, and catkin-like; sexes on separate plants.

**Edible Uses:** Fruit, coffee, condiment, Tea.

**Fruit:** Raw or cooked .A soft, mealy, sweet, resinous flesh. The fruit is often used as flavouring in sauerkraut, stuffings, vegetable pates etc, and is an essential ingredient of gin. The aromatic fruit is used as a pepper substitute. An essential oil is sometimes distilled from the fruit to be used as flavouring. The roasted seed is a coffee substitute. A tea is made by boiling the leaves and stems .A tea made from the berries has a spicy gin-like flavour.

**Medicinal Uses:** Antiseptic; Aromatherapy; Aromatic; Carminative; Tonic; Diaphoretic; Diuretic; Rubefacient; Stomachic;

Juniper fruits are commonly used in herbal medicine; they are especially useful in the treatment of digestive disorders plus kidney and bladder problems, the fully ripe fruits are strongly antiseptic, aromatic, carminative, diaphoretic, strongly diuretic, rubefacient, stomachic and tonic. They are used in the treatment of cystitis, digestive problems, chronic arthritis, gout and rheumatic conditions.

**Other Uses:** Fiber; Fuel; Ground cover; Hair oil; Incense; Repellent; Resin; Strewing; Tinder. The essential oil distilled from the fruits is used in perfumes with spicy fragrances.



*Juniperus communis* Linn.

#### CYCADACEAE

**GENERA-** Cycas Linn.

*Cycas revoluta* Thunb.

**English name:** Sago palm (King Sago Palm)

**Distribution in Nainital:** D.S.B. Campus, Boat house garden.

**General distribution and habitat:** China, a rugged trunk, topped with whorled feathery leaves has lead to the common name "Sago Palm".*Cycas revoluta* Thunb. (**Sago Cycad**), is native to southern Japan. The subtropical *C. revoluta* Thunb. is native to the Far East and has been used as a choice container and landscape plant for centuries

**General description:** *Cycas revoluta* Thunb. one of the most primitive living seed plants, are very unusual and popular ornamentals. A slow growing palm- like dioecious tree or shrub 1.8to3m producing suckers. Trunk columnar unbranched, rarely forked clothed with old leaf bases, very low to subterranean in young plants, but lengthens above ground with age.

**Leaves:** 60- 150cm. long, petiole thick quadrangular; leaflets 9-18cm. long, less than 5mm. wide, sub-opposite, stiff terminating in a sharp pointed tip. NEW LEAVES emerge all at once in a circular pattern, thus grow out into a feather-like rosette, margin revolute, the basal leaflets become more like spines.

**Cones:** The male cone is pineapple shaped , apical cylindrical or ovoid oblong 8-40cm. long, 1.5-4cm. in diameter, shortly peduncled. Microsporophylls (stamens) lanceolate- cuneiform 2-3.8cm long, 11-17mm wide, truncate,woody, covered with pollen sacs beneath. The apical end is sterile, lower wedge shaped is fertile. Megasporophylls forming an apical crown in a rosette form, densely hairy, stalk longer than blade with 4-6 ovules that are covered with thick down; blade ovate lacinate nearly to the midrib with 12-18 linear curved spinous segments

**Seeds:** Seeds are brownish-red, the shape of a flattened marble, glabrous 1.5-3.5cm.long, apex emarginated, bright orange or yellow in colour. Pollination can be done naturally by insects or artificially.

**Uses:** Edible Uses

**Parts:** Seed; Stem.

cooked. They can be dried and ground into a powder then mixed with brown rice and fermented into 'date miso' or 'sotetsu miso'.  
The heart or pith of the trunk is sliced and eaten  
baked or powdered.

**Edible**

**Seed - raw or**

**Medicinal Uses:** Astringent; Cancer; Diuretic; Emmenagogue; Expectorant; Tonic. The leaves are used in the treatment of cancer and hepatoma. The terminal shoot is astringent and diuretic. The seed is emmenagogue, expectorant and tonic. It is used in the treatment of rheumatism. Substances extracted from the seeds are used to inhibit the growth of malignant tumors.



*Cycas revoluta* Thunb.

### GINKOACEAE

**GENERA-** *Ginkgo* Linn.

*Ginkgo biloba* Linn.

**English:** Maiden Hair Tree

**Hindi name:** Ginkgo (The living fossil)

**Distribution in Nainital:** Cultivated near Govt. house, around D.S.B. campus, Snow view area (old Govt. house).

**General distribution and habitat-** South East China, Japan .It grows on rich sandy soils .The plant prefers light (sandy), medium (loamy) and heavy (clay) soils and requires well-drained soil. The plant prefers acid, neutral and basic (alkaline) soils. It cannot grow in the shade. It requires dry or moist soil and can tolerate drought. It can tolerate atmospheric pollution.

**General description:** Ginkgo is an attractive and deciduous tree of pyramidal form. It is about 30m tall, with fan shaped deciduous leaves.

**Bark:** Light greyish brown with irregular ridges, eventually becoming deeply furrowed. Trunk pyramidal and sparsely branched.

**Branches:** Irregularly whorled or produced at indefinite intervals. Branchlets horizontal or drooping with spur like shoots.

**Leaves:** Alternate, simple, fan-shaped, 2 to 3 inches long and wide; parallel, fan-like venation petiole long, light green above and below.

**Flower:** Dioecious; tiny green male flowers appear in spring as pendulous catkins from shoots in pairs or in threes, each consisting of along stalk bearing on each side below. The apex, a naked. Female "cones" are 1 1/2 to 2 inch long peduncles, bearing 1 to 2 ovules, present in mid-spring. Ovule is surrounded at the base by a collar like rim.

**Fruits:** On female trees, the tan-orange oval fruits are pendulous from the spur shoots.

**Seed:** They have a silvery shine ("silver apricot/nut"). The ripened fleshy seed coat when falling on the ground and decaying has a 'disagreeable' odour (like rancid butter) as a result of the presence of butyric (butanoic) acid. Drupe-plum like, orange colour.

**Use:** Medicinal Uses and Indications

Based on studies conducted in laboratories, animals, and humans, many health care professionals may recommend *Ginkgo Linn.* for the following health problems:

**Dementia and Alzheimer's disease:** Ginkgo is widely used in Europe for treating dementia. Its use is primarily due to its ability to improve blood flow to the brain and because of its antioxidant properties. The evidence that Ginkgo may improve thinking, learning, and memory in people with Alzheimer's disease (AD) has been highly promising.

**Eye problems :**The flavonoids found in Ginkgo may help halt or lessen some retinal problems (that is, problems to the back part of the eye). Retinal damage has a number of potential causes, including diabetes and macular degeneration. Macular degeneration (often called age-related macular degeneration or ARMD) is a progressive, degenerative eye disease that tends to affect older adults and is the number one cause of blindness in the United States. Studies suggest that Gingko may help preserve vision in those with ARMD.

**Memory Impairment:** Ginkgo is widely touted as a "brain herb." Researchers recently reviewed all of the high-quality published studies on Ginkgo and mild memory impairment (in other words, people without Alzheimer's or other form of dementia), and concluded that ginkgo was significantly more effective than placebo in enhancing memory and cognitive function. Ginkgo is commonly added to nutrition bars, soft drinks, and fruit soothies to boost memory and enhance cognitive performance.

**Other uses:** In addition to these health problems, health care professionals may also recommend ginkgo for a variety of other ailments, including altitude sickness, asthma, depression, disorientation, headaches, high blood pressure, erectile dysfunction, and vertigo.

**Edible Uses: Seed:** Raw (in small quantities), or cooked [A soft and oily texture the seed has a sweet flavour and tastes somewhat like a large pine nut .The baked seed makes very pleasant eating, it has a taste rather like a cross between potatoes and sweet chestnuts .The seed can be boiled and used in soups, porridges etc .It needs to be heated before being eaten in order to destroy a mildly acrimonious principle .The seed is rich in niacin .It is a good source of starch and protein, but is low in fats .These fats are mostly unsaturated or monosaturated .An edible oil is obtained from the seed.



*Ginkgo biloba Linn.*

PINACEAE

GENERA- *Abies* Mill.

*Abies pindrow* Royle

English name: West Himalayan Fir or Low Level Fir

Hindi name: Raga or Righa

**Distribution in Nainital:** Lariakanta, east of Nainital, Snow view area on Zoo road.

**General distribution:** Afganistan, India (Western Himalaya), Nepal, Pakistan)Habitat and range. It grows at altitudes of 2,400-3,700 m in forests together with deodar cedar, blue pine and morinda spruce, typically occupying cooler, moister north-facing slopes.

**General description:** A large and evergreen tree with a dense conical columnar crown of dark green foliage, attaining a height of 45-60m and a girth of 2.5-4 m.

**Branches:** horizontal or drooping, whorled. The shoots are greyish-pink to buff-brown, smooth and glabrous (hairless).

**Bark:** smooth on young stem, dark grey, and rough with deep vertical furrows on old stems.

**Leaves:** variable two ranked, on opposite sides of a twig; needle like, flattened, lower surface with two pale powdery bands on either side of the midrib, tip notched.

**Flowers:** monoecious male catkins clustered; stamens with two linear pollen sacs. Female flowers in cones, which are solitary or in distant pairs, erect, dark purple. Ripe cones erect cylindrical.

**Seeds:** have long wings longer than the seeds.

**Uses:** Fuel; wood.

**Wood:** light, soft, not very durable. Used for house interiors, cases, furniture, water troughs and fuel. The wood is used for making matches and paper pulp.



*Abies pindrow* Royle

GENERA- *Cedrus* Trew.

*Cedrus deodara* Roxb.

English name: Himalayan Cedar

Hindi name: Deodar, Diar

**Distribution in Nainital:** D.S.B. area, below China peak, Kilbury, Sher ka danda.

**General distribution and habitat:** cedar is native to the western Himalaya in eastern Afghanistan, northern Pakistan, Northwest and North-Central India, South Western Tibet and Western Nepal, occurring

at 1500-3200 m altitude. It is commonly mixed with fir, deodar, blue pine and at higher elevation with *Quercus semicarpifolia* Smith., maple etc.

**General description:** an evergreen tree attaining a height of 250 feet and may spread to the diameter of 3m. It has a conical appearance when it is young and drooping branches in the end. Trees that are old attain round shape. Branches are arranged in horizontal manner and shoots are pedunculated.

Trunk is straight and thick. The branches that are on the top are smaller than the lower ones.

**Bark:** thick and rough in appearance and is greyish brown.

**Leaves:** 2.5-3.8cm long, dark green, sharply pointed, in tufts of 15-20.

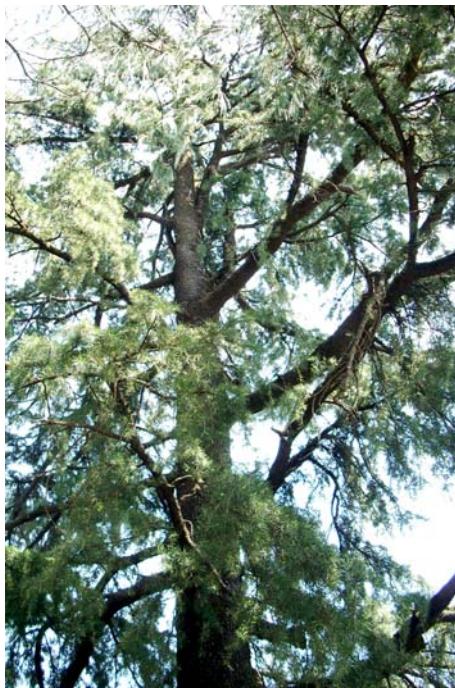
Male and female flowers are often on separate trees, but some times on the same tree in which case they are on separate branches.

**Cones:** erect barrel shaped. Catkin solitary, at the ends of the branchlets, cylindric. Female cones solitary ovoid, green dark brown when mature, erect. Scales numerous fans shaped breaking from the stout woody axis.

**Seeds:** triangular with a broad wing.

**Uses:** It is widely grown as an ornamental tree, much planted in parks and large gardens for its drooping foliage. Cedar wood oil, extracted from the plant, is used for catarrhal conditions of the respiratory tract. It is an expectorant. It is also useful for ulcers and skin diseases.

In India, *Cedrus deodara* oil has been shown to possess insecticidal and antifungal properties and to have some potential for control of fungal deterioration of spices during storage.



*Cedrus deodara Roxb.*

**Genera- Picea Link.  
*Picea smithiana* Wall.**  
**English name:West Himalayan Spruce,  
Morinda Spruce  
Hindi name: Kala Chiulu**

**Distribution in Nainital:** St. xaviers school, near Sherwood college, High court area, Ayarpatta.

**General distribution and habitat:** Usually found on N. and W. slopes inhabiting the drier upper areas often in association with silver fir or deodar, 2100 - 3600 meters from Afghanistan to Nepal. Restricted to subtropical high altitude, temperate, and boreal regions of the northern hemisphere.

**General description:** A very large evergreen tree with pendulous branches attaining a height of 60m and above and a girth up to 5.7m.

**Branches:** whorled with strong nodal pseudowhorls and additional scattered weaker internodal branches. Short (spur) shoots absent.

**Bark:** gray to reddish brown, Rough, cut by shallow furrows into small plates.

**Leaves:** borne singly and spirally around the branches, 4 sided and stiff, 2.5 to 3.8cm long, needle like with sharp points.

**Flowers:** monoecious, male catkins, solitary, erect, nearly sessile in the axils of upper leaves.

**Cones:** borne on year-old twigs. Pollen cones single or grouped, axillary, oblong, and yellow to purple; pollen shed in spring. Seed cones green to purple, maturing pale to dark brown in autumn, 4-8 months from pollination, usually shed at maturity, borne mostly on upper branches, pendent, ovoid to cylindric, sessile or terminal on leafy branchlets; scales persistent, elliptic to fan-shaped, thin, lacking apophysis and umbo; bracts included.

**Seeds:** dark grey or blackish, wing spoon shaped and light brown.

**Uses:** Edible Parts: Flowers; Inner bark; Seed; Seedpod.

**Edible Uses:** Condiment; Gum; Tea

Inner bark : dried, ground into a powder and then used as a thickener in soups etc or added to cereals when making bread. A refreshing tea can be made from the young shoot tip, rich in vitamin C .The bark is very water resistant and is used for roofing and making water troughs.

**Wood:** soft to moderately hard. Used in construction, shingles, crates, household purposes etc. It is also valued for its use in the pulp industry to make paper.



*Picea smithiana* wall.

**Genera- *Pinus* Linn.**

***Pinus roxburghii* Roxb.**

**English name: Pine (Himalayan long needle pine)**

**Hindi name: Chir**

**Distribution in Nainital:** around kailakhan, pines, Hanumangarh, with occasional trees in Nainital catchment.

**General distribution and habitat:** Afghanistan, Bhutan, India (North West Himalaya to Assam, Arunanchal pradesh (absent in Kashmir valley), Pakistan. The **Chir Pine** (*Pinus roxburghii* Roxb.) named after William Roxburgh, is native to the Himalaya. It generally occurs at lower altitudes than other pines in the Himalaya, from 500-2000 m, occasionally up to 2300 m.

**General description:** a large evergreen tree, nearly deciduous in dry localities, usually not exceeding 30m in height, rarely 55m. A girth of 3m have been recorded in favorable conditions. Branches up to middle age whorled, crown elongated to pyramidal shaped afterwards becoming spreading or umbrella shaped.

**Bark:** reddish-brown, thick and deeply fissured at the base of the trunk, thinner and flaky in the upper crown

**Leaves:** are needle-like, in fascicles of three, very slender, 20-35 cm long and distinctly yellowish green.

**Flowers:** are monoecious (individual flowers are either male or female, but both sexes can be found on the same plant) and are pollinated by Wind.

**Scales:** woody with a curved beak.

**Cones:** ovoid conic, 12-24 cm long and 5-8 cm broad at the base when closed, green at first, ripening glossy chestnut-brown when 24 months old.

**Seeds:** 8-9 mm long, with long membranous wing and are wind-dispersed.

**USES: Edible Uses**

Condiment, Manna, Seed

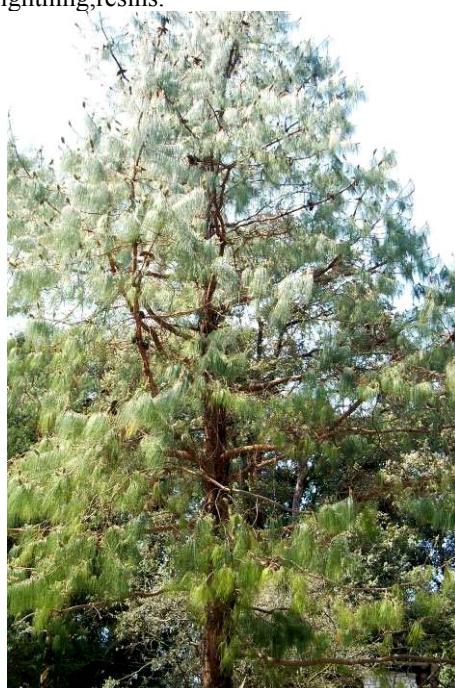
**Seed:** Raw or cooked. It has a strong flavour of turpentine and is only eaten as an emergency food. A sweet edible manna exudes from the bark and twigs it is actually a gum. Vanillin flavour is obtained as a by-product of other resins that are released from the pulpwood.

**Medicinal Uses:** Antiseptic; Diaphoretic; Diuretic; Rubefacient; Stimulant; Vermifuge. The turpentine obtained from the resin of all pine trees is antiseptic, diuretic, rubefacient and vermicular. It is a valuable remedy used internally in the treatment of kidney and bladder complaints. It is also very beneficial to the respiratory system and so is useful in treating diseases of the mucous membranes and respiratory complaints such as coughs, colds, influenza and TB. Externally it is a very beneficial treatment for a variety of skin complaints, wounds, sores, burns, boils etc.

The wood is diaphoretic and stimulant. It is useful in treating burning of the body, cough, fainting and ulcers.

**Other Uses**

Charcoal, Dye, Herbicide, Ink, lightning.resins.



*Pinus roxburghii* Roxb.

***Pinus wallichiana* A. B. Jackson**

**English name: Himalayan Blue Pine.**

**Hindi name: Chilla, Chiulu**

**Distribution in Nainital:** Sigri area (Kilbury) and Kilbury road, in D.S.B. campus.

**General distribution and habitat-** Bhutan, India (all along east and west Himalaya: Kashmir, Sikkim, Uttarakhand) Nepal, Pakistan. Found in valleys and foothills at elevations of 1800-3900 m, sometimes in pure stands but often in association with conifers including *Cedrus deodara*, *Abies pindrow*, *Picea smithiana* and *Juniperus excelsa* subsp. *polycarpos*, and with broadleaved species including *Quercus semicarpifolia*, *Betula utilis*, *Acer* and *Ilex* species.

**General description-** An evergreen Tree growing to 25m by 10m at a fast rate. Tree may reach 50 m height with straight trunk and short, down curved branches. Branches are longer in solitary trees, creating a dome-like crown.

**Bark** -Orange-brown to gray-brown; initially smooth but developing shallow fissures and flakey plates over time. Branches in regularly spaced whorls smooth. Young shoots glaucous, later turning pale grey-green, smooth, ribbed, and darkening with age.

**Leaves-** in bundles of 5, basal sheaths deciduous, 15-20 cm long, often curved at the base, slender, flexible, abaxial side green, ventral side with multiple bluish-white stomatal lines .

**Flowers-** monoecious (individual flowers are either male or female, but both sexes can be found on the same plant) and are pollinated by Wind. Catkin ovoid. Male strobilli on lower branches, often in dense clusters on younger twigs. Female cones in groups of 1-6, 20-30 cm long, erect when young but later pendant bluish-green when young, maturing to light brown with pale brown apophyses.

**Seeds-** bluish, acute at both the ends, compressed wings 3 times the length of seeds.

**Uses-** Seed - raw or cooked. It has a very resinous flavour and so is not much relished. The seed is quite small, to 7mm long. The honeydew from aphid infested leaves is eaten as manna. Vanillin flavouring is obtained as a by-product of other resins that are released from the pulpwood. The needles contain a substance called terpene, this is released when rain washes over the needles and it has a negative effect on the germination of some plants, including wheat.

**Wood** - Moderately hard, durable, highly resinous. Used in construction, carpentry etc. Good firewood but it gives off a pungent resinous smoke. The wood is rich in resin. It can be fractured and used as a torch.



*Pinus wallichiana* A.B.Jackson

#### TAXACEAE (YEW FAMILY)

**GENERA- TAXUS Linn.**

*Taxus baccata* Linn.

**English name:** Common Yew

**Hindi name:** Thuner

**Distribution in Nainital:** In Botanic garden near Khurpatal (cultivated)

**General distribution and habitat-** *Taxus baccata* Linn. is a conifer native to Western, Central and southern Europe, NorthWest Africa, Afghanistan, India (Eastern and West Himalaya from Kashmir to Arunanchal Pradesh, Naga Hills, khasi hills Manipur), Myanmar, South West China, West Pakistan. Europe, including Britain, The plant prefers light (sandy), medium (loamy) and heavy (clay) soils, requires well-drained soil and can grow in heavy clay soil. It requires dry or moist soil and can tolerate drought.

**General description:** It is a small to medium-sized evergreen tree, growing 10-20 m (exceptionally up to 28 m) tall, with a trunk up to 2 m (exceptionally 4 m) diameter.

**Bark:** The bark is thin, reddish or scaly brown, coming off in small flakes aligned with the stem.

**Leaves:** lanceolate, flat, dark glossy green, 1-4 cm long and 2-3 mm broad, arranged spirally on the stem, but with the leaf bases twisted to align the leaves in two flat vertical rows. The leaves are highly poisonous.

**Flowers:** dioecious, male flowers in catkins which are subglobose and solitary in the leaf-axils, stamens about ten, pollen sacs 5-9,globose,arranged around the filament beneath the tip of the stamen. Female flowers solitary, axillary, each consisting of a few imbricate scales around an erect ovule, which is surrounded at the base by a membranous cup shaped disk.

**Seed:** 4-7 mm long partly surrounded by a modified scale which develops into a soft, bright red berry-like structure called an aril.

**Uses:** Edible Uses

Edible

Parts: Fruit.

Edible Uses: Tea.

Fruit: Raw Very sweet and gelatinous.

#### **Medicinal Uses:**

Antispasmodic; Cancer; Cardio tonic; Diaphoretic; Narcotic; Emmenagogue; Expectorant; Homeopathy; Purgative.

The yew tree is a highly toxic plant that has occasionally been used medicinally, mainly in the treatment of chest complaints. The plants contain the substance 'Taxol' in their shoots. Taxol has shown exciting potential as an anti-cancer drug, particularly in the treatment of ovarian cancers. All parts of the plant, except the fleshy fruit, are antispasmodic, cardio tonic, and diaphoretic, emmenagogue, expectorant, narcotic and purgative. The leaves have been used internally in the treatment of asthma, bronchitis, hiccup, indigestion, rheumatism and epilepsy.

#### **Other Uses**

Fuel;

Ground cover; Hedge; Incense; Insecticide; Wood



*Taxus baccata* Linn.

**TAXODIACEAE (RED WOOD FAMILY)**

**GENERA- *CRYPTOMERIA* D. Don.**

*Cryptomeria japonica* D.Don

**English name:** Japanese Cedar

**Hindi name:** Sugi

**Distribution in Nainital:** Govt. house planted

**General distribution and habitat:** Sugi [Japanese] is the national tree of Japan where it occurs naturally in pure and mixed stands. Also found in China, India (Shillong, Darjeeling). It grows in forests on deep, well-drained soils subject to warm, moist conditions at elevations from below 1100 m to 2500 m.

**General description:** It is a very large evergreen tree, reaching up to 70 m (230 ft) tall and up to 300 cm in diameter with a conical crown and a straight, slender trunk.

**Bark:** reddish brown to dark gray, fibrous, peeling off in strips.

**Leaves:** persisting 4 or 5 years, needle-like, pale green, spirally arranged in 5 ranks, bright to blue-green foliage. Branches usually in whorls, horizontal or drooping, Shoots green, glabrous.

**Flowers:** Male and female flowers on different parts of the same branch. Cone solitary, brownish, globular.

**Cones:** male cones axillary toward apex of second-year branchlets usually crowded into a terminal, sessile, oblong raceme of 6-35, ovoid or ovoid-ellipsoid. **Female cones** are borne in groups of 1-6, terminal, solitary or occasionally aggregated, sessile, globose or subglobose, rosette like and resembling opening buds.

**Seeds:** dark brown, irregularly triangular, each edge narrowed into a rudimentary wing.

**Uses: Medicinal Uses** **Depurative**

Oil and/or a resin from the plant is depurative and also used in the treatment of gonorrhoea.

**Other Uses: Incense, Shelterbelt, Wood**

The leaves are very aromatic and are used as incense sticks. A fairly wind-tolerant tree; it can be used in shelterbelt plantings. Wood - light, fragrant, fine grained. The wood is strongly rot resistant, easily worked, and is used for buildings, bridges, ships, lamp posts, furniture, utensils, and paper manufacture. Old wood that has been buried in the soil turns a dark green and is then much esteemed.



*Cryptomeria japonica* D.Don.

**GENERA- *Taxodium* Rich.**

*Taxodium mucronatum* Ten.

**English- Marsh Cypress (Montezuma Bald Cypress)**

**Distribution in Nainital:** cultivated at Govt. house garden ( gupta 1968)

**General distribution and habitat:** North America, India (Dehradun Forest Research Institute, cultivated) native to much of Mexico (South to the highlands of southern Mexico), and also southernmost Texas, USA. Cypress is primarily a riparian tree, growing along upland riversides, not in swamps or lakes. They are very drought-tolerant and fast-growing which has led to them being frequently cultivated there in parks and gardens. They favor climates that are rainy throughout the year or at least with high summer rainfall.

**General description:** the tree is large; semi evergreen with two types of branches 1- the persistent branches with axillary buds, 2- the deciduous branches attached to the persistent shoots but without axillary buds.

**Bark:** The bark is green in young trees but turns brown and scaly in older trees.

**Leaves:** alternate, in 2 ranks or not. Adult leaves divergent to strongly appressed, linear or linear-lanceolate to deltate, generally flattened.

**Cones:** The plants are monoecious, with male and female cones generally appearing on different branches. Male cone is small, round structure, but becomes oblong at maturity and colour turns dark brown. Microsporophylls are spirally arranged on the cone axis and are surrounded by ovate scales. Female cones maturing and shattering in 1 season, nearly globose; scales falling early, 5-10, valvate, peltate, thin and woody

**Seeds:** 1-2 per scale, irregularly 3-angled, wingless.

**Uses:** The trees are especially prized for their wood, of which the *heartwood* is extremely rot and termite resistant. A biochemical called cypressene is believed to act as a natural preservative in the heartwood. Wood was much used in former days in southeastern USA for shingles. The shredded bark of these trees is used as a mulch.



*Taxodium mucronatum* Ten.

### Conclusion

The present study identified the presence of 15 species of 14 genera under 8 families. These are: *Araucaria cunninghamii* Sweet, *Cephalotaxus griffithii* Hook f., *Biota orientalis* (Linn) Endt, *Cupressus torulosa* D.Don, *Juniperus communis* Linn., *Cycas revoluta* Thunb., *Ginkgo biloba* Linn, *Abies pindrow* Royle, *Cedrus deodara* Roxb. , *Picea smithiana* wall, *Pinus roxburghii* Roxb., *Pinus wallichiana* A.B.Jackson, *Taxus baccata* Linn, *Cryptomeria japonica* D.Don , *Taxodium mucronatum* Ten.

<b>Family</b>	<b>Genera</b>	<b>Species</b>
Arucariaceae	1	1
Cephalotaxaceae	1	1
Cupressaceae	3	3
Cycadeceae	1	1
Ginkgoaceae	1	1
Pinaceae	4	5
Taxaceae	1	1
Taxodiaceae	2	2
Total	8	14
		15

Most of the species belongs to higher altitude. In Nainital the dominance of these species occurs in Ayarpatta, Govt. house, Kilbury, China peak, Snow view, Sher ka danda. *Cedrus deodara* Roxb. *Cupressus torulosa* D.Don, *Pinus roxburghii* Roxb. Occurs in wild state while all others are grown as ornamental plants.

### Acknowledgements

We extend thanks to Vice Chancellor, Kumaun University, Nainital and Head, Department of Botany, Kumaun University, Nainital for providing necessary facilities and encouragements.

### REFERENCES

1. Arnold, C.A. Classification of the Gymnosperm from the view point of palaeobotany. *Bot. Gaz.* 1948;110:2612.
2. Beissner, G. and Hooker , J.D. *Genera plantarum* Kew 1862-63.
3. Biswas, K. The distribution of Wild Gymnosperms in the Indian Empire. *J.Indian bot. Soc.*, 1933; 12(1): 24-27.
4. Chamberlain, C.J. *Gymnosperm Structure and Evolution* . Chicago 1935.
5. Chhonker, U.P.S. & N.S. Bisht.Gymnosperm flora of Nainital and adjacent region. *Proc. India Sci.Cong. Abst*1968; 3:273.
6. Dogra, P.D. Gymnosperm of India II. Chilgosa Pine ( *Pinus gerardiana* Wall.) *Bull.Nat.Bot . Gdn.Lucknow* 1964.
7. Duthie, J.F. *Catalogue of plants of kumaun and adjacent portions of Garhwal and Tibet* . compiled by R.Strachey London, lovell Reive and Co. Ltd 1906.
8. Dutta, S.C. *An Introduction to Gymnosperm* . Asia Publication House 1973.
9. Gupta, R.K. *Flora Nainitalensis*, Navyug publications New Delhi 1968:434-442.
10. Hooker J.D. *The Flora of British India*.London 1888;5:463-686.
11. Jain, S.K. and R.R. Rao. *A hand book of field and Herbarium Method*, New Delhi 1976.
12. Kalakoti , B.S.(1983). *Flora of Nainital Hills* Ph.D. thesis, Kumaun University Nainital.
13. Kalakoti, B.S.&Y.P.S.Pangtey. Additions to the flora of Nainital. *J.Econ . & Tax. Bot* 1984;4:193-195
14. Osmaston, A.E. *A Forest flora for kumaun*. Allahabad: Superintendent, Government press, United Provinces 1927.
15. Pandey, B. & P.C. Pande. Ethnobotanical studies on Gymnospermic plants of Kumaun Himalayas. *J.Econ. Taxon Bot.* 1999; 23 (2): 253-256.
16. Raizada, M.B., K.C. Sahni. Living Indian Gymnosperms. I. *Indian For. Res. (NS) Bot.* 1958;5:73-150.
17. Sahni, K.C. *Gymnosperm in Encyclopedia of India national history* General Edit. R.E. Hawkins, Oxford University press, Delhi 1986:129-134.
18. Sahni, K.C.*Gymnosperms of India and adjacent countries*. Bishen Singh and Mahendra pal Singh, Dehradun 1990.
19. Singh K.P., V. Mudgal. Gymnosperms in Floristic diversity and conservation strategies in India, vol.1, *Cryptogams and Gymnosperms. (ed. V. Mudgal and P.K. Hajra)* Bot. Survey of India. 1997:443-472.
20. Uniyal, S.K. & A. Awasthi. Gymnosperms of Uttar Pradesh; an enumeration. *Indian J. Forestry*, 2000; 23(2): 228-231.

# *Report and Opinion*

ISSN 1553-9873

Marsland Press  
525 Rockaway PKWY, #B44  
Brooklyn, New York 11212, the United States  
Telephone: 718-404-5362  
[sciencepub@gmail.com](mailto:sciencepub@gmail.com)  
<http://www.sciencepub.org>  
<http://www.sciencepub.net>

ISSN 1553-9873

