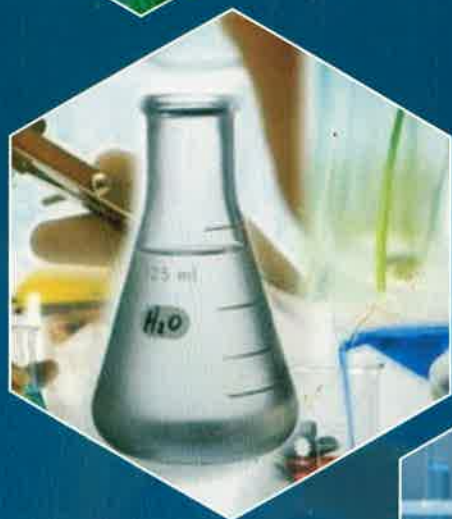


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QUALITY APPRAISAL, MARKETISATION STATUS AND CONSERVATION STRATEGY OF TRADITIONAL MEDICINAL PLANTS IN INDIA

M.P. Trivedi¹, U.K. Sinha² and Y.C. Simhadri³

Key words : Traditional medicinal plants, Quality appraisal, Marketisation, Conservation strategy.

Traditional medicinal plants play an important role in our social health system. They are available in wild or cultivated forms. Some species have been tagged as critically endangered. The global market for herbal products is estimated to be US\$ 6.2 billion which is poised to grow US\$ 5 trillion by the year 2050 with a growth rate of 7%. India's share in the global medicinal plants related export trade is 0.5 percent. There is an urgent need to inventorise and record all ethnobiological information culturally blended among diverse ethnic groups. The present communication is a sincere endeavour to this end.

INTRODUCTION

In Ancient oriental texts human body has been identified as the homeland of various diseases which are caused by diverse pathogens (fungi, bacteria, viruses, protozoans and other microbiota). They may also arise due to environmental pollutants, or may have genetic roots. Sex linked recessive disorders are colourblindness, hemophilia and congenital night blindness. Autosomal recessive anomalies include sickle cell anaemia, phenylketonuria, alkaptonuria, albinism, etc. Diseases like HIV and cancer have created havoc and fear in national and international communities. Anxiety and mental agony stand out as another serious concern. Lack of physical exercise and sluggishness among people have fostered the market of anti-diabetic medicines.

Nature has provided us the medicinal plants to counter many of these ailments. WHO has listed over 21,000 medicinal plant species world wide. Heywood (1991a) reported some 25,000 species of medicinal plants. Out of a total 2,000-2,500 drugs used in curing human diseases in India, only about 200 are of animal origin and an equal number of mineral origin; the rest are of plant origin. The use of medicinal plant has become an integral part of our daily life in different manners (Uniyal and Uniyal, 2002). Our traditional system of medicines, i.e. Ayurveda, Siddha, Unani and Homoeopathy are based on herbal drugs. The well established drugs such as aspirin, codeine, quinine, reserpine, scopolamine, theophylline and vinblastine were all developed from plants and used medicinally for centuries by various civilizations.

Basis of medicinal value of plants

It is due to presence of specific chemical substances such as alkaloids, resins, gums, glucosides, mucilages, tannins, essential and fatty oils which provide physiological action in human body (Das and Das 2002, Trivedi and Nupur, 2006).

The drug obtained from the medicinal plants is quite safe, cheaper and easily available and suits to the local and cultural needs of the people. The health awareness and fear of side effects of allopathic medicines are main reasons for shifting to herbal treatments (Kirtikar and Basu 1984, Sharma 2004, Nargus *et al.*, 2004).

Five amrits in Ayurveda

These are Sarp Gandha, ashwagandha, tulsi, satavar and Amla. The botanical name of Sarp Gandha is *Rauvolfia serpentina* (Apocynaceae), Ashwagandha *Withania somnifera* (Solanaceae), tulsi- *Ocimum sanctum* (Lamiaceae), Shatavar- *Asparagus racemosus* (Liliaceae) and Amla- *Emblica officinalis* (Euphorbiaceae).

Sarp Gandha lowers the blood pressure, ashwagandha increases strength and stamina, tulsi counters cough, cold and enhances immune system, Shatavar rejuvenates and amla is taken as the best source of vit. C and enhances immunity. All these five species have proven significance and are being used by majority of people.

Indian medicinal plants at risk

In the year 2015, IUCN Red List of Threatened Plants reveals the addition of 44 medical plant species from India.

There are 3 categories of such plants :

1. Vulnerable
2. Endangered
3. Critically endangered

In all the 3 categories, the number of plant species has been reduced or will reduce by 80% within 3 generations in critically endangered ones, by 50% within 3 generations in endangered species and by 30% in vulnerable species. These conditions are due to overexploitation, habitat loss and road constructions (Dhyani, 2016).

Some critically endangered species are *Aconitum chasmanthum*, *Chlorophytum borivillianum*, *Lilium polyphyllum*, *Nardostachys jatamansi*, *Tribulus rajasthanensis* and *Commiphora wightii* etc.

Works on Traditional Medicinal Plant

- Jain (1965) has studied medicinal plants of tribals of Bastar.
- Das and Das (2002) surveyed the medicinal uses of local plants by the natives of Vaishali districts.
- Sharma (2004) has listed ethno-medico religious plant of Hadoti Plateau of S.E. Rajasthan.
- Tomar and Singh (2005) worked on medicinal uses of

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some indigenous plants among the village people of Barnawa in Baghpat district (U.P.)

- Tomar and Singh (2006) have worked on ethno therapeutics of some medicinal plants from Khatauli block of Muzaffarnagar district (U.P.)
- Tomar (2008) recently worked on some more folk medicinal plants from same district (Muzaffarnagar).
- Trivedi *et al.* (2007) have extensively surveyed 125 drug yielding plants in Patna and Vaishali districts of Bihar.
- Singh (2010) has listed traditional herbaceous medicinal plants of Bhojpur district (Bihar).
- Pareek and Trivedi (1910) have reported an urgent need to inventorise and record the vast ethnobiological information available with the diverse ethnic communities before the traditional cultures completely vanish. They have focused on plant genetic resource conservation in Kalandera region, Jaipur.
- Sulaiman (2010) worked on ethnobotany of medicinal plants of some remote areas of north Bihar (Sitamarhi and Tarai areas of Nepal).
- Sehgal (2015) has worked on diversity of medicinal plants in Hamirpur district of Himachal Pradesh, India.

TRADE OF MEDICINAL PLANTS

Medicinal plants are sources of wide range of products, e.g., medicine, dietary supplements, food stuffs and cosmetics.

According to WHO 80% of the population relies on the plant based medicines (Pandey *et al.*, 2007). Eighty five percent of traditional medicine involves the use of plant extracts (Farnsworth, 1988).

The bulk of the drug yielding plants is traded domestically and internationally. Contractors, collectors and traders are involved in marketing. Supply chain is very long and has 6 or 7 marketing stages. It involves primary collectors and producers, local contractors, regional wholesale markets, large whole sale markets and specialized suppliers, Industrialists buy from suppliers and wholesalers.

India including Bulgaria and Nepal have banned the export of several wild species in their raw material form but export of finished material is allowed.

MARKET CONDITIONS

Kumar and Janagam (2011) have worked on Exim pattern of medicinal plants in India. The export-import Bank of India in its report for the year 1997 puts medicinal plants related trade in India at US \$ 5.5 billion and the same is growing rapidly. According to WHO, the International market of herbal products is around US \$ 6.2 billion which is expected to grow to US \$ 5 trillion by the year 2050. They reported India's source in the global medicinal plants related export trade at just 0.5%. India has wide and extensive experience in traditional medicines but it has not capitalised the trade in developed countries. It is worthwhile to identify these diseases rampant in developed countries for which no medicines are

available. This would enable rapid access to these herbal medicines in developed countries.

MOUTH TO MOUTH MARKETING

It is very common in villages and even in cities. Use neem stick as tooth brush, take tulsi extract for combating cough and cold, use marigold leaf extract on cut, use leaf paste of chirchiri on head to combat headache, take ajwain powder for bowel upset, take pudina leaf or in capsule for correcting stomach disorder, use turmeric powder with lime on site of sprain and others. These all are examples of mouth to mouth marketing.

Patanjali is selling medicines to cosmetics from retail shops and promising to make available the drugs at our home. In yoga session, these medicines are also being advertised.

If we concentrate on annual demand for prioritised medicinal plants in India and rely on 2004-05 data (source National Medicinal Plants Board) the highest annual growth rate (%) goes in favour of Indian aconite (31), amla (22.5), Sen (21.8), *Bacopa* (20.1), Guggal (19.2), Sandalwood (19.1), Atis (18.4), Holy basil (17.9), *Chlorophytum* (17.2), long pepper (16.3), Liquorice root (15.9), Indian barberry (15.5), Flame lily (15.4), *Shatavari* (15.1), Ashoka tree (15), Picrorhiza (12.9), Ashwagandha (9.1), Bael tree (9.6), Indian Tinospora (9.1), Costus (8.9), Jatamansi (8.7) and in the range of 1-5% Kalmegh (*Andrographis*), black night shade etc.

COLLECTION OF MEDICINAL PLANTS AND ITS QUALITY

They are collected from the wild or cultivated sources. The collection is in the form of bark, leaves, fruits, flowers, woods or roots. Illegal and unscientific collection is common. Wild resource is being lost due to collection of roots, the most difficult part to harvest sustainably. Due to constant exploitation *Dioscorea*, *Ephedra*, *Solanum*, *Rauvolfia*, *Parkia* and others have become threatened (Krishnamurty, 2006), Globally the cultivated materials are available in meagre amount. This is due to high production cost and requires sophisticated management expertise.

In India, we have cheap labour to undertake labour intensive work of collection. Optimal commercialization requirements are :

- (a) Standardised collection methods
 - (b) Ensured quality and quantity
 - (c) Control pest harvest handling
 - (d) Unadulterated material
 - (e) Commercially desirable genotypes
 - (f) Product standards according to consumer demand.
- Quality includes identity, purity and safety as well as efficacy. There are several challenges involved. In assessing quality, we should focus on the following points :
 - Plants have a variety of chemical constituents.
 - The bioactivity varies according to day, season, constellor position and to arid or marshy region.

The bioactivity also depends on the way the plant has been collected, pressed and stored.

Specific recommendations are there for collection of drug yielding plants and the preparations of formulations in order to obtain the best efficacy.

Need of Chromatography and Bioassay

Chromatography is a biochemical tool by which varying chemicals can be isolated and differences in chemical profiles can be judged. The bioactivity of collected plants can be evaluated or prepared according to traditional advice.

Trade in medicinal plants is difficult to be estimated

This is due to unrecorded or poorly classified trade in local area. Domestic trade is also poorly recorded. Plants are collected in unregulated manner resulting into serious damage to biodiversity. Thus it is very difficult to assess global trade in all medicinal plants. There is no individual identification by official trade statistics.

Consumers in developed countries are still dependent on allopathic drugs and are not using traditional medicines as frequently as those in developing countries. Developing countries are the dominant exporters.

In India, around 80% export is in the form of raw materials including dried plant extracts and isolated ingredients. The export of finest medicinal products mostly homoeopathic and ayurvedic medicines account for the remaining 20%. China, The Republic of Korea, Chile, India, Brazil and Thailand have a long tradition of use of medicinal plants and are major exporting countries. China and India, both population giants and have an ancient heritage of traditional herbal based medicines, are worlds largest markets for such plants but they are not largest traders.

Patanjali, *Dabur* and *Himalaya* drugs are doing an efficient trading. They have good infrastructure and are preparing drugs from medicinal plants. They have modern equipments for extract and tablet/capsule formulations. We have no idea about their research aspect. Baba Ramdev stresses on Yoga and ayurvedic medicines for health care. During Yoga session persons performing the *Asan* and *Pranayam* are interviewed. They make statements about their curative history. Thus *Patanjali* is bypassing all the ayurvedic companies like *Dabur*, *Baiydanath*, *Siddha*, *Hamdard* and others.

Basis of medicine formulations in Ayurvedic drugs

The medicine formulations are based on as mentioned in *Charak Samhita*, *Bhav Prakash*, *Nighantu*, *Bhaisajya Ratnawali*, *Sushrut Samhita*, *Sharangdhar Samhita* and other renowned Ayurvedic literatures.

Conservation of medicinal plants needed on urgent basis

In every household *tulsi* is being worshipped. *Peepal* is protected and worshipped. The *Peepal* plant represents giant ecosystem and gives shelter to varieties of wild animals and epiphytes. Their seeds are eaten by crows and birds and finally dropped on the roof of buildings. The plant is not

uprooted by worshipper because in Geeta *Lord Krishna* has stated that 'I am *Peepal* among trees'.

Points of Concern

1. Legislation to control harvesting is inadequate and legislation of trade is ineffective.
2. Lack of awareness among many of the end users as the extent to which wild harvested material used has become a subject of concern. Traders provide no information on the extent of wild harvesting.
3. Low price of wild harvested material has made the procurements of alternative sources of raw material financially unattractive.
4. There exists a limited number of measures for controlling international trade in medicinal plants.
5. There is need of new policy and an easier mechanism to control the trade of plants.
6. There is little or no legislation restricting the use of wild harvested materials in finished products or for assuring the sustainable utilisation of medicinal plants.

TRADING SECTORS

A market survey of 800 households found that traditional medicines were not just used in rural areas but increasingly in urban areas as well.

Cunningham (1996) described three trading sectors for medicinal plants. At the first level there is the national trade in medicinal plants which can involve 100 of species.

The second level again is informal and consists of trades across the national borders but within the same continent.

in Asia, *Nardostachys grandiflora* and *Valeriana jatamansi* are examples of species which are threatened but both are still traded from Nepal to India.

The third level comprises formal export trade. Here only a limited of species were traded in significant volumes.

Cunningham cites Cameroon which exports 4 species to Europe including *Prunus africana* (a bark extract of which is used in the treatment of benign prostratic hypertrophy), all of which is exported to France and, *Pausinystalia johimbe* 65% of which is exported to Holland, 18% to Germany and the rest to Belgium, Luxembourg and France.

The major trading companies are located in Hamberg, New York, Tokyo and Hongkong. They play an enormously powerful role in the medicinal plant trade.

China's total output of medicinal plants from both cultivated and wild harvested sources is 1600000 tonnes. In Germany it is 40,000 tons. China is also a significant exporter of medicinal materials with export sale in 1993 reported at US \$ 27 million.

Strategy for medicinal plant in trade

1. Incentives for collectors and farmers to keep the production of medicinal plants sustainable.
2. Government support for research on these plants.
3. Policies regarding exports of medicinal plants.
4. Promotion of processing in India.

Urgent conservational measures are needed for mass propagation of medicinal plants. Extensive survey is needed to study their distributional pattern in varying ecological niches. Plants should be judged as rare, seldom present, often present, mostly present and constantly present. They should be protected in homegardens, State and National gardens.

Micropropagational works of medicinal plants are going on in different Universities for their mass multiplication. In Patna University Trivedi and Anupama (2011) have worked successfully on micropropagation of *Withania somnifera* and Rashmi and Trivedi (2014a, 2014b) on micropropagation of *Catharanthus roseus*, *Nerium odorum* and *Rauvolfia serpentina*. Prabha and Rolly (2011) worked on quantification of important biomolecules, micropropagation and conservation of commercial medicinal plants (*Asparagus racemosus*, *Chlorophytum borivilianum* and *Phyllanthus amarus*). These are ingredients of several Ayurvedic preparations. Indian Medicinal Plant Board has prioritized their propagation and conservation.

Marker compounds i.e. Phyllanthin and hypophyllanthin were estimated by HPTLC in *Phyllanthus amarus* (Prabha and Rolly 2011). Ten weeks old calli in MS medium with BAP were most suitable for phyllanthin production. Kumari (2014) has successfully cultured anther in *Asparagus racemosus*. In *Chlorophytum* species, haploids and doubled haploids were induced by culturing anthers (Prabha et al. 2012).

Trivedi et al., (2015) have worked out the effect of various growth hormone concentrations and combination on protocol optimization for *in vitro* rapid propagation of *Withania somnifera*. Due to poor viability of stored seed and a lack of definite protocol for *in vitro* multiplication, the present work was undertaken.

Works are going on for micropropagation of *Centella asiatica*, *Scoparia dulcis*, *Curcuma caesia* and others. Extension work is needed for micropropagated plants from research laboratory to farmer's field.

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IMPACT OF SPOROZOASIS ON THE PRODUCTIVITY AND QUALITY OF TASAR COCOONS OF *Antheraea mylitta* D.

Smita Singh and K.B. Sharma

Key words : Impact, sporozoasis, productivity, quality, tasar cocoons, *Antheraea mylitta*

The paper describes the impact of sporozoasis, a serious disease of tasar silkworm, on its rearing performance and quality of tasar cocoons during the seed crop and commercial crop seasons. The results obtained are indicative of the fact that the effective rate of rearing (E.R.R. %), cocoon weight, shell weight, shell ratio and filament length of tasar silk yarn evidently get deteriorated due to the impact of sporozoasis as compared to control. The significant loss in productivity and quality of tasar cocoons of *Antheraea mylitta* is presumed to occur due to the infection of *Nosema* parasite causing pebrin diseases so named as sporozoasis. The loss of productivity and quality of tasar cocoons during the commercial crop season as compared to seed crop season is relatively lesser, which accounts for the significant seasonal variation in relation to the disease.

INTRODUCTION

The production of tasar silk of great commercial importance is based on the culture of different species of *Antheraea* belonging to family saturniidae of order lepidoptera. The principal tasar producing species are *Antheraea mylitta*, *Antheraea pernyi*, *Antheraea roylei* and *Antheraea proylei* existing in tropical and temperate tasar producing zones in our country. Among these *Antheraea mylitta* D., the indigenous tropical tasar silkworm, is very popular and usually reared on tasar host plants namely *Terminalia tomentosa*, *Terminalia arjuna* and *Shorea robusta* during the seed crop (July-August) and commercial crop (September-October) seasons in the tropical belt of India. Tasar culture being practised outdoors suffers great loss of crop (70-80%) due to some serious diseases like microsporodiosis, bacteriosis, virosis and mycosis as investigated by Ahsan (1975). Among these the estimated crop loss due to sporozoasis alone in tropical tasar silkworm is reported to be nearly 40% (Jolly and Sen, 1972).

The sporozoan disease of *Antheraea mylitta* is caused by a microsporidian, *Nosema* species, which is monosporoblastic in nature. The spores of *Nosema* causing dreadful pebrine disease in tasar silkworm are bright, oval in shape but vary in size. They are $5.80 \pm 1.16 \mu$ in length and $2.30 \pm 0.46 \mu$ in width (Akai, 1998). The investigations on the transmission of sporozoasis or so called Nosemosis have revealed that tasar worms acquire infection perorally as well as transovarially. Sluggishness, reduced feeding, thin and darker body, black spots over the integument and stunted growth constitute important characteristics of the pebrine disease of *Antheraea mylitta*. Some notable investigations on the quantitative and qualitative characters of tropical tasar silk have been carried out by Iyenger (2005, 2008). The methods for the grainage operations have been worked out by Krishnaswamy *et al.* (1972).

MATERIALS AND METHODS

The *Nosema* infected diseased as well as non-diseased tasar cocoons of *Antheraea mylitta* D. were obtained from the rearing sites of Chaibasa (Jharkhand). The tasar cocoons were stored separately in Sericulture Research Laboratory, University Department of Zoology, Magadh University, Bodh-Gaya.

PG. Department of Zoology, Magadh University, Bodh-Gaya. All the grainage operations were carried out as per the methods suggested by Krishnaswamy *et al.* (1972). The rearings of diseased (experiment) and non-diseased (control) larvae were carried out on the foliages of *Terminalia arjuna* plants separately during the seed crop and commercial crop seasons. The data in respect of E.R.R.%, cocoon weight, shell weight, shell ratio, length and size of tasar yarn were carefully collected, analysed and presented in Table-1 during both the seasons.

RESULTS AND DISCUSSION

Results obtained have clearly shown that the productivity of tasar cocoons (8.0% and 10.0%) as well as quality of cocoons in respect of cocoon weight (7.58 and 8.10g), shell weight (1.0 and 1.13g), shell ratio (9.11 and 10.21 %), length of tasar yarn (432 and 464m) and size of tasar yarn (7D and 80) as compared to control (E.R.R. 20.0 and 23.0; cocoon weight 10.93 and 11.12g; shell weight 1.82 and 1.90g; shell ratio 11.53 and 11.92%, length of tasar yarn 590 and 628 mtr and size of tasar yarn 11D and 12D) evidently get deteriorated due to the significant impact of sporozoasis during the seed crop and commercial crop seasons. However, the relative losses in the economic characters of tasar during the commercial crop season have been found lesser than the seed crop season, which account for the seasonal effects on the productivity and quality of tasar cocoons of tropical tasar silkworm.

The results so observed become very clear when we consider the fact that the *Nosema* species, the protozoan parasite, is the serious pathogen of tasar silkworm which causes the dreadful pebrine disease owing to its pathogenic actions. The pathogenic impact of the said pathogen has adversely affected and impaired the growth and development of tasar larvae. As a result, sharp deterioration in the productivity and quality of tasar cocoons appears to be the logical outcome and stand to meaningful conclusion and very much in conformities with the earlier works carried out by different sericologists. Further, relatively better productivity and quality of tasar cocoons during commercial crop as

compared to seed crop are probably due to the fact that the commercial crop season provides better and conducive conditions with desired extrinsic factors of environment than the seed crop season.

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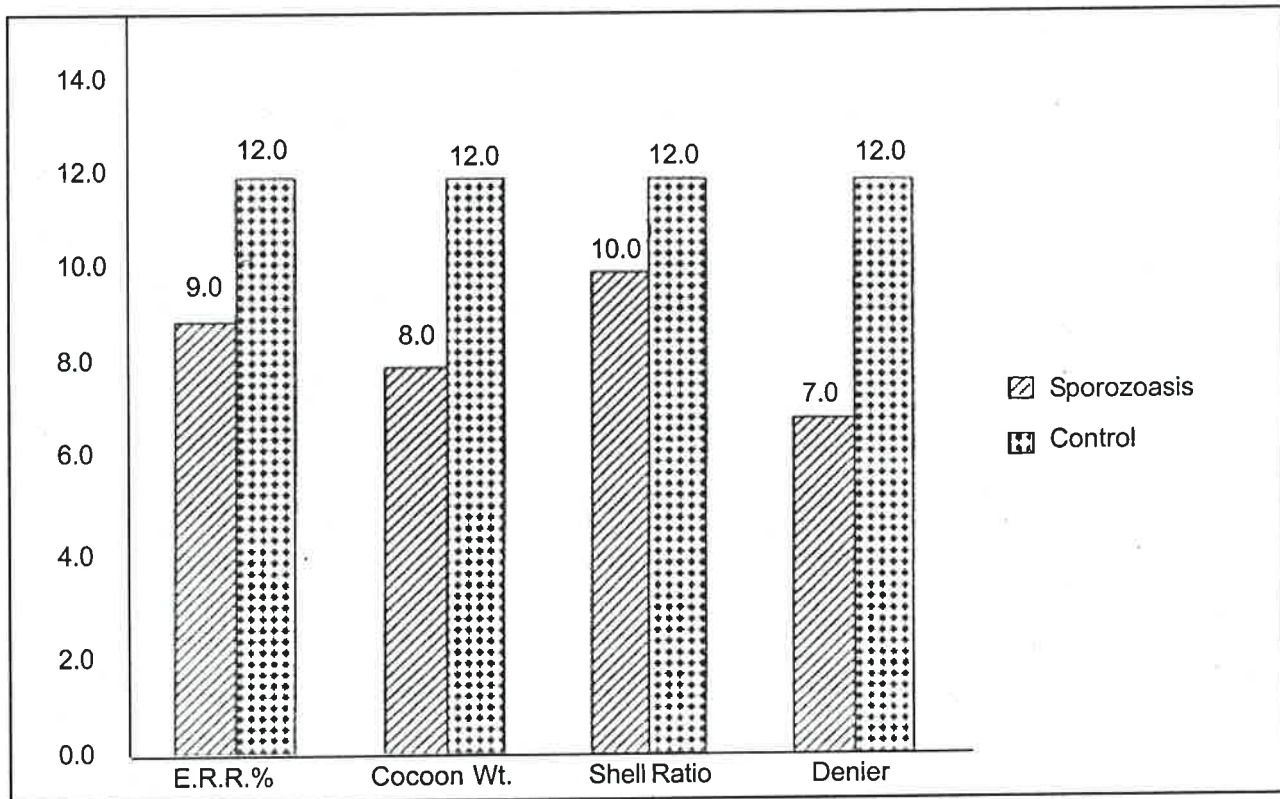


Fig. : Histogram showing average relative productivity and quality of tasar cocoons of *Antheraea mylitta* under the diseased and non-diseased conditions.

Table-1 : Table showing impact of sporozoosis on the productivity and quality of tasar cocoons of *Antheraea mylitta*.

S. No.	Economic characters (Average)	Season	Sporozoosis	Control	C.D at 05% level for Characters
1.	E.R.R. % I II	I 10.0	8.0 23.0	20.0	**
2.	Cocoon weight (gm.) I II	I 8.10	7.58 11.12	10.98	*
3.	Shell weight (gm.) I II	I 1.13	1.0 1.90	1.82	*
4.	Shell ratio (%) I II	I 10.21	9.11 11.92	11.53	*
5.	Length of tasar yarn (mtr.) I II	I 464	432 628	590	**
6.	Size of tasar yarn (D) I II	I 8D	7D 12D	11D	**

E.R.R. : Effective rate of rearing, I : Seed crop season, II : Commercial crop season, D : Denier, * : Significant, ** : Highly Significant.

AN ASSESSMENT OF CYTOTOXIC POTENTIALITY OF *Morus nigra* LEAF EXTRACT ON THE ROOT MERISTEM CELLS OF *Vicia faba*.

Himshikha Yadav*

Key words : *Morus nigra*, cytotoxicity, mitodepression, *Vicia faba*.

The present study attempts to investigate cytotoxic potentiality of *Morus nigra* leaf extract on *Vicia faba* root meristem cells. Different concentrations of aqueous leaf extract of *Morus nigra* have been found to be mitodepressive in dose and time dependent manner and caused several chromosomal aberrations.

INTRODUCTION

Morus nigra (Moraceae) commonly called mulberry is considered to have been originated in Himalayan region of Indo-China. Besides being the sole food plant of silkworm, the mulberry has medicinal significance also. Mulberry leaves have a special quality of moisturizing capacity for skin. Sam Baipi, root of *Morus alba* L. is a traditional Chinese medicine for cough and asthma. Luo *et al.* (1994) had reported that the alcohol extract of Sam Baipi displayed against HIV *in vitro*. Antimicrobial and cytotoxic activity of 18 prenylated flavonoids isolated from medicinal plants, *Morus mongolica*, *Sophora flavescens* and *Echinosophora korensis* was evaluated by Sohn *et al.* (2004) and proved to be antifungal and antibacterial.

The present work aims to investigate the cytotoxic and mitodepressive potentiality of *Morus nigra* leaf extract on mitosis in *Vicia faba* root meristem cells due to its significant position in the field of medicine.

MATERIAL AND METHODS

To obtain stock solution, 1ml leaf extract of *Morus nigra* was dissolved in 1000 ml of distilled water. The required ascending concentrations of 100ppm, 250ppm, 500ppm, 750ppm and 1000ppm were prepared by serial dilution method from stock solution. The *Vicia faba* seeds were presoaked for 12hrs in water and then grown in sterile moist sand at 30°C - 35°C for obtaining the secondary roots by the technique of Kihlman (1975). First of all, roots were cut without any treatment to find control value of mitotic index for *Vicia faba* root meristem.

The roots were then treated with different concentrations of *Morus nigra* leaf extract aqueous solution for two hours, four hours and six hours and after that roots were cut carefully and then fixed in Carnoy's solution (3 ethanol: 1 Acetic acid) for 24 hrs and transferred to 70% alcohol for preservation. The root tips had been hydrolyzed in 1N HCl for 5 minutes and squashed in 2% acetocarmine for cytological studies. The slides were temporarily sealed and examined. The mitotic index had been calculated using the method of Mousa (1982). Chromosomal aberrations and their percentage in each treatment were recorded. To examine recovery treated roots were left in distilled water for 24 hrs and mitotic index was recorded.

RESULTS AND DISCUSSION

To assess the cytological impact of aqueous solution of *Morus nigra* leaf extract on *Vicia faba* root meristem the concentrations viz., 100ppm, 250ppm, 500ppm, 750 ppm and 1000ppm were used for 2 hr, 4 hr and 6 hrs. The mitotic index and different chromosomal aberrations caused by *Morus* leaf extract are presented in Table-1.

A significant decrease in the mitotic index of *Vicia faba* root tip cells was evident when treated with all concentrations and at all durations as compared to control value. Mitodepression is directly proportional to the concentration and time of exposure in most of the cases. The observed mitotic index for *Vicia faba* root meristem in controlled condition was 22.82 and this increased to 25.22 in 100ppm/2hr aqueous leaf extract treatment and declined from 20.37 to 10.25 in 100ppm/4hr and 1000ppm/6hr treatments respectively as compared to control value 22.82. Recovered mitotic index is also shown in Table-1.

No significant aberration was recorded at prophase. Breakage, clumping, scattering, Ring and stickiness of chromosomes were observed at metaphase.

Breakage and scattering of chromosomes at metaphase were observed in the treatments of all concentrations of aqueous solution of *Morus nigra* leaf extract. Percentage of chromosomal breakage enhanced as 6.25, 11.11 & 14.81 in 100 ppm, 250 ppm and 500 ppm treatments respectively whereas reduced to 4.54 in 750ppm and again increased to 10.10 in 1000 ppm treatments. Clumping and stickiness of chromosomes was found only in 100ppm aqueous leaf extract treatment and ring formation was observed in 250 ppm aqueous leaf extract only. Extrusion of chromosomes and polarity abolition at anaphase were reported and no specific trend in their induced percentage by treatments of aqueous leaf extract of *Morus* was reported. Yadav *et al.* (2005) found stickiness, extrusion and polarity abolition of chromosomes when treated root meristem cells of *Allium cepa* with heavy metal. Yadav *et al.* (2005) also reported polarity abolition in *A. sativum* treated with synthetic food colours. Yadav and Yadav (2007) also observed breakage and scattering of chromosomes at metaphase. They again noticed polarity abolition at anaphase when root tip cells of *Vicia faba* were treated with *Momordica* fruit extract aqueous solution.

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Mitodepression by aqueous leaf extract of *Morus nigra* also supports its cytotoxic effects. Akinboro and Bakare (2007) reported cytotoxic and genotoxic effects of aqueous extracts of five medicinal plants on *Allium cepa*. Saxena *et al.* (2010) also observed carbofuran induced cytogenetic effects in root meristem cells of *Allium cepa* and *Allium sativum*. Akinboro *et al.* (2011) also examined mutagenic and antimutagenic potentials of fruit juices of five medicinal plants in *Allium cepa*.

Based on these findings, this study therefore sought to evaluate cytotoxic potentiality of aqueous extract from leaves of *Morus nigra* with a view to its safe use in folkloric medicine.

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TABLE-1 : Mitotic Index, frequency of aberrations and their percentage as induced by aqueous solution of *Morus nigra* leaf extract on *Vicia faba* (2n=12)

Concentration	100 ppm			250 ppm			500 ppm			750 ppm			1000 ppm			C O N T R O L					
	2	4	6	%of abr. (Conc wise)	2	4	6	%of abr. (Conc wise)	2	4	6	%of abr. (Conc wise)	2	4	6		%of abr. (Conc wise)				
Mitotic index (in %)	25.22 ±1.10	20.37 ±2.03	17.73 ±0.90		17.67 ±0.83	17.26 ±0.83	14.55 ±0.64		19.62 ±0.78	14.54 ±1.40	12.39 ±0.67		16.66 ±0.78	12.43 ±1.62	10.30 ±0.91		13.66 ±1.43	12.28 ±0.66	10.25 ±0.48	22.82	
Recovered Mitotic Index (in %)	24.29	22.85	20.00		18.75	17.32	14.72		19.87	16.08	14.40		17.58	12.65	10.20		13.63	12.43	11.58	-	
Types of aberrations	-	Br M	Br M	6.25	Br M	-	-	11.11	Br M	-	-	14.81	Br M	-	-	4.54	Br M	Br M	-	10.10	
	-	-	-	-	C.S. M	-	C.S. M	5.55	-	-	-	7.40	-	-	-	-	-	-	C.S. M	-	10.10
	-	-	cmp	3.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	M	-	-	Rg M	-	-	5.55	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sc	Sc	-	12.50	-	Sc	11.11	Sc	Sc	Sc	Sc	11.11	Sc	Sc	Sc	18.18	Sc	Sc	Sc	10.00	
	M	M	Sk	6.25	-	M	-	M	M	M	M	-	M	M	M	-	M	M	M	-	
	-	-	M	10.00	Ex	-	Ex	6.66	Ex	Ex	Ex	-	Ex	Ex	Ex	-	Ex	Ex	Ex	28.57	
	Ex	'A'	'A'	-	'A'	'A'	'A'	-	'A'	'A'	'A'	-	'A'	'A'	'A'	-	'A'	'A'	'A'	-	
	-	-	-	-	-	-	-	-	-	P.A.	-	-	-	-	-	-	-	-	-	14.28	
	-	-	-	-	-	-	-	-	-	'A'	-	-	-	-	-	-	-	-	-	-	

Abbreviations: Br 'M'- Breakage of chromosomes at metaphase, C.S. 'M' - Chromatid Separation at metaphase, Cmp 'M' - Clumping of Chromosomes at metaphase, Rg 'M' - Ring at metaphase, Sc 'M' Scattered metaphase, Sk 'M' - Stickiness of chromosomes at metaphase, Ex 'A' - Extrusion of Chromosome at anaphase, PA 'A' - Polarity Abolition at anaphase.



ETHNO-MEDICINAL PLANTS USED BY ETHNIC COMMUNITY (MUSHAHAR) IN PHARKIYA REGION OF KOSHI BELT, BIHAR

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Key words :

Ethno-medicine, Mushahars, Pharkiya region, North-East Bihar.

Herbal medicines have been in prevalent use for the cure of most of the common and serious diseases across the world. Due to ethnic and economic reasons, a major section of the marginalized population largely depends on medicinal plants for rescue and relief from diseases and related sufferings. During the present study a total of 71 plant species have been screened from the Pharkiya region of Koshi belt where poverty and incidence of diseases are reportedly quite high. A large section of local population especially the ethnic groups such as mushahars (rat catchers) traditionally depend mainly on these plants. Various other facts and parameters pertaining to the ethnic community and the herbal medicines have been studied in detail.

INTRODUCTION

Man's dependence on plants as natural resource for food, shelter and medicine has been an established saga of human history. This relationship is quite intimate and intricate since early days and the same is reflected in all our traditional beliefs and life styles (Rigveda, 4500-1600 B.C., Charak Samhita, 1000-800 B.C., Sushrut Samhita, 800-700 B.C.). In spite of different alternative modes of treatment available, value of herbal medicines has assumed tremendous significance in the cure of various diseases and ailments the human race suffers from. In fact 80% of the rural world population depends on plant resources for the sustainable primary health care. A substantive amount of indigenous knowledge has been built up through "trial and error" methods since early days of civilization (Arber, 1938). During recent years an area has been specified for ethno-medicines where the detailed knowledge of plants and their parts used by aboriginal population in the cure of diseases has developed (Sofowora, 1982). The area carries the total account of beliefs, knowledge, concepts and practices of ethnic people to cure, prevent and mitigate human sufferings. Focus to health has received special impetus now a days and value of ethno-medicine is scientifically proved. There have been various agencies such as indigenous pharmacopoeia, folklore and herbal charms that have strengthened this domain of human knowledge (Weiner, 1971).

India has been recognized as a great repository of medicinal plants. Some of them are very rare and exclusive natural property of the nation. About 2500 plants species used as healing agents have been recognized. Such a magnificent diversity provides the foundation behind the establishment of a branch of medicinal science, the Ayurveda (Gadgil, 1993). During the course of present investigation an area extending within the range of 750 square miles in the Pharkiya region of Koshi belt has been surveyed ethno-medicinally. The area is a homeland of ethnic community called Mushahar which constitutes a major section in this poverty stricken region. Because of the ethnic and economic reasons, this community

has learnt the secret value of medicinal plants in the area. In total, 71 plant species have been recorded from this area through periodic surveys and personal interactions. The local population has recognized various plant parts and products to be used as herbal medicines.

STUDY AREA : Historical texts reveal that in the middle of 16th century Raja Todarmal, Finance Minister of Emperor Akbar, started to survey the entire area. Due to thatching grasses and shifting the path of perennial rivers such as Ghaghri, Koshi, Kareh, Kamla, Bagmati, Burhi Gandak and Ganga he could not survey this area. So he adopted the policy of "Farak Kiya". "Farak" is a Persian word which means to separate. That is why this area is called "Pharkiya region".

Pharkiya region measures 750 square miles. It has 7 Police thanas named as Khagaria, Gogri, Chautham, Parbatta, Alauli, Beldour and Simri Bakhtriyarpur. Out of them Simri Bakhtriyarpur forms part of Saharsa district and rest are parts of Khagaria district.

TOPOGRAPHY : Pharkiya region lies in between 25° 15'-25° 50' N latitude and 86° 20' -86° 54' E longitude. Its average maximum and minimum temperature ranges between 36.6°C and 20.9°C. The average annual rainfall is 557.5mm.

The area is the homeland of an ethnic community called Mushahars. The Mushahars were once rat catchers but this activity has been almost obscure. They are now landless agricultural labourers. They are one of the most marginalized groups in India and have suffered social and economic discrimination. Although the Mushahars are Hindu, they believe in a number of tribal deities. (Hunter, 1877; O' Malley, 1925). They are found more or less throughout Pharkiya region and their population is about 1.25 lakh.

MATERIALS AND METHODS

Periodic survey of the area has been undertaken between 2009-2013 at a regular interval of 3-4 months each year. The demographic account of the local population and distribution pattern of the ethnic community (mushahars) have been spotted. A knowledge of medicinal plants and the way of use have been known through personal interaction of the village "Vaidyas", "Ojhas", "Gunnies" and "Malies". They are basically

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ethnic doctors who provided readymade information. For scientific confirmations patients were also interviewed personally to judge the efficacy of traditional knowledge.

The collected plant species were taxonomically identified through herbarium matching and also through taxonomic keys (Hains, 1924; Hooney, 1950; Jain *et al.*, 1978, 1991; Pal *et al.*, 1998). The dried specimens have been preserved in herbarium records.

RESULTS AND DISCUSSION

The results have shown that of the 71 plants species, the 66 species are grouped under 39 dicot families and likewise 5 species fall under 3 families of monocots. The list of collected plant species has been shown in Table-1. This table presents account of plant species, their local names, habits, plant parts used, present occurrence and medicinal

uses of the collected specimens. Pie charts-1 and 2 give an account of percentage of habits and percentage of occurrence of the plants under reference. Table 2 gives an account of various plant parts used in different species under reference. A graphical representation of different diseases *vis-a-vis* number of plants species has been shown in the Graph-1. Photographs of ethnic women with collected medicinal plants and preparation of medicines have been shown in subsequent photographs 1 and 2.

The area under reference has been found to be highly reproductive in terms of medicinal plants and shows over dependence of local population on these plants. A sustainable bio-conservation of some rare plant species with high medicinal potential and viable commercial value has been advised. (Chandel *et al.*, 2013).

TABLE-1 : List of Collected Ethno-medicinal Plants.

Sl. No.	Scientific Name & Family	Local Name	Habit	Parts used	Occurrence	Ethno-medicinal uses
1	<i>Abroma augusta</i> , Linn (Sterculiaceae)	Ultakamal	Shrub	Root, barks	common	Used in menstrual ailment, uterine trouble and diabetes.
2	<i>Abrus precatorius</i> , Linn (Fabaceae)	Ratti	Shrub	Seed	Ruderal	Powder of seed is used in asthma and cardiac disease.
3	<i>Abutilon indicum</i> , Linn (Malvaceae)	Kanghi	Shrub	Seed, Root	common	Used in cough, piles, gonorrhoea and fever.
4	<i>Acacia arabica</i> , willd (Mimosaceae)	Babul	Tree	Branches of stem and leaves	common	Used in toothache and ulcer.
5	<i>Adhatoda vasica</i> , Nees (Acanthaceae)	Bakas	Shrub	Leaf	common	Juice prepared from leaves used in asthma and cough.
6	<i>Anacyclus pyrethrum</i> , DC (Asteraceae)	Akarkara	Herb	Flower, Root	common	Helpful in joint pain and epilepsy.
7	<i>Andrographis paniculata</i> , Nees (Acanthaceae)	Kalmegh	Herb	Leaf	Endangered	Useful in curing fever and overfulness of stomach.
8	<i>Anona squamosa</i> L. (Anonaceae)	Sarifa	Tree	Leaf	common	Paste of leaves used in headache and jaundice.
9	<i>Argemone mexicana</i> , Linn (Papaveraceae)	Peela kataya	Fruicose herb	latex	common	Latex used in skin disease.
10	<i>Aristolochia indica</i> , Linn (Aristolochiaceae)	Astakbatti	Twiner	Root	Endangered	Root paste used in snake bite.
11	<i>Artemisia vulgaris</i> , Linn (Asteraceae)	Damnak	Shrub	Leaf	Endangered	Leaf juices helpful in fever, stomach disorder and diabetes.
12	<i>Bacopa monieri</i> , Linn (Scrophulariaceae)	Jalneem	Creeper	Whole plant	Endangered	Helpful in insomnia and tension.
13	<i>Bambusa tulda</i> , L. (Poaceae)	Bans	Woody herb	Stem and Young shoot	common	Shoot mixed with lime used in healing of wound.
14	<i>Barleria prionitis</i> , Linn (Acanthaceae)	Pilabasa	Small shrub	Root and Leaf	common	Helpful in abdominal disorder, fever, cough, dropsy and toothache.
15	<i>Boerhaavia diffusa</i> , Linn (Nyctaginaceae)	Punamava	Herb	Root	common	Used in anaemia, asthma and jaundice.
16	<i>Caesalpinia bonducella</i> , Fleming (Caesalpinaceae)	Karanj	Shrub	Leaf and Seed	common	Used in fever, pox, diabetes, leprosy and malarial fever.
17	<i>Calotropis procera</i> , Ait (Asclepiadaceae)	Aak	Shrub	Latex Leaves	common	Leaf juice mixed with cardamom generally used as antidote.

18	<i>Cannabis sativa</i> , Linn (Cannabaceae)	Bhang	Herb	Leaves	common	Paste of leaves is used to remove tiredness.
19	<i>Carica papaya</i> , Linn (Caricaceae)	Papita	Small tree	Latex, Fruit	common	Fruits improve appetite and remove digestive disorder.
20	<i>Cassia augustifolia</i> , Vahi (Caesalpiniaceae)	Sanay	Shrub	Leaf and Pod	common	By eating they "remove constipation and jaundice.
21	<i>Cassia fistula</i> , L (Caesalpiniaceae)	Amaltas	Tree	Leaf	common	Leaf removes sore and kills ring worms.
22	<i>Catharanthus roseus</i> , L (Apocyanaceae)	Sadabahar	Fruiticose herb	Whole plant	Rare	Anti-cancerous and anti-diabetic.
23	<i>Chrysanthemum coronarium</i> , Hort (Asteraceae)	Guldaudi	Fruiticose herb	Leaf	common	Helpful in skin burn and leprosy.
24	<i>Cissus quadrangularis</i> , Linn. (Vitaceae)	Harjor	Climber	Root, Stem and Leaf	Climber	Helpful in arthritis, piles and asthma.
25	<i>Citrus medica</i> , Watt (Rutaceae)	Kagaji nimbu	Shrub	Fruit	common	Juice of fruit removes indigestion and increase appetite.
26	<i>Cleome viscosa</i> , Linn (Capparidaceae)	Hulhuli	Herb	Leaf and Seed	common	Used in headache, uterine trouble and worms.
27	<i>Clerodendron indicum</i> , Linn (Verbenaceae)	Ishargat	Shrub	Root, Stem and Leaves	Rare	Helpful in snake bite and rheumatism.
28	<i>Clitoria ternatea</i> , Linn (Fabaceae)	Aparajita	Creeper	Root, leaf	Rare	Used in headache, bleeding and migrain.
29	<i>Coccinia indica</i> , W & A (Cucurbitaceae)	Jangali Kundari	Climber	leaf	common	Leaf juice removes skin disease.
30	<i>Coleus aromaticus</i> , Benth (Lamiaceae)	Patta ajwain	Herb	leaf	Rare	Used in indigestion.
31	<i>Coriandrum sativum</i> , Linn (Apiaceae)	Dhania	Herb	Whole plant	common	Used in gastric, sunstroke and indigestion
32	<i>Croton sparciflorus</i> , Linn (Euphorbiaceae)	Mirchaia	Herb	Latex	common	Used as antiseptic and helpful in insect bite.
33	<i>Curcuma domestica</i> , Val (Zingiberaceae)	Haldi	Herb	Rhizome	common	Used in cold, fever, cough, eczema and diabetes.
34	<i>Cuscuta reflexa</i> , Linn (Convolvulaceae)	Amarbel	Herb	Stem	Endangered	Helpful in skin trouble.
35	<i>Cynodon dactylon</i> , Linn (Poaceae)	Doob	Herb	Leaf	common	Chewed leaves help in checking bleeding, diarrhoea, eczema and hiccuping.
36	<i>Datura metel</i> , Linn (Solanaceae)	Datura	Fruiticose herb	Leaf	common	Leaf paste used in wound.
37	<i>Euphorbia hirta</i> , Linn (Euphorbiaceae)	Dugdhika	Herb	Latex	Abundance	Milky latex used in treatment of wounds and cracks.
38	<i>Euphorbia nerifolia</i> , Linn (Euphorbiaceae)	Sehand	Shrub	Leaf, Stem Latex	Abundance	Used in cough, earache and toothache) Latex used in skin disease.
39	<i>Euphorbia thymifolia</i> , Linn (Euphorbiaceae)	Chhoti Dudhi	Climber	Root	Endangered	Drugs obtained from roots are useful in fever, skin disease & loss of appetite.
40	<i>Ficus glomerata</i> , Roxb (Moraceae)	Gular	Tree	Fruit	common	Helpful in indigestion.
41	<i>Glycyrrhiza glabra</i> , Linn (Fabaceae)	Mulethi	Shrub	Roots and Stem	common	Drugs obtained from roots and stem are believed to be useful in cough, sore, throat, abdominal pain & epilepsy.

42	<i>Gymnema sylvestre</i> , R.Br. (Asclepiadaceae)	Gunnar	Climber	Stem	common	It decreases the level of sugar in diabetes.
43	<i>Heliotropium indicum</i> , Linn. (Boraginaceae)	Hathisur	Herb	Flower,	Roots	Used in boils, wounds, common swelling and snake bite.
44	<i>Hibiscus rosa-sinensis</i> , Linn (Malvaceae)	Arhul or Gurhal	Shrub	Leaf	common	Paste of leaf applied on hairs for their proper growth.
45	<i>Hydrocotyle asiatica</i> , Linn (Apiaceae)	Brahmi	Herb (Mandukparni)	Leaf	common	Removes nervous disorder, high B.P. and insomnia.
46	<i>Kalanchoe pinnata</i> , Linn (Crassulaceae)	Pattharchatta	Herb	Leaf	common	Dissolves stone in kidney.
47	<i>Lawsonia alba</i> , Linn (Lythraceae)	Mehndi	Shrub	Leaf	Endangered	Leaves are applied locally on boils, burns and skin diseases
48	<i>Linum usitatissimum</i> , Linn (Linaceae)	Tisi	Herb	Seed	common	Used in ripening of wounds, high B.P., burns and skin disease.
49	<i>Lippia nodiflora</i> , (Verbenaceae)	Jalpipari	Herb	Entire plant	common	Acts as blood purifier and helpful in diarrhoea.
50	<i>Melia azadirachta</i> , Linn (Meliaceae)	Neem	Tree	Barks & Root	Endangered	Bark breaks the periodic sequence of fever (malaria) and used in skin diseases.
51	<i>Mentha piperita</i> , Linn (Lamiaceae)	Pipermint	Herb	Leaf	common	Leaf decoction used in removing jaundice.
52	<i>Mentha spicata</i> , Linn (Lamiaceae)	Pudina	Herb	leaf	common	Infusion of leaves used in rheumatic pain and indigestion
53	<i>Momordica charantia</i> , Linn (Cucurbitaceae)	Karela	Climber	Fruit	common	Fruits help in blood purification.
54	<i>Mucuna prurita</i> , Hook (Fabaceae)	Kavachh	Climber	Fruit and Seeds	common	Helpful in joint pain and T.B.
55	<i>Musa sapientum</i> , Linn (Musaceae)	Kela	Long	fruit	Abundance	Fruits used in removing digestive ailments.
56	<i>Nerium indicum</i> , Mill (Apocynaceae)	Kaner	Shrub	Leaves	Endangered	Leaf paste used in wound.
57	<i>Ocimum canum</i> , Sines (Lamiaceae)	Vantulsi	Herb	Leaf	common	After taking orally leaf juice is helpful in removing cough and headache.
58	<i>Papaver somniferum</i> , Linn (Euphorbiaceae)	Posta Khas-Khas	Herb	Seed	common	Used as worm killer and in cough & pain.
59	<i>Phyllanthus niruri</i> , Linn (Euphorbiaceae)	Bhui Amla	Tree	Fruit	common	Fruit powder after mixing goat milk is helpful in treatment of cough.
60	<i>Piper longum</i> , Linn (Piperaceae)	Piper	Climber	Fruit	Endangered	It gives a feeling of warmth & causes sweating.
61	<i>Punica granatum</i> , Linn (Punicaceae)	Anar	Shrub	seed	common	Testa of seed used in dysentery.
62	<i>Rauwolfia serpentina</i> , Benth (Apocyanaceae)	Sarggandha	Shrub	Root	common	Juice of roots are used in reducing B.P. and also useful in diseases of bowels and in fever.
63	<i>Sesamum indicum</i> , Linn (Pedaliaceae)	Til	Herb	Leaf	common	It removes obstructions in kidney. It is also used in the cases of congested heart failure.
64	<i>Sesbania grandiflora</i> , Linn (Fabaceae)	August	Herb	Leaf, Flower Root	common	Useful in epilepsy, night blindness & rheumatism.
65	<i>Solanum nigrum</i> , Linn (Solanaceae)	Makoi	Herb	Whole plant	common	Plant parts are taken as food to treat cough.

66	<i>Tagetes erecta</i> , Linn (Asteraceae)	Genda	Fruiticose herb	Leaves	common	Leaves used in healing of wound and check bleeding.
67	<i>Terminalia bellerica</i> , Roxb. (Combretaceae)	Bahera	Herb	Fruit	Endangered	Used in removing cough in child.
68	<i>Terminalia chebulu</i> , Retz. (Combretaceae)	Haray	Herb	Fruit	Endangered	Used in removing cough in child.
69	<i>Thuja orientalis</i> , Linn (Cupressaceae)	Morpankhi	Shrub	Green flat branches	Endangered	Useful in rheumatism, vomiting, fever and cough.
70	<i>Trigonella foenum-graecum</i> , Linn (Fabaceae)	Methi	Herb	Leaves	common	Leaves used in constipation and remove indigestion.
71	<i>Zingiber officinale</i> , Rose (Zingiberaceae)	Adrakh	Herb	Leaves	common	Used in sciatica, rheumatism, gout and asthma.

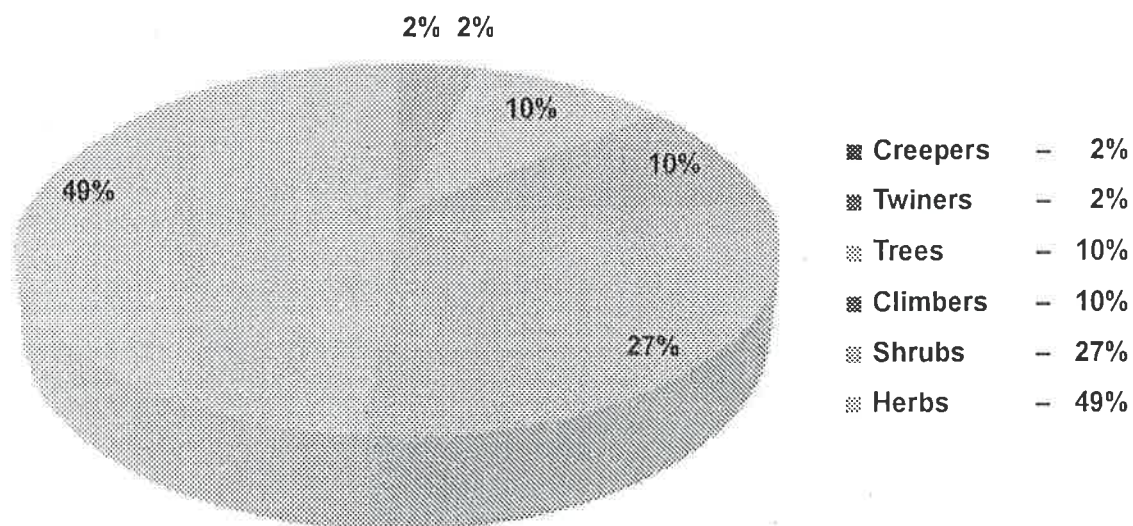


Fig. 1 : Showing percentage of habit of plants

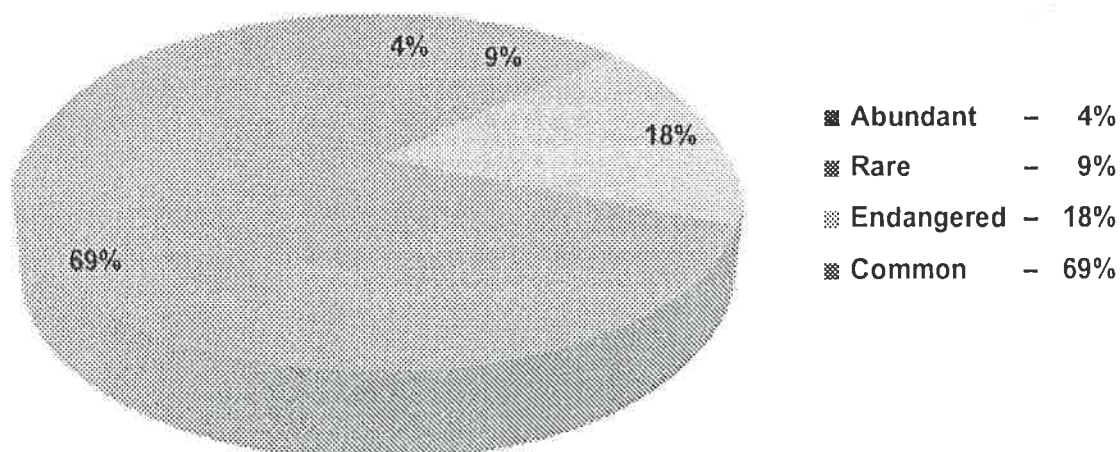
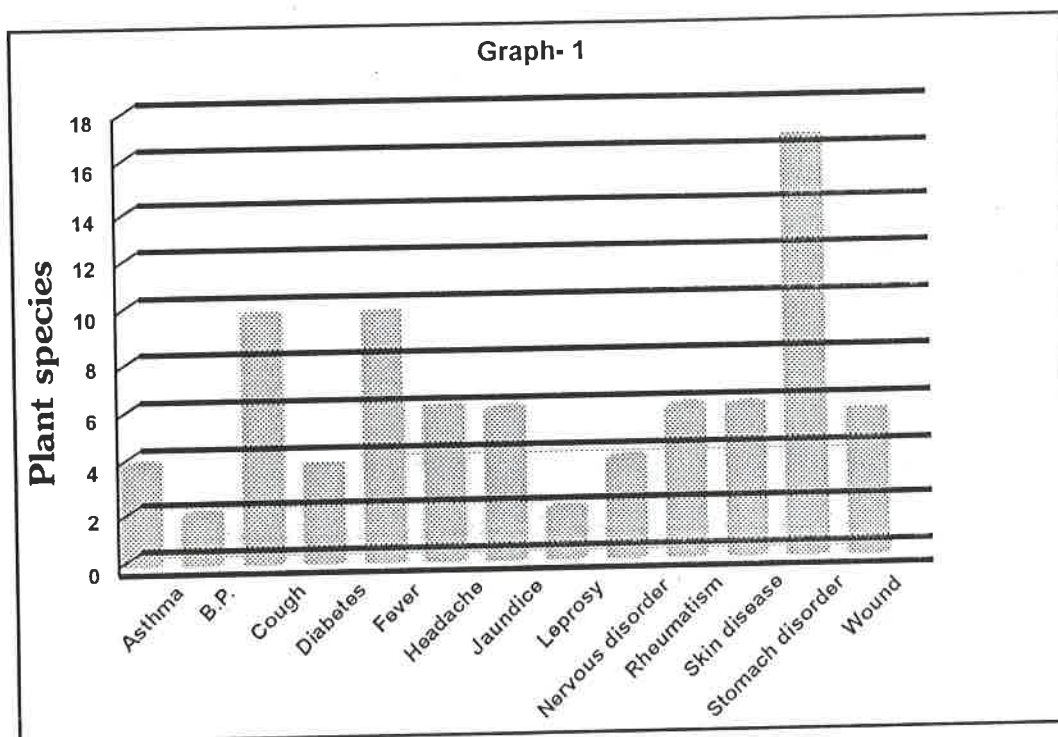


Fig. 2 : Showing percentage of occurrence of plants

Diseases of Pharkiya Region

Several diseases occur in this region such as anaemia, asthma, B.P., cardiac disease, cold, cough, diabetes, diarrhoea, dysentery, eczema, epilepsy, fever, gonorrhoea,

gout, headache, hiccupping, jaundice, kidney failure, menstrual problem, leprosy, nervous disorder, night blindness, piles, rheumatism, skin disease, stomach disorder, T.B., toothache and wound. Out of them common diseases are shown graphically.



Graph 1: Showing types of diseases

TABLE 2 : Plants parts and number of plant species used in different diseases

Plant parts used	Root	Stem	Leaf	Flower	Fruit	Seed	Bark	Whole plant
Number of plant species	13	09	22	03	10	07	02	05

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Fig. 1 : A mushahar woman selling Ayurvedic medicines in Village Hatt



Fig. 2 : A mushahar woman preparing paste and decoction by crushing medicines

RELATIVE IMPACT OF DISEASES ON THE BIOCHEMICAL CONTENTS OF TASAR SILKWORM *Antheraea mylitta* D. (SATUNIIDAE : LEPIDOPTERA)

Vinta Kumari

Key words : *Impact, diseases, silkworm, biochemical contents.*

The present communication describes the relative impact of four different types of diseases of tasar silkworm namely microsporidiosis, polyhedrosis, bacteriosis and mycosis on the biochemical contents at larval, pupal and adult stages of its life cycle. The results obtained are indicative of the fact that said diseases adversely affect the protein, carbohydrate, lipid and ash contents (% -age) at different stages of the life cycle of *Antheraea mylitta* D. The estimated biochemical contents in relation to impacts of said diseases are significantly lesser than the control with relative variations. The evident decrease in the percent biochemical contents at different stages of life cycle of *Antheraea mylitta* is probably on account of the pathogenicity of different invading pathogens with unique physio-genetic make up causing the said diseases. Among the four diseases the relative impact of microsporidiosis causing pebrine disease has been found to be more harmful as compared to other diseases.

INTRODUCTION

The tropical tasar silkworm, *Antheraea mylitta* D. belonging to family Saturniidae of the order Lepidoptera suffers great loss of crop due to diseases like microsporidiosis, polyhedrosis, bacteriosis and mycosis (Jolly and Sen, 1972). The evident biochemical variations in relation to free amino acid contents among the diseased and non-diseased tasar silkworm have been reported by Agrawal *et al.* (1974). The epidemic nature of nosema infection causing microsporidiosis has been investigated in potato tubeworm by Allen and Brunsen (1949). Griyaghey *et al.* (1975) has reported that microsporidiosis in *Antheraea mylitta* has assumed a menacing proportion in the major tasar tracts of Bihar. The disease, which is transovarially transmitted, affects emergence, reproductive potentials, viability and quantitative cocoon character of the tasar insect and there are reports of thermic control of microsporidiosis up to the desired extent. Likewise, polyhedrosis in the tropical tasar silkworm, *Antheraea mylitta* is responsible for 20-25% of crop loss (Sharma and Pandey, 1990). Sharma and Pandey (1990) have further investigated the useful effects of some egg surface sterilants in minimising the polyhederal disease in tasar silkworm. The pathological nature of bacteriosis due to bacterial infection has been carried out in tasar silkworm in relation to deterioration in the quantitative and qualitative characters of tasar (Griyaghey and Gupta, 1978). Pandey (1989) has found significant behavioural and biochemical differences in relation to diseased and non-diseased conditions in indigenous tasar silkworms. He has reported that the bacterial (bacteriosis) and fungal (mycosis) infections retard the growth and development of tasar worm and seriously impair the tissues resulting in the physiological disturbances. However, biochemical studies in respect of diseases of tasar silkworm are quite fragmentary; hence, a comprehensive picture concerning relative variations in respect of various diseases has not yet emerged. The present communication has been designed to examine the relative

biochemical variations in relation to different diseases of Indian tasar silkworm at various stages of the life cycle.

MATERIAL AND METHODS

The haemolymph of larva, pupa and adult tasar silkworm (*Antheraea mylitta*) infected by the diseases like microsporidiosis, polyhedrosis, mycosis and bacteriosis were carefully collected and further estimated for different biochemical contents as per the method given below :

(a) Estimation of protein : The protein content at different stages of life cycle was estimated by determining the amount of nitrogen by Duma's method (Bernard, 1954) and multiplying it by 6.25. This gave the amount of protein present. The data were carefully recorded for each set of experiment.

(b) Estimation of lipid : The weight of larva, pupa and adult stages of *Antheraea mylitta* were taken and placed in saxhlet with heating mantle (250 ml capacity) to extract the lipid. Petroleum ether was used as solvent and the extraction period was kept in the range of 24 to 30 h. The insoluble residues obtained were dried separately in an oven maintained at 25°C for 2 to 3 h till the constant weights were obtained. The difference in weight before and after the lipid extraction gave the lipid content in the body of the insect at different stages in relation to three types of diseases. The data were recorded separately.

(c) Estimation of Carbohydrate : By using the following equation the percent carbohydrate content at larva, pupa and adult stage of diseased tasar silkworm were calculated and recorded in the table. Carbohydrate = Dry weight of the insect - (weight of protein + weight of lipid + weight of ash).

(d) Estimation of ash : In order to estimate the ash content, the larval, pupal and adult stages of the insect were weighed separately and heated in crucibles on spirit lamps for 10 to 14 h. The weights were taken again after cooling which gave the amount of ash. The data were collected separately for different stages with respect to three diseases and presented in the table to ascertain relative variations.

RESULT AND DISCUSSION

Data concerning biochemical variations due to four popular diseases of *Antheraea mylitta* are given in the Table. From the perusal of the data it is evident that percent protein (52.51, 50.42, 53.54), lipid (18.19, 13.93, 15.43) and carbohydrate (7.39, 10.39, 7.39) contents are relatively lesser due to microsporidiosis (Nosema infection) in comparison to polyhedrosis (viral infection), bacteriosis (bacterial infection) and mycosis at larval, pupal and adult stages of tasar silkworm. The significant decrease in the concentrations of protein, lipid and carbohydrate in relation to different diseases of tasar silkworm has been observed in the following relative order : Microsporidiosis : Polyhedrosis : Bacteriosis : Mycosis. However, the percent concentrations of protein, lipid and carbohydrate in all the four diseased conditions of tasar silkworm are significantly lower as compared to normal and healthy tasar silkworm (control). The percent protein (60.62, 57.42, 59.45), lipid (24.42, 18.32, 19.61) and carbohydrate (10.72, 14.92 and 10.53) contents at larval, pupal and adult stages of *Antheraea mylitta* under non-diseased (control) condition clearly reveal the marked differences among diseased and non-diseased conditions. No significant variations in the percent ash content in respect of diseases have been recorded, which is indicative of the fact that different diseases of tasar silkworm do not affect the percent ash content.

The aforesaid results have led us to believe that the said diseases of tasar silkworm evidently lessen the biochemical concentration and retard the growth by their different modes

of infection with relative variations owing to different physiogenetic make up of said pathogens causing different diseases among the tasar silkworm.

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TABLE
Table showing biochemical variations in relation to various diseases of tasar silkworm, *Antheraea mylitta* D.

Sl. No.	Diseases of tasar silkworm	Percent Protein			Percent Lipid			Percent Carbohydrate			Percent Ash		
		Larval	Pupal	Adult	Larval	Pupal	Adult	Larval	Pupal	Adult	Larval	Pupal	Adult
1.	Microsporidiosis	52.51 +0.12	50.42 +0.21	53.54 +0.23	18.19 +0.13	13.93 +0.13	15.43 +0.5	7.39 +0.28	10.39 +0.5	7.39 +0.6	5.75 +0.6	10.10 +0.6	10.10 +0.6
2.	Polyhedrosis	54.56 +0.5	53.44 +0.5	55.51 +0.5	19.25 +0.16	14.57 +0.29	16.39 +0.8	8.40 +0.56	11.28 +0.12	8.12 +0.13	5.78 +0.5	10.12 +0.5	10.13 +0.15
3.	Bacteriosis	55.62 +0.19	54.53 +0.25	56.61 +0.16	20.42 +0.25	15.20 +0.18	16.85 +0.5	8.97 +0.43	11.98 +0.27	8.87 +0.16	5.74 +0.6	10.13 +0.6	10.17 +0.5
4.	Mycosis	56.34 +0.28	55.29 +0.26	57.31 +0.19	21.38 +0.28	16.27 +0.16	17.32 +0.06	9.02 +0.12	12.56 +0.19	9.35 +0.14	5.78 +0.12	10.18 +0.16	10.20 +0.16
5.	Control	60.62 +0.15	57.42 +0.21	59.45 +0.24	24.42 +0.6	18.32 +0.9	19.61 +0.16	10.72 +0.24	14.92 +0.16	10.53 +0.15	5.80 +0.5	10.25 +0.10	10.29 +0.13
	CD at 0.5% level	**	***	**	***	**	**	***	**	**	***	**	-

** Highly Significant

* Significant

- Not Significant

SEWAGE AND WASTE PROCESSING AEROBIOLOGY : MICROBIAL CONTAMINANTS AND RISK ASSESSMENTMahesh Roy¹ and Om Prakash²Key words : *Sewage, waste, aerobiology, microbes, risk assessment*

Urban sewage and waste are found to contain a host of microbes including bacteria, viruses and fungi. Usually most of the microorganisms associated with sewage and waste materials are not respiratory pathogens or normally airborne, but workers involved in the handling, processing and recycling of waste and sewage and local populations may be exposed to some of the potential airborne pathogens and allergens found as components of municipal sewage and waste. The present communication attempts to review the available reports on the airborne microbes that may grow or occur in sewage and assess the aerobiological hazards resulting from these bioaerosols. Global reports appear about the occurrence of 34 microbial contaminants in waste and sewage materials of which 25 are known pathogens and 9 are established allergens. A total of 18 bacterial species, 9 fungal species and 7 viruses have been identified globally to occur as hazardous microbial agents in wastes. Percentage composition of a typical mixture of airborne fungi in waste composting facility has also been worked out. Finally ever present potential for exposure to hazardous bioaerosols incurred by the waste and sewage has largely been documented.

INTRODUCTION

Increase in global population, coupled with intensive animal and livestock production practices, have resulted in the generation, accumulation, and disposal of large amounts of wastes around the world (Pillai & Rieke, 2002). Organic materials present in the sewage and waste can be breeding grounds for several biocontaminants including bacteria, viruses and fungi. Workers engaged in the handling and disinfection treatment of these waste materials are subject to occupational hazards. Aerosolization of microbial pathogens, endotoxins, allergens, odours and dust particles is an inevitable consequence of the generation and handling of waste material and sewage. Proximity of human populations to municipal waste treatment facilities and their exposure to bioaerosols are matters of concern in many parts of the world. Hence, it is considered worthwhile to review the problem of sewage and waste aerobiology and make a risk assessment of the microbial contaminants reportedly present in the sewage and waste materials.

Sewage and Waste Aerobiology

Sewage sludge is primarily composed of sediments of organic matter of waste water. This organic matter has a complex and unpredictable mixture that may vary seasonally and geographically. The sanitized organic matter from sewage sludge is commonly used in agriculture to enrich the soil and, the bioresidues of sewage are useful as a source of nutrients for plants. Waste and sewage also contain a wide variety of microbial pathogens, allergens and endotoxins. Some of these biocontaminants become airborne around sewage and waste disposal and treatment localities, and become potential hazards to surrounding human populations. A list of the airborne microbes reportedly growing or occurring in sewage is presented in Table-1.

Viruses have occasionally been isolated (7 types only) in sewage but no data on their frequency of occurrence are available (Bitton, 1980; Hers and Winkler, 1973).

Waste composting facility may contain a typical mixture of fungi which may be found airborne in and around sewage treatment plants (Fig. 1).

Measurements of Microbial Emissions in Activated Sludge Units

Various kinds of bubble ventilation and sprayers used in waste water processing result in aerosolization of biocontaminants. Measurements of microbial emissions in various activated sludge units have shown that lowest airborne levels occur with bubble ventilation, and that spray devices used for foam elimination lead to high airborne levels of microbes (Wanner, 1975). Airborne microbial concentration above sewage sludge pools measured 50-100,000 cfu/m³ depending on the weather conditions. Levels between 500 and 1500 cfu/m³ were measured at a distance of 50 and 100m from the sewage facility. At distances of 200-400m the levels of airborne microbes were about the same as normally measured in the outside air. Considerably higher levels of microbes were measured in a closed sewage sludge pool. Airborne levels of microbes were found to be about 10,000-25,000 cfu/m³ in the immediate vicinity of the activated sludge unit.

The composition included coliform bacteria (1-2%) and enterococci (2-4%). Besides the intestinal bacterial flora other unidentified pathogenic agents have been found present in the aerosols. Closed sewage sludge processing units, thus, harbour a great risk of airborne infections, while the hazard in open-air pools is much lower. A typical mixture of airborne bacteria in a waste composting facility has been illustrated in Fig. 2.

Dust, Particulates, Endotoxins & MVOCs

Pellets from paper and plastic waste are produced by many companies for burning as fuel. Such manufacturing processes add dust and particulates to the atmosphere. Several measurements were made to determine dust,

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particulates, microbes and endotoxin concentrations during 1998 and 1999 in a Finnish plant by Tolvanen (2001). The concentrations of dust and particulates were found low, but the microbial concentrations, especially in the summer and in the autumn, were at a level potentially causing occupational health hazards.

The total concentration of airborne microbes was 4.8×10^6 cfu/m³ (approx.). The concentration of endotoxins were high in summer and in autumn (340-1000 ng/m³) and exceeded permissible limits of 30 ng/m³ (Lavoie *et al.*, 1996). However, during winter endotoxins were recorded in lower concentrations (4.7-33 ng/m³). Typical airborne concentrations of microbes and endotoxins in various waste processing facilities have been summarized in Table 2.

Liu *et al.* (2002) studied the diversity and distribution of microbes in brewery-degrading anaerobic sludges, and recorded *Methanosaeta concilii*, *Clostridium*, *Xanthomonas* species and *Desulfovibrio* species. Of these, only *Clostridium* species pose potential health threat in humans.

Airborne fungal spores and their metabolites cause health hazards to workers engaged in composting facilities. Fischer *et al.* (1999) investigated workers exposure to airborne fungal spores at different working locations in composting installations. The results indicate that the spectrum of microbial volatile organic compounds (MVOCs) and mycotoxins produced can be specific for certain species.

Apart from pathogenic and allergenic aggravations, fungi may have some different toxicological impacts on human health.

Risk Assessment of Airborne Biocontaminants from Sewage & Wastewater

The sewer workers are exposed to droplet aerosols that may contain a large variety of infectious, immunotoxic and allergic biohazards. The infectious agents include viruses (hepatitis virus, polioviruses, coxsackieviruses, rotaviruses, adenoviruses, Norwalk virus), bacteria (*Salmonella* spp. *Shigella* spp., *Campylobacter jejuni*, *Yersinia enterocolitica*, *Legionella pneumophila*, *Halicobacter pylori*, *Listeria monocytogenes*, *Mycobacterium xenopi*), parasitic protozoa (*Giardia lamblia*, *Entamoeba histolytica*) and helminthes (Clark, 1987; De Luca *et al.*, 1998; Stampi *et al.*, 1999). A significant risk is also posed by microbial allergens and toxins, of which endotoxin is considered as a most important hazard (Laitinen *et al.*, 1994; Lundholm & Rylander, 1983; Mattsby & Rylander, 1978; Melbostad *et al.*, 1994; Mulloy, 2001; Rylander, 1999 and Thorn *et al.*, 2002b).

A number of studies have been made on sewage pathogens and the occupational hazards of workers in waste processing plants. The risks of airborne hazards associated with wastewater treatment plants have been reviewed by Seidel (1983), who found the risks to be controllable.

A survey of work related symptoms among sewage workers conducted in Sweden to assess the risk for workers (Thorn *et al.*, 2002a) revealed that risks increased significantly

for respiratory symptoms, including chronic bronchitis and toxic pneumonitis, as well as for central nervous system problems such as headache, fatigue, and concentration difficulties over workers in non-sewage industries. An increased risk for non-specific work related gastrointestinal symptoms was found among the sewage workers. Causal relationship could not be specifically identified.

Aspergillosis (a lung infection caused by various species of *Aspergillus*) occurs as an occupational disease in relation to sewage or composting (Joseph, 1983). In the latter environments the causative pathogen is most often *Aspergillus fumigatus*.

Wastewater treatment workers are potentially exposed to a variety of infectious agents and toxic materials. Khuder *et al.* (1998) examined the prevalence of infectious diseases and associated symptoms among wastewater treatment workers who exhibited a significantly higher prevalence of gastroenteritis, gastrointestinal symptoms and headache.

The occurrence of viruses, bacteria, yeast, fungi and zooparasites in sewage sludge has epidemiologic concerns for sewage sludge recycling facilities and their employees (Dumontet *et al.*, 2001).

Perhaps the greatest hazard from sewage is the potential for human pathogenic viruses and bacteria to cause infections among workers. The most serious risk of infection from wastewater involves the potential contamination of raw water and treated drinking water.

In a study of sewage treatment plants in Sweden by Thorn *et al.* (2002b), the amounts of airborne endotoxin were found to be generally low. However, higher endotoxin values were found at certain worksites located indoors. The results suggest that the exposure levels are relatively stable over short time periods but that higher levels can be recorded during work processes involving wastewater agitation.

Rylander (1999) studied the health effects among sewage treatment workers, who reported considerably higher nose irritation, fatigue and diarrhoea. The results confirmed previous studies on the presence of airways and intestinal inflammation among workers in sewage treatment plants. Endotoxin is the most likely causative agent whose concentrations exceeded recommended permissible levels. Pontiac fever is a less serious form of disease that can occur from the inhalation of contaminated water droplets (Gregersen *et al.*, 1999). The study showed that the fever was caused by *L. pneumophila* emitted to the environment by the uncovered decanter.

Sigsgaard (1999) studied the health hazards in waste management workers in Denmark. The results showed wide ranging symptoms and diseases from occupational asthma to gastrointestinal and skin ailments. Under normal circumstances with good hygienic practices and use of the proper protective equipment by an educated workforce, garbage handling induces a small risk of occupational asthma. The majority of asthma cases identified are linked to poor perception of the risk related to organic dust exposure.

During the last three decades, a growing interest in recycling of domestic waste has developed. A review of occupational health problems associated with collection of domestic waste was undertaken by Poulsen *et al.* (1995) to assess their significance and possible causes. An excess risk of chronic bronchitis was reported in waste collectors in Geneva and data indicate an excess risk for pulmonary problems among waste collectors compared with the total workforce. High incidence of gastrointestinal problems, irritation of the eye and skin and symptoms of organic dust toxic syndrome have been reported among workers collecting the biodegradable fraction of domestic waste.

The urban poor in Third World countries often take out a living scavenging through garbage dumps and are exposed to a variety of health hazards (Fry *et al.*, 2002). No epidemiological data are available to assess the actual risks.

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TABLE-1. Airborne biocontaminants that may grow or occur in sewage

Sl. No.	Biocontaminants	Type	Nature	Reference (Pathogen/Allergen)
1.	<i>Acinetobacter</i>	Bacteria	Pathogen	Rosas <i>et al.</i> (1996)
2.	Adenovirus	Virus	Pathogen	Hers & Winkler (1973)
3.	Adenovirus	Virus	Pathogen	Rao & Melnick (1987)
4.	<i>Aeromonas</i>	Bacteria	Pathogen	Dumontet <i>et al.</i> (2001)
5.	<i>Alcaligenes</i>	Bacteria	Pathogen	Rosaset <i>al.</i> (1996)
6.	<i>Alternaria</i>	Fungi	Allergen	Rosas <i>et al.</i> (1996)
7.	<i>Aspergillus</i>	Fungi	Allergen	Rosas <i>et al.</i> (1996)
8.	<i>Bacillus anthracis</i>	Bacteria	Pathogen	Dumontet <i>et al.</i> (2001)
9.	<i>Brucella</i> spp.	Bacteria	Pathogen	Dumontet <i>et al.</i> (2001)
10.	<i>Candida</i> spp.	Bacteria	Pathogen	Dumontet <i>et al.</i> (2001)
11.	<i>Cladosporium</i>	Fungi	Allergen	Rosas <i>et al.</i> (1996)
12.	<i>Clostridium botulinum</i>	Bacteria	Pathogen	Dumontet <i>et al.</i> (2001)
13.	<i>Clostridium perfringens</i>	Bacteria	Pathogen	Dumontet <i>et al.</i> (2001)
14.	<i>Corynebacterium</i> spp.	Bacteria	Pathogen	Higgins & Burns (1975)
15.	Coxsackievirus	Virus	Pathogen	Dumontet <i>et al.</i> (2001)
16.	<i>Cryptococcus neoformans</i>	Bacteria	Pathogen	Dumontet <i>et al.</i> (2001)
17.	Echovirus	Virus	Pathogen	Dumontet <i>et al.</i> (2001)
18.	<i>Exophiala</i>	Fungi	Allergen	Sutton <i>et al.</i> (1998)
19.	<i>Fusarium</i>	Fungi	Allergen	Lavoie <i>et al.</i> (1996)
20.	<i>Klebsiella</i> spp.	Bacteria	Pathogen	Rao & Melnick (1987)
21.	<i>Listeria monocystogenes</i>	Bacteria	Pathogen	Pillai & Ricke (2002)
22.	<i>Mucor</i>	Fungi	Allergen	Higgins & Burns (1975)
23.	<i>Mycobacterium</i>	Bacteria	Pathogen	Higgins & Burns (1975)
24.	<i>Nocardia</i>	Bacteria	Pathogen	Higgins & Burns (1975)
25.	Norwalk virus	Virus	Pathogen	Rao & Melnick (1987)
26.	Parvovirus	Virus	Pathogen	Rao & Melnick (1987)
27.	<i>Penicillium</i>	Fungi	Allergen	Lavoie <i>et al.</i> (1996)
28.	<i>Phialophora</i>	Fungi	Allergen	Dumontet <i>et al.</i> (2001)
29.	<i>Pseudomonas aeruginosa</i>	Bacteria	Pathogen	Higgins & Burns (1975)
30.	Reovirus	Virus	Pathogen	Rao & Melnick (1987)
31.	<i>Rhizopus</i>	Fungi	Allergen	Rosas <i>et al.</i> (1996)
32.	<i>Serratia</i>	Bacteria	Pathogen	Rosas <i>et al.</i> (1996)
33.	<i>Staphylococcus</i> spp.	Bacteria	Pathogen	Higgins & Burns (1975)
34.	<i>Streptococcus faecalis</i>	Bacteria	Pathogen	Rao & Melnick (1987)

TABLE-2. Typical Airborne Concentrations in Waste Facilities.

Sl. No.	Biocontaminants	Conc. Level	Facility	Reference
1.	Bacteria (cfu/m ³)	11,879 21,201 - 84,806 972 1,091 662 6700	Waste composting Waste composting (Shedding) Waste composting (Maximum) Wastewater treatment (Cyclone) Waste water treatment (Sludge) Waste transfer station	Hryhorczuk <i>et al.</i> (2001) Jager <i>et al.</i> (1994) Folmsbee & Stewart (1999) Lavoie <i>et al.</i> (1996) Lavoie <i>et al.</i> (1996) Hryhorczuk <i>et al.</i> (2001)
2.	Funji (cfu/m ³)	13,451 1,000,000 - 10,000,000 7800 5,151 - 19,064 5,059 181 1,317 4,900	Waste composting Waste composting Waste composting Waste composting (Shedding) Waste composting (Maximum) Wastewater treatment (Cyclone) Waste water treatment (Sludge) Waste transfer station	Hryhorczuk <i>et al.</i> (2001) Fischer <i>et al.</i> (1999) Lacey & Crook (1988) Jager <i>et al.</i> (1994) Folmsbee & Stewart (1999) Lavoie <i>et al.</i> (1996) Lavoie <i>et al.</i> (1996) Rosas <i>et al.</i> (1996)
3.	Total microbes (cfu/m ³)	700 137,400 50 - 100,000 3,000,000,000 46,000 54,000 8,000 4,700 4,800,000	Waste composting (Shipping) Waste composting (Curing) Sewage sludge pools Trash recycling (Max.) Garbage handling Composting areas Water purification Paper sorting Paper and plastic recycling	Van Der Werf(1996) Van Der Werf(1996) Wanner (1975) Sigsgaard <i>et al.</i> (1990) Sigsgaard <i>et al.</i> (1990) Sigsgaard <i>et al.</i> (1990) Sigsgaard <i>et al.</i> (1990) Sigsgaard <i>et al.</i> (1990) Tolvanen (2001)
4.	Endotoxins (ng/m ³)	1.94 1.9 - 47 3 - 39 3.8 - 32,170 340 - 1,000	Waste composting Waste composting Sewage treatment (Water basins) Sewage treatment (Sludge handling) Paper and plastic Recycling (Summer)	Hryhorczuk <i>et al.</i> (2001) Van Der Werf (1996) Rylander (1999) Rylander (1999) Tolvanen (2001)

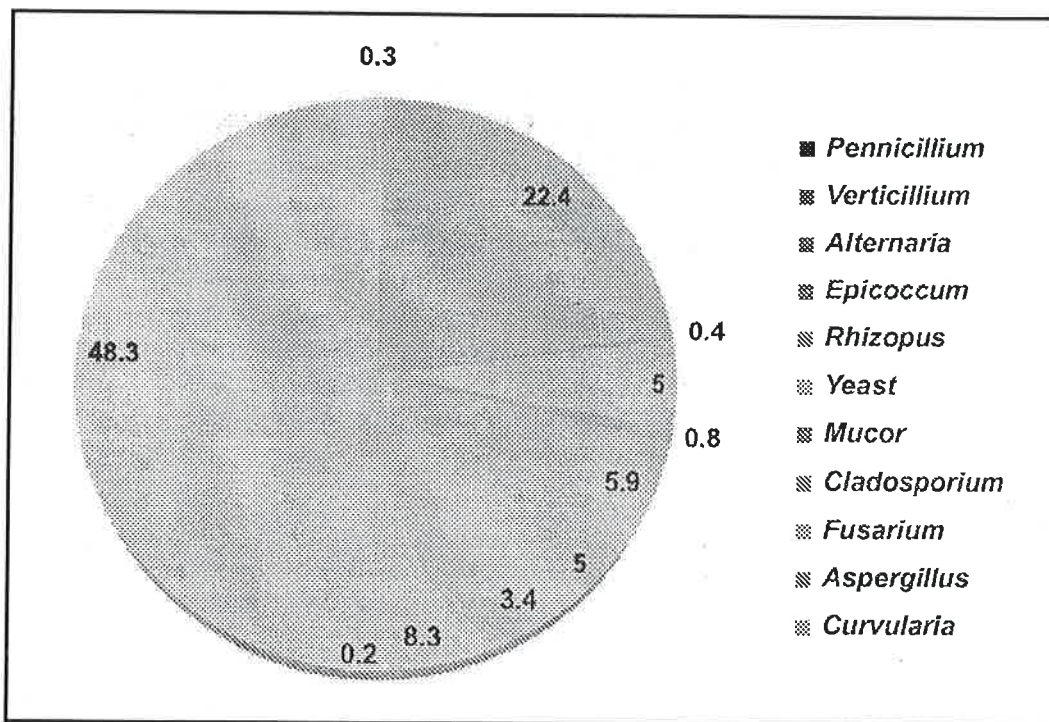


Fig. 1 : Typical mixture of airborne fungi in a waste composting facility (After Hryhorczuk *et al.* 2001)

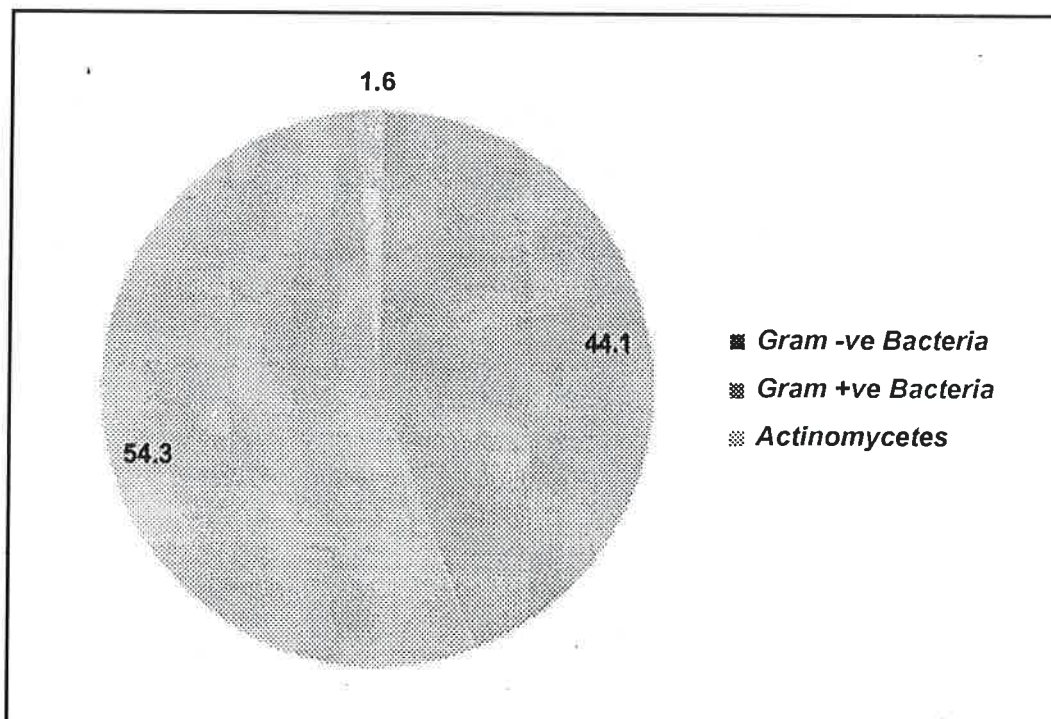


Fig. 2 : A Typical mixture of airborne bacteria in a waste composting facility (After Hryhorczuk, 2001)

CONTRIBUTION OF SELECTED VARIABLES TOWARDS MARITAL SATISFACTION

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Key words : *contribution, marital satisfaction, variables*

A working woman today refers to a woman who works outside her home for a wage or a salary. Now a days most of the women have been coming forward to work in order to create a meaning for them or out of economic necessity. A sample size of 300 individuals belonging to different professions and positions were selected. The contribution of selected variables, viz., value, sexual adjustment, attitude towards marriage and job satisfaction shows that they have significantly contributed towards marital satisfaction in a positive way. In contrast, sexual unfaithfulness of husband and marital conflict had significant negative contribution towards marital satisfaction.

INTRODUCTION

Marriage appears to have been a well established institution in India right from the Rig Vedic age. It has been considered as one of the most important of all the 'Hindu Sanskaras'. Research evidences indicate that certain personality factors, intelligence, dominance and extraversion are associated with adjustment in marriage. In case of the dominance variables, a differential relationship with adjustment in marriage was observed in the two groups (Kumar and Rohatogi, 1984). Secure attachment has been proposed to be an inner resource associated with effective coping and greater psychological well being whereas avoidant and ambivalent attachment may place adults at a higher risk for maladaptive coping and psychological distress (Mikulincer and Florian, 1998).

Among the major psychological disorders, depression has been studied most extensively and has been shown to have a strong link with marital distress. Women's perception of social support, in turn, appears to be related to their marital satisfaction (Gotlib and Whiffen, 1989).

Marital satisfaction is defined as the amount of satisfaction husbands and wives receive from their marriage relationship. The relative relationship satisfaction scale consists of six domains of relationship functioning, i.e., physical intimacy, love experienced, conflict resolution, relationship equality, quality of communication and overall relationship. Increase in the relationship satisfaction scale indicates higher level of satisfaction.

When demands and expectation on household work participation are not met, frustration and conflict increase which affects mental and physical health of women (Lerner and Galambos, 1988). Higher level of negative emotional expressiveness characterizes relationships that are high in marital conflict and low in marital satisfaction (Wong *et al.*, 2009). The present study was conducted regarding contribution of selected socio-psycho-personal and economic characteristics of respondents towards marital satisfaction.

MATERIALS AND METHOD

The survey design of research was used in the present study. The study was conducted in Chotanagpur region of Jharkhand. Four districts, viz., Ranchi, Hazaribagh, Ramgarh and Bokaro were selected for field investigation. A total of 300 working women up to 62 years of age were selected purposively from education (college and school teacher), health (doctor and nurse) and other services (officer and clerk). Multiple linear regression coefficients were worked out with the factors presented in Table-1.

RESULTS AND DISCUSSION

Value, sexual unfaithfulness of husband, sexual adjustment, attitude towards marriage, job satisfaction and marital conflict had significant regression with marital satisfaction (Table-1).

TABLE-1. Multiple regression coefficients of selected variables with marital satisfaction (N=300)

Selected factors	Regression coefficient (b)	Std Error	P Value
Income	0.309	0.667	0.645
Interference of elders	-0.464	0.240	0.054
Temperament	1.176	0.712	0.100
Value	1.775 *	0.605	0.004
Sexual unfaithfulness of husband	-0.399 *	0.169	0.019
Sexual adjustment	1.997 *	0.625	0.002
Adaptability	0.045	0.189	0.812
Performance in two roles	0.117	0.089	0.191
Attitude towards marriage	0.225 *	0.102	0.028
Job satisfaction	0.067 *	0.028	0.015
Marital conflict	-0.073 *	0.028	0.010
R=	0.709		
R ² =	0.547		
Adjusted R ² =	0.527		

* significant at 0.05 percent probability level

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These selected variables contributed more than half towards marital satisfaction as depicted by R^2 value 0.55. Among six important factors, sexual unfaithfulness of husband and marital conflict contributed significantly in negative direction.

Working women employed in higher service

Among respondents belonging to higher service (N=150), nine variables had strong correlation with marital satisfaction, but

only four factors, viz., interference of elders, sexual adjustment, attitude towards marriage and marital conflict had significant multiple linear regression with marital satisfaction. The contribution of these variables towards marital satisfaction is 57% which is depicted by R^2 value, i.e., 0.57. Value and adaptability are two important factors which contributed maximum towards marital satisfaction of doctors.

TABLE-2. Regression coefficient (b) among respondents in higher service (N=150)

Selected variables	Regression (b _j) value			
	Doctors (N=50)	Officers (N=50)	College teachers (N=50)	Overall (N=150)
Income	1.209	3.226	-0.914	-
Interference of elders	-0.306	-1.699	-0.377	-0.763 *
Temperament	2.360	1.095	-0.690	0.720
Interest	0.528	0.181	-1.255 *	-
Value	3.851 *	1.820	-1.861 *	0.797
Sexual unfaithful of husband	0.840	0.386	0.059	-
Sexual adjustment	-2.412	4.623 *	4.708 *	4.265 **
Adaptability	-1.326 *	0.758	1.167**	0.411
Performance in two role	0.432	-0.139	0.167	0.098
Attitude towards marriage	-0.193	0.171	0.581 **	0.291 *
Job satisfaction	-0.016	0.048	0.011	0.003
Marital conflict	-0.028	-0.320 *	-0.080 *	-0.119 *
R value=	0.725	0.813	0.958	0.75
R ² value=	0.526	0.661	0.918	0.57
Adj R ² value=	0.417	0.511	0.882	0.53

* significant at 0.05 percent probability level, ** significant at 0.01 percent of probability level.

The selected eleven independent variables explained the variability in marital satisfaction to the extent of 52.6% as depicted by R^2 value. Among officers, sexual adjustment and marital conflicts are two variables which contributed significantly towards marital satisfaction. The total variability explained by the selected variables towards marital satisfaction is 66.1%. Altogether six variables, viz., interest, value, sexual adjustment, adaptability, attitude towards marriage and marital conflict significantly contributed towards marital satisfaction and total variability explained by selected variables were 91.8% in case of college teachers. None of these variables were found commonly contributing towards marital satisfaction among these three categories of respondents.

Working women employed in lower service

Among the majority of the respondents belonging to lower service (N= 150), marital satisfaction is dealt by five factors, i.e., interference to elders, value, sexual unfaithfulness of husband, attitude towards marriage and job satisfaction. The contribution of these variables towards marital satisfaction is 57% which is depicted by R^2 value, i.e., 0.76.

Income and temperament had significant regression with marital satisfaction among school teachers. The variability in marital satisfaction is explained by the variables like income, interference of elders, temperament, value, sexual unfaithfulness of husband, sexual adjustment, adaptability,

performance in two roles, attitude towards marriage, Job satisfaction and marital conflict to the extent of 70.5% as depicted by R^2 value. The sexual unfaithfulness of husband and adaptability are two factors which contributed significantly towards marital satisfaction among nurses. The overall contribution of selected variables explained the variability up to 63.5%. Among clerks, income, sexual adjustment, performance in two roles and job satisfaction were found to be significant for marital satisfaction. The selected factors contributed 86.1 towards marital satisfaction. Sexual unfaithfulness of husband and adaptability were two factors which contributed significantly towards marital satisfaction in case of nurse. These selected variables contributed up to 63.5%.

It is apparent that there was a significant effect of similarity or dissimilarity between the spouses with regard to sexual urge as such, that was found to be so much effective marital adjustment as the harmony or disharmony between their sexual response both in its physical and emotional aspects - their accordant or discordant attitudes towards their sexual desires, sexual approach and the actual sex act. Sexual adjustment was found to be present in maritally well-adjusted working women. Sexual adjustments play an important part in establishing marital harmony.

TABLE-3. Regression coefficient (b) among respondents having lower service (N=150)

Selected factors	Regression (b _i) value			
	School Teacher (N=50)	Nurse (N=50)	Clerk (N=50)	Overall (N=15)
Income	5.659 **	-	-0.408 *	-
Interference of elders	-1.849	-	-	0.993 **
Temperament	4.224 **	-	-0.316	0.962
Value	-	2.162	-0.101	-
Sexual unfaithfulness of husband	-0.669	-1.791 **	-	1.778 *
Sexual adjustment	-0.495	-	2.536 *	-0.644 *
Adaptability	-	-1.054 *	-	0.369 *
Performance in two roles	-	0.083	1.066 **	-0.328
Attitude towards marriage	-	-0.271	0.312	0.188
Job satisfaction	0.027	0.037	0.113 **	0.345 *
Marital conflict	-	-	-0.063	0.135 **
R value=	0.839	0.797	0.928	-0.054
R2 value=	0.705	0.635	0.861	0.76
Adj R2 value=	0.647	0.564	0.825	0.57

* significant at 0.05 percent probability level, ** significant at 0.01 percent of probability level.

Successful marriage is a dynamic growing relationship in which the personalities of both partners continue to develop. It reaches a relatively high level of personal satisfaction. Both parents get at least what they expected from marriage. The more they get, the greater is the relative success. The couples achieve relatively full use of their personal resource and draw freely upon environmental resource to further their adjustment increase their mutual happiness.

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EFFECT OF DIETARY VARIATION ON THE FREE AMINO ACIDS CONTENT IN THE LARVAL HAEMOLYMPH OF *Antheraea mylitta* D.

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Key words : *Effect, dietary variation, amino acids, haemolymph, Antheraea mylitta.*

Free amino acids in the larval haemolymph of *Antheraea mylitta* cultured on tender, mature and coarse leaves of *Terminalia arjuna* have been studied by paper chromatography. The evident variations in the number and concentration of free amino acids have been found in the larval haemolymph in relation to quality of leaves. The study reveals that the haemolymph of larvae cultured on mature leaf contains greater amount of free amino acids in comparison to larvae cultured on tender and coarse quality of leaves. The differences in the free amino acids content are probably due to the dietary variation in the quality of foliages consumed by the larvae of tasar silkworm.

INTRODUCTION

Tasar silkworm which is of great economic importance is usually reared on different qualities of leaves of tasar food plants under outdoor conditions, particularly in the forest areas by the tribals for their livelihood. The rearing of tasar worms on various qualities of leaf has been found to provide marked variation in the commercial characters of tasar (Anonymous, 2008). The culture of tasar larvae on primary food plant, viz., *Terminalia tomentosa*, *Terminalia arjuna* and *Shorea robusta* accounts for greater productivity and also good quality of cocoons (Mohan, et al., 2012). The rearing of larvae on secondary food plants has always resulted into poor quantity and quality of the cocoons (Mishra, 2014). The interchange of food plants from primary to secondary and from secondary to primary has been found to affect the metabolic activities of tasar worms. The biochemical variations in the larval haemolymph relation to diseased and non diseased conditions have extensively been worked out (Bensassi et al., 1961; Agrawal, 1974). The present investigation is a report on the laboratory experiment designed to evaluate the biochemical differences in the free amino acid contents in the larval haemolymph in relation to different qualities of feeding leaves.

MATERIALS AND METHODS

The larval haemolymph of 5th instars cultured on tender, mature and coarse leaves was collected separately and preserved under laboratory conditions. 1ml. haemolymph was taken at every stage for the analysis of amino acids. Analar chemicals were used for the experiment.

Haemolymph was first of all deproteinised with ethanol (70% v/v) and was centrifuged for 10 minutes at 3000 rpm. The protein free clear supernatant was evaporated to dryness on a water bath. Fats and lipids were removed by extracting the residue with ether (1 ml) and the residue was dissolved in isopropanol (1.5ml10% v/v). All the extracts were prepared in the same manner and used for two dimensional paper partition chromatography.

10 ml of the extract was applied on Whatman no. 1 filter paper (20x20 cm). The chromatograms were first run in butanoacetic acid: water (4: 1 :5, v/v) in ascending manner and after overnight drying, the second run with phenol: water

(4:1, v/v). The chromatograms were further dried at room temperature.

Chromatograms were sprayed with ninhydrine solution in acetone (0.25%, w/v). The Chromatograms were further dried at room temperature.

Sprayed chromatograms were heated in an air oven at 100°C for 20 minutes. The amino acids were later identified by comparing R. F. values with known standards run under the same experimental conditions.

The results for the different qualities of leaves in relation to activities of amino acid contents were tabulated in the form of traces (+, -), present (+), absent (-) and higher concentration (++) [Table 1].

RESULTS AND DISCUSSION

Perusal of the table clearly indicates that the haemolymph of the larvae cultured on mature leaves contains 19 amino acids, viz., cystic acid, aspartic acid, glutamic acid, lysine, glycine, λ alanine, glutamine, proline, tyrosine, threonine, histidine, arginine, methionine sulphoxide, valine, leucine, isoleucine, alanine, asparagines and cystine, whereas haemolymph of the larvae cultured on tender and coarse leaves contain 16 and 15 amino acids respectively. The concentration of threonine, arginine and valine is lower in the haemolymph of the larvae reared on tender leaves. Glutamine, leucine, and tyrosine is altogether absent in the larval haemolymph cultured on tender leaves. However, the larval haemolymph of larvae cultured on coarse leaves accounts for total absence of glutamine, leucine, tyrosine and threonine. The concentration of arginine, protein, glutamic acid and valine is lower.

The study thus reveals that the amount and concentration of free amino acids in the larval haemolymph of *Antheraea mylitta* cultured on mature leaves are relatively greater than tender and coarse leaves.

Variation in the number and concentration of free amino acids in relation to dietary changes have been evidenced by the work of Drihon et al. (1951) and Ishimori and Muto (1951) in the silkworm *Bombyx mori*. Sinha et al. (1975) have also found variation in the free amino acid pattern among healthy

and diseased larval haemolymph of *Antheraea mylitta*. The present investigation in respect of variation in the free amino acids is very much in conformity with above findings. The

study thus suggests that mature leaves should be preferred for better quantitative and qualitative results in the field of sericulture.

TABLE-1
Biochemical analysis of free amino acids in the 5th instar larval haemolymph of
A. mylitta* cultured on tender, mature and coarse leaves of *T. arjuna

S.N.	Amino Acids	Tender leaves	Mature leaves	Coarse leaves
1.	L-alanine	+ -	++	+
2.	Arginine	+	+	+
3.	Asparagine	+	+	+
4.	Asparatic Acid'	+	+	++
5.	B-analine	+	++	+
6.	Cysteic Acid	+	+	-
7.	Cystine	+	++	+
8.	Glutamic Acid	-	+	++
9.	Glutamine	+	+	-
10.	Glycine	+	++	+
11.	Histidine	-	+	+
12.	Leucin/Isoleucin	+	++	+
13.	Lysine'	+	++	+
14.	Methionine-sulphoxide	+	+	-
15.	Proline	+	++	-
16.	Serine	+ -	+	-
17.	Threonine	-	++	-
18.	Tyrosine	+	++	-
19.	Valine	-	+ -	-

N.B.: Present =+ Abundance = ++
Traces =+ - Absent = -

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ANALYSIS OF HEAVY METAL CONTAMINATION AT DELHI STRETCH OF RIVER YAMUNA

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Key words : Heavy metals, river Yamuna, Delhi.

Yamuna River flowing in Haryana through Delhi is demanding continuous monitoring and assessment owing to its increasing pollution. With the development of industrial activities, growing human population, agricultural and domestic run off, the river is getting contaminated by heavy metals which are adversely affecting human and aquatic life. Contagion by heavy metals such as mercury and lead can lead to serious ecological problems owing to their accumulation, toxicity and non-biodegradability even at trace levels. The present investigation aims at assessment of concentrations of heavy metals in waters of Yamuna collected from different sites in Delhi covering approximately 22 km stretch of the river. The data was compared with that of national and international agencies such as WHO (World Health and IS. The concentration of heavy metals detected was higher than that of permissible limits. Hence it is mandatory that efficient steps should be taken to reduce this heavy metal pollution.

INTRODUCTION

In recent years heavy metal toxicity in water has emerged as a serious concern when their concentrations exceed the permissible level leading to adverse effects on living organisms. Non-Degradability and bioaccumulation of these heavy metals (arsenic, cadmium, iron, cobalt, chromium, copper, manganese, mercury) make them "chemical time bombs". At high concentrations they affect the neurological functions and interfere with synthesis and metabolism of living organisms. Increasing population, changing agricultural patterns and industrial developments have further worsened the situation. Discharge of untreated industrial waste water contaminated with these heavy metals into the water bodies, especially rivers,

led to their accumulation in aquatic species along the food chain posing a health hazard and serious threat to living organisms. Other anthropogenic sources of this contamination include mining, disposal of untreated effluents and metal chelates, indiscriminate use of metal containing fertilizers and pesticides in agricultural areas. A decrease in the pH value of water increases the solubility of metals in water by virtue of which they get locked up in the sediments for years. The maximum permissible tolerant concentrations for metals in natural waters for protection of human health as recommended by the Environmental Protection Agency (EPA), WHO and CPCB have also been considered.

TABLE-1 : Maximum Permissible Concentrations (MPC) of Various Metals in Natural Waters for the Protection of Human Health

Metal	mg m ⁻³ As per EPA	WHO mgh	CPCB mg/l	BIS IS- 10500 (2012) mg/l
Lead	5	0.1	0.1	0.1
Cadmium	10	0.003	2	0.003
Cobalt		0.05	NA	NA
Copper		2.0	3	0.05
Nickel	13.4	0.02	3	0.02
Manganese	50	100	2	0.03
Chromium	50	0.05	2	0.05
Iron	300	0.03	3	0.03
Zinc		3.0	5	5.0

Source : EPA (1987); Federal Register 56 (110): 26460-26564 (1991).

mg m⁻³= PPb. mg/l = ppm mgh =

TABLE-2 : Catastrophic effect of some heavy metals on living organisms.

Metal	Consequences/Source.
Lead	Poisoning causes gastrointestinal, neuromuscular and central nervous system disorders. It can also cause liver and kidney damage, reduced haemoglobin formation and birth defects. The high concentration of Pb in water may be due to lead bases battery making industries and through vehicle emissions.

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Iron	It is the earth's one of most plentiful resources. High level of Fe results in nausea, vomiting, anxiety, tension and metabolic disorders. High levels of iron are due to the fact that it is seeped through soil and enters the river along with rain water runoff.
Zinc	Zinc is one of the most important trace elements which plays a vital role in protein synthesis and physiological and metabolic process of organisms. Sources of Zn entering into rivers could be the electroplating industries and sewage effluents. High concentration of zinc can lead to toxicity and many health disorders.
Cadmium	Cadmium can cause serious health problems even when ingested in small concentration. It causes lung problems and kidney damage. Battery making small industries, dye making plants and pigment making industries are responsible for high concentration of Cd in rivers.
Chromium	Chromium has carcinogenic effects. The presence of Cr is due to electroplating industries in Wazirabad, Badli and Mangolpuri.
Copper	Copper is an essential nutrient. Low concentration of copper can cause headache, vomiting and diarrhoea and high concentration causes gastrointestinal, liver and kidney disorders. Contamination of drinking water with high concentration of copper may lead to chronic anemia and Wilson's disease. Copper particulates are released into the atmosphere by windblown dust from anthropogenic sources, primarily copper smelters and ore processing facilities. The fate of elemental copper in water is complex and influenced by pH, dissolved oxygen and the presence of oxidizing agents and chelating compounds or ions.

In the present investigation detection of heavy metals in waters of River Yamuna collected from different locations (Wazirabad to Okhla Barrage) in Delhi has been undertaken. The River is contaminated with heavy metals, due to wastewaters coming from the Najafgarh drain and other small drains. This study has also formulated some policy measures and suggested some preventive steps to contain this menace of degradation of natural water bodies.

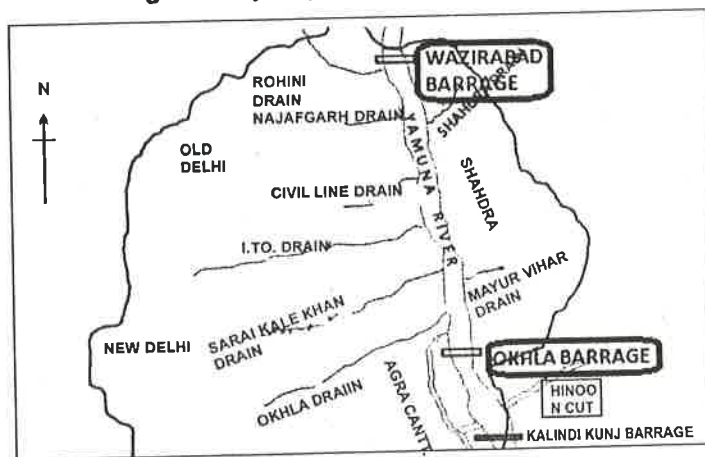
MATERIALS AND METHODS

The present study was carried out in Delhi at sites adjoining the river Yamuna. Five sites were selected namely Najafgarh drain, Wazirabad (upstream), ISBT, Maharani Bagh, and Okhla. The map (Fig. 1) shows the actual locations chosen for the analysis of some of the heavy metals with their close connectivity to river Yamuna. Sampling was done early in the morning and samples were collected and analyzed according to the standard methodology of AHPA (1998) and Trivedi & Goel (1986). Detection of (Zn, Fe, Cr, Cd, Pb and Cu) was done by following the standard method of APHA. Standard solutions of the different elements of interest were prepared separately and measurements were done on Atomic Absorption Spectrophotometer (AAS), Zenith 700P Analytik Jena Germany using the appropriate element hollow cathode lamp of selected wavelength.

RESULTS AND DISCUSSION

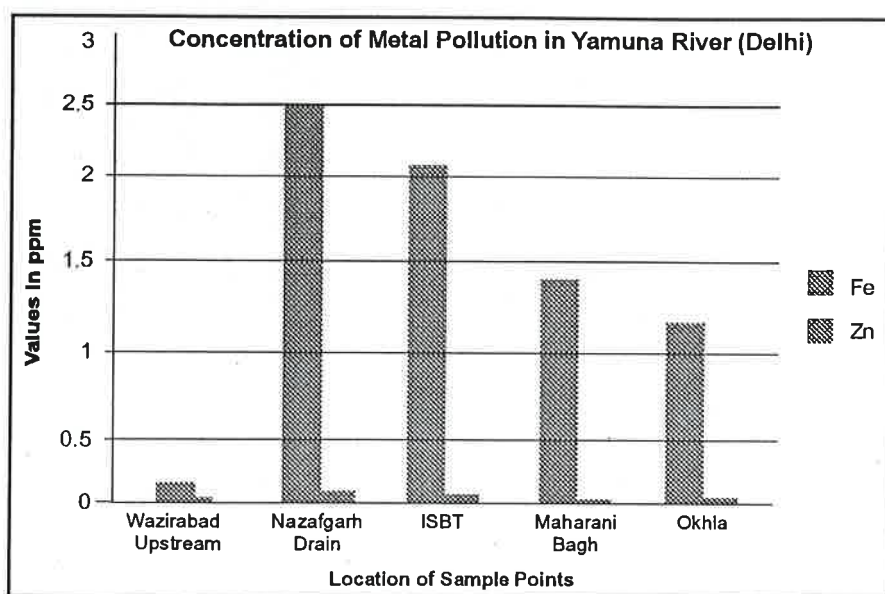
The map showing the sampling stations has been given in Fig.-1. Table-1 summarizes the maximum permissible concentration limits of common heavy metals in natural waters while Table-2 shows the effects of heavy metal pollution on the living organisms. Table-3 summarizes the concentration of various heavy metals at the different sampling sites. The values are higher for two metals namely Iron and zinc which are supported graphically (Fig.-2).

Fig. 1 : Map depicting sampling sites.



Site	Concentration of metals in ppm(mg/l)					
	Fe	Zn	Cu	Pb	Cd	Cr
Wazirabad upstream	0.192	0.046	<0.05	<0.05	<0.05	<0.05
Nazafgarh Drain	2.548	0.206	<0.05	<0.05	<0.05	<0.05
ISBT	2.126	0.102	<0.05	<0.05	<0.05	<0.05
Maharani Bagh	1.362	0.093	<0.05	<0.05	<0.05	<0.05
Okhla	1.27	0.073	<0.05	<0.05	<0.05	<0.05

Fig. 2 : Concentration of heavy metals (ppm) at various sampling sites



The results indicated that till inlet of Delhi at entry point the metallic pollution in river Yamuna is very less. As the river enters Delhi due to dumping of untreated drains metallic pollution rises sharply. From the data collected it is very much evident that almost at points downstream Wazirabad barrage the river flow is totally from various drains meeting the river. The small amount of improvement at Okhla stretch is probably due to mixing of Hindon cut canal water in the river.

When water samples were collected and analyzed for heavy metals (Zn, Cu, Fe, Cd, Cr, Ni and Pb) it was found that the concentration of iron was beyond the maximum permissible limits set by WHO. The study revealed the heavy metal content in the water of river Yamuna is beyond the normal range and is extremely dangerous for human consumption. The cause for this extremity in values is due to the accumulation of civic wastes and industrial effluents as the sewage of the city is directly discharged into the river along with the industries also discharging their effluents directly into the river. This is in agreement with the studies (Hasan *et al.*, 2012) who reported that the level of heavy metals increasing in the rivers is due to discharge of industrial effluents and civic pollution of various kinds.

RECOMMENDATIONS

Water pollution is indeed perilous both for the aquatic and human life; hence it is the need of the hour to assess the water quality of rivers for such pollution.

1. Industrial units effluent monitoring should be done at regular interval with provision and effective penal provisions. Various iron pickling and electroplating industries in area of Wazirpur, Badli etc. needs to be monitored strictly.
2. Research work should be carried out to study the accumulation of heavy metals in the crops which are irrigated by such polluted water.

3. Investigation studies and continuous monitoring should be conceded for disposal of industrial effluents and other wastes. Industrial waste disposal to sewer system and Yamuna needs to be prevented.

4. Idol immersion in the river is major source of metallic pollution during festive period that needs to be checked.

5. A study of the effect of heavy metals on the people residing in these locations should be carried out.

6. Awareness in all possible ways should be inculcated.

7. Government should pay attention to improve water quality taking into consideration the concentration of heavy metals.

8. People should not be allowed to dispose their civic waste in the water.

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ASSESSMENT OF BIOGENIC AEROALLERGENS IN THE ATMOSPHERE OF ARA AND THEIR IMPLICATIONS IN ALLERGIC DISEASES

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Key words : Assessment, aeroallergens Ara, allergic diseases.

The present aerobioallergenic investigation at Ara intends to carry out a comprehensive qualitative and quantitative analysis of airborne bioallergens and the involvement in causing various forms of allergic disorders in the local population. Primary objective of this study was to monitor the incidence of pathogenic and allergenic bioparticles in the atmosphere of Ara over a period of two successive years (July 2013 to June 2015) assuming their implicitly in causing various plant diseases and allergic manifestations in humans.

Two dimensions of environmental biopollution have been taken into consideration, the first being investigations into the airspora with identification of aeromycological and allergenic dominants and the second pertaining to the clinical investigation on allergy.

Aerospora study has been made by volumetric continuous Tilak Air Sampler and clinical investigations have been performed at the allergy clinic of Dr. Modi, associated with Nalanda Medical College & Hospital, Patna.

INTRODUCTION

Airborne aeropathogenic materials comprising fungal spores and a host of inanimate elements such as dust constitute a group of inhalent allergens causing several types of allergic ailments and human health problems. Many allergic human diseases such as asthma, rhinitis and a range of cardio-respiratory, nasobronchial and gastrointestinal disorders are attributed to inhalation of air borne fungal spores and pollen grains (Shivpuri & Agrawal, 1969; Shivpuri & Shivpuri, 1976; Shivpuri 1978, Chanda & Mandal, 1978). The need of undertaking periodical monitoring of these offending agents in the aerial environment of India has already been recognized (Chanda and Mandal, 1978). Allergic respiratory diseases due to airborne fungal spores have also been reported in India since mid fifties (Kashliwal *et al.*, 1955; Bhargava *et al.*, 1965; Kashliwal *et al.*, 1961).

The cases of local population suffering from various allergic diseases are revealed by clinical reports. Pollen and fungal spore surveys were conducted in the regional atmosphere of Ara emphasizing their concentration, relative abundance and seasonal variations.

Detailed surveys of various allergic manifestations in allergic patients may be quite informative and helpful in understanding the incidence trend and nature of offending elements and in the prevention and treatment of these distressing conditions. With this aim a comprehensive clinical trial was conducted on allergic patients attending the allergy clinic of Dr. Modi at Patna.

MATERIAL AND METHODS

Air sampling was done by operating continuously the Tilak Air Sampler (Tilak and Kulkarni, 1970) at four different locations in Ara town from July, 2013 to June, 2015. The sampling sites, viz., H. D. Jain College Campus, J.J. College Campus, New Campus of V.K.S. University, Ara and Gangi area had been chosen with the idea that these four sites

witnessed unique vegetational diversity, occupational activity and general features. The air sampler was operated for equal periods at each of these four sites at a constant height of two meters above ground level. The slides were scanned for estimating the concentration of fungal spores, pollen grains, hyphal fragments and their percentage contribution and seasonal variations.

The details of the sampler operation, cellotape mounting, preparation of slides and scanning were the same as described by Tilak and Kulkarni (1970).

Clinical investigation includes 119 patients of Ara who attended the said Allergy Clinic from July, 2013 to June, 2015 for various allergic complaints. The patients were subjected to a detailed history of their presenting symptoms, past illness, other associated allergies, family history of allergy and other relevant diseases and various factors aggravating the disease. The patients were also clinically examined. The data so obtained were analyzed critically in relation to age, sex, place of residence, age of onset of disease, familial and occupational factors/systems involved and various common allergenic factors.

RESULTS & DISCUSSION

Out of 43 spore types recorded on the four sampling sites, 9 fungal spores and three pollen grains constitute the allergenic components. Mean annual concentrations and percentage contributions of these spore types for both the years of study have been presented in Table - 1.

The fungal spore types belonged to either Ascomycotina or Deuteromycotina. *Chaetomium* and *Penicillium* were the only Ascomycotina components, contributing lowest percentage to the total allergenic airspora. Of the fungal spore types belonging to Deuteromycotina, the highest contribution was of *Cladosporium* (61.84% in 2013-14 and 64.05% in 2014-15) while the lowest was that of *Epicoccum* (0.47% in 2013-14 and 0.27% in 2014-15).

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Although the relative concentration of allergenic pollen types recorded in this study did not show any significant differences, *Parthenium hysterophorus* had the highest percentage contribution (3.48% in 2013-14 and 3.20% in 2014-15).

Out of 119 patients, 68 (57.14%) patients were males and 51 (42.86%) were females. Clear cut family history was present in 39 (32.77%) patients. 31.95% of patients belonged to the age group 21-30 years representing the highest percentage, thus confirming it to be the most susceptible and sensitive age group for allergic manifestations (Table-II). This was followed by the age group 11-20 years encompassing 21.87% of patients, then 31-40 years (21.02%), 41-50 years (11.77%), 50-60 years (10.02%) and lastly 1-10 years (3.37%).

Disease-wise distribution reveals that bronchial asthma is the commonest of allergic manifestations (41.2%). 21.1% of the patient suffered with allergic rhinitis and 20.5% with bronchial asthma with rhinitis. Dermatological allergies were manifested in 6.7% of the patients, while 0.6% of the patients presented with urticaria. Only 0.89% of patients came primarily for their manifestations of allergic symptoms of headache and conjunctivitis (Table- III.)

Analysis of aggravating factors showed that dust was the commonest offending agent for the manifestation of bronchial asthma, allergic rhinitis and bronchial asthma with rhinitis. Seasonal predilection was found to be the next important factor in the above nasobronchial allergic aggravations. In dermatological allergic manifestations, contactants and diet are also important factors along with some seasonal predilection (Table - IV).

The present clinical investigation includes 119 patients exclusively belonging to the different areas of Ara. As the patients were self motivated for their allergic diagnosis or reported to the clinic on being referred by other local hospitals or general practitioners, the sample may represent the average population of the city. The male patients outnumbered female patients. Prevalence of most of the diagnosed allergic diseases was more common in the age group of 21-30 years. Similar observations have earlier been made by Mittal *et al.*, (1978) at Kanpur. Positive family history was recorded in 32.3% of the patients which indicates a familial predisposition as emphasized by other workers (Corr. *et al.*, 1964; Singh, 1973). Occupational relation with allergic symptoms was very marked in the present sample.

Onset of allergic symptoms in the majority of patients was found to occur in the first or second decade of life. A gradual decreasing trend in the appearance of disease symptoms was observed with the advancing age of patients.

Out of the six types of allergic diseases diagnosed, bronchial asthma was of the most frequent occurrence. Incidence of allergic rhinitis and bronchial asthma with allergic rhinitis were the next common nasorespiratory allergic conditions. The reason may be that the nasorespiratory mucosa is exposed to common allergens like dust, fungal spores and pollen, etc. Dermatological allergic manifestations occupied second position after nasorespiratory allergy which was primarily caused due to exposure to contactants and intake of dietary items with certain amount of seasonal predilection. Effect of season on the aggravation of nasobronchial allergic symptoms was most conspicuous.

TABLE-I
Variation in the yearly mean concentration and the percentage contribution of different spore types to the total allergenic airspora.
(From 1st July, 2013 to 30th June, 2015)

Sl. No.	Spore type	No. of spores/m ³ of air		%age contribution to the total allergenic airspora	
		2013-14	2014-15	2013-14	2014-15
1.	<i>Alternaria</i> Nees.ex Wallr.	283066	295078	12.88	12.24
2.	<i>Aspergillus</i> Link.	67214	65114	3.06	2.70
3.	<i>Chaetomium</i> Kunje. ex Fr.	12152	7126	0.56	0.30
4.	<i>Cladosporium</i> Link ex Fr.	1358630	1539622	61.84	64.05
5.	<i>Curvularia</i> Boedijn	172914	205366	7.88	8.55
6.	<i>Epicoccum</i> Link.ex Wallr.	10248	6286	0.47	0.27
7.	<i>Fusarium</i> Link. Ex. Fr.	9968	11298	0.45	0.47
8.	<i>Helminthosporium</i> Link ex. Fr.	58968	53186	2.68	2.22
9.	<i>Penicillium</i> Link. Ex Fr.	5810	5698	0.26	0.24
10.	<i>Croton bonplandianum</i> Baill.	72184	70154	3.28	3.92
11.	<i>Parthenium hysterophorus</i> L.	76398	76804	3.48	3.20

TABLE-II
Age and sexwise distribution of patients

Sl. No.	Age group years	No. of Male patients	No. of Female patients	Total patients	Average %-age of Male	Average %-age of Female	Average %-age of both sexes in diff. groups.
1	1-10	3	1	4	57.14	42.86	3.37
2	11 - 20	14	12	26			21.87
3	21 - 30	23	15	38			31.95
4	31 - 40	13	12	25			21.02
5	41 - 50	6	8	14			11.77
6	41 - 60	9	3	12			10..02
Total		68	51	119			

TABLE - III
Disease wise distribution of patients

Sl. No.	Disease	Male	%of Male	Female	%of Female	Total	% age of both Male & Female
1	Bronchial asthma	28	57.14	21	42.86	49	41.18
2	Allergic rhinitis	15	60.00	10	40.00	25	21.00
3	Bronchial asthma & rhinitis	15	60.00	10	40.00	25	21.00
4	Skin allergies	5	62.05	3	37.05	08	6.73
5	Urticaria	5	45.45	6	54.55	11	9.24
6	Others (Headache & conjunctivitis)	-	-	1	100.00	01	0.85

TABLE-IV
Aggravating factors % as reported by patients

Sl. No.	Diagnosis	No. of Patients	Dust	Food	Effect of season	Contactants	Others
1	Bronchial asthma	49	21	11	13	3	1
2	Allergic rhinitis	25	12	7	4	1	1
3	Bronchial asthma & Allergic rhinitis	25	10	5	6	3	1
4	Skin allergies	08	2	2	3	1	-
5	Urticaria	11	-	5	4	1	1
6	Others (Headache & conjunctivitis)	01	-	-	-	1	-

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DISTRIBUTION AND MORPHOLOGICAL TRAITS OF BAMBOO OF HAZARIBAG, RAMGARH AND CHATRA DISTRICTS OF JHARKHAND AND THEIR SUSTAINABLE ETHNOBOTANICAL UTILIZATION

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Key words : Bamboo, morphological diversity, sustainable, ethnobotanical, utilization.

No country of South East Asia is without indigenous bamboo flora. This natural resource plays a major role in the livelihood of rural people and in rural industry. It helps in poverty reduction, woman empowerment and environmental preservation. It could be observed in socio-economic development of rural poor including tribal community and small producer groups. Bamboo is a word that conjures up different images in the mind; images of construction material, furniture, handicrafts, basket ware, mating, paper, food fodder and fuel. No wonder then, that this resource has been variously called including "the poor man timber". Only 5 species have been recorded from the villages of three districts (Hazaribagh, Chatra and Ramgarh) of North Chotanagpur. This paper primarily describes the morphology and sustainable utilization of different bamboo species mainly by tribes since decades.

INTRODUCTION

Bamboos are tree like woody grasses belonging to family Poaceae and sub-family Bambusoideae which are exceptionally diverse plants and unevenly distributed in various parts of humid tropical, sub-tropical and temperate regions of the earth where the annual rainfall ranges between 120 to 400 cm and temperature varies between 16°C to 38° C (Subramanian, 1998). Bamboo is regarded as the "Emperor" among the grasses. It is one of the most productive, fast growing, sustainable, versatile and environment friendly plant species. Commonly referred to as "The Green Gold" of the 21st century. It is available at much lower price compared to wood and is as strong as the strongest wood. It has found applications as an alternative source of depleting and costly wood resources and an option to expensive construction and furnishing materials and one of the most primitive plant species that survive today. Bamboo is very important forest product for forest depending people in North Chotanagpur. It controls soil erosion, wind break and landscaping and also helps in soil stabilization and carbon dioxide sequestration. It is used from cradle to coffin and solves so many environmental problems (Tewari, 1992). Some bamboo species like *Dendrocalamus strictus* (bonbans) *Bambusa balcooa*, *B. bambos*, etc. are used for edible purpose. The most widely used species for edible purpose is *D. strictus*.

Worldwide there are more than 1250 species under 75 genera (Soderstrom and Ellis, 1988). About 80% of species and areas are confined to South and South East Asia, mostly in China, India and Myanmar. There are 138 species in India spread across 24 genera (Subramanian, 1998). India possesses 25% of the species found in the world; 43% species are found in Asia with rich species diversity. India is one of the leading countries of the world after China in bamboo production. An estimated 8.96 million ha forest area of the country is covered with bamboo (Rai and Chauhan, 1998).

This constitutes around 12.8 percent of total area of forest cover in country.

The knowledge of bamboo distribution with botanical description and their utilization is far from satisfactory and there are many gaps in our knowledge. With increased population pressure, natural stand of bamboo and its diversity, have declined considerably. Further no systematic and concerted effort has so far been made towards documentation of information on the subject, particularly in Hazaribag, Chatra and Ramgarh districts. Moreover, there exists some controversy over the availability of different bamboo species growing in and outside the forest. However, information on species distribution in these districts is not available. The present study aims at filling up this gap and assessing the bamboo species distribution, genetic variability and their ethnobotanical utilization.

MATERIAL AND METHODS

Simple random sampling procedure was adopted and field survey was carried out. A total of 30 villages were randomly selected covering three districts, i.e., Hazaribagh, Chatra and Ramgarh. In general, ten villages were selected from each district. The selection of villages in each district was done randomly and the total bamboo plantations were documented in the field from each village, information related to morphological traits (culm/non culm forming, node/internode distance, shape & size of sheath, foliage, culm colour, culm diameter, type of flowering, flowering time, etc.) were recorded. Questionnaires and schedules were organised for taking the data on use of Bamboo for livelihood purposes. Open ended interview from the members of different tribal communities were also conducted to record the ethnobotanical uses of bamboo species. The bamboo species were identified, on the basis of morphological and anatomical descriptions of plants (Campbell, 1988; Varmah and Bahadur, 1980; Tewari, 1992) and culm sheath morphology (Chatterji and Raizada, 1963).

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RESULTS

Species distribution

The main species recorded in the natural forest areas are *Dendrocalamus strictus* (more than 98% as recorded) and *Bambusa bamboos* (in some places). The specieswise bamboo distribution in Hazaribag, Chatra and Ramgarh districts of North Chotanagpur division of Jharkhand are *B. bamboos*, *B. nutans*, *B. tulda*, *B. striata*, and *D. strictus*.

B. striata is commonly found as ornamental plant in some selected places of Hazaribag. Among the species listed above *D. strictus*, *B. nutans*, and *B. tulda* are three species found throughout the three districts of North Chotanagpur except in very few villages. Results on species distribution in study in the study area reveal that *B. nutans* is widely or most frequent. *D. strictus* second frequent and *B. tulda* is third frequent species in all the three districts of North Chotanagpur and cover most of the bamboo areas. The next dominating species is the *B. bamboos* (Kanta bans) which is found at some places.

Botanical description and their uses

Taxonomic name : *Bambusa bamboos* (L.) Voss

Common name : Kanta bans

Botanical description : It is the longest bamboo of North Chotanagpur. The culms were 20.583 m long that are usually strong, bright to dark green and shining. Nodes are slightly swollen and lower nodes produce roots. The mean length of internode was 28.312 cm long and mean value of diameter was 8.7408 cm. The branches were curved that develop from all nodes in upward direction, lower branches long, spreading and with recurved spines and spines usually in threes. The branches of big and old bamboo were usually bent towards the ground. The mean length of culm sheath was 25.66 cm and breadth was 20.92 cm at the base. It had leathery texture with dark brown hairs. It was deciduous at the time of branch development. The mean length of blade was 6.54 cm and breadth was 7.61 cm at base that was erect and triangular with smooth outer surface and inner side covered with dark brown, velvety hair. Leaves are highly variable in size. The mean length of leaves was 17.14 cm and breadth was 2.068 cm.

TABLE-1 : Measurement of different parameters of *B. bamboos*

	Height (m)	Diameter (cm)	Internode Length (cm)	C. sheath		Blade		Leaves	
				Length (cm)	Breadth h (cm)	Length (cm)	Breadth h (cm)	Length (cm)	Breadth h (cm)
Mean	20.583	8.7408	28.312	25.66	20.92	6.54	7.61	17.14	2.068
Stdev	3.5075	1.9196	5.7462	4.230	4.753	0.611	1.12	3.187	0.411
SE±	0.8614	0.4796	1.4265	1.039	1.183	0.148	0.27	0.795	0.102
CV%	17.018	22.176	20.288	16.37	23.07	9.298	14.4	18.68	19.92

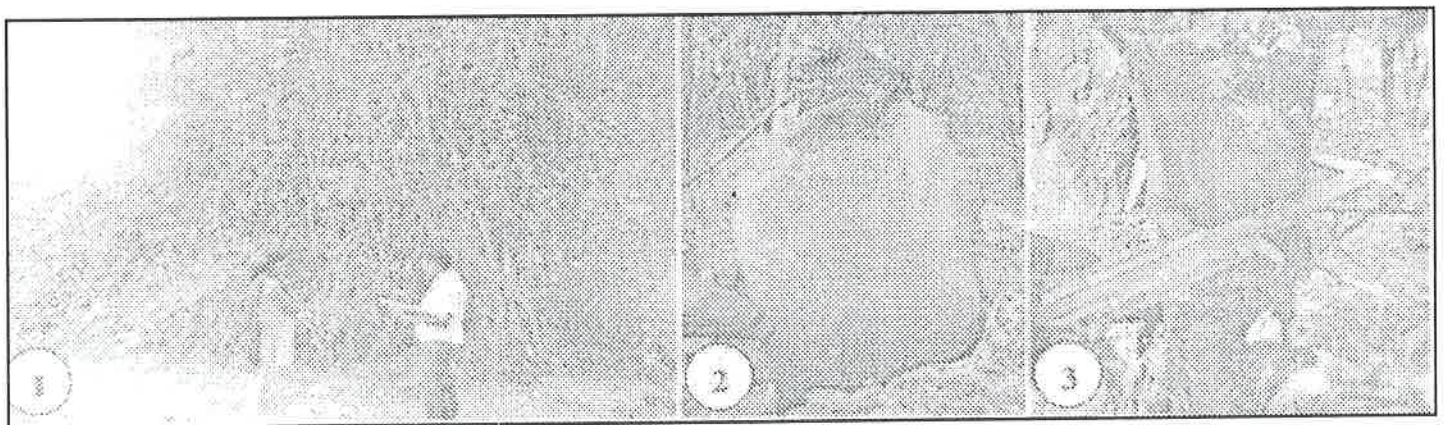


Fig - 1 : *B. bamboos* at Kandtari village of Barkagaon block (Hazaribag) (2) Culm sheath of *B. bamboos* (3) Measurement of culm diameter

Uses including ethnobotanical importance :

In Hazaribag, Ramgarh and Chatra districts, this is one of the commercial species. It is the most preferred bamboo for house construction (roof & roof tiles, door & windows frame), scaffolding, ladders and props for small bridges. It is also used for manufacturing of value added product like Sofa chair, lamp stand, magazine holder, flower stand, lamp holder, corner chair, pen stand, stool, shoe rack, wall hangers, fishing apparatus, sports good, sitting bench, toys, etc.

The spiny branches are used for fencing and support sticks for climbing crop plants in the agriculture field. It is good species for boundary planting. It is good soil binder due to their peculiar clump formation and fibrous root system and hence plays an important role in soil and water conservation. This bamboo is used in construction of well ladders 'lattha' and their poles which is used for digging of well. Some villagers do worship this bamboo after marriage which is one of the important traditional uses. The marriage 'Maur'

(traditional cap) are hanged over the branches of *B. bambos*. This type of worship is prevalent at Kandtari village of Barkagaon block (Hazaribag).

Taxonomic name: *Bambusa nutans* (Wall. Ex Munro)

Common name: Jawa bans or Ropa bans or Dehati bans

Botanical description : From Table 2, results show that it is a medium-size bamboo. The mean culm height is 17.4 m long and diameter 7.1536 cm. The culm is dark to dull green in colour. There are many brances above and fewer branches

below, usually unbranched below the culm. There is white ring found below the nodes and nodes are slightly thickened and often with hair. Lower nodes bear rootlets. The mean length of internodes is 35.133 cm. The mean length of culm sheath is 23.32 cm and breadth is 22.46 cm at the base. Scattered black hairs are present on the back of culm sheath. The mean length of blade is 7.45 cm and breadth 6.94 cm at base with black hair on the outer surface. The auricle is well developed. Leaves are 21.21 cm long and 2.641 cm broad.

TABLE-2 : Measurement of different parametes of *B. nutans*

	Height (m)	Diameter (cm)	Internode Length (cm)	C. sheath		Blade		Leaves	
				Length (cm)	Breadth (cm)	Length (cm)	Breadth (cm)	Length (cm)	Breadth (cm)
Mean	17.4	7.1536	35.133	23.32	22.46	7.45	6.94	21.21	2.641
Stdev	2.7815	1.0153	5.2522	4.423	4.697	1.306	1.92	3.397	0.629
SE±	0.6219	0.2270	1.1744	0.989	1.050	0.292	0.43	0.759	0.140
CV%	15.980	14.221	14.903	18.99	20.70	17.37	26.1	16.05	23.94

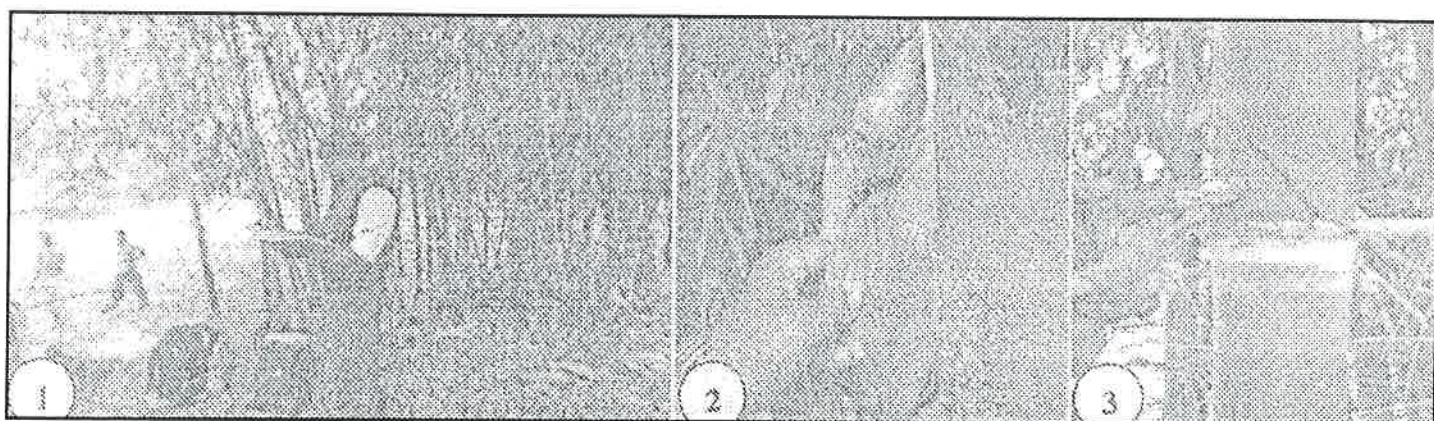


Fig.- 2 : *B.nutan* at Dhangadha village ofTundwa block (Chatra) (2) Culm Sheath (3) Showing white ring below the node

Uses including ethnobotanical importance :

The culm is thick, good, strong, straight and used locally for various purposes, mainly for poles such as electric poles, flag poles, house construction poles, shadi, puja pandal construction poles, stage construction poles etc. in every places. Bamboo culms are generally also used in house construction mainly for roofs and roof tiles, door and window frames, scaffolding, furniture, cooking utensils, ladders, cart yoke, boat, bridges, boundary wall,etc. It is also used for making cradle, coffin, fish trapping nets, fishing rods, fuel, kites, sports-goods, toys,etc.

The culms of bamboo are largely used in agriculture for green houses and animal shed construction, fencing, props and support sticks. Leaves are used as fodder, especially for goats. Plants control the soil erosion and also help in soil and water conservation and CO₂ sequestration. It is also used for value added product like sofa chair, lamp stand, magazine

holder, flower stand, lamp holder, comer chair, pen stand, stool, shoe rack, wall hangers, etc.

Taxonomic name : *Bambusa striata* (Lodd. ex Lindl.)

Common name : Pila bans

Botanical description: The data of Table-3 mean height of culm is 10.15 m. and diameter 6.0335 cm at BH. The culm colour is yellow with light green stripes or rarely light green with yellow stripes. The mean internode distance is 23.402 cm at or near the BH and wall thickness is 1.177 cm. The mean culm sheath length is 16.18 cm and breadth is 29.57 cm at the base. The breadth of culm sheath is larger than length. The outer surface of culm sheath is covered with brown black hair. The edges are ciliated and have two auricles. The culm sheath is broad, rounded and often beautiful when young. The mean length and breadth of blade is 7.01 cm and 7.65 cm respectively. Average length of leaves is 21.1 cm and breadth 2.795 cm.

TABLE-3 : Measurement of different parameters of *B. striata*

	Height (m)	Diameter (cm)	Internode Length (cm)	C. sheath		Blade		Leaves	
				Length (cm)	Breadth (cm)	Length (cm)	Breadth (cm)	Length (cm)	Breadth (cm)
Mean	10.15	6.0335	23.402	16.18	29.57	7.01	7.65	21.10	2.795
Stdev	1.6630	0.7838	2.9474	1.087	2.201	0.905	1.17	3.174	0.664
SE±	0.3718	0.1752	0.6590	0.243	0.492	0.202	0.26	0.709	0.148
CV%	16.384	12.992	12.594	6.718	7.442	12.91	15.3	15.04	23.76

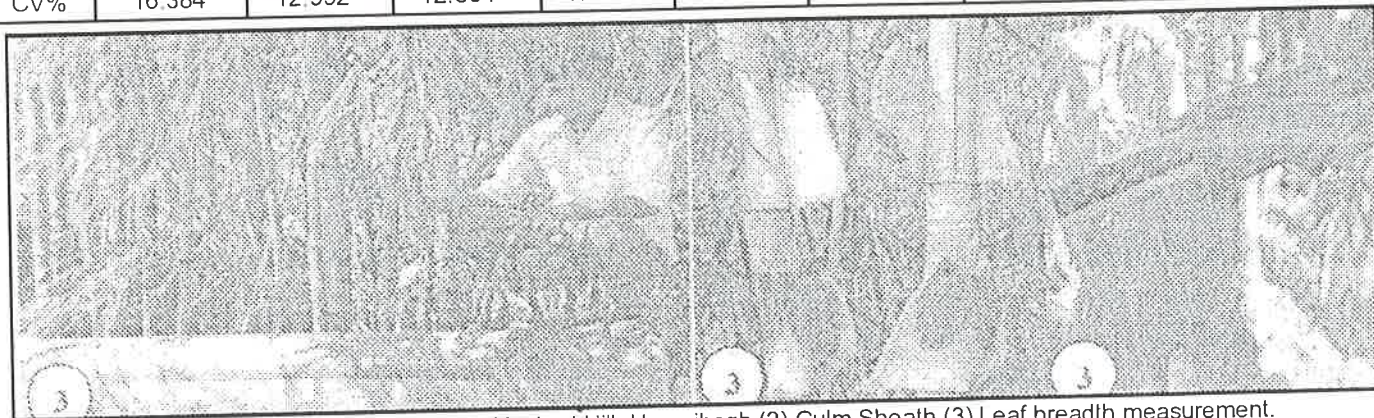


Fig.- 3 : *B. striata* at D.A.V. School, Kanhari Hill, Hazaribagh (2) Culm Sheath (3) Leaf breadth measurement.

Uses including ethnobotanical importance :

This species is used as ornamental plant mainly for garden decoration, making decorative items and handicrafts like corner flower stand, hanging lamp, lamp holder, table flower pot, hanging wall flower pot, flower stand, pen stand, etc. It is an important species for manufacturing of value added products. Taxonomic name : *Bambusa tulda* (Roxb.) Common name : Taral bans

Botanical description : This species may be evergreen or deciduous. The mean height of culm is 17.75 m long. The culm is strong, glabrous, upright and smooth. The young culm is green when young and grey-green at maturity. The young

culm may be dark green in colour with slight whitish stripes on internode that comes easily. The mean length of internode is 51.189 cm and diameter was 7.5429 cm at BH. The lower nodes have fibrous roots. The branches may come out from almost all nodes, but lowest nodes have horizontal branches and almost leafless. The mean length of culm sheath is 21.15 cm and breadth is 16.34 cm. The inner surface of culm sheath is smooth and often with whitish powder and outer surface covered with brown hair. The mean length of blade is 7.348 cm and breadth 6.71 cm with broadly triangular structure. The average length of leaves is 21.10 cm and breadth 2.866 cm at middle with linear-lanceolate or lanceolate shape.

TABLE-4 : Measurement of different parameters of *B. tulda*

	Height (m)	Diameter (cm)	Internode Length (cm)	C. sheath		Blade		Leaves	
				Length (cm)	Breadth (cm)	Length (cm)	Breadth (cm)	Length (cm)	Breadth (cm)
Mean	17.75	7.5429	51.189	21.15	16.34	7.348	6.71	21.10	2.866
Stdev	1.8039	1.3624	6.5213	2.749	2.015	0.581	0.80	3.460	0.624
SE±	0.4417	0.3373	1.5960	0.678	0.496	0.140	0.19	0.858	0.154
CV%	10.134	18.038	12.764	13.01	12.33	7.947	11.9	16.38	21.80

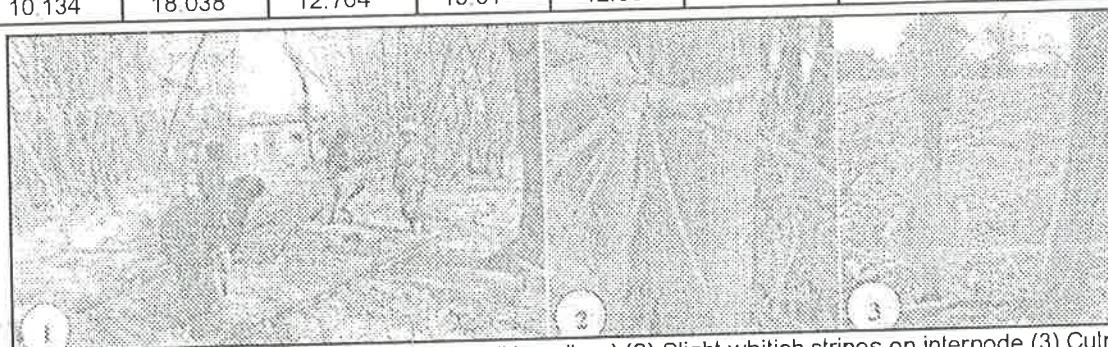


Fig.- 4 : (1) *B. tulda* at Jamuyari village of Ichak block (Hazaribagh) (2) Slight whitish stripes on internode (3) Culm Sheaths

Uses of *B. tulda* including ethnobotanical importance :

It is utilised for various purposes depending upon its properties. It plays an important role in the daily life of people. This species is very useful for house construction, rafters, thatching, roofing, doors and windows frame scaffolding, flag poles etc. Culms are used to make several different types of weapons like bows and arrows by tribes of Chatra district.

It is an important edible bamboo species specially for making excellent pickles. It is one of the two (*D. strictus* and *B. tulda*) most important edible species. Young shoot or *Karil* as locally called is used for making vegetable, Chutney, Sandhna, etc. Leaves are used as fodder, especially for goat.

According to people of some areas of these three districts, it is traditionally favoured for basketry and woven application. The culm is used in almost the whole study area for making handicrafts like baskets (Ganja, Mouni, Tokri, Khanchia, Douri, Dala, Dalia), Taraju, Jhadu, food-grain containers, mats, hats, hand, fan, shupe, etc. Due to fast growing, easy propagation, soil binding properties and short period required to attain maturity, it is an ideal species for use in afforestation (especially as a soil stabilizer & water conservation) and social

forestry (especially in Check dam, river, etc).

Taxonomic name : *Dendrocalamus strictus* (Roxb.)

Common name : Lathi bans, Pahari bans, Bon bans, Jungli bans.

Morphological description : The mean height of culm is 12.238 m. It is pale blue green when young and dull green or yellowish when old and much curved above half of its height. The nodes are generally swollen with lower nodes often with rootings. The mean length of internode was 25.155 cm with thick walls and almost without hollow space. Therefore, it is also called solid bamboo. The mean diameter is 5.4946 cm at BH. Culm sheath is long with auricle small or absent. The mean length of culm sheath is 20.37 cm and breadth 10.04 cm at the base. The culm sheath is covered with golden brown stiff hairs on the back. The mean length of blade is 6.356 cm and breadth 4.04 cm at the base and is erect, triangular and smooth. The auricle was short or may be completely absent. The mean length of leaf is 20.42 cm and breadth 2.784 cm at the middle. The leaves are highly variable, small in dry localities and long in moist areas.

TABLE-5 : Measurement of different parameters of *D. strictus*

	Height (m)	Diameter (cm)	Internode Length (cm)	C. sheath		Blade		Leaves	
				Length (cm)	Breadth (cm)	Length (cm)	Breadth (cm)	Length (cm)	Breadth (cm)
Mean	12.238	5.4946	25.155	20.37	10.04	6.356	4.04	20.42	2.784
Stdev	2.0823	1.51-81	3.8743	4.086	1.342	1.128	0.78	3.081	1.310
SE±	0.4897	0.3564	0.9170	0.952	0.312	0.264	0.18	0.664	0.296
CV%	17.036	27.635	15.360	20.01	13.42	18.20	19.0	14.74	42.82

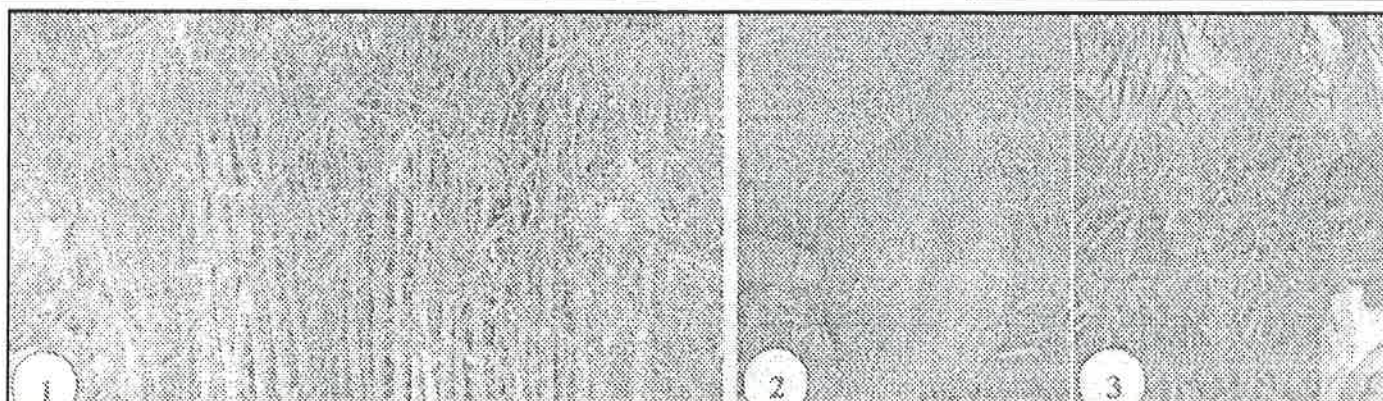


Fig.- 5 : (1) *Dendrocalamus strictus* at Chorka village of Barkagaon block (Hazaribag) (2) Culm Sheath (3) Leaves

Uses of *D. strictus* including ethnobotanical importance:

D. strictus is used for manufacturing different types of weapons like spears, lathi, archery bows and arrows.

It is also an edible bamboo species specially for making excellent vegetables. It is one of the most important edible species. Young shoots or *Karil* as locally called is used for making vegetables, chutney, sandhna etc. Leaves are used as fodder, especially for goat. Culms are used as poles for house construction, scaffolding, ladders, bridges, etc. It is used in flag sticks, rafters, thatching and roofing. Sometimes,

cradle and coffin is also made by this bamboo. This bamboo is used in agricultural implements like sticks, tool handle, akhain, fencing, anchors, etc.

DISCUSSION

Out of 24 genera comprising 138 species, 8 genera with 32 species are distributed in the peninsular India especially the Western Ghats and the others in the north eastern states (Subramanian, 1998). The Indian state having richest species diversity is Manipur with 53 species (Sobita Devi and Sharma, 1993) followed by Arunachal Pradesh with 50 species.

Altogether the north eastern states have 63 species (Sharma *et al.*, 1992). North east India supports more than 50% of total genetic resources which is followed by peninsular India where Eastern and Western Ghats are located which accounts for about 23% of genetic resources occurring naturally. A total of 10 bamboo species have been recorded from villages of Jharkhand. In Jharkhand, bamboo covers 226850 ha forest areas equivalent to 9.61% of total forest areas of state (Nathr *et al.*, 2012). Under the present investigation only 5 bamboo species have been recorded from 30 villages covering three districts mainly Hazaribagh, Chatra and Ramgarh of North Chotanagpur of Jharkhand which have been used by the locals since decades. Out of the five species, *Bambusa nutan* and *Dendrocalamus strictus* is an found to have a wide range of distribution throughout in three districts (Hazaribagh, Chatra & Ramgarh). *D. strictus* is an important forest genetic resource because this species is extensively used as vegetable, agriculture farm tools and building construction. *B. nutan* is also important homestead genetic resource because this species is also extensively used as daily use articles building construction. Lal *et al.*, (1952) have shown that various marketable products such as curry, candy, chutney, pickle, etc. could be prepared from the young shoots of this species.

This particular use has been documented throughout the three districts (Hazaribagh, Chatra & Ramgarh) of North Chotanagpur and is known to all the tribal communities residing in this area. The three species, viz., *Babusa tulda*, *B. bambos* and *B. striata* holds importance because of their use as food, fodder, fuel, building construction, handicraft, musical instruments, weapons, ornamental decoration, etc. and are widely distributed throughout the study area. *B. bambos* is one of the most useful bamboos for constructional purposes (Yudodibroto, 1987, Vivekanandan, 1987). A man is born in a bamboo cradle and goes away in a bamboo coffin. In between, everything is possible with bamboo.

Among all the species, *B. bambos*, locally known as Kanta bans is the tallest bamboo having mean culm length 20.583 m as well as thickest bamboo having mean diameter 8.7408 cm at breast height. With respect to internode length, *B. tulda* has maximum mean internode length (51.189 cm). Kanta bans (*B. bambos*) exhibits maximum mean culm sheath length (25.66 cm) and maximum breadth (29.57 cm) in Pila bans (*B. striata*). Blades are more or less similar except in *D.*

strictus. The maximum mean length (21.21 cm) of leaf was reported from *B. nutans* and maximum breadth (2.866 cm) from *B. tulda*.

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IMPACT OF DISEASES ON THE TASAR COCOONS OF *Antheraea mylitta* D. (SATURNIIDAE : LEPIDOPTERA)

Priyanka Bhagat and V.N. Singh

Key words : *Polyhedrosis, Tasar silk yarn, Denier, seed crop and commercial crop.*

The present communication accounts for the relative effects of four different types of serious diseases, viz., microsporodiosis, bacteriosis, virosis and mycosis on the quality of tasar silk producing cocoons of *Antheraea mylitta* D. during the seed crop and commercial crop seasons. Results obtained are indicative of the fact that all the four diseases of tasar silkworm adversely affect the quality of tasar cocoons as well as tasar silk yarn. Among the four diseases the microsporodiosis caused by sporozoan parasite (*Nosema* infection) has been found to be relatively more serious affecting the cocoon weight, shell weight, shell ratio and tasar silk yarn as compared to three other said diseases. The relative variations in respect of qualitative characters of tasar cocoons in relation to aforesaid diseases are probably due to the different nature and mode of infection of four different pathogens causing four different diseases of tasar silkworm.

INTRODUCTION

Indian tasar silkworm, *Antheraea mylitta* D. suffers great loss of crop (70% to 80%) due to some serious diseases like microsporodiosis, bacteriosis, polyhedrosis and mycosis caused by different pathogens during the seed crop and commercial crop seasons. The estimated crop loss due to microsporodiosis (pebrin disease) alone in case of *Antheraea mylitta* D. is reported to be to the tune of 40% (Sen and Jolly, 1972). Apart from this, the viral infection (polyhedrosis), bacterial infection (bacteriosis) and also fungal infection (mycosis) have been found to adversely affect the quantitative and qualitative characters of *Antheraea mylitta*, the popular tasar silk producing insect of great commercial value (Ahsan and Jamney, 1975).

Some significant investigations in relation to relative effect of different pathogens causing serious diseases among the sericigenous insects have been carried out by earlier workers in order to understand the extent of harm caused by the said diseases on the productivity and quality of silk yarn under different conditions (Akai, 1998; Bhatia *et al.*, 2010; Kirsur, 2003; Moon *et al.*, 2007; Naik *et al.*, 2005; Pandey *et al.*, 2012 and Sharma *et al.*, 2013).

The present communication has been designed to understand the relative impacts of four serious diseases of tasar silk producing insect *Antheraea mylitta* on the quality of tasar cocoons during two different seasons of rearing in the larger interest of wild tasar culture practiced by poor rearers on different tasar host plants in the tropical tasar belts of our country.

MATERIALS AND METHODS

The infected cocoons of *Antheraea mylitta* due to diseases like microsporodiosis, bacteriosis, polyhedrosis and mycosis were collected during seed crop (July-August) and commercial crop (Sep -Oct.) seasons. The cocoons were stored separately under normal laboratory condition and further analysed for the different qualitative parameters, viz., cocoon wt. (gm), shell wt. (gm), tasar filament length (m), non-breakable filament length (m), filament denier and reliability as per the methods suggested by Jolly (1971). The experiments were carried out for both the seed crop and commercial crop seasons. A comparative picture in relation to four different diseases with respect to qualitative characters of tasar cocoons has been presented in the Table.

TABLE

Table showing effect of different diseases on the qualitative characters of cocoons of *Antheraea mylitta* D.

Sl. No.	Characters	Season	Microsporodiosis	Bacteriosis	Polyhedrosis	Mycosis	Control
1.	Av. weight of cocoons (gm.)	I	10.40	11.68	11.79	11.81	11.95
		II	11.68	11.72	11.80	11.86	12.16
2.	Av. shell weight per cocoons (gm.)	I	1.28	1.30	1.37	1.38	1.41
		II	1.30	1.36	1.39	1.40	1.43
3.	Av. length of filament per cocoon (m.)	I	740	750	751	761	769
		II	744	750	755	761	768
4.	Av. Non-Breakable Filament length per cocoon	I	230	230	240	242	247
		II	232	238	246	249	251
5.	cocoon (m.) Av. Filament Denier	I	5.62	6.12	6.62	6.62	6.71
		II	5.68	6.14	6.72	6.73	6.79
6.	per cocoon (%) Av. reelability (%)	I	73.3	75.2	78.0	78.4	80.2
		II	75.7	75.8	78.2	78.8	81.0

Season I - Seed Crop

Season II- Commercial Crop

RESULTS AND DISCUSSION

The Table reveals that the qualitative characters of cocoons during seed crop and commercial crop, viz., average wt. of cocoons (10.40 and 11.68) due to microsporodiosis, (11.68 and 11.72) due to bacteriosis (11.79 and 11.80) due to polyhedrosis and (11.81 and 11.88) due to mycosis exhibit evident variations during seed crop and commercial crop as compared to control (11.95 and 12.16). Similarly other qualitative characters such as average shell wt., average length of filament, average non-breakable filament length, average filament denier and reelability during seed crop (1.28, 740, 230, 5.62, 73.3) and commercial crop (1.30, 744, 232, 5.68, 75.7) due to microsporodiosis, (1.30, 750, 230, 6.12, 75.2) and (1.36, 750, 238, 6.14, 75.8) due to bacteriosis, (1.47, 751, 2.0, 6.62, 78.0 and (1.39, 755, 246, 6.72, 78.2) due to polyhedrosis and (1.38, 761, 242, 6.62, 78.4) and (1.40, 761, 249, 6.73, 78.8) due to mycosis as compared to control (1.41, 769, 247, 6.71, 80.2) and (1.43, 768, 251, 6.79, 81.0) show variations for both the seasons. However, the pathogens also account for these variations. However, the adverse effect of microsporodiosis as compared to three other diseases on the qualitative characters of tasar cocoons is highly significant. The table further reveals that the adverse effect of mycosis on quality of cocoons is relatively less than microsporodiosis, polyhedrosis and bacteriosis. The qualitative characters of cocoons during commercial crop season have been found to be relatively better than the seed crop season, which account for the seasonal variation.

The results presented here have led us to believe that the relative variations in the qualitative characters of cocoons in respect of four different diseases are probably due to different nature and mode of infection of four different pathogens. However, microsporodiosis appears to be more harmful than three other pathogens such as bacterial, viral and fungal. The relative superiority of commercial crop cocoons as

compared to seed crops cocoons in respect of diseases is presumably due to differences in the environmental conditions between two different seasons. Thus it is logical to believe that commercial crop season provides conducive environment for the culture of tasar silk worms than the seed crop season.

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BIOCHEMICAL ANALYSIS OF ACTIVITY OF SUPEROXIDE DISMUTASE (SOD) IN HUMAN FEMALE SALIVA UNDER DIFFERENT REPRODUCTIVE EVENTS AND METABOLIC DISORDER CONDITIONS

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Key words : Saliva, Superoxide Dismutase, pre-pubertal, Parous, non-parous, menopausal, diabetogenic.

When salivary antioxidant enzyme Superoxide dismutase (SOD) activity in saliva of different reproductive physiological conditions like, pre-pubertal, parous, non-parous, menopausal and diabetic conditions was estimated in human female subjects, the results revealed a highly significant ($p < 0.001$) increased activity in parous and non-parous pre-ovulatory and ovulatory phases in comparison to pre-pubertal saliva. But in menopausal condition it showed ($p < 0.05$) decreased activity than parous post-ovulatory ($p < 0.001$) and decreased activity of parous pre-ovulatory ($p < 0.05$) from ovulatory salivary activity. Diabetogenic human female salivary SOD activity showed a ($p < 0.001$) decreased activity in comparison to parous pre and ovulatory salivary activity. Decreased action menopausal salivary SOD were also highly significant ($p < 0.001$) from non-parous pre and ovulatory saliva. In diabetogenic condition the salivary SOD activity showed a highly significant ($p < 0.001$) decreased level than parous ovulatory and ($p < 0.01$) highly significant from non-parous ovulatory salivary activity. All such increased and decreased activity of SOD in saliva of various reproductive events and in pathological conditions in human female subjects might be due to the oxidative stress in women during secretion of ovarian hormones during different reproductive physiological and pathological conditions.

INTRODUCTION

Human saliva is a non-invasive biofluid possessing several functions involved in oral health and homeostasis. It originated mainly from three pairs of major salivary glands and from a large number of minor salivary glands like Von Ebner glands and Bandin-Nuhm gland (Carran *et al.*, 2005). It provides several opportunities in diagnosis, toxicology and in forensic science and many salivary proteins offer great potential in chemical and epidemiological research in oral as well as in general health studies (Chiappin *et al.*, 2007).

Reactive oxygen species (ROS) plays a number of significant diverse roles in female reproductive biology including uterine environment, oocyte maturation and ovulation corpus luteum function and regression (Riley and Behrman, 1991). Ovarian estrogen has been shown to have *in vitro* antioxidant effect on membrane phospholipid peroxidation (Sugioka *et al.*, 1987). Various biomarkers of oxidative stress have been demonstrated earlier in normal cyclic human ovaries (Agarwal *et al.*, 2005; Alagendrans *et al.*, 2007; Burger *et al.*, 1968). All follicular stages were examined for the expression of SOD. There is a delicate balance between reactive oxygen species and antioxidant enzymes in ovarian physiology which ultimately control and integrate different processes of reproduction.

Therefore, the present proposed investigation has been undertaken to know antioxidant enzyme SOD activity in different phases of reproductive events in human female

subjects to assess the timing and magnitude of changes in parameters of antioxidant quantity status in relation to fluctuation of steroid hormones during reproductive cycle, various states and pathological conditions in human female subjects.

MATERIAL AND METHODS

The studies were performed in 60 different human female volunteers of age group 19 to 40 yrs categorized as pre-pubertal, parous, non-parous, menopausal and diabetogenic.

Collection of samples : The human female's unstimulated whole saliva was collected during various periods of parous and non-parous volunteers, viz., pre-ovulatory, ovulatory and post-ovulatory phases and also from pre-pubertal, menopausal and diabetogenic stages and were stored at -70°C for further use (Navazesh and Christensen, 1981). Subjects were asked not to swallow any saliva during collection period. Saliva volume was measured with the tube sealed and then frozen in dry ice until taken back to the laboratory for processing. All the saliva samples of different category of female subjects were placed into salivate tube using a natural cotton swab insert and centrifuged at 400g for 10 minutes at 4°C . The supernatant was further processed for the estimation of Superoxide Dismutase enzyme activity in saliva sample by the method of Kakkar *et al.* (1984).

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TABLE -1 : Level of Superoxide Dismutase (SOD) in Saliva Samples of Different Conditions in Human Female Subjects.

Sl. No.	Name of different conditions with symbols	Level of Superoxide Dismutase (in unit/l) mean \pm SE of 5 samples	P-Value
1.	Pre pubertal-(a)	2.04 \pm 0.48	
2.	Parous I. Pre ovulatory -(b) II. Ovulatory - (c) III. Post ovulatory-(d)	7.69 \pm 0.66 6.89 \pm 1.01 3.99 \pm 0.76	a to b - (p<0.001) HS a to c - (p<0.01) HS
3.	Non- parous I. Pre ovulatory-(e) II. Ovulatory-(f) III. Post ovulatory-(g)	6.79 \pm 0.83 5.37 \pm 0.91 1.79 \pm 0.34	a to e - (p<0.01) HS, a to f - (p<0.02)S d to g - (p<0.05) HS
4.	Menopausal-(h)	1.61 \pm 0.37	b to h - (p<0.001) HS c to h -(p<0.01) HS d to h -(p<0.05) S e to h -(p<0.001) HS f to h - (p<0.01) HS
5.	Diabetogenic -(i)	1.81 \pm 0.83	b to i -(p<0.001) HS c to i - (p<0.01) HS e to i - (p<0.001)HS f to j - (p<0.02)S

RESULTS AND DISCUSSION

Cyclic changes in various physical properties and biochemical characteristics of saliva are known to reflect the hormonal changes associated with the reproductive cycle (menstrual cycle) and may be utilized clinically to determine the time of Alagendrans *et al.*, 2007). Just as a car engine generates unwanted exhaust fumes where it burns fuel during motion, similarly our body generates harmful byproducts in the process of metabolic activity. Each day our internal organs generate about 10^{10} free radicals as by-products by natural processes (Babior,1977) and creates oxidative stress in the cell. According to Fridovich, (1975) oxygen utilizing cells contain the metallo enzyme superoxide dismutase (SOD)

which promotes the dismutation reaction at cytoplasmic pH range. Reactive oxygen species (ROS) play a number of significant diverse roles in human female reproductive biology like uterine physiology, oocyte maturation and ovulation as well as corpus luteum function and regression (Riley and Behrman,1991).

In this study the level of SOD in prepubertal, menopausal and in diabetic stage showed a highly significant decreased level of SOD activity in comparison to parous and non- parous reproductive phases like pre-ovulatory, ovulatory and post-ovulatory of reproductive cycle. The fluctuating level of SOD in different conditions in human female subjects might be due to ovarian hormonal secretion and its imbalance during conditions. As earlier findings of Pliner and Flemming (1983) and Tenovuoa *et al.* (1981) indicated that increased 17- β estradiol level showed an inhibitory action on physiological

hormone concentration on superoxide dismutase activity. A highly significant (p<0.05) decrease activity of SOD in saliva of non-parous post-ovulatory phase of menstrual cycle in comparison to parous post-ovulatory salivary SOD activity might be an indication of disturbed ovarian hormone level in non-parous women. Earlier report of Sculley and Langley Evans (2002) also suggested that increasing SOD activity is a sensitive marker of increased ROS production.

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RELATIVE INFLUENCE OF DIETARY VARIATIONS ON THE REARING PERFORMANCE OF *Philosamia ricini* Bsd.

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Key words : . Dietary variation, rearing performance, *Philosamia ricini*.

The present paper accounts for the relative impacts of three different food plants of eri silkworm, *Philosamia ricini* Bsd. on the rearing performance in terms of productivity and quality of eri silk cocoons. The results obtained are indicative of the fact that rearing of the eri silkworm on the foliages of *Ricinus communis* (Castor) as compared to *Carica papaya* (Papita) and *Eteropanax fragrans* (Kessuru) food plants has distinct supremacy over the two other food plants in respect of productivity and quality of eri silk cocoons. The said variations are probably due to the differences in the nutritional content of food plants attributable to species diversity and resulting biochemical diversity in the foliage, used for missing the eri crop. The findings are largely in conformity with the earlier works (Anonymous, 2008; Goel *et al.*, 2010; Jolly *et al.*, 1975; Kar, 2009; Kumar, 2010 and Mishra *et al.*, 2014).

INTRODUCTION

Silk producing insects are famous for producing mulberry, tasar, eri and muga silks of great commercial importance. These silkworms are usually reared on the foliages of different food plants under domesticated, semi domesticated and wild conditions in the silk producing belts of our country for uplift of rural economy as well as the source of earning much needed foreign currencies.

Among the four popular varieties of natural silks, the eri silk produced by *Philosamia ricini* Bsd. belonging to family Saturniidae of order Lepidoptera has received crucial importance in recent years on account of its economic importance. Eri culture is very popular in Assam and North-Eastern states of India. Apart from this popular production, rearing of eri silkworms are also carried out in the states of Bihar, Jharkhand, West Bengal and some areas of Uttar Pradesh and Uttranchal on the foliage of castor, papaya and kessuru food plants. Eri silkworm is multivoltine and reared during different seasons. The eggs are white and hatch in 7 to 10 days. The hatched larvae are allowed to feed on foliages of food plants till cocoon formation stage under domesticated conditions with the periodical change of feeds.

The review of literature reveals that some notable investigations on eri culture have been carried out by Choudhary (1974), Goel *et al.*, 2010, Jolly, *et al.*, 1975, Kar, 2009, Mishra, 2014 and many others. However, the impact of dietary changes on the rearing performances of eri silkworms in respect of productivity and quality of eri silk cocoons have not yet been carried out. As a result we fail to understand the relative effects of different diets on the eri culture in respect of quantitative and qualitative performances. In view of the noted gaps in knowledge the present communication has been designed to understand the role of dietary variation on its economic characters in the larger interest of sericulture.

MATERIALS AND METHODS

A lot of 300 newly hatched larvae of *Philosamia ricini* divided into three replicates (100 x 3) were separately reared on three different food plants, viz., *Ricinus communis*

(Castor), *Carica papaya* (Papita) and *Eteropanax fragrans* (Kessuru) under domesticated conditions till the formation of eri cocoons as per the methods suggested by Jolly *et al.*, 1975. The hatched larvae at the initial stage were fed on the tender leaves of food plants up to the third stage and thereafter on mature leaves in feeding trays up to final stage of cocoon formation. The periodical change of feeds were maintained. The cocoons formed on three different food plants were collected and evaluated in respect of effective rate of rearing (E. R.R. %), cocoon weight (g), shell weight (g) shell ratio (%) and size of eri silk filament (D). A comparative analysis in relation to relative impacts of three different food plants on the quantitative and qualitative performance of *Philosamia ricini* were made and recorded in the table.

RESULTS AND DISCUSSION

The results obtained reveal that the rearing performance of *Philosamia ricini* on the foliages of castor (ERR 22%, cocoon weight 10.13g, shell weight 0.99g, shell ratio 10.16% and filament size 21 D) are evidently better than papaya (ERR. 19.0%, cocoon weight 10g, shell weight 0.90g, shell ratio 9.96% and, filament size 18D) and also kessuru (ER.R. 17.0%, cocoon weight 9.32g, shell weight 0.82g, shell ration 9.10% and filament size 16D) food plants in respect of productivity and quality of eri cocoons. It is thus very clear that the dietary variations have significant effects on the rearing performance of *Philosamia ricini*. The table further reveals the poor and relatively inferior rearing performance of *Philosamia ricini* on the foliages of kessuru food plant.

These variations may be due to relative differences in the nutritional contents of the foliage of three different food plants belonging to different species existing in diverse climatic and ecological conditions of their respective areas. The relative richness of nutritional and desired biochemical contents in the foliage of castor food plant as compared to papita and kessuru food plant appear to be the potent and vital factors for the said variations and stand to logical and meaningful conclusion. The findings are very much in conformity with the results obtained by [Anonymous, 2008; Goel *et al.*, 2010, Jolly, *et al.*, 1975, Kar, 2009, Kumar, 2010; and Mishra, 2014].

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TABLE - 1
Table showing relative impacts of different food plants on the rearing performances of Eri Silkworm, *Philosamia ricini*

S.No.	Rearing Parameters	F - I Castor	F-II Papaya	F - III Kesseru	C.O. at 0.5% level for characters
1.	E.R.R. (%)	22.0	19.0	17.0	**
2.	Cocoon weight (gm.)	10.13	10.0	9.32	*
3.	Shell weight (gm.)	0.99	0.90	0.82	*
4.	Shell ratio (%)	10.16	9.96	9.10	*
5.	Filament size (D)	21D	18D	16D	**

** = Highly Significant
* = Significant
D = Denier

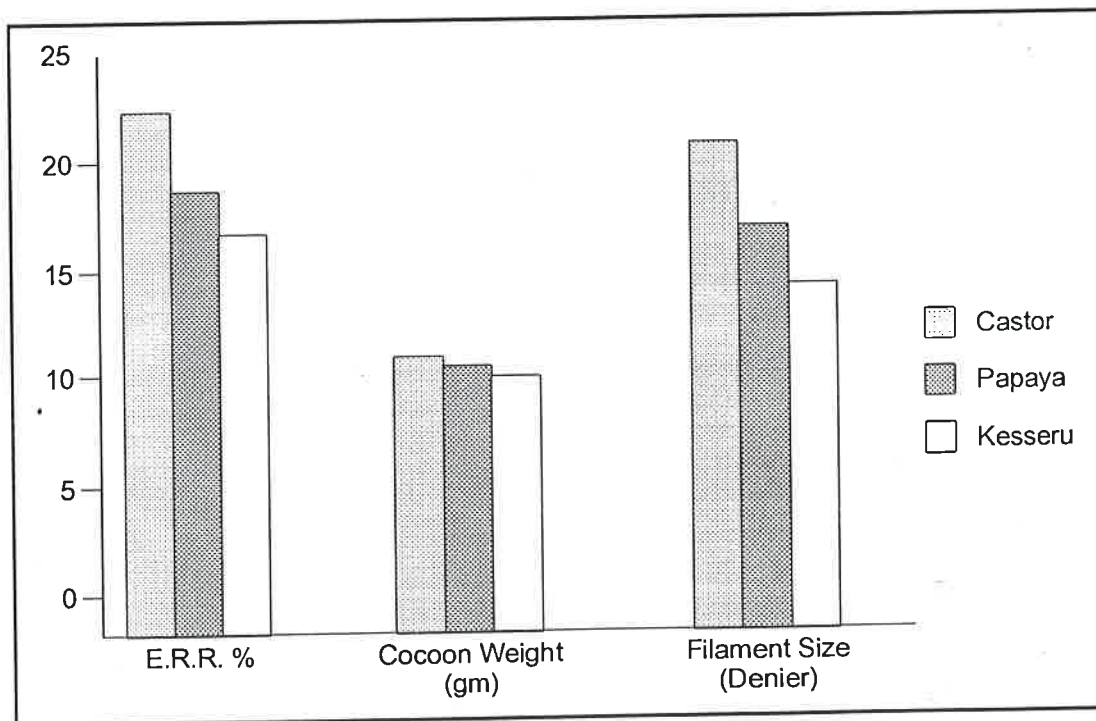


Fig. : showing relative impacts of three different food plants on the productivity and quality of eri silk.

CHANGES IN SALIVARY ASCORBIC ACID LEVEL IN DIFFERENT REPRODUCTIVE PHYSIOLOGICAL AND METABOLIC DISORDER CONDITIONS OF WOMEN

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Key words : Saliva, Ascorbic Acid, Pre-pubertal, Parous, non-parous, menopausal, diabetic.

A quantitative study of salivary Ascorbic Acid in 63 women of different reproductive physiological conditions (i.e., prepubertal, parous, non-parous, menopausal and metabolic disorder condition Diabetic showed a highly significant ($p < 0.001$) increased level of ascorbic acid in saliva in parous ovulatory phases of women in comparison to prepubertal condition. Salivary ascorbic acid in non-parous pre-ovulatory showed increased level ($p < 0.01$) whereas ovulatory phase showed increased level ($p < 0.01$) in comparison to prepubertal condition. But a decreased level ($p < 0.001$) of salivary ascorbic acid was observed in menopausal and diabetic women saliva in comparison to parous ovulatory women saliva. In metabolic disorder state (diabetes) the ascorbic acid in saliva showed its increased level ($p < 0.05$) from non-parous pre-ovulatory and ($p < 0.01$) from non-parous ovulatory but ($p < 0.05$) increased from menopausal women saliva and a ($p < 0.05$) increased level from menopausal condition. In menopausal condition the salivary ascorbic acid showed its ($p < 0.02$) and ($p < 0.05$) decreased level from pre-ovulatory & ovulatory phase salivary ascorbic acid respectively. All such findings might be a reflection of cyclic ovarian hormone secretion during different reproductive physiological conditions of women and disturbed salivary secretion in metabolic disorder conditions.

INTRODUCTION

Human saliva, an easily available biological fluid shows cyclic variation in its composition during the reproductive cycle of women and the changes may be correlated with the hormonal status of the individuals and may also be induced by exogenous administration of sex hormones. Granger *et al.*, (2007) reported that many systemic diseases affect salivary gland function and its biochemical composition. Its flow rates affect concentration of salivary substances (Proctor and Carpenter, 2007). Earlier reports of Streckfus and Bigler (2002) indicated that saliva has become popular in recent decades as a medium for measurement of numerous biomolecules. The greatest advantage, when compared to blood sample collection, is that saliva is readily accessible and easy to use for each biochemical investigation Chiappin *et al.* (2007). reported that biochemical analysis of saliva provides important information about the functioning of various organs within the body. Earlier reports of Bandek-Spat (1973) indicated that salivary biochemical constituents show variation during different physiological condition and are influenced by age, diet, diurnal factors and of way of its collection. Humphrey and Williamson (2001) and recently Malamud and Rodriguez (2011) reported saliva as a non-invasive systemic sampling measure for medical diagnosis and research and called it as "a diagnostic fluid".

Ascorbic acid is an antioxidant which neutralizes reactive oxygen species and controls and regulates ovarian physiology (Agrawal *et al.*, 2005). Hershkovich *et al.* (2007) and Lemay *et al.* (1982) reported increased level of ROS during menstrual cycle of women which indicates role of antioxidant in the physiology of reproduction. Guarnaccia *et al.* (2000) reported three principal functions viz., its role in promotion of collagen

synthesis, and hormone production and its ability to protect cells from free radicals which may be sufficient to explain its role in reproductive process. According to Nakano and Asada (1987) ascorbic acid reacts rapidly with O_2 , OH and singlet oxygen and helps in removing hydrogen peroxides. It may also prevent gametes from damage by free radicals during production and fertilization (Burger *et al.*, 1968).

In view of the noted context the proposed work has been undertaken to assess the level of ascorbic acid during various reproductive physiological conditions and in metabolic disorder status to establish the role of this molecular species in the reproductive physiology of women.

MATERIALS AND METHODS

Subjects : The studies were performed in 63 different human female volunteers of age group (19 to 40 yrs) categorized as prepubertal, parous, non-parous, menopausal and diabetogenic.

Collection of samples : The human female unstimulated whole saliva was collected during various periods of parous and non-parous volunteers, viz., pre-ovulatory, ovulatory and post ovulatory phases and also from pre-pubertal, menopausal and diabetogenic stages and were stored at -70°C for further use (Navazesh and Christensen, 1981). Subjects were asked not to swallow any saliva during the collection period. Saliva volume was measured with the tube sealed and then frozen in dry ice until taken back to the laboratory for processing. All the saliva samples of different category of female subjects were placed into salivate tube using a natural cotton swab insert and centrifuged at 400g for 10 minutes at 4°C . Ascorbic acid in saliva was analyzed by titrametric method of Harris and Roy (1935).

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TABLE : Level of Ascorbic Acid in Saliva Samples of Different Conditions in Human Female Subjects

Sl. No.	Name of different conditions with symbols	Level of Ascorbic acid (in unit/l) mean \pm SE of 5 samples	P-Value
1.	Pre pubertal-(a)	4.94 \pm 0.70	
2.	Parous I. Pre ovulatory -(b) II. Ovulatory - (c) III. Post ovulatory-(d)	9.87 \pm 3.71 13.48 \pm 1.46 6.28 \pm 1.29	a to c - (p<0.01) HS
3.	Non- parous I. Pre ovulatory-(e) II. Ovulatory-(f) III. Post ovulatory-(g)	10.32 \pm 2.14 11.37 \pm 1.78 5.33 \pm 1.13	a to e - (p<0.05) S a to f - (p<0.01) HS
4.	Menopausal-(h)	3.49 \pm 0.47	c to h -(p<0.01) HS e to h -(p<0.02) S f to h -(p<0.005) S
5.	Diabetogenic -(i)	4.71 \pm 0.32	c to i - (p<0.01) HS e to i - (p<0.005) S f to i - (p<0.01) S h to i - (p<0.005) S

RESULTS AND DISCUSSION

The results and findings as indicated in the table showed highly significant increased level of ascorbic acid in saliva of parous ovulatory women in comparison to prepubertal condition which was a reflection of active ovarian hormonal estrogen secretion but a significant increased level during non-parous pre-ovulatory and highly significant increased level at the extent of (p<0.01) might have been due to the disturbed ovarian secretion in non-parous women in comparison to parous women. But a highly significant decreased level of salivary ascorbic acid in menopausal and diabetogenic condition in comparison to parous ovulatory level salivary ascorbic acid might have been due to the hormonal changes during menopausal condition and hypofunction or salivary gland in diabetogenic condition in metabolic disregulation state of women. Earlier reports of Dodds and Dodds (1997) also indicate hypofunction of salivary gland in diabetic women. Studies of Chen *et al.* (2005) and Davis *et al.* (2005) indicate that salivary biochemical constituents change due to hormonal changes that happen after menopause. Salivary ascorbic acid level in menopausal and diabetogenic condition also showed a significant decreased level in comparison to non-parous pre-ovulatory and ovulatory phase of menstrual cycle, and a significant increased level of salivary ascorbic acid in diabetogenic condition to menopausal condition might be due to the low salivary flow rate. Recent report of Liisz *et al.* (2008) indicated that salivary flow rate affects the composition of salivary secretion.

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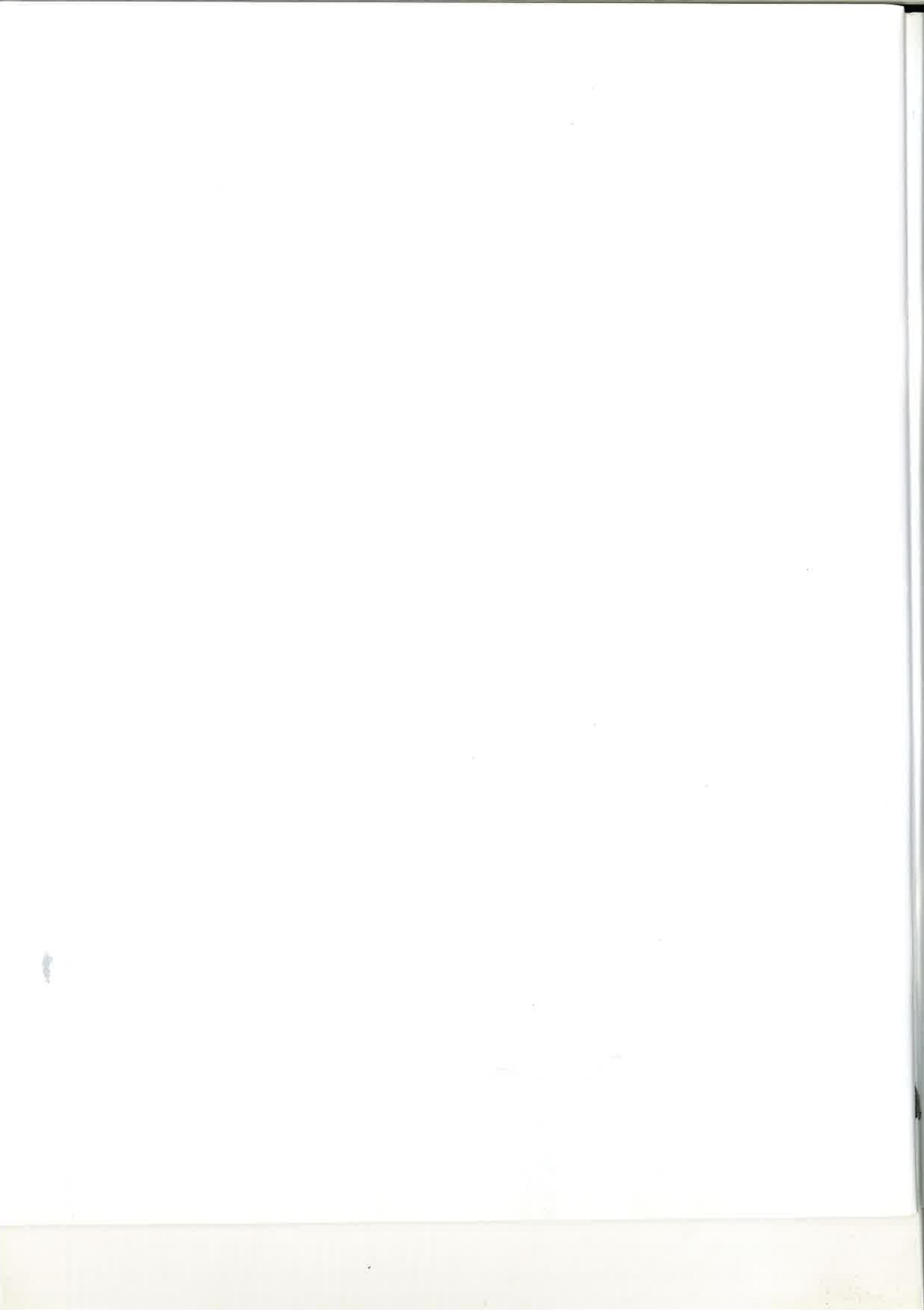
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ROOTING PATTERN IN *Cymbopogon citrates* (D.C.) Stapf

Shambhu Kumar Gupta¹, Rohit Sharma², Rahul Sharma³ and S.K. Pandey⁴

Key words : Rooting pattern, fibrous root-stock, soil binding

The root system in *Cymbopogon citrates* is well-spread, deep and prolific, with tuft-like growth at the base of main plant, covering a large soil mass which bear excellent soil binding quality. The study suggests the possibility of using *Cymbopogon citrates* as a potential bioagent for soil conservation especially on dams.

INTRODUCTION

Cymbopogon citrates (DC.) Stapf of Poaceae family is a wild, perennial, aromatic grass with stiff stems arising from short rhizomatous rootstocks. The plant is native of Ceylon and is widely distributed throughout tropics. Oil is obtained from the leaves by steam distillation. The oil contains 70-90% of aldehydes consisting largely of citral. The oils are used in cosmetics, soaps and as a raw material for the commercial synthesis of Vitamin-A. The plants are grown on the bunds for soil conservation (Purseglove, 1978).

MATERIALS AND METHODS

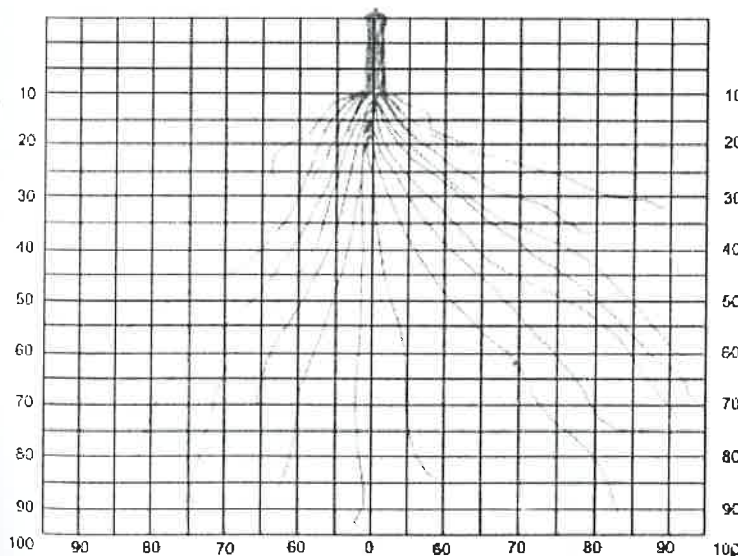
Root distribution pattern of *Cymbopogon citrates* growing naturally under rainfed conditions in an oxisol was studied following the profile excavation method (Bohm, 1979). The soil of experimental site is a typical laterite belonging to the soil order oxisol. Externally the soil is sandy clay, loam containing 29% coarse and 21.2% fine sand, 14.5% silt and 31.3% clay with pH 5.3. The distribution pattern of roots were studied. For this purpose, a trench was dug at a distance of 1.25 metre from the plant to a depth of 125 cm. Then the roots were exposed carefully by removing the soil from the

plant side of the trench. The roots were then washed and sectioned into different zones. The dry weight of the roots collected from different sections were recorded from the plant.

RESULTS AND DISCUSSION

The root distribution pattern of *Cymbopogon citrates* in the soil profile to depth of 100 cm and to a lateral distance of 100 cm is shown in Figure-1. The plant produces a large quantity of roots and its 75% occur on 40 cm. laterally and vertically from the base of the plant. About 94% of the roots reside within 60 cm laterally around the plant and the roots seldom go beyond 80 cm laterally from the plant. The length of the longest lateral root measured 92 cm. 93% of the total roots occur within 40 cm depth and the roots did not go beyond 86 cm depth. (Salam *et al.*, 1991; Meerabai, 1993). Thus the deep and spreading nature of the roots, with tuft-like development at the base enables to cover a large soil mass with excellent soil binding capacity. This property of *Cmbopogon citrates* can be well explained in conservation farming to reduce soil erosion. This study suggests the possibility of using *Cymbopogon citrates* as a potential bioagent for soil conservation.

Figure : 1



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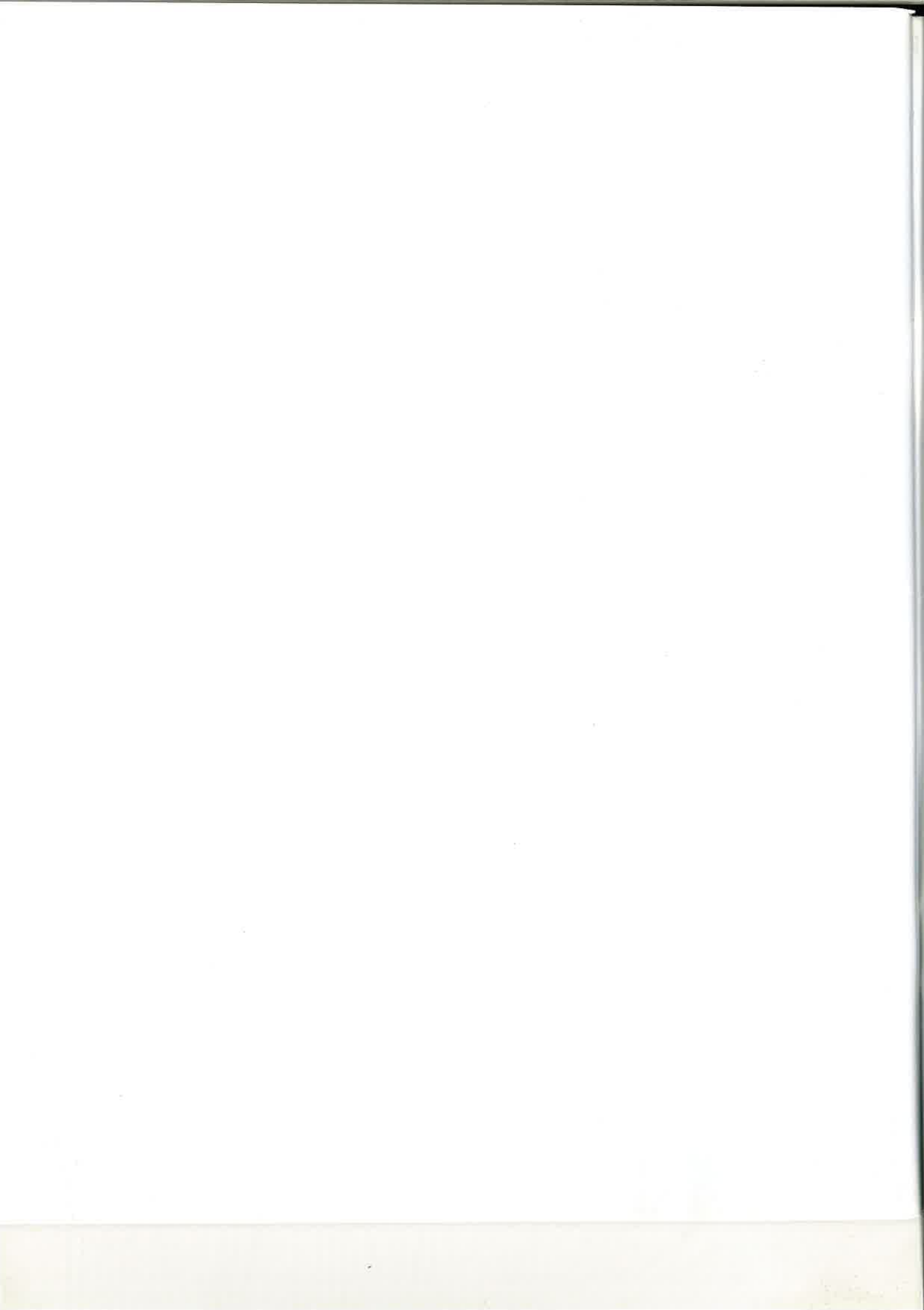
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CHANGES IN SEMINAL ASCORBIC ACID LEVEL IN DIFFERENT ABO-SYSTEMS OF BLOOD GROUP IN HUMAN SUBJECTS

Nutan Bala, P. Parashar, Asit Kumar*, A.K. Dubey and A.K. Singh**

Key words : Seminal, Ascorbic Acid, ABO-Systems, Blood Group.

When seminal ascorbic acid of 78 human volunteers of the age group of 25- 40 yrs. of different blood groups were estimated by standard biochemical methods, a significant ($p < 0.05$) increased level in O-blood group of human subjects were observed in comparison to those of A blood group. The increased level of ascorbic acid in the semen of O-blood group of subjects also showed a significant ($p < 0.05$) increased level in comparison to B-blood group of human volunteers. These results may be attributed to immunological intervention in the physiology of reproduction in men as the immunological and biological properties reside in specific but different chemical groupings.

INTRODUCTION

Almost every step in the reproductive process is vulnerable to immunologic impairment. In every step from the gonadotropin releasing factor to the parturition, specific molecules are involved which, because of their chemical nature and size, are potentially antigenic under certain circumstances. Spermatozoa in immunologic cells contain both tissue-specific and species specific antigens. Recent report by Natarajamani *et al.* (2014, 2015) indicated that blood groups in women have been associated with infertility and ovarian reserve and quality of oocyte. Mathur *et al.* (1988) reported that special antigens on sperms of autoimmune infertile men were not present on sperms of normal men (Whitkin *et al.*, 1988; Lynch and Howe, 1987). Some women carry antibodies unique to their husbands sperm and some carry antisperm antibodies (asa) against antigens common to all sperms. The spermatozoa suspended in the fluid medium at the time of ejaculation is known as seminal fluid. The amount of seminal fluid and the number of spermatozoa it contain provide a classic index for male fertility. Trivedi *et al.*, (2003) reported that seminal ascorbic acid is the index of infertility in men. Earlier findings of Gupta and Gupta (1965) indicated a relationship between azoospermia and ABO-system of blood group in men. In this context, the present investigation has been undertaken to study the level of ascorbic acid in relation to ABO-system of blood group in male subjects.

MATERIAL AND METHODS

78 young and clinically healthy volunteers of age group between 25-40 yrs were involved in this study. According to ABO blood grouping system, they were divided into 4 groups, A, B, AB and O and their clinical ABO blood grouping was done consequently by using slide method of Daie (1963).

From volunteers of all categories, semen were collected by masturbation with an abstinence of minimum of five days. The semen was collected in a dry, clean, sterilized, graduated wide centrifuge tube and was left for one hour to liquify (Lavin *et al.*, 1980) at room temperature (Boonsaeng, 1981). The

seminal ascorbic acid was estimated by standard biochemical titrametric method of Haris & Ray (1932). Results were analysed using Student 't' test.

RESULTS AND DISCUSSION

Many investigators working on mammalian semen consider that the metabolic activity of spermatozoa is correlated with their fertilizing capacity. Seminal fluid is the nongametic portion of human ejaculation which acts as a vehicle for spermatozoa. Halpern, Ky and Robert (1967) reported that human antibodies against constituents of seminal plasma occur. On the other hand, ABO-blood group antigens are regarded as RBC-antigens, and they are actually expressed on a wide variety of human tissue. Other blood cells like T-cells, B-cells and platelets have ABO-blood group antigens that have been absorbed from the plasma in individuals who are secretors and found in a soluble form in saliva and other bodily fluid. Spermatozoa and seminal plasma contains proteins of high molecular weight which may act as antigen in female genital tract. ABO-antibodies in the serum are formed naturally. A highly significant increased level of seminal ascorbic acid in O-blood group of subjects than A-blood group and a significant increased level of ascorbic acid in semen of O-group than B blood group of human subject might be due to the absence of ABO-antigens. Variation in γ -globulin level might be responsible for such increased level of ascorbic acid in semen of O-blood group subjects. As earlier findings of Klopstock *et al.*, (1963) indicated, that variation in γ -globulin level may account for differences in the ratio of serum seminalspermagglutinin titers. They reported that occasionally higher spermagglutinin titers were found in seminal plasma. Then the serum and in this condition it is likely that the antibodies are also produced locally in the genital tract, as earlier reported by Manie *et al.* (1945). This immunological response might be responsible for increase in seminal ascorbic acid level, which acts as a protective component in the harmful effect of immunity.

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TABLE- 1 : Seminal ascorbic acid in relation to ABO-system of blood group in men

Sl.No.	Age group of seminal donors (in years)	Blood group of semen donors	Seminal ascorbic acid level (in mg/dL)
1.	25-35	A (21)	8.132 ± 0.3737 ^a
2.	27-40	B (17)	9.568 ± 0.3268 ^b
3.	19-36	AB (09)	9.617 ± 1.1675 ^c
4.	25-40	O (31)	11.521 ± 241f ^d

p value : No. in paranthesis indicate the in between number of samples

a to b = P < 0.05 (S)

a to O = P < 0.001 (HS)

b to O = P < 0.05 (5)

S = Significant

HS = Highly significant

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