

Proceedings of the National Seminar on  
**TRADITIONAL KNOWLEDGE**  
and  
**SOCIAL PRACTICES**  
Promoting Biodiversity Conservation



**ZOOLOGICAL SURVEY OF INDIA**



**PROCEEDINGS OF THE NATIONAL SEMINAR  
ON TRADITIONAL KNOWLEDGE AND  
SOCIAL PRACTICES PROMOTING  
BIODIVERSITY CONSERVATION**

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*In collaboration with*  
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## FOREWORD

Biological Resources were earlier regarded as “Common Heritage” of mankind. But this notion has changed. Today, even the Traditional Knowledge (TK) associated with living resources is an intangible component of the resource itself. As TK needs to be preserved through documentation and also to be protected from being exploited and misused commercially, Convention on Biological Diversity (CBD) under Article 8(j) provides for respecting, protecting and rewarding the Knowledge, Innovations and Practices (KIP) of local communities. In this context a one-day National Seminar on “**Traditional Knowledge and Social Practices Promoting Biodiversity Conservation**” was held on 24<sup>th</sup> September, 2011 providing a platform for presenting and gathering data on these issues. This premier institute, the Zoological Survey of India (ZSI), Kolkata organized this seminar as sponsor in collaboration with Social Environmental and Biological Association (SEBA), West Bengal Biodiversity Board (WBBB) and Ramakrishna Vivekananda Mission Institute of Advanced Studies (RKVMIAS) Eminent animal and plant scientists as well as anthropologists and sociologists were present in the seminar as resource persons and invited speakers, and a large number of students, researchers and participants attended the seminar and also contributed and presented papers (oral and poster) on traditional knowledge and social practices relevant for promoting biodiversity conservation in India.

The Director and the staff of the Zoological Survey of India (ZSI), are thankful to all the three collaborators of this seminar, who had volunteered and made the seminar a grand success. The efforts made by SEBA, and those of reviewers and editors in bringing the Proceedings of this seminar are thankfully acknowledged and highly appreciated.

Dated, the 3<sup>rd</sup> March, 2014

Dr. K. Venkataraman  
Director,  
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## PREFACE

The oriental society and civilization is few thousand years' ancient; naturally, the society particularly through the services of its talented persons like sages, *vaidyas* (ancient doctors) and philosophers of different time spell, had adopted the use of various materials (including living and non-living both); different processes (for performing different essential day to day work); or occasional social practices. Ultimately, through trial and error and subsequent observations, the best among them have formed an integral part of the life style of society.

This is established, that those nations have documented their age-old knowledge, and enriched it with their subsequent addition of observation and innovation, they have advanced rapidly, particularly in science. Thus, entire Europe, though they had started far later than the Orient, is now enormously ahead of us, resulting high standard of life. Sadly, this aspect, that is the documentation had always been neglected in India and most Afro-Asian countries. Even to write our own history, we are to depend on documents of Megasthenes, Marco Polo or Xuanzang. Without recording and with rapid development and changes in society, there remain every risk of losing this potential of knowledge and thus for every future plan of research and development, we may have to start from zero base, resulting not only wastage of time, money and labor, but also at the risk of lagging behind.

In reality, the problem is that, science at present time is showing fantastic and spectacular development in most of its heavy and flamboyant branches like electronics, nuclear physics, space science, genetic engineering, molecular biology, nano-technology etc. Beside them, people are not ready to remember or even to recognize the other major aspect i.e., 'documentation' of old experiences, though that is equally important, and not less essential.

The necessity of this seminar on Traditional Knowledge and Social Practices Promoting Biodiversity Conservation was fortunately felt by the following four organizations and actually organized by the Zoological Survey of India (ZSI), in collaboration with Social Environmental and Biological Association (SEBA), West Bengal Biodiversity Board (WBBB) and Ramakrishna Vivekananda Mission Institute of Advanced Studies (RKVMIAS). They have volunteered and sponsored the arrangement. As a result, a good number of papers on traditional knowledge and social practices could be recorded in this proceeding. But actually many similar seminars should be held, at different corners of the country viz. universities and research laboratories and be documented to encourage patenting intellectual property rights and preventing piracy of traditional knowledge on biodiversity and bioresources of the country.

### **Joint Convenors**

Dr. Ambarish Mukherjee &  
Dr. Amalendu Chatterjee

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SECTION - I  
**TRADITIONAL KNOWLEDGE**

## **TRADITIONAL KNOWLEDGE REGARDING ORAL HYGIENE OF RURAL PEOPLE OF PURULIA DISTRICT IN WEST BENGAL**

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### **ABSTRACT**

Educated and conscious people in the world are now spending more and more money to maintain their oral hygiene than before. Evidences indicate that chronic teeth and gum diseases may create the heart diseases, diabetes and lung problems. The cost of maintaining oral health also increases over time. In a country like India, where most of the people are poor and uneducated, majority of them are hardly able to take the advantages of modern science and technology designed for the maintenance of oral health status. In such a situation, spending money for oral care, instead of food and clothing, is nothing but luxury to them. In fact, the oral health status of general rural people of India is not so bad owing to the fact that most of the rural people of India take care of their oral health according to their traditional knowledge and belief. They use various plants, plant parts, animals or animal products to maintain their day to day oral hygiene and even in some pathological conditions. These bioresources are easily available in their surroundings and that too, almost at free of cost. This paper intends to document some of the traditional knowledge and beliefs regarding oral hygiene, which are still prevailing in the culture of rural people of Purulia district in West Bengal.

**Key words** : *Oral hygiene, datan, rural people, Purulia, traditional knowledge*

### **INTRODUCTION**

Oral hygiene is the practice of keeping the mouth and teeth clean to prevent oral problems, especially dental caries, gingivitis, bleeding gum and bad breath. Tooth decay and gum disease are the most common ailments today. World Health Organization (WHO) has identified oral health as a neglected area of general health (1). Several

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recent clinical studies show a direct link between poor oral hygiene and serious systemic disease, such as, cardiovascular disease (heart attack/stroke), bacterial pneumonia, diabetes complications, osteoporosis, extreme low or high birth weight and premature delivery in case of pregnant woman (2). So conscious people all over the world now spend more and more money to maintain their oral hygiene than before and the cost of maintaining oral health is also increased over time.

In developing countries, like India, there is low awareness of the importance of oral hygiene. About 65% Indians believe that taking care of one's teeth is not as important for grooming, as taking care of hair, skin, etc. In general, 53% of Indian suffer from common toothache, bleeding gums, bad breath, decayed tooth, etc. (3). Nearly half of the Indian people do not use tooth brush and tooth paste for cleaning teeth (4). This rate reaches to almost cent per cent in remote villages. In a country like India, where most of the rural people are extremely poor and uneducated, spending money for oral care, instead of food and clothing, is nothing but luxury. But the astonishing fact is that, most of the Indian villagers, by and large, possess bright smile and healthy teeth and gum. In some cases, their dental condition is even better than that of the urban people. Though they have no access to any modern dental care facilities or products still they inherit a rich source of traditional knowledge to maintain their oral hygiene. This paper intends to document the oral hygiene related traditional knowledge of rural people of Purulia district of West Bengal.

## **MATERIAL AND METHODS**

### ***Study area***

Purulia district has been selected for the research work. It consists of 20 blocks, covering 6259 sq km. Geographically, the district is the westernmost part (Lat. 23°42'-22° 43' N and Long. 86° 54' - 85°49' E) of West Bengal. It mostly consists of undulated erosional terrain (pene-plane). There are several dome-shaped small hills and a few of them are covered by dense forest. As per report of the forest department total area under forest is 1,15,226 hectare. The natural forests of the district are mostly of mixed nature and restricted to northwest part of the district covering Ajodhya hills and Panchet hills of northeast. Ethnic groups of this region mostly belong to Bedias, Bedomajhis, Bhumijis, Bhunias, Birhores, Chikbaraiks, Karmalis, Koramudis, Loharas, Manhalis, Mundas, Oraons, Parharias, Sabars and Santhals.

### ***Methodology***

From all the 20 blocks of the district a good number of sample villages were selected. Ethnobiological explorations were undertaken particularly in isolated dense and hilly forest areas where they live with their age-old manners and customs and spread of education and communication facilities are less. Developmental projects have not brought any changes in them. Herbalists, medicine-men and common people/tribal were interviewed for information on the use of bioresources for

maintaining oral health. The methods of information collection and documentation included group discussions, discussion with knowledgeable individuals, participatory observations and direct observations by the authors. References are cited as numbers in parantheses.

## **OBSERVATIONS**

Almost all the villagers of remote villages of the district use '*datan*' or '*datun*' for their day to day maintenance of oral hygiene. *Datan* is generally a tree twig, which is used as tooth brush with or without any traditional tooth powder as mentioned below. In few cases, villagers simply use their traditional tooth powder with finger. They are so much accustomed with such practice that some of the older villagers simply refuse to accept and use popular brand of commercial tooth paste at free of cost.

*Datan* of Neem, Sal, Kuranj, Ramdatun (Kumarika) and Sindhuar (Nishinda/Begna) are most popular among the villagers. These *datans* are sold at Rs. 2 per bunch containing 8-10 *datans* at local village market. In addition to this, at least 27 other plant twigs, mid rib of leaf of Khejur and the middle portion of Konga leaf, which are easily available in their surrounding and almost at free of cost, are also used as *datan* (Table 1).

### ***Preparation of datan***

Twigs of 15-20 mm thick of selected plants are cut down and made into pieces of 15-20 cm in length. Such twigs generally have a thin skin. One end of the stick is chewed such that all the fibers are separated and looked like a brush (locally called 'kuchi'). This brush is used to rub over all the sides of all teeth. When the task of brushing is completed, they just spitted out all the little bits of plant fiber. This *datan* is disposable implying that it is used only once. After cleaning the teeth, some of the villagers split the *datan* into two parts, of which one part is transformed into a U-shaped tongue -cleaner.

### ***Preparation of traditional tooth powder***

Some of the villagers use traditional tooth powder with or without any *datan*. They prepare this powder by grinding dried leaf of Guava, dried leaf of Neem, dried bark of Babla, Halud (turmeric), Fitkari (Potash alum:  $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$ ), Bit noon (Black salt) and seed of clove (long) in 5:5:5:5:5:2:1 ratio. This powder not only cleans their teeth, but also keeps the teeth away from unhygienic threats.

### ***Therapeutic use***

#### **1. Loosening of teeth:**

- (i) Powder of Sirish (*Dalbergia lanceolaria*, *Albizia lebbek*) : root's bark used as tooth powder.
- (ii) Powder of Churchu (*Casearia elliptica*) : stem's bark (dried) also used to prevent loosening of teeth.

**Table 1.** List of plants used by the rural people of Purulia district as datan and their significance

Sl. No.	Vernacular Name/ Scientific Name	Remarks (Significance/Medical importance)
1.	<b>Neem</b> <i>Azadirachta indica</i>	<ol style="list-style-type: none"> <li>1. Most recognized datan not only in the district, but all over the country.</li> <li>2. Bitter in taste.</li> <li>3. Mouth gets refreshed.</li> <li>4. Makes teeth and gum stronger and healthier, prevents dental caries, loosening of teeth and reduces intestinal problems.</li> </ol>
2.	<b>Sal</b> <i>Shorea robusta</i>	<ol style="list-style-type: none"> <li>1. One of the most popular datans, considered as sacred.</li> <li>2. Coppice of the plants are used.</li> <li>3. Astringent in taste.</li> <li>4. Good formation of 'kuchi' (brush like end of the datan).</li> <li>5. Prevents toothache, swelling and bleeding gum.</li> <li>6. Available at all the markets in the district.</li> </ol>
3.	<b>Kuranj</b> <i>Derris indica</i>	<ol style="list-style-type: none"> <li>1. One of the popular datans among the rural villagers, available in village markets.</li> <li>2. Mouth gets refreshed.</li> <li>3. Astringent in taste.</li> <li>4. Prevents toothache, bad breath, bleeding gum, oral ulcer, etc.</li> </ol>
4.	<b>Ramdatun</b> <i>Smilax wightii</i> , <i>Smilax zeylanica</i>	<ol style="list-style-type: none"> <li>1. One of the popular datans among the rural villagers, available in village markets.</li> <li>2. Good formation of 'kuchi'.</li> <li>3. Sweeter in taste.</li> <li>4. Mouth gets refreshed.</li> <li>5. Removes bad oral smell, mouth ulcer, makes teeth and gum stronger and prevents bleeding gum.</li> </ol>
5.	<b>Sindhuar</b> <i>Vitex negundo</i>	<ol style="list-style-type: none"> <li>1. One of the popular datans among the rural villagers, available in village market.</li> <li>2. Good formation of 'kuchi'.</li> <li>3. Prevents bleeding gum, toothache and dental caries.</li> </ol>
6.	<b>Babla</b> <i>Acacia nilotica</i>	<ol style="list-style-type: none"> <li>1. Datan mostly used by villagers.</li> <li>2. Astringent in taste.</li> <li>3. Prevents bleeding gum, bad oral smell and provides relief from dental pain.</li> </ol>
7.	<b>Guhi babla</b> <i>Acacia nilotica</i> ssp <i>astringens</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the tribal villagers and forest goers</li> <li>2. Good formation of 'kuchi'.</li> <li>3. Repulsive odour ( guhi = stool).</li> <li>4. Prevents loosening of teeth and dental caries.</li> </ol>
8.	<b>Asan</b> <i>Terminalia crenulata</i> , <i>Terminalia tomentosa</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the forest dwellers and forest goers.</li> <li>2. Removes oral smell.</li> <li>3. Astringent in taste.</li> </ol>
9.	<b>Karj</b> <i>Bribelia squamosa</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the forest dwellers and forest goers.</li> <li>2. Good formation of 'kuchi'.</li> <li>3. Astringent in taste.</li> <li>4. Prevents swelling of gum and dental caries.</li> </ol>

Traditional knowledge regarding oral hygiene.....

Table 1. contd.

Sl. No.	Vernacular Name/ Scientific Name	Remarks (Significance/Medical importance)
10.	<b>Dhela</b> <i>Alangium salvifolium</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the poor villagers.</li> <li>2. Good formation of 'kuchi'.</li> <li>3. Prevents bad oral smell and swelling of gum.</li> </ol>
11.	<b>Ajinr/Peara</b> <i>Psidium guajava</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the villagers.</li> <li>2. Mouth is refreshed by light fragrance of guava.</li> <li>3. Astringent in taste.</li> <li>4. Prevents bad oral smell and bleeding gum and, makes gum strong.</li> </ol>
12.	<b>Tentul</b> <i>Tamarindus indica</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the villagers.</li> <li>2. Good formation of 'kuchi.'</li> <li>3. More or less sour in taste.</li> <li>4. Tongue gets cleaned.</li> <li>5. Makes teeth stronger and prevents dental caries.</li> </ol>
13.	<b>Jam</b> <i>Syzygium cumini</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the villagers.</li> <li>2. Astringent in taste.</li> <li>3. Prevents bleeding gum and makes teeth stronger.</li> </ol>
14.	<b>Dudh ghata/Ghetu</b> <i>Clerodendrum viscosum</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the villagers.</li> <li>2. Astringent in taste.</li> <li>3. Tongue gets cleaned.</li> <li>4. Prevents oral smell and cure painful swelling of gum (locally called 'Muskura') .</li> </ol>
15.	<b>Palas</b> <i>Butea monosperma</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the villagers.</li> <li>2. Astringent in taste.</li> <li>3. Good formation of 'kuchi'.</li> <li>4. Prevents loosening of teeth, tongue also gets cleaned.</li> </ol>
16.	<b>Mohua</b> <i>Madhuca longifolia</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the tribal villagers.</li> <li>2. Good formation of 'kuchi'.</li> <li>3. Astringent in taste but with good fragrance.</li> <li>4. Popularly used to cure 'Muscure' (painful swelling of gum).</li> <li>5. Helpful in treating bleeding gum, swelling of gum and loosening of teeth.</li> </ol>
17.	<b>Burilat</b> <i>Uvaria hamiltoni</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the villagers.</li> <li>2. Good formation of 'kuchi'.</li> <li>3. Astringent in taste.</li> <li>4. Prevents tounge ulcer and makes teeth stronger.</li> </ol>
18.	<b>Chirchiti/apang</b> <i>Achyranthes aspera</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the villagers.</li> <li>2. Astringent in taste.</li> <li>3. Prevents loosening of teeth,dental caries and toothache.</li> </ol>
19.	<b>Kou/Arjun</b> <i>Terminalia arjuna</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the villagers.</li> <li>2. Good formation of 'kuchi'</li> <li>3. Astringent in taste.</li> <li>4. Prevents oral smell, removes stain and makes teeth stronger.</li> </ol>
20.	<b>Cheka konar/Kural</b> <i>Bauhinia purpurea,</i> <i>Bauhinia varigata )</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the tribal villagers.</li> <li>2. Good formation of 'kuchi'.</li> <li>3. Astringent in taste.</li> <li>4. Prevents dental caries and bleeding gum.</li> </ol>

Table 1. contd.

Sl. No.	Vernacular Name/ Scientific Name	Remarks (Significance/Medical importance)
21.	<b>Kapsa</b> <i>Phespesia lanpas</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the tribal villagers and forest goers.</li> <li>2. Good formation of 'kuchi'.</li> <li>3. Astringent in taste.</li> <li>4. Prevents oral smell and swelling of gum.</li> </ol>
22.	<b>Churchu</b> <i>Casearia elliptica</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the forest goers and forest dwellers.</li> <li>2. Good formation of 'kuchi'.</li> <li>3. Astringent in taste.</li> <li>4. Makes teeth stronger, prevents bad oral smell, oral ulcer and tongue also gets cleaned.</li> </ol>
23.	<b>Sisoo</b> <i>Dalbergia sissoo</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the villagers.</li> <li>2. Good formation of 'kuchi'.</li> <li>3. Quasi- bitter in taste.</li> <li>4. Prevents oral smell and loosening of teeth.</li> </ol>
24.	<b>Boriari/ Berela</b> <i>Sida cordata</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the villagers.</li> <li>2. Good formation of 'kuchi'.</li> <li>3. More or less sweeter in taste.</li> <li>4. Prevents swelling of gum and makes teeth stronger.</li> </ol>
25.	<b>Putus</b> <i>Lantana camara</i>	<ol style="list-style-type: none"> <li>1. Used by most of the villagers ( around 50%).</li> <li>2. Mouth gets refreshed.</li> <li>3.. Prevents oral smell, bleeding gum and mouth ulcers.</li> </ol>
26.	<b>Kurchi</b> <i>Holarrhena antidysentricaa,</i> <i>Holarrhena pubescens</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the tribal villagers and forest goers.</li> <li>2. Good formation of 'kuchi'.</li> <li>3. Astringent in taste.</li> <li>4. Prevents toothache and dental caries.</li> </ol>
27.	<b>Sachi Verra/Varenda</b> <i>Jatropha gossypifolia</i>	<ol style="list-style-type: none"> <li>1. Datan of common villagers.</li> <li>1. Good formation of 'kuchi'.</li> <li>2. Mouth gets refreshed.</li> <li>4. Prevents oral smell, bleeding gum and dental pain.</li> </ol>
28.	<b>Bat</b> <i>Ficus benghalensis</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the villagers.</li> <li>2. Good formation of 'kuchi'.</li> <li>3. Astringent in taste.</li> <li>4. Prevents oral smell and bleeding gum.</li> </ol>
29.	<b>Bans</b> <i>Bambusa arundinacea,</i> <i>Bambusa tulda</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the villagers. Bamboo twigs are used.</li> <li>2. Good formation of 'kuchi'.</li> <li>3. Mild sweeter in taste.</li> <li>4. Prevents oral smell, swelling of gum and makes teeth stronger and cleans tongue very well.</li> </ol>
30.	<b>Khejur</b> <i>Phoenix sylvestris</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the villagers. Mid rib of the leaves are used.</li> <li>2. Good formation of 'kuchi'.</li> <li>3. Somewhat sweeter in taste.</li> <li>4. Prevents swelling of gum and makes teeth stronger and cleans tongue very well.</li> </ol>

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Table 1. contd.

Sl. No.	Vernacular Name/ Scientific Name	Remarks (Significance/Medical importance)
31.	<b>Konga/kantala</b> <i>Agave cantala</i>	<ol style="list-style-type: none"> <li>1. Mostly used by the villagers; middle portion of fleshy leaves are used.</li> <li>2. Good formation of 'kuchi', almost like cotton or sponge.</li> <li>3. Mild sweeter in taste</li> <li>4. Prevents bad oral smell, loosening of teeth and bleeding gum.</li> </ol>

**Note :** In addition to the plants in Table 1, several other plants like Kul/ Ber (*Ziziphus mauritiana*, *Zizyphus jujube* ), Arahar (*Cajanus cajan*, *Cajanus indicus* ), Buich (*Cordia nyxa* ) have also been reported to be used as 'datan' by many villagers.

**Table 2.** Utility- wise use of 'datan' by the rural people of Purulia district

Utility/Function	Name of datans
Good formation of kuchi	Bans, Karpas, Boriari, Sal.
Refreshness of mouth	Sachi Verra, Neem, Ramdatun, Kuranj.
Prevention of bad oral smell	Babla, Kuranj, Churchu.
Prevention of toothache and dental caries	Babla, Kuranj, Apanj,Neem.
Mouth ulcer, gingivitis	Gue babla, Kuranj, Churchu.
Bleeding gum	Sindhur, Bat, Kuranj, Mohua, Sachi Verra.
Swelling of gum	Mohua, Latex of Sachi Verra.
Loosening of teeth	Mohua, Kuranj, Apanj.
Cleaning of teeth	Neem, Ramdatun, Sal, bans, Peara, Khejur, Putus.
Removal of stain	Arjun.
Over all maintenance of oral hygiene	Neem, Sal, Kuranj.

**2. Bleeding gum:**

- (i) Teeth to be brushed with Ramdatan (*Smilax wightii*) after chewing 5-7 Sindhuar/ Nishindha leaves with digestive salt ( Bit noon ) for 7-10 days.
- (ii) Sachi Verra/Varenda's ( *Jatropha gossypifolia* ) datan alone can also prevent the problem.

**3. Oral smell:**

- (i) Use of Sachi Verra/Varenda's ( *Jatropha gossypifolia* ) datan provides effective result.
- (ii) Chewing of 1-1½ pieces of Anantamul (*Hemidesmus indicus*) 5-6 times a day for 5 days generally is helpful.
- (iii) Chewing of few Tulshi leaves after every meal for a week can solve the problems effectively.

**4. Toothache/Dental caries:**

- (i) Tooth powder is prepared by grinding 10g Joan (*Trachyspermum ammi*), 10g Mouri (*Foeniculum vulgare*), 5g Long (*Syzygium aromaticum* ) and 10g Fitkari (Potash alum:  $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$ ). This powder is used with Sindhuar

- (*Vitex negundo*) datan twice a day for a week. This practice also helps to prevent other oral problems like swelling and bleeding gum, loosening of teeth, etc.
- (ii) Pea-size globules (tablets) are prepared by grinding 4-5 Tulshi leaves (*Ocimum sanctum*) and 2-3 black peeper (*Piper nigrum*). These globules are to be pressed for half an hour at the affected area.
  - (iii) Application of few drops latex of Sachi Verra/Varenda (*Jatropha gossypifolia*) helps to relieve pain.

## DISCUSSION

Throughout India and Southeast Asia hundreds of million of village people are able to keep their gums free of disease and infection, even though they have limited access to modern dental care. They simply use Neem twigs and leaves to brush their teeth. This traditional way of cleaning the teeth and the tongue is as effective as our modern methods and this practice of using neem to heal and rejuvenate gum disease is verified in modern clinical studies (6).

It is true that many practices or habits of rural people for maintaining their oral hygiene are far from scientific validation. It is equally true in case of urban educated people also. In fact, most common habits of urban educated people relating to oral hygiene are responsible for doing potential harm. Tooth brushing with toothpaste is responsible for tooth wear, gingival recession and dentine hypersensitivity (7). Most of the dental hygiene products, tooth paste and mouth washes in everyday use contain toxins that have been linked to allergies, neurological problems, arthritis, gastrointestinal discomforts, blindness, cancer and even death (8). A few of these ingredients include Fluoride (mostly as sodium fluoride), Sodium Lauryl Sulfate (SLS), FD and C-blue dyes 1 and 2, Triclosam, Hydrated silica, Acrylic polymer and Artificial flavouring and sweeteners (petrochemically derived aspartame). The mucosal lining inside of the mouth has an absorption efficiency of over 90%. Because of this, chemical particles which are small enough, get into our blood in no time and are accumulated in the liver, kidneys, hearts, lungs and other tissues (8) with potentially harmful long-term effects, no matter how well we rinse. Also by excessive use of toothpaste with a high abrasive factors, whitening agents or high alcohol mouth rinses, the oral probiotics and their naturally balanced microenvironment may be disturbed. An unbalanced microenvironment in the oral cavity may compromise the body's first line of defense essential for good oral health (9). But most of the teeth cleaning is achieved by the mechanical action of tooth brush, and not by the toothpaste. Salt and baking soda are among materials that can be substituted for commercial toothpaste. Still, if we want to use ready-made toothpaste, we can use toothpaste containing safe ingredients which are also easily available in the market. But most of us are still using toothpaste containing toxic ingredients because our consumption pattern is determined solely by aggressive advertisement, which is induced by the profit maximizing corporate sector, not by the consumer's scientific criteria.

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## TRADITIONAL KNOWLEDGE ON MEDICINAL USES OF PLANTS BY THE TRIBAL PEOPLE OF BIRBHUM DISTRICT, WEST BENGAL, INDIA

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### ABSTRACT

This study documents the traditional knowledge of the tribal people of different forest areas of Birbhum district, West Bengal, India regarding medicinal uses of 29 plants which belong to 19 families, 24 genera and 25 species of dicotyledons and, 3 families, 4 genera and 4 species of monocotyledons. These species are used by the tribal people in formulation of 19 types of herbal preparations for curing 15 different types of diseases and ailments. Many of these preparations are new as they have not been recorded earlier. Of the 29 medicinal plants, as many as 24 are collected by the tribal people from the wild, 2 from cultivation and 5 from commercial sources. The investigated plant taxa have been alphabetically enumerated along with their botanical names, families, local or tribal names, locality of collection, parts used, name of the diseases, mode of administration, etc. Some noteworthy medicinal plants thus documented include *Aerva javanica* Juss. ex Schult. (Amaranthaceae), *Azadirachta indica* A. Juss. (Meliaceae), *Buchanania lanzan* Spreng. (Anacardiaceae), *Datura metel* Linn. (Solanaceae), *Elephantopus scaber* Linn. (Asteraceae), *Holoptelea integrifolia* (Roxb.) Planch. (Ulmaceae), *Lannea coromandelica* (Houtt.) Merrill. (Anacardiaceae), *Streblus asper* Lour. (Moraceae), *Swertia chirata* Buch.-Ham. (Gentianaceae), *Tagetes patula* Linn. (Asteraceae), *Terminalia chebula* (Gaertn.) Retz. (Combretaceae), etc.

**Key words:** *Traditional knowledge, medicinal uses, tribal people, Birbhum district, West Bengal*

### INTRODUCTION

Ethnobotany can be defined as the total natural and traditional relationship and interactions between man and his surrounding plants. In India during last four decades scientific studies have been concerned to different aspects of ethnobotany of specific tribes, of certain regions, of particular plant groups or diseases and on other perspectives sub- or interdisciplinary approaches (Jain, 1965, 1981, 1987, 1991,

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1997; Mandal and Yonzone, 1988; Mandal, 1988; Majee *et al.*, 1997; Mondal *et al.*, 1998; Rahaman and Mandal, 1998; Singh and Pandey, 1998; Maheshwari, 2000; Trivedi and Sharma, 2004).

The present investigation provides some significant information regarding ethnomedicinal uses of plants by the Santal tribe of Birbhum district, West Bengal, which are new to the existing inventory of Indian ethnomedicinal investigations. This study holds the continuity of works done on this line earlier in the district that ultimately be of a great help for preparing a full length detailed inventory of ethnobotany and ethnomedicine of Birbhum district as well as West Bengal in future.

District Birbhum is quite rich in natural resources and it is one of the smallest district of West Bengal. The district extends over about 4528.61 sq km and it is situated between 87° 10' and 88° 20' East longitude and between 23°33' and 24°35' North latitude. Tribal population of the district is 6.7% of its total population (Census of India, 2001). The tribal people of the district are mainly dependent upon the forest flora to meet their day to day needs. They use the plant resources in various ways, *e.g.*, in curing the diseases and ailments, for food, fibres, shelter, household implements, etc. Moreover, it is evident from a few scattered reports (Mandal, 1988; Mondal *et al.*, 1998; Banerjee, 2000; Pradhan *et al.*, 2008; Rahaman *et al.*, 2008, 2009; Ghosh *et al.*, 2011) that systematic and extensive ethnobotanical explorations are necessary.

## **MATERIALS AND METHODS**

Frequent field trips were conducted to collect the ethnomedicinal information from different tribal areas of Birbhum district, West Bengal for last one year (2010-2011). The data on ethnomedicinal uses of plants were collected from various tribal medicine men and other knowledgeable persons of the study areas following the standard methods (Jain, 1987; Jain and Mudgal, 1999). To confirm the authenticity of the collected data, it has always been cross checked by interviewing other tribal medicine men of the same and other localities. The collected plant species were carefully identified with the help of different floras (Varma, 1981; Guha Bakshi, 1984; Sanyal, 1994). The collected plant specimens have been preserved as herbarium specimens following the method of Jain and Rao (1977) and preserved in the Visva-Bharati Herbarium (VBH) of the Botany Department, Visva-Bharati, Santiniketan for future references.

## **RESULTS AND DISCUSSION**

Altogether 29 ethnomedicinal plants have been recorded from different forest areas of Birbhum district, which are used by the tribal people in 19 different formulations that cure 15 types of diseases and ailments. Of those ethnomedicinal formulations, 10 are based on single species (monoherbal) and are used in curing half sided headache, body ache, cold and cough, cut, measles, pox and toothache. In 9 other cases, compound drug preparations (polyherbal) are used in treatment of intermittent fever, burn, stomach ache, acidity, white discharge, dysentery, dyspepsia, etc. Analysis of the individual plant parts, shows that roots and rhizomes are used

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in 3 cases, leaves in 4 cases, stems in 2 cases, flowers and fruits in 4 cases, seeds in a single case, bark in 12 cases and whole plants or shoots in 3 cases, percentage contribution of which is shown in Fig. 1.

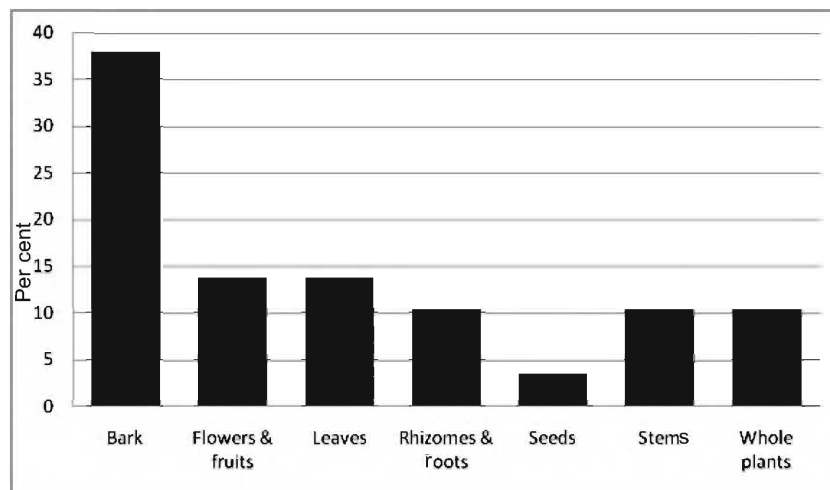


Fig. 1. Percentage contribution of different plant parts used as drugs

Of the total 29 plants involved, materials of 24 plants are collected by the tribal people from the wild, 2 from cultivation and 5 from commercial sources. These investigated plant taxa spread over 25 species, 24 genera and 19 families of dicotyledons and 4 species, 4 genera and 3 families of monocotyledons (Table 1).

**Table 1.** Percentage contribution of the recorded plant species and their groups.

Taxa	Dicotyledonous plants		Monocotyledonous plants	
	Total No.	Contribution (%)	Total No.	Contribution (%)
Family	19	65.51	3	10.34
Genus	24	82.75	4	13.79
Species	25	86.20	4	13.79

Habitually the investigated taxa fall under 4 groups - Trees (15 in number), Shrubs (2 in number), Herbs (10 in number) and Climbers (2 in number) and their respective percentage has been defined (Fig. 2).

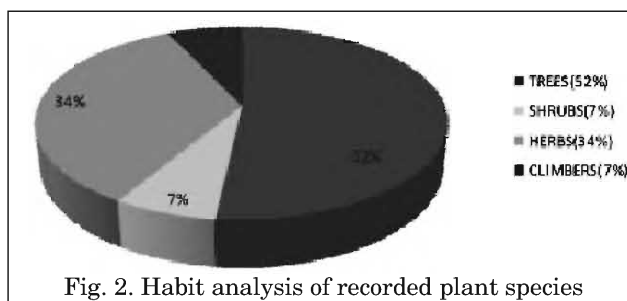


Fig. 2. Habit analysis of recorded plant species

The data collected in this study were compared with those in the standard literature on medicinal and ethnomedicinal studies of West Bengal as well as India (Kirtikar and Basu, 1935; Chopra *et al.*, 1956; Uphof, 1968; Jain, 1981, 1991, 1997; Tarafder, 1983, 1984; Agarwal, 1986; Mandal, 1988; Mondal *et al.*, 1998; Banerjee, 2000; Maheshwari, 2000; Trivedi and Sharma, 2004; Rahaman *et al.*, 2007, 2008, 2009; Das *et al.*, 2009; Ghosh *et al.*, 2011) and the uses presented in this study were found to be new as they have not been recorded earlier in the mentioned literature.

The investigated plant species have been enumerated along with their botanical names, families, locality of collection, local or tribal names, parts used, mode of administration, etc. (Table 2).

**Table 2.** Enumeration of the investigated taxa

Sl. No.	Botanical name & family	Local & Tribal name and locality of collection	Parts used	Disease	Mode of administration
<b>A. MONOHERBAL PREPARATIONS</b> (Single plant is used in preparation)					
1.	<i>Acacia nilotica</i> (Lam.) Willd. ex Del ssp. <i>indica</i> (Benth.) Brenan (Mimosaceae)	<i>Babla, Kikar</i> Goalpara and Kanokpur	Leaves	Toothache	About 3-5 gm fresh leaf administered orally by chewing once a day for 7 days at morning in empty stomach.
2.	<i>Aerva javanica</i> Juss.ex Schult. (Amaranthaceae)	<i>Bishahari</i> Khairdanga, Bautia and Fuldanga	Leaves	Cuts and wounds	4 or 5 leaves are made into paste and applied twice a day for 2-3 days on affected parts.
3.	<i>Bambusa aurundinacea</i> Roxb. (Poaceae)	<i>Bans</i> Goalpara	Bark	Cuts and wounds	Bark paste is mixed with lime (1:1) and applied on affected areas once a day for 4-5 days.
4.	<i>Cocos nucifera</i> Linn. (Arecaceae)	<i>Narkel</i> Raipur and Gonpur	Fruits	Measles & pox	Water of green fruits are applied on the body in initial stage twice a day for 3 days.
5.	<i>Datura metel</i> Linn. (Solanaceae)	<i>Dhutra</i> Ballavpur	Leaves	Cold, cough and swelling of throat	Slightly warmed 1- 2 fresh leaf paste applied twice daily for 3 days on infected part
6.	<i>Elephantopus scaber</i> Linn. (Asteraceae)	<i>Phudna</i> Khairdanga, Gonpur and Illumbazar	Roots	Half sided headache	About 10 gm of roots are made into paste and applied on affected area once a day for 5-7 days.

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Table 2 contd.

Sl. No.	Botanical name & family	Local & Tribal name and locality of collection	Parts used	Disease	Mode of administration
7.	<i>Holoptalea integrifolia</i> (Roxb.) Planch. (Ulmaceae)	<i>Pata badam</i> Bidyadharpur	Bark	Body ache	50-60 gm bark paste mixed with 10-20 gm salt (NaCl <sub>2</sub> ) and after slightly warming applied on the body twice a day for 2-3 days
8.	<i>Justicia gendarussa</i> Burm. f. (Acanthaceae)	<i>Bishalyakarani</i> Bautia	Whole plant	Body ache	Whole plants are cut into small pieces and boiled in water. Half cup of decoction massage on the body thrice a day for 2-3 days.
9.	<i>Tagetes patula</i> Linn. (Asteraceae)	<i>Ganda</i> Goalpara	Leaves	Cuts and wounds	3-5 leaves are made into paste and applied on the affected parts twice a day for 4-5 days.
10.	<i>Terminalia chebula</i> (Gaertn.) Retz. (Combretaceae)	<i>Haritaki</i> Khairdanga, Aahmmedpur and Bautia	Fruits	Cold & cough	A fruit is administered orally by chewing once a day for 3 days.
<b>B. POLYHERBAL PREPARATIONS</b> (more than one plants are used in preparation)					
11.	(a) <i>Sida rhombifolia</i> L. (Malvaceae) (b) <i>Piper nigrum</i> L. (Piperaceae)	(a) <i>Kuruni</i> (b) <i>Golmorich</i> Shibarampur and Aahmmedpur	Stem  Fruits	Dyspepsia	About 50-60 gm stem of <i>S. rhombifolia</i> L. & 21 pieces of fruits of <i>P. nigrum</i> L. are made into paste and administered orally once a day for 7 days at morning in empty stomach.
12.	(a) <i>Curcuma longa</i> Linn. (Zingiberaceae) (b) <i>Nymphaea nouchali</i> Burm.f. (Nymphaeaceae)	(a) <i>Halud, Haldi</i>  (b) <i>Lal shaluk</i> Goalpara and Sehera	Flowers  Rhizomes	Period problems	Rhizomes of <i>N. nouchali</i> Burm.f. & flowers of <i>C. longa</i> Linn. are made into paste, then administered orally once a day for 4-5 days.

Table 2 contd.

Sl. No.	Botanical name & family	Local & Tribal name and locality of collection	Parts used	Disease	Mode of administration
13.	(a) <i>Andrographis paniculata</i> (Burm.f.) Wall. ex Nees (Acanthaceae)	(a) <i>Kalmegh</i>	Whole plant	Stomach-ache	Whole plant of <i>A. paniculata</i> (Burm.f.) Wall. ex Nees & stem of <i>Swertia chirata</i> Buch.-Ham. (1:1) are made into paste and administered orally once a day for 3 days.
	(b) <i>Swertia chirata</i> Buch.-Ham (Gentianaceae)	(b) <i>Chirata</i> Raipur, Gonpur and Bautia	Stem		
14.	(a) <i>Papaver somniferum</i> Linn. (Papaveraceae)	(a) <i>Posta</i>	Seeds	Stomach-ache and dysentery	3-5 gm seeds of <i>P. somniferum</i> Linn. are made into paste and dissolved in a cup of stem juice of <i>S. officinarum</i> Linn., then administered orally once a day for 2-3 days.
	(b) <i>Saccharum officinarum</i> Linn. (Poaceae)	(b) <i>Aakh</i> Goalpara and Kanokpur	Stem		
15.	(a) <i>Azadirachta indica</i> A. Juss. (Meliaceae)	(a) <i>Neem</i>	Bark	Dysentery	Barks of <i>A. indica</i> A. Juss., <i>M. indica</i> L., <i>S. cumini</i> (L.) Skeels. & <i>T. arjuna</i> (Roxb. ex DC.) Wt. & Arn. are made into paste, then filter. Half cup of this juice mixed with 3-4 g lime [Ca(OH) <sub>2</sub> ] are administered orally once a day for 3 days in the morning.
	(b) <i>Mangifera indica</i> L. (Anacardiaceae)	(b) <i>Aam</i>	Bark		
	(c) <i>Syzygium cumini</i> (L.) Skeels. (Myrtaceae)	(c) <i>Jam</i>	Bark		
	(d) <i>Terminalia arjuna</i> (Roxb. ex DC.) Wt. & Arn. (Combretaceae)	(d) <i>Arjun</i> Ballavpur and Kanokpur	Bark		
16.	(a) <i>Buchanania lanzan</i> Spreng. (Anacardiaceae)	(a) <i>Piyal</i>	Bark		Barks (1:1:1:1) of <i>B. lanzan</i> Spreng., <i>M. longifolia</i> (Koenig) McBride var. <i>latifolia</i> (Roxb.), <i>S. rubusta</i> Gaertn. and <i>T. arjuna</i> (Roxb. ex DC.) Wt. & Arn. are cut into small pieces, then boiled with water and applied on
	(b) <i>Madhuca longifolia</i> (Koenig) McBride var. <i>latifolia</i> (Roxb.) (Sapotaceae)	(b) <i>Mahua, Mol</i>	Bark Bark		
	(c) <i>Shorea rubusta</i> Gaertn. (Dipterocarpaceae)	(c) <i>Sal</i>			

Table 2 contd.

Sl. No.	Botanical name & family	Local & Tribal name and Locality of collection	Parts used	Disease	Mode of administration
16.	(d) <i>Terminalia arjuna</i> (Roxb. ex DC.) Wt. & Arn. (Combretaceae)	(d) <i>Arjun</i> Khairdanga, Goalpara and Illumbazar	Bark	Burn	the affected areas twice a day for 5-7 days.
17.	(a) <i>Elephantopus scaber</i> Linn. (Asteraceae)	(a) <i>Phudna</i>	Roots	Intermittent fever	Roots (1:1) of <i>E. scaber</i> Linn. & <i>I. frutescens</i> R. Br. are cut into small pieces, and then make a small bundle. This bundle is hung around the neck for 7 days.
	(b) <i>Ichnocarpus frutescens</i> R. Br. (Apocynaceae)	(b) <i>Shyاملata</i> Khairdanga	Roots		
18.	(a) <i>Lannea coromandelica</i> (Houtt.)Merrill (Anacardiaceae)	(a) <i>Jeol</i>	Bark	Acidity	Barks of <i>S. asper</i> & <i>L. coromandelica</i> (1:1) are made into paste and then filter. Half cup of soup is administered twice a day for 4-5 days before a meal.
	(b) <i>Streblus asper</i> Lour. (Moraceae)	(b) <i>Saorah</i> Bannodanga and Gonpur	Bark		
19.	(a) <i>Achyranthes aspera</i> L. (Amaranthaceae)	(a) Apang, Charchare	Whole plants	White discharge	10 gm of <i>A. aspera</i> L. plant & 3 pieces fruits of <i>P. nigrum</i> Linn. are made into paste and administered orally once a day for 3 days at morning in empty stomach.
	(b) <i>Piper nigrum</i> Linn. (Piperaceae)	(b) Golmorich Shibarampur, Goalpara and Sehera	Fruits		

## CONCLUSION

Awareness has been created among the academic people regarding the documentation of traditional knowledge of any indigenous society worldwide. Like other traditional knowledge system, the knowledge of the Santal community of Birbhum district regarding herbal medicines should be conserved through its documentation before it gets lost for ever. The data documented here in this study will be helpful in preparation of the district as well as state level inventory of ethnobotany and ethnomedicine. The information served through this investigation should further be explored and validated scientifically for enrichment of our life sustaining systems.

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## **TRADITIONAL KNOWLEDGE OF FISHERMEN COMMUNITIES OF SUNDARBAN, WEST BENGAL**

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### **ABSTRACT**

Fishermen communities of Sundarban possess a wealth of traditional knowledge acquired through close and intimate association with nature. The accumulated body of knowledge of both finfish fishers and crabfishers, developed from practical experiences gained over centuries, is transmitted from generation to generation. This knowledge is not handed down orally alone. It is learnt through active participation of the fishers and socialization of the children to occupation. The knowledge system of marine fisherfolk includes selection of fishing ground, knowledge about cosmology, lunar position, weather, topography of sea-bed, depth of water, colour of water, food of fish, movement and behavior of fish, etc. The crabfishers of Sundarban rely largely on traditional knowledge system in identifying the right burrows, position of crab in the burrow, selecting appropriate site for setting multiple baited line in the creek, choosing appropriate fish bait for line fishing, adopting measures for treatment of bait for better durability as well as methods of preservation of crabs for marketing, etc. They have vast traditional knowledge regarding conservation issues on the stock of fish, crustaceans and other aquatic organisms as well as birds and wild animals. They have also observed certain taboos in this connection that reflect the wisdom of these fishermen communities in preserving the environment and ecology of Sundarban and also of southern Bengal.

**Key words :** *Fishermen community, conservation; fish, crab, Sundarban*

### **INTRODUCTION**

Despite sophisticated technology used in modern fishing all over the world, the coastal fisherfolk of Sundarban depend on age-old technology and traditional knowledge system for fishing (Raychaudhuri, 1980; Pramanik, 1993; Nandi and Pramanik, 1994; Pramanik and Nandi, 1999, 2004, 2011). But, their traditional knowledge system is time-tested and developed as a result of close and intimate association with sea, land and people for generations. Folk knowledge of these fishers, however, exhibits their profound knowledge about marine environment and ecology as well as conservation and management of fisheries resources of this region. Their traditional knowledge

relates to innovations, indigenous regulations, social and religious practices, beliefs, values, ethics, etc., which are embedded in local culture, customs and environment and transmitted from generation to generation. In the present communication, an attempt is made to understand the traditional knowledge and wisdom of the coastal fisherfolk of Sundarban and their indigenous means of management towards conservation of natural resources and maintenance of order in the fishing industry as well as the significance of fish in their socio-cultural and religious life.

### **DATA COLLECTION**

Marine fisherfolk of Sundarban have a rich legacy of traditional knowledge. So, information and data pertaining to traditional knowledge of the fish fishers and crab fishers of Sundarban coast have been gathered over two decades of field surveys as well as long association with them. These field surveys mainly comprise observations and informal discussion with groups and individuals of all ages, young and old, male as well as female. Traditional knowledge is also gathered from the marine and estuarine fisherfolk associated with fishing expedition in the sea, setting up of fishing camps on land and also from fishers associated in the symbiotic relations with a wide spectrum of people comprising of fishermen, fishworkers, money lenders, vendors, godown owners, traders, etc. (Raychaudhuri, 1980; Pramanik, 1993; Nandi and Pramanik, 1994; Pramanik and Nandi, 2004, 2011).

### **TRADITIONAL KNOWLEDGE**

Sundarban fisherfolk have profound traditional knowledge and wisdom, signifying fish in their socio-cultural and religious life, as well as traditional means of conservation and management of natural resources towards maintenance of cooperation and order in the fishing industry.

#### ***Traditional knowledge on ecology, environment and fish biology***

Marine fisherfolk of Sundarban possess a wealth of traditional knowledge regarding use of fish and coastal environment, topography of sea bed, cosmology, sequence of tide and ebb, colour and current of water as well as movement, habit, habitat, food of fish and crabs, etc., which constitute an important aspect of this study.

#### **(i) Selection of fishing ground**

On the basis of traditional knowledge, the fish fishers and crab fishers of Sundarban coast, like other fishing communities in India and abroad, select their fishing site as successful fishing depends on the proper selection of the fishing ground. The depth of the sea is an important factor in locating the fishing ground for fishes. In this process, they examine the depth of water, nature of soil and sea bed, colour of water, etc., before setting their net. The fisherfolk of Sundarban have identified the depressions with specific depth of Hugli estuary and have given a local name to each of them, such as, *Bakkhalir hal*, *Chur Saheber hal*, *Sagarer hal*, etc.

The soil condition of the sea bed is another factor for the selection of the fishing ground. For setting bag nets fishermen avoid sandy soil (*bali mati*) which lacks stickiness and cannot hold the anchor against current. The crabfishers also select suitable site for setting multiple baited line in the mangrove forests on the basis of their indigenous knowledge.

**(ii) Selection of fishing zone/ spot**

In inshore as well as offshore area of Sundarban coast two types of nets, gill nets (*chhandi* and *sele jal*) and bag nets (*behundi jal*) – are extensively used in the Bay of Bengal. Fishermen themselves of this region have demarcated fishing zone for each type of net groups. Fishermen belonging to their respective fishing zones possess adequate knowledge about topography of sea bed. The crab fishers of Sundarban rely largely on traditional knowledge system in identifying the right burrows, position of crab in the burrow and selecting appropriate site for setting single as well as multiple baited line (*don*) in the creek. The experienced crab fishers are able to recognize the right hole inhabited by crabs from the imprints of their appendages near the mouth of the burrow. They search for temporary shelters (*khoch*) during ebb tide to set the line.

**(iii) Knowledge on food and behaviour of fishes**

Fishermen also examine the colour of water for locating the shoal of fish. Fishermen, based on their indigenous knowledge, can identify the shoal of fish by observing the colour of water. According to them, the colour of water appears murky where fish is abundant and such murky coloured water is due to constantly washing of the bodies of fish. Fishermen have gained the knowledge of fish behaviour from their long experience. They know that the shoal of fish cannot withstand the relatively higher velocity of current in the deeper portion of the sea bed. The strong currents push the shoal of fish to the relatively higher portion. According to these fishermen, most of the fishes move with the current and against the wind, while some of the fishes, such as, *hilsa*, *tapse*, *bacha*, *etc.*, move against the current. Fishermen are of the opinion that the food of fish is abundant in the relatively flat area of the sea bed where decomposed wooden particles are temporarily deposited. The smaller fish is the food of larger fish and fishermen know from their experience which type of fish is the food of what type of fish species. Fishermen, by dint of their keen observation of marine life have found different habits of the different kind of fish. Some species move close to the level of sea bed (*bhola*, *med*, *etc.*) and some move near the surface water (*hilsa*, *pomfret*) and others move in between the two levels (*rupapati*, *phasa*, *pata*, *etc.*).

**(iv) Knowledge on food and behaviour of crabs**

Crabfishers of Sundarban mostly use either dry or fresh fish as bait in multiple baited line and molluscs meat is sometime used in single baited line. They treat the fresh fish in salt water for several days to make the bait more durable. The fishermen

are fully aware of the clinging habit of crabs. During hook fishing sometimes crab being agitated strongly clings to the hook with its chela and the crabfishers then pulls the crab out of the hole. Similarly, at the time of line fishing, when crabs cling to the bait and tension develops on the line fishermen catch these clinged crabs with the help of scoop net. The crabfishers are aware of the fighting habits of the crabs. That is why they earlier used to put mangrove twigs on the baskets as well as in the holds of the boat to prevent infighting. Nowadays crabfishers tie the chela for easy handling and to arrest infighting.

**(v) Knowledge about lunar position**

Fishermen fix up the date of setting their nets by considering the *tithi* (lunar position). They are convinced that there is a close relationship between the quantity of catch and the rate of flow of tidal water. Fishermen are of opinion that they usually get more fish during ebb (*bhata*) than during the tide (*jowar*) when the shoal of fish is scattered due to increase of both volume and pressure of water.

**(vi) Knowledge about weather condition**

Fishermen can foresee stormy weather by observing the colour of clouds and nature of winds.

**(vii) Knowledge about cosmology**

Fishermen, who go deep into the Bay of Bengal where shore is not visible, depend upon some prominent stars, such as, Adam Surat tara, Sat tara, Dhruba tara, Sandhya tara, Puber tara, etc., for locating the shore. They ascertain their direction observing the flow of water during the tide and ebb, when stars are not visible.

***Traditional knowledge on fishing techniques***

Fisherfolk of Sundarban have their traditional knowledge on indigenous fishing crafts, gears and techniques as well as their traditional means of conservation and management of fishery resources and for maintenance of peace, cooperation and order in the fishing industry.

**(i) Knowledge about fishing crafts**

Fisherfolk of Sundarban mostly use country boats, locally called *nauka* of various sizes and called by different local names, such as, *jele dingi*, *chhandi nauka*, *dingi nauka*, *khile nauka*, etc. The seagoing fishing boats, namely, *jele dingi*, and *chhandi nauka* are strongly built with *sal* (*Shorea robusta*) and *segun* (*Tectona grandis*), while estuarine/ riverine fishing boats, viz., *dingi nauka* and *khile nauka* are often light built with local wood, such as, *babla*, *khirish*, *arjun*, etc. The professional crab fishers of Hooghly-Saptamukhi estuary in Sundarban use two types of boats, locally known as *dingi* and *paukha*. These crab fishing boats are light and built by local carpenters with local wood. But the crab fishers of Tardah (Bhangar P. S.) and Pratapnagar (Sonarpur P. S.) use relatively strongly built boat (also called *dingi*) made of *sal* wood

*Traditional knowledge of fishermen communities.....*

as they resort to long duration trip (12 days) for crab fishing in turbulent waters of Matla-Thakuran estuary of Sundarban.

**(ii) Knowledge about fishing gears**

In Sundarban bag net, locally called *behundi jal*, occupies a significant position in marine fishing. This net is funnel-shaped and bag-type, 75-150 ft in overall length. It has a wide mouth (75-150 ft), short wings (20-25 ft) and fairly long cod-end through which catches are emptied. Marine and estuarine fishers also use gill net, locally called *sele jal* and *chhandi jal* for fishing in the Sundarban region. *Sele jal* is set in the sea for capturing *sele* fish (*Polynemus indicus*) during winter. *Sele jal* is rectangular in shape (12-15 ft x 15-20 ft, each piece) and the meshes are uniform in size and square in shape. *Chhandi jal*, also called *hilsa jal*, is extensively used in the rivers during rainy season. It is also rectangular in shape (1000 ft in length of 50 pieces by 10-12 ft) and meshes are uniform in size and square shaped. The size of these nets, their mesh size and thread used, etc., differ from place to place depending on the fishing unit, fishing ground, catches and the need to minimize the operational cost (Pramanik and Nandi, 2004, 2011).

**TRADITIONAL MANAGEMENT MECHANISMS**

Gradual increase in number of fishermen with fishing fleets and consequently the scarcity of space both in the fishing ground (sea) and in the camp site (beach) have aggravated the problems of crowding and gear conflict. The coastal fishermen traditionally cooperate and solve their problems by indigenous regulations and management mechanisms as follows :

**(i) Cooperation on land**

As the participant fishermen are numerous and space is insufficient, the traditional practice is first come, first serve in the dry fish sectors of Sundarban. Possession of a particular plot for successive years enables fishermen to acquire tenancy right, limiting over-crowding and unlimited entry of other castes in this occupation. The new fishing unit can set up fishing camp on the beach only when it gets permission from the Fishermen's Association functioning on that beach. The association selects the sight and determines the area of land/ plot to be allotted. So, new entry is always subjected to the approval of fishermen's association, which prevents unrestricted expansion of fishing pursuits.

**(ii) Cooperation on the sea**

In Sundarban, fishing groups are formed on the basis of variety of fishing gears and fishing techniques. The bag net fishing is done in a body at particular portion of the sea during particular period of the year. Similarly, gill net fishing is done collectively at a different place in the sea. To avoid the possibility of gear conflicts

between fishing groups/ units, fishermen use separate fishing zones in the fishing ground. Fishermen plant wooden/ iron posts in the sea with the signal at the top to mark their selected fishing grounds so that the other fishing units can easily recognise it. The system of deciding the matter by lot tery is also in vogue for peaceful existence in the fishing ground.

Fishermen use signal in the fishing ground for their safety. They use green flag in case of submerged nets and white flag in case of floating nets. A fishing unit facing danger is required to use red flag. They use flag of different colours during the day and lights of corresponding colours at night (Pramanik and Nandi, 1999; 2004). Fishermen's Association makes rules to avoid breach of peace both on land and in the fishing ground. In case of any dispute between the fishing units the matter is brought to the notice of the Fishermen's Association for solution. The decision of the association is binding

### **TRADITIONAL SOCIO-RELIGIOUS PRACTICES**

Traditional socio-religious practices of the fisherfolk of Sundarban have been developed through centuries. But, these practices, which have now been vanished or fast vanishing, contain important elements of conservation and management strategies when regulations in other forms in the matter of exploitation of fisheries resources were almost non-existent.

#### **(i) Taboo against fishing**

Traditionally, from time immemorial, fishing as an occupation was confined strictly to particular communities in West Bengal including Sundarban. It was never an open access occupation as infiltration to the fishing occupation was not possible because of social stigma attached to it. The ancient Hindus prescribe a close season from the middle of October to the end of January when fish descend to the sea after completing the act of spawning. The crabfishers of Sundarban are aware of the moulting of crabs. The hook fishers refrain from catching crabs from 2<sup>nd</sup> lunar day to 5<sup>th</sup> lunar day after fullmoon or newmoon, the moulting period of crabs, when the crabs remain very soft after moulting. So, the traditional caste system and the ancient close season were very effective mechanism for protection of fish stock.

#### **(ii) Taboo against fish eating**

The people of Bengal who are very fond of eating fishes also traditionally observe fish taboo for variety of reasons. In Bengal, the social practices of Hindus prohibit the eating of of hilsa from the last day of Durga puja (sometime in October) to Sri Panchami or Saraswati puja (end of January), which corresponds with the spawning period of hilsa. The Brahmin widows abstain from eating fish. Hindus invariably eschew fish for the entire mourning period at the time of death of a family members. As such, taboos against fish eating, in the past and also in some cases at present, help conserve fishes. But, mostly due to ignorance, the real meaning and purpose of the ancient social practices which are on the wane, are ignored as superstitions.

**(iii) Worship of deities, crafts, gears, fish, etc.**

Fisherfolk of Sundarban observe certain religious practices for gaining support from supernatural being to face the risk of life and uncertainty of catch. They offer pujas to crafts, gears, catch of fish and crabs, domestic/village deities including forest and animal deities before, during and after the fishing expedition for appeasement, successful haul and safety of the unit members. They keep the sanctity of occupation and usual code of conduct during fishing expedition. Fishermen regard fish not only as an item of consumption but also as an item of worship. So, the professional fishers especially fishermen by caste and occupation do not resort to indiscriminate or destructive fishing. They also do not kill wild animals and birds at the time of fishing expedition to preserve the sanctity of the environment which, in turn, promote conservation of wild animals.. They consider the mother ocean as their community asset and a life-sustaining system rather than a hunting ground. They think any breach of conduct, verbal or otherwise, relating to their occupation as unethical and immoral act. They know very well the psychological influence of observance of sanctity in occupation as it gives them not only confidence, but also comfort and a sense of security.

**(iv) Belief systems**

Several fish varieties (skates, rays, Bombay duck, etc.) earlier were considered non-edible because of superstition. This belief system helped preservation of those fish species as well as ecological balance. But now, all fish species including juveniles, whether liked or disliked by the people are extensively harvested and used as fishmeal and poultry feed (Pramanik and Nandi, 2004).

## **DISCUSSION**

Globally, the coastal ecosystems are facing severe threats of habitat degradation and over exploitation of marine living resources. The factors responsible for these threats have been studied and suitable options suggested for their conservation. But, many such options are beset with hindrance owing to social, economic and political reasons. Often the cost of enforcement of legal restrictions is very high, particularly when there are large number of resource users. In Sundarban, the traditional knowledge, social-religious practice, belief system and ethical values of the fisherfolk have contributed to the sustainability of forest and fishery resources of this region. The fishermen of Kerala have also realized the need to revive, strengthen, and enhance their cultural belief in the context of fisheries management (Kurien, 1995). It is also mentioned that the traditions, beliefs, values and ethics of the traditional society have contributed to the inland fishery resources of Sri Lanka (Ulluwishewa, 1995). In this context, Jentoft (1999) and Chong (2000) have stressed that fisheries management is more about the governance of human behaviour than fish behaviour. It is, therefore, imperative to understand the proper needs and behaviour including belief as well as value system along with self-made rules of the fishermen for better

fisheries management (Pinkerton, 1989; Smith, 1990; McGoodwin, 1990; Suseno, 2000). Mention is made that the right to fish carries with it the obligation to adhere to code of conduct and self-made rules in a responsible manner. Thus, there is necessity to set out certain principles and standard of behaviour for such practices that relate to effective conservation, management and development of living aquatic resources (Sinha, 2001). However, in the Sundarban coast, owing to absence of effective legal provisions, the emphasis is given on the voluntary compliance of the indigenous rules made by the Fishermen's Association. It is true that force cannot ensure compliance of the rules to a large number of resource users of Sundarban coast.

### CONCLUSION

The present study has revealed that both finfish fishers and crabfishers of Sundarban have accumulated a body of knowledge and developed dependence on traditional knowledge in coastal fisheries from practical experiences gained over centuries. They have formulated rules, social stigma, taboos, etc., for them to ensure conservation of resources. They have also formulated the traditional code of conduct for maintaining peace and avoiding gear conflict in the fishing ground. In spite of these, the existing indigenous management practices and regulations are not sufficient/efficient enough to cope with the problems of overcrowding and over-exploitation confronting the marine fisheries of Sundarban coast. A management regime based on social acceptance, with the power of moral persuasion from within the group of participants is perhaps the only way to manage widely dispersed resources which are shared by a multitude of small scale fishermen and various other users.

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## TRADITIONAL MANAGEMENT PRACTICES FOR AQUACULTURE IN EAST KOLKATA WETLANDS, WEST BENGAL

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### ABSTRACT

Present study is an attempt to encompass the usage pattern of macrophytes and fish culture practices which have been a tradition to purify city sewage in drainage water of East Kolkata Wetland (EKW). During the present study it has been found that instead of using stagnant water pool effluents in fisheries as a conventional alternative, fisheries are using an indigenous technique of sequencing sewage ingress to become more efficient, effective, economically viable and environment friendly. Management of this natural stabilization area is done through a more cost effective traditional way by the use of floating macrophyte species, *i.e.*, *Eichhornia crassipes* (water hyacinth), *Salvinia* spp., *Lemna* spp. (duckweed), *Pistia stratiotes* (water lettuce) and emergent macrophyte species, *i.e.*, *Typha* sp. (cattail), *Juncus* sp. (rush), *Phragmites* sp. (reed), *Eleocharis* sp. (spike rush), *Saururus cernuus* (lizardis tail), also by a wide range of fish species which include common carp, grass carp, Indian major carp, tilapia, silvercarp, etc., during different periods.

**Key words :** *Traditional management, aquaculture, East Kolkata Wetland*

### INRODUCTION

Traditional knowledge generally refers to the long-standing traditions and practices of certain regional, indigenous or local communities. Traditional knowledge also encompasses the wisdom, knowledge and teachings of these communities. In many cases, traditional knowledge has been orally passed for generations from person to person. There exists a diversity of local or traditional practices for ecosystem management. These include multiple species management, resource rotation, succession management, landscape patchiness management, and other ways of responding to and managing pulses and ecological surprises (Berkes *et al.*, 2000).

Wetlands are invaluable components of the environment, ecology, resource potential and biodiversity in West Bengal and India. Biological and natural traditional treatment

of water is also considered the most economically feasible approach to enable reuse of wastewater in aquaculture. The East Kolkata Wetland (EKW) of West Bengal, a Ramsar site of India, is the largest urban wetland ecosystem covering 12,500 ha area which includes 286 wastewater fed fish ponds producing 10,915 metric tons of fish annually (Chattopadhyay, 2002) from huge composite effluent mixed city sewage along with large volume of municipal wastewater, tanneries and other small scale industries. The practice developed by 20,000 natural ecologists, *i.e.*, the farmers as well as the fisherman of East Calcutta Wetland is the natural processes coupled with informal practices which contribute significantly to wastewater treatment and promote recycling of the sewage water. East Calcutta Wetland's resource recovery system, developed by local people through the ages, has saved the city of Kolkata from the costs of constructing and maintaining wastewater treatment plants (Raychaudhuri, 2008).

The objective of this paper is to provide the information about the traditions practiced to manage aquaculture from sewage fed fish ponds in the East Kolkata Wetlands, Kolkata. West Bengal.

### **STUDY AREA**

A part of EKW which is managed by the East Kolkata Fishermen Cooperative Society is taken into consideration for the present study on waste-fed freshwater system. This wetland is located beside Eastern Metropolitan Bypass near Ruby Hospital (within 6 km and covers an area of 5852.14 ha, of which 3898.70 ha (45.93%) and used for fish farming. There are 108 waterbodies comprising of hatching pools, nursery ponds and mating pond.

### **MATERIAL AND METHOD**

Monthly surveys have focused on how traditional knowledge is generated within these communities, *i.e.*, through farmers' experimentation and how it is extended to the different members of the community through generations. Total land area, waterbody area, number of waterbodies, species of fish cultured, species of macrophytes used, pond soil and pond water preparation for aquaculture and procedures followed by the farmers were recorded. Regular interactions with the farmers revealed various procedures and periods of fish hatching, cultivation and harvesting in hatching pools, nursery ponds and stock ponds respectively.

The links between these traditional or indigenous knowledge sources and mechanisms, their functioning and relationship with sustainable wetland management are explored in this research.

### **OBSERVATIONS AND RESULTS**

Farmers of EKW adopt the following in connection with wastewater treatment for aquaculture :

- (i) Water hyacinth and duckweeds are spread in the ponds for decomposition of solid wastes and heavy metals and minerals.

*Traditional management practices for aquaculture...*

- (ii) Drying of ponds is undertaken during winter. Silt is removed at least once in three years.
- (iii) Dikes are used for the cultivation of horticultural crops like banana, mango, guava, papaya, jackfruit, coconut, areca nut and trees like sal, segun, eucalyptus, gulmohar, mohua, arjun, etc.

The wastewater treatment system for aquaculture includes : (i) Sewage intake system; (ii) Passing through settling pond; (iii) Duckweed and other macrophyte culture complex; (iv) Pond preparation; (v) Cultivation ponds; (vi) Macrophyte screening; and (vii) Outlet systems.

**1. Sewage intake system**

Direct sewage water from the municipal wastewater channels is poured into the primary pond where a bamboo filter is arranged for screening off large solid particles.

**2. Passing through settlement or secondary pond**

This first pond allows the large and heavy particles to settle down at the bottom of the pond. A settling pond collects and slows water flow so that suspended solids (sediments) have time to precipitate or settle out of the water. Some applications of settling ponds include capturing runoff from farms (agricultural waste), construction projects (soil sediment) and mines (sediment and toxic waste). Settling ponds eventually become filled up and are to be dredged to remain in operation. Polluted water is diverted to settling ponds to remove solids, such as, iron oxide. When dredged, these sediments are treated as contaminated waste. For this purpose water is kept in this secondary pond for 2-4 days.

**3. Duckweed, water hyacinth and other macrophyte culture complex**

The duckweed culture complex comprises of a series of duckweed ponds where aquatic macrophytes like *Spirodela*, *Wolffia* and *Lemna* are grown. The wastewater is taken on gravity or pumped through intake system into duckweed culture system where it is retained for 7-10 days before allowing to fish-ponds. The duckweed culture unit helps in removal of heavy metals and other chemical residues that otherwise get into human food chain through cultured fish. These also serve as nutrient pumps, reduce eutrophication effects and provide oxygen from their photosynthetic activity. The wastewater with BOD<sub>5</sub> levels of about 100 mg/l can be treated with a total retention time of 5 days, with final BOD<sub>5</sub> levels brought down to 15-20 mg/l, meeting the required standards of different parameters for discharge into natural waters.

**4. Traditional method of pond preparation**

This includes : (i) drying of the pond bottom (soil); (ii) liming and (iii) applying disinfectants and Mohua oil cake, and mustard oil cake.

Sewage fed ponds are pumped out to be dried generally in winter. Due to seasonal drying and inundation, the floodplains become very rich in food availability for aquatic living organisms during high waters, offering rich nursery and feeding grounds for the

larvae, hatchlings, fry, etc., of the populations of a large number of fish species. Kerosene is generally used as insecticide. Mohua oil is also used, which helps in eradicating excess water macrophytes that compete for nutrition with the fish species.

##### **5. Sewage-fed fish-pond or tertiary pond**

Treated water is released in the hatching pools, nursery ponds and stock ponds where fish species of different sizes are cultivated. Species like *Labeo rohita*, *Labeo bata*, *Catla catla*, *Cirrhina. mrigala*, *Hypophthalmichthys molitrix*, *Oreochromis niloticus* are released in the same pond for polyculture at their fingerling stage.

Separate ponds are used for the eggs to hatch. After a gap of ~10 days since their release, eggs are screened through fine mesh net or cotton cloth to detect their hatching.

In the stock ponds fish are kept for about a period of about 5 months where they attain a weight of about 250-400 gms/fish, *i.e.*, marketable size and then harvested.

##### **6. Macrophyte screening**

Excess spread of macrophytes depletes dissolved oxygen content of the pond water by reducing the surface of contact with atmosphere and also obstructs sun rays from reaching deep inside. Concentrations above 100 ppm were acutely toxic to the plants (O'Keeffe *et al.*, 2003). Surface feeders like grasscarp, *Puntius singhala* are released by the farmers before the release of cultivable species to ensure the elimination of these weeds.

##### **7. Water release**

Combined sewer systems comprise of sewers that are designed to collect rainwater runoff, domestic sewage and industrial wastewater in the same pipe. Most of the time, combined sewer systems transport all of their wastewater to this sewage fed fish ponds, where it is treated for a long period of time and then discharged to a water body. In the stock ponds fish are kept for a period of about 5 months before harvesting. From this stock pond, water is being released to the main canal, once the fish attain almost a weight of 250-400gms.

##### **Remarks :**

This tradition is now becoming endangered. These wetlands are today under threat of encroachment, and perhaps extinction - mainly because of pressures exerted by the ever expanding metropolis, Kolkata, which need to be brought under societal awareness to conserve for our benefits and also for conservation of wetland flora and faunal diversities.

## **DISCUSSION**

Aquaculture is the controlled production, propagation and rearing of aquatic organisms of economic importance in a controlled environment, such as, ponds, channels and enclosures, using a higher density of cultured aquatic organisms than is normally found in nature. In recent years, natural and artificial wetlands have been used to treat raw sewage and partially-treated effluents. Wastewater is considered as

an important element that will contribute to solving the problem of water scarcity in the city, as long as it can be treated in an efficient way and be used in the aquacultural (Edwards, 1993) and agricultural sector.

Aquaculture is not a practice new to East Kolkata Wetland's fishermen. Sewage fed fish ponds have been used for rearing fish for generations, although production remains extensive rather than intensive. Production based traditional knowledge relates to the best locations, times and means of wild hatchling collection or to techniques of hatchling production, such as, correct temperature, water quality, proper management of water through different macrophytes, liming, mahua khol and most suitable feed. Environmental degradation has been hastened, which has increased the pressure on these aquatic ecosystems. Increased exploitation of aquatic resources is also the result of poor management practices.

A large number of experimental studies have also been carried out on the use of fresh or processed water hyacinths as fish feed. O'Keeffe *et al.* (2003) reported on the heavy metal absorption property, especially cadmium, of water hyacinths. Snow and Ghaly (2008) stated that water hyacinth, in comparison to other macrophytes, shows maximum reduction of pollution load with longer retention time, thus leaving the water medium suitable for reuse in aquaculture. Again, through photosynthetic activity of water hyacinth, enough oxygen for growth of bacteria is released around the roots and leaves that are in contact with water. In turn, the bacteria release nutrients by digesting the pollution. Zhuan-Ta *et al.* (1985) reported that water hyacinth (dried water hyacinth leaf meal) under similar conditions in China contained 20.3% crude protein, 22.6% ash, 1.8% fat, 1.2% carbohydrate, 13.8% fibre and 2.9% phosphorous and thus this macrophyte can also be utilized as fish feed. These macrophytes are harvested in EKW twice a week. The wastewater is taken on gravity or pumped through intake system into duckweed culture system where it is retained for 7-10 days before allowing to fish-ponds.

Traditional knowledge extends into many spheres of this sewage fed aquaculture. These may be placed in two broad categories: production and trade. Nowadays farmers are facing too much problem due the pipe blockage by plastic bags. By clogging sewer pipes, plastic grocery bags create stagnant water blocking the mouth of inlet pipes; this hampers the inflow of water into the primary pond. For these upcoming situations farmers nowadays often require pumping machines to draw ample amount of sewage water from the drainage pipes. Thus, this present situation is rendering the farmers shift from the traditional practices followed so far.

## **CONCLUSION**

The limited studies and observations made so far on the aquaculture practices of the farmers of EKW are inadequate to draw any conclusion on the use of emergent macrophytes as fish feed or water purifier. Further studies are needed on them. It is apparent from historical and contemporary accounts that wastewater aquaculture has a long tradition and is currently widespread. However, from the present study it

appears that there is considerable pollution and degradation of the environment due to lack of awareness in people. Therefore, it is important to treat the waste water before it gets disposed into environment.

Wetlands supporting fish culture in peri-urban Kolkata have an ecological value and the International Union for Conservation of Nature and Natural Resources (IUCN) has recognised this, leading to the recognition of wastewater fishponds as a special category of man-made wetlands due to their contribution to preserving nature (Edward 1996). So we need to take care of this pollution and degradation prone zone through the culture of traditional knowledge, which buffers many hazards of the environment and helps us reutilize and recycle the waste water, to save our society.

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PLATE – I, Figs. 1-3. The wastewater treatment system for aquaculture (EKW) :



Fig. 1. Macrophyte culture complex of EKW.



Fig. 2. Dyke passing through settlement pond.



Fig. 3. Banana and other tree plantation on the dyke.

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PLATE – II, Figs. 4-7. The wastewater treatment system for aquaculture (EKW) :



Fig. 4. Natural stabilization/settlement by water hyacinth.



Fig. 5. Filtration pond.



Fig. 6. Water hyacinth culture unit



Fig. 7. Duckweed culture unit.

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PLATE – III, Figs. 8-12. The wastewater treatment system for aquaculture (EKW) :



Fig. 8. Mohua oil treatment



Fig. 9. Plastic bags inside causing blockage



Fig. 10. Blockage due to plastic bags deposition



Fig. 11. Waste disposed inside EKW



Fig. 12. Plastic waste inside EKW

PLATE – IV, Figs. 13-15. The wastewater treatment system for aquaculture (EKW) :



Fig. 13. *Oreochromis niloticus* grown in EKW



Fig. 14. Major carp fishes grown in EKW



Fig. 15. *Catla catla*, grown in EKW

## **INDIGENOUS KNOWLEDGE ON NOMENCLATURE OF FRESHWATER WETLANDS OF WEST BENGAL**

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### **ABSTRACT**

Indigenous people gather knowledge exploring man-environment interactions. In the present communication, indigenous knowledge of the local people on nomenclature of freshwater wetlands of West Bengal is communicated based on our experiences during the course of investigations on faunal resources of wetlands of West Bengal. Nomenclaturally, different types of small to medium sized freshwater wetlands are differently termed by the indigenous people. These are either natural or man-made wetlands, such as, *pukur*, *doba*, *dighi* as man-made wetlands, while *beel*, *baor*, *haor*, *daha*, *jheel*, *jola*, *jhora*, *chhara*, etc., as natural wetlands. Some of these terms are universally used all over West Bengal, for example *pukur* means pond, while some others are locally used with ecological connotation, for example, *jhora* indicates small hill streams of Darjeeling Himalayas. Indigenous people can orally communicate correctly about various wetland types in their conversation, though they are sometimes unable to define them appreciably on the basis of origin, size, naturalness, vegetation and other features. But their long acquaintance with wetlands and deep rooted knowledge about local environment can be of much use for classification, characterization and documentation of wetlands of the country.

**Key words :** *Freshwater wetlands, nomenclature, traditional knowledge*

### **INTRODUCTION**

Indigenous knowledge (IK) is usually tradition-based cultural expressions exemplified by narratives, folksayings, etc., generated and updated by the local people. Being part and parcel of nature, man has developed certain intelligible concepts exploring man-environment interactions. It has been the assertion that IK is dynamic and it evolves over time within a particular culture as the local communities possess the capacity

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to adapt to changing circumstances (Chambers, 1983; IIRR, 1996). Possessing such knowledge and possessing the capacity to adapt and apply it in the face of changing environmental scenario or socio-economic conditions is essentially the root of sustainable natural resource management. As such, indigenous knowledge (IK) is now recognised as an important tool in making contribution towards natural resource management systems, particularly in the developing world (Brokensha *et al.*, 1980; Richards, 1985; Warren *et al.*, 1995). Recognising, empowering and incorporating indigenous knowledge in participatory rural development projects, IK has become an integral means of ensuring socially, environmentally and economically sustainable natural resource management nowadays.

In the present communication, indigenous knowledge of the local people on nomenclature of freshwater wetlands of West Bengal is communicated based on our experiences during the course of investigations on faunal resources of wetlands of West Bengal. The various wetland types or terms, their location and district-wise distribution are presented in this paper. However, this paper aims to document such aboriginal knowledge about wetland nomenclature for disseminating the same to a wider readers.

### HISTORICAL PERSPECTIVE

Historically wetlands or waterbodies have undergone gradual changes in profile with time, content and course of water flow from catchment and watershed areas. These lead to siltation and accretion of wetlands and thus bringing change in water chemistry and also depth of waterbody eventually leading to change in the phytal and faunal make-up of the wetlands. As a result, this brings changes in the name (both English and Vernacular) of the wetlands, such as, rivers become oxbow lakes, then beels and then water meadows and so on.

Waterbodies or wetlands have also high profile historical rather mythological perspective in West Bengal. This is appreciably applicable in case of larger waterbodies called *dighies* in West Bengal, which are excavated by the then *zaminders*, the feudal landlords. In Birbhum district there is an interesting folktale regarding a *dighi* in the name of Yogadyadevi at Rampurhat. In autumn, a bungle seller was passing beside this pond. A beautiful young lady who was sitting at the *ghat* came to him and wore bungles from him. On asking for money for the bungles the lady requested the bungler to take payment from her father who was the priest of Yogadya temple. When bungler approached the priest he was astonished and told that he had no daughter. Then both of them came to the bank of the *dighi*. Other people in the locality also came along with them. They found none in the *ghat*. But, the *devi* showed her bungle-worn hand from the middle of the pond. Even today it is said that bathing in this *dighi* is equivalent to bathing in the Ganges (Mitra, 2004). In East Midnapore district at Tamluk there was a legend relating to a *sarovar* located beside *Bargabhma* temple that says if anybody dip any brass utensils in this *sarovar* it turned into gold. Such stories abound relating to the larger waterbodies of West Bengal. This shows local

people have how much reverence for *dighies* and *dahas* and how much they have contributed to meet water crisis by storing water and towards excavation of waterbodies of West Bengal.

### OUTLINE CLASSIFICATION OF WETLANDS

The outline classification of freshwater wetlands is based on their physical and bio-ecological characteristics. Amongst the inland wetlands, the freshwater wetlands include river systems, streams, irrigation canals, floodplains as well as freshwater reservoirs, hydrodams, lakes, ponds and marshes including rice fields (Alfred and Nandi, 2001). Among the 22 wetland types (IUCN, 1989) the existing freshwater wetlands of West Bengal belong to following categories (Table 1).

**Table 1.** Different wetland types existing in West Bengal

Lacustrine	1. Permanent	(i) Permanent freshwater lakes (>8ha) (ii) Permanent ponds (<8ha)
Palustrine	1. Seasonal	(i) Seasonal lakes (>8ha)
	2. Emergent	(i) Permanent marshes and swamps (ii) Permanent peat forming swamps (iii) Seasonal marshes
	3. Forested	(i) Shrub swamps (ii) Swamp forest
Man-made wetlands	1. Aquaculture	(i) Aquaculture ponds
	2. Agriculture	(i) Ponds and small tanks (ii) Irrigated land and irrigation channel (iii) Seasonally flooded arable land

### INDIGENOUS NOMENCLATURE

Nomenclaturally, different types of small to medium sized freshwater wetlands are differently named by the indigenous people (Anonymous, 2002). This is true in case of naming different wetland types in West Bengal as well as in India. These wetland types are either natural or man-made wetlands. Such as, *beel*, *baor*, *haor*, *daha*, *jola*, *jhora*, *chhara*, etc., are natural wetlands, while *pukur*, *doba*, *dighi* are man-made wetlands. Some of these terms, for example, small man-made waterbody known as *pukur* means pond whereas lowland natural depressions known as *beels* are universally used all over West Bengal, while some others, such as, *jhora* indicates small hill streams of Darjeeling Himalayas is locally used with ecological connotation.

Basically there are 12 categories of freshwater wetlands existing in West Bengal (Table 1) as per scientific literature. But the local people have their own way of classifying, characterizing and naming of wetlands. Their indigenous knowledge

regarding characteristic features of different wetland types is reflected in nomenclature of wetland types, which is shown in Table 2.

**Table 2.** Indigenous knowledge on nomenclatural categorization of some wetland types

Wetland type	Origin	Ecology	Status	Wetland conceptual characterization
<i>Pukur</i>	M	P	P/T	Small waterbody excavated individually/ locally
<i>Doba</i>	M	P	P/T	Very small waterbody for specific/ domestic use
<i>Garya</i>	M	P	P/T	Very small pond for sanitation/afterwash purpose
<i>Dighi/Sagar</i>	M	L	P	Large deep pond usually excavated by zaminders
<i>Sarova/Sayar/Tarag/Sarashi</i>	M	L	P	Large aesthetical and well decorated pond
<i>Bundh</i>	M	L	P/T	Reservoir with embankment on three sides
<i>Jheel</i>	N/M	L/P	P/T	Small waterbody natural or man-made
<i>Daha/Radh</i>	N	L	P	Abysmal whirlpool site of river or rivulets
<i>Dahar</i>	N	F	T	Floodplain wetlands used for agriculture
<i>Beel</i>	N	F	P	Extensive shallow saucer-like floodplain marsh
<i>Baor</i>	N	R	P	Cut off meandering river course of south Bengal
<i>Haor</i>	N	F	T	Large muddy floodplain marsh of Haora district
<i>Jola</i>	N	F	P/T	Large shallow and muddy floodplain marsh
<i>Jhora</i>	N	R	P/T	Very shallow hill streams of Darjiling Himalaya
<i>Jore</i>	N	R	T	Very shallow hill streams of Puruliya district
<i>Jalkar</i>	N/M	L/R	T	Large shallow wetland for fish and paddy culture

Note : 1. In column Origin : M = Man-made, N = Natural.

2. In column Ecology : P = Palustrine, L= Lacustrine, F = Floodplain.

3. In column Status : P = Permanent, T = Temporary.

All the above mentioned wetlands form a unique mosaic of habitats with extremely rich diversity of flora and fauna in West Bengal. Traditionally they are locally categorized into different types based on their physical nature and usage patterns. It is revealed that the freshwater wetlands in the State encompass a wide variety of dynamic ecosystems ranging from natural lakes (*daha, radh*), man-made lakes (*dighi* and *jheel*), man-made reservoir (*bundh*), freshwater marshes (*haors*), oxbow lakes (*baors*), freshwater depressions (*beels*), fish ponds and tanks (*pukur, taraag, doba, jola*) and hill streams (*jhora* and *jore*). The faunal and floral compositions are relatively uniform throughout the *haors, beels, jheels* and *baors* but the composition and dominance varies with time and seasons.

### CONCEPTUAL CHARACTERISATION

Floodplain wetlands of West Bengal are locally known as *beels, dahas, haors* and *jheels*. But *baors* (also called *beels* in some areas) are mostly cut off meanders of the

river Ganga and its tributaries. Some of them are oval, dumbbell-shaped or riverine in appearance. The open *baors* are linked permanently with rivers retaining riverine level all along. The closed *baors* or *beels* are not very stable due to erratic water renewal through rainfall. The *beels* are naturally rich in nutrients due to the allochthonous supply of organic matter through the catchment runoff and autochthonous sources of macrophytic decomposition besides the death and decay of other aquatic organisms. *Beels* which are smaller in size and elongated in shape are sometimes locally called as *jheels*.

*Dighies* are man-made large and deep stagnant waterbodies and *pukur* or pond, is smaller in size than *dighies*, can be described as a small body of shallow stagnant water, permanent or semi-permanent, usually well dominated with aquatic plants. The latter are generally made as a result of man's activities for draining of fields, making facilities for the drinking water and especially for irrigation of gardens, parks and sanctuaries. There are lots of sacraments in the rural areas to dig *pukur*, such as, the exact place for digging where much water will be received, how much deep it should be to remain perennial, proportionate height of the bank, etc. These *pukurs* are also named differently according to their uses like '*khirki pukur*' which lies behind the house and '*taal pukur*' means a large pond. *Taraag* is also a kind of *pukur* which is big and deep. The *dighies* and *pukurs* which are well decorated are named as *sarovars* or *sarashi*.

In western highland and plateau region of West Bengal, mainly in the districts of Purulia, Bankura and Birbhum, some lowlands or fields where water comes through surface run-off are reserved by making high level of clay dumpings so as to make high embankment around its three sides. These are called '*bundhs*', viz., Saheb-Bandh of Purulia.

*Dobas* are the shallow inundations filled with water which mostly dried up in summer season. In ancient time, there were some *dobas* which were used mainly for sanitation purposes. These were locally called '*garya*'. *Khanas* are dishevelled water-logged lowlands where mostly animals drink water. Irrigation canals of West Bengal are locally named as '*khaals*'.

## DISTRIBUTION

In West Bengal, freshwater wetlands spread over 3.35 lakh ha excluding rivers, canals and paddy fields, of which tanks and ponds have highest area of 2.76 lakh ha, followed by *beels*, oxbows and derelict waterbodies of 0.42 lakh ha and reservoirs of 0.17 lakh ha (Anonymous, 1996). Wetlands of this state, especially freshwater wetlands, vary widely because of regional and local differences in soils, topography, altitude, climate, hydrology, water chemistry, vegetation, and other factors like anthropogenic activities. More than 42,500 ha of water area is under *beels* which spread throughout the state except in few districts like Purulia and Midnapore. Distribution of various freshwater wetland types in some of the district of West Bengal (Nandi *et al.*, 1993-2007; Anonymous, 2002; Mitra, 2004) are shown hereunder.

- Bankura, Purulia, Birbhum:** Pukur, Bundh and Beel  
**Bardhaman:** Pukur, Sayar and Beel  
**Darjeeling:** Pukur, Jhora  
**Dinajpur:** Pukur, Beel, Dighi, etc.  
**Howrah:** Pukur, Jala, Haor, Daha  
**Hugli:** Pukur, Khaal and Beel  
**Jalpaiguri:** Pukur, Jala, Beel, etc.  
**Kochbihar:** Pukur, Chhara and Beel  
**Kolkata:** Pukur, Taraag, Jheel, Khaal, etc.  
**Malda:** Pukur, Beel and Dighi  
**Murshidabad:** Pukur, Jheel, Dighi  
**Nadia:** Pukur, Beel, Baor, Haor  
**North 24 Parganas:** Pukur, Daha, Baor, Haor, Beel, etc.  
**South 24 Parganas:** Pukur, Beel, Jheel, etc.

#### CONCLUING REMARKS

It is observed that the indigenous people can orally communicate correctly about various wetland types in their conversation, though they are sometimes unable to define them appreciably on the basis of origin, size, naturalness, vegetation and other features. But their long acquaintance with wetlands and deep rooted knowledge about local environment can be of much use for the classification, characterization and documentation of wetlands of the country. But, the utilization of indigenous knowledge has rarely happened. Unfortunately, a lot of such valuable knowledge is lost as elders pass away before it can be passed on to the next generations. As such, it is felt that during the course of wetland inventory, researchers need to consult knowledgeable local people for their traditional and/or indigenous knowledge on various characteristic features of wetlands known to them through generation to develop a database on wetlands of West Bengal.

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## **PATENTING OF TRADITIONAL KNOWLEDGE**

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### **ABSTRACT**

Traditional Knowledge (TK) associated with biological resources is an intangible component of the resource itself and it has the potential of being translated into commercial benefits. India which is a megadiversity developing country is rich in agricultural biodiversity, traditional and indigenous knowledge, both coded and informal. Some of the TKs include wound-healing properties of “*haldi*” or turmeric, anti-diabetic properties of “*karela*” or bittergourd, fungicide qualities of “*neem*” that have been long in use in India and have been handed over down for many generations by word of mouth, often with some extra inputs, but without any clear tradition of ownership or custodianship. Literary and artistic works based upon or inspired by traditional culture or folklore have been given seemingly innovative identities through different interpretations. This has led to misuse and misappropriation of knowledge by private commercial concerns. The main issue is that patents have been granted for inventions that are not original but a derivation of TK. Over the past few years, the patent system has been criticized for its failure to prevent such misuse of TKs. Hence there is a need to create databases and TK registers which will bring some transparency to the patent process and prevent such blatant piracy of TKs.

**Key words:** *Traditional knowledge, traditional culture, biodiversity, biopiracy, patent.*

### **INTRODUCTION**

Traditional Knowledge comprises of the vast expanse of knowledge, innovations and practices of indigenous and local communities embodying their traditional lifestyles. TK refers to tradition-based literary, artistic or scientific works, performances, inventions, scientific discoveries, designs, marks, names and symbols, undisclosed information and all other tradition-based innovations and creations resulting from intellectual activity in the industrial, scientific, literary or artistic fields.

Traditional knowledge may be categorized as :

(1) Agricultural knowledge; (2) Scientific knowledge; (3) Technical knowledge;

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(4) Ecological knowledge; (5) Medicinal knowledge including related medicines and remedies; (6) Biodiversity related knowledge and (7) Expressions of folklore.

TK is also known by other names – Indigenous Knowledge (IK), Traditional Environmental Knowledge (TEK) and Local Knowledge (LK) and typically distinguishes one community from another. Human communities have always generated, refined and passed on knowledge from generation to generation. TK played and still plays a vital role in the daily lives of the vast majority of people. It is essential to the food security and health of millions of people in the developing world. The nature of TK is such that more of it is transmitted orally than written down. In the absence of any accessible written record, a patent examiner in one country is unable to access documentation that would challenge the novelty or inventiveness of an application based on TK. This has led to controversial patent cases involving TK and Genetic Resources. Only recently has the international community sought to recognize and protect TK in the event of a number of cases arising in what is often referred to as “Biopiracy”. The Action Group on Erosion, Technology and Concentration (ETC) defines it as: “The appropriation of the knowledge and genetic resources of farming and indigenous communities by individuals or institutions seeking exclusive monopoly control (usually patents or plant breeders’ rights) over these resources and knowledge.”

#### **TRADITIONAL KNOWLEDGE: SOME EXAMPLES**

##### **(A) Global**

- Thai traditional healers use plao-noi to treat ulcers.
- The San people use Hoodia cactus to stave off hunger while out on long hunting trips.
- Sustainable irrigation is maintained through traditional water systems as the aflaj in Oman and Yemen and the qanat in Iran.
- Indigenous healers in the western Amazon use the Ayahuasca vine to prepare various medicines, imbued with sacred properties.
- Traditional healers of Samoa use the bark of the *mamala* tree to treat hepatitis and other diseases.
- To the semi nomadic Bela people, who inhabit villages across the region near the Niger River in Mali, the grass like wild rice that grows along irrigation ditches and in wet spots during the rainy season is a gift. It is survival on a stack - shelter for homes, fodder for livestock and food when times are lean.

##### **(B) Indian**

(1) Turmeric or Haldi (*Curcuma longa* Linn.) is a plant of the ginger family yielding saffron coloured rhizomes.

- Used as a spice for flavouring Indian cooking.
- An effective ingredient in medicines (to heal wounds and rashes), cosmetics and as colour dye.

*Patenting of traditional knowledge...*

(2) Neem (*Azadirachta indica* A. Juss.) is a tree from India, South and South-East Asia.

- Neem extracts can be used against hundreds of pests and fungal diseases that attack food crops.
- The oil extracted from its seeds used to treat colds and flu.
- Mixed in soap, as a low cost relief from malaria, skin diseases and even meningitis.

(3) Basmati (*Oryza sativa* Linn.)

- A long and slender variety of rice.
- A major export crop for both India and Pakistan and livelihood of thousands of farmers in the two countries.
- Has great demand due to its aroma.

(4) Karela (*Momordica charantia* Linn.)

- Used as vegetable, having excellent medicinal virtues. This bitter gourd is antipyretic tonic, appetizing, stomachic and laxative. It is also used in native medicines of Asia and Africa.
- It's juice contains a hypoglycemic or insulin-like principle, designated as 'plant-insulin', which has been found highly beneficial in lowering the blood and urine sugar levels. It is also highly valuable in chronic constipation and haemorrhoids, *i.e.* piles.
- Being rich in all the essential vitamins and minerals, especially vitamin A, B1, B2, C and iron, its regular use prevents many complications, such as, hypertension, eye complications, neuritis and defective metabolism of carbohydrates. It increases body's resistance against infection.
- It's cellulose content increases peristalsis. So, it's regular use prevents habitual constipation.

(5) Jeevani

- It is a herbal medicine developed by the scientists of the Tropical Botanic Garden and Research Institute located in Kerala based on the traditional medicinal knowledge of the Kani tribe found in the Thiruvananthapuram district. It is derived from the arogyapaacha plant (*Trichopus zeylanicus*), a small rhizomatous, perennial herb found in Sri Lanka, Southern India and Malaysia.
- It activates the body's natural defenses. Activates the cellular immune system and has adaptogenic properties as evidenced by anti-peptic ulcer and anti-fatigue effects.

(6) Traditional forms of water harvesting

- *Tankas* (small tank) are underground tanks, found traditionally in most Bikaner houses built in the main house or in the courtyard.
- Traditional stepwells are called *vav* or *vavadi* in Gujarat, or *baolis* or *bavadis* in Rajasthan and northern India. Built by the nobility usually for strategic and/or philanthropical reasons, they were secular structures from which everyone could draw water. Most of them are defunct today.
- Dungs or Jampoies are small irrigation channels linking rice fields to streams in the Jalpaiguri district of West Bengal.
- *Cheruvu* are found in Chittoor and Cuddapah districts in Andhra Pradesh. They are reservoirs to store runoff. *Cheruvu* embankments are fitted with *thoomu* (sluices), *alugu* or *marva* or *kalju* (flood weir) and *kalava* (canal).

### REASONS FOR PROTECTING TK

(1) **Equity considerations** : Custodians of TK should be respected and should receive fair compensation if TK leads to commercial gain. This would encourage the younger members of the communities to carry forward the traditional practices.

(2) **Conservation concerns**: Protection of TK contributes to the wider objective of conserving the environment, biodiversity and sustainable agricultural practices.

(3) **Preservation of traditional practices and culture**: Protection of TK would be used to raise the profile of the knowledge and the people entrusted with it both within and outside communities. This would promote further use of the knowledge and prevent the loss of traditional life styles.

### CONTROVERSIAL PATENT CASES INVOLVING TK AND GENETIC RESOURCES

#### ● Turmeric

- In 1995, two Indian Nationals at the University of Mississippi Medical Centre were granted US patent No. 5401504 on use of “turmeric in wound healing”.
- CSIR requested the US Patent and Trademark Office (USPTO) to re-examine the patent as turmeric has been in use as medicine for thousands of years in India.
- Their claim was supported by documentary evidence of TK, including an ancient text and a paper published in 1953 in the Journal of the Indian Medical Association.
- USPTO upheld the CSIR objections and revoked the patent.
- This was a landmark case as for the first time a patent based on TK had been successfully challenged by a developing country.

*Patenting of traditional knowledge...*

- **Neem**

- In 1994, the EPO granted European Patent No. 0436257 to the US Corporation W.R. Grace and USDA for a method for controlling fungi on plants by the aid of hydrophobic extracted neem oil.”
- In 1995, a group of international NGOs and representatives of Indian farmers filed a legal opposition against the patent.
- They submitted evidence that the fungicidal effect of extracts of neem seeds had been known and used for many centuries in Indian agricultural practices and thus the invention was not novel as was being claimed.
- The patent was revoked by EPO in 2000.

- **Basmati**

- The battle for Basmati rice started in 1997 when US Rice breeding firm Rice Tec Inc. was awarded a patent seeking a monopoly over various rice lines including some having characteristics similar to Basmati rice.
- India requested a reexamination of this patent in 2000 upon which the patentee withdrew a number of claims.
- In 1998 Rice Tec applied for registration of the trademark “Texmati ” in UK claiming that “Basmati ” was a generic term .
- Indian Civil Society organizations filed a petition seeking to prevent US-grown rice from being advertised with the word “Basmati”. But the US Dept. of Agriculture and the US Federal Trade Commission rejected it in May 2001 arguing that “American grown Basmati” is not misleading and deemed it a generic term.
- The problem is that other countries like Australia, Egypt, Thailand and France also grow Basmati type rice and taking lead from US may officially deem Basmati a generic term.
- The name “Basmati” can be protected by registering it as a Geographical indication. But India and Pakistan will have to explain why no action was taken for the past 20 years.

- **Jeevani**

- In South India the medicinal knowledge of the Kani tribes led to the development of a sports drug named Jeevani which is an anti-stress and anti-fatigue agent, based on the herbal medicinal plant arogyapaacha. Indian scientists at the Tropical Botanic Garden and Research Institute (TBGRI) used the tribal know-how to develop the drug. The scientists isolated 12 active compounds from the fruits of the plant. The knowledge was divulged by three tribal members, while

the customary rights to the practice and transfer of certain traditional medicinal knowledge within the Kani tribes are held by tribal healers, known as *Plathis*.

- Three patents claiming processes for the preparation of herbal drugs based on the plant were filed in India. TBGRI, the sole patent holder on Jeevani as an immunomodulator committed to share royalties with the Kani. The technology was then licensed to the Arya Vaidya Pharmacy, Ltd., an Indian pharmaceutical manufacturer pursuing the commercialization of Ayurvedic herbal formulations. A trust fund was established to share the benefits arising from the commercialization of the TK-based drugs for the welfare of the Kanis and for the sustainable use and conservation of biological resources. The creation of a trust has installed trust and confidence amongst the members of the indigenous community.

In spite of the above efforts, some questions remain to be answered :

- (1) Whether the Kanis are entitled to the patent as an inventor or joint inventor or traditional healers?
- (2) Since the plant is native to India, Sri Lanka and Malaysia, should the benefits be shared at the level of individual, clan (Kanis), state (Kerala) or nation (India, Sri Lanka and Malaysia).

### **SYSTEMS OF TK PROTECTION**

There are two forms of intellectual property related protection systems with regards to traditional knowledge. They are :

**Positive protection :** Giving traditional knowledge holders the right to take action or seek remedies against any misuse of TK. Any system of positive protection of TK must provide for :

- ◆ Recognition of value and promotion of respect for TK systems.
- ◆ Responsiveness to the actual needs of TK holders.
- ◆ Repression of misappropriation of TK and other unfair and inequitable uses.
- ◆ Protection of tradition based creativity and innovation.
- ◆ Support of TK systems and empowerment of TK holders.
- ◆ Promotion of equitable benefit sharing from use of TK.

**Defensive protection :** Safeguarding against illegitimate intellectual property rights acquired by third parties over TK. Any system of defensive protection of TK must provide for :

- ◆ The criteria defining relevant prior art apply to TK.

### *Patenting of traditional knowledge...*

- ◆ A mechanism to ensure that the TK constituting prior art is available and accessible to search authorities.

It is suggested that these two approaches should be undertaken in a complementary way as a comprehensive approach to protection of TK.

Examples are emerging which illustrate how the current intellectual property system can be utilized to commercialize TK or prevent its misuse. For example, the Aboriginal and Torres Strait Islander artists in Australia have obtained a national certification trademark. This is intended to help promote the marketing of their art and cultural products and deter the sale of products falsely claiming to be of Aboriginal origin. Others include the use of copyright protection in Canada to protect tradition based creations including masks, totem poles and sound recordings of aboriginal artists; the use of industrial designs to protect the external appearance of articles such as head dresses and carpets in Kazakhstan and the use of geographical indications to protect traditional products such as liquors, sauces and teas in Venezuela and Vietnam.

### **LEGAL CONCEPTS FOR THE PROTECTION OF TRADITIONAL KNOWLEDGE**

Certain other legal concepts for TK protection are :

- ◆ Prior informed consent (PIC): As per this principle TK holders should be fully consulted before third parties use their knowledge.
- ◆ Equitable benefit sharing: This principle prescribes the balancing of the interests of the right holders and the general public.
- ◆ Unfair competition: Unfair competition means any act of competition contrary to honest practices in industrial or commercial matters and includes various acts that mislead the public or cause confusion. This principle allows for action to be taken against false or misleading claims that a product is authentically indigenous, or has been produced or endorsed by, or otherwise associated with a particular traditional community.
- ◆ Patents: When practitioners innovate within the traditional framework, they can use the patent system to protect their innovations.
- ◆ Distinctive signs: Such signs include trademarks, collective marks, certification marks and geographical indications. Traditional signs, symbols and terms associated with traditional knowledge may be protected as distinctive marks.
- ◆ Customary laws: Customary laws, protocols and practices are the ones which define how traditional communities develop, hold and transmit TK.

### **CERTAIN NON-IPR MECHANISMS OF TK PROTECTION**

Traditional knowledge has been protected by certain mechanisms which are beyond the domain of intellectual property. Such mechanisms include :

- ◆ Environmental : The Convention on Biological Diversity (CBD), signed at the United Nations Conference on Environment and Development (UNCED) in 1992, was the first international environmental convention to develop measures for use and protection of biodiversity and related TK. It also provided for the sharing of benefits arising from any commercialization of TK.
- ◆ Trade and development : The World Trade Organization Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs), established rules for creating and protecting intellectual property in 2001.
- ◆ Health: The World Health Organization (WHO) has recognized the relevance of TK in the field of medicine as a source of primary health care in the Primary Health Care Declaration of Alma Ata.
- ◆ Food and agriculture : The International Treaty on Plant Genetic Resources for food and agriculture provides for the recognition of farmers' rights and the protection of TK relevant to plant genetic resources for food and agriculture.

Besides these, other fora and institutions are also working on different aspects of traditional knowledge, namely, World Bank , United Nations Conference on Trade and Environment (UNCTAD) , the Andean Community of Nations, the Inter- American Development Bank and the African Union. The World Intellectual Property Organization (WIPO) is working on the relationship between Intellectual Property Rights, Biodiversity and TK. WIPO established the Intergovernmental Committee on Intellectual Property and Genetic Resources, TK and Folklore (IGC-GRTKF).

In 1999, following the ultimately successful but expensive Indian challenge of the turmeric and basmati patents granted by USPTO it was agreed that the Indian National Institute of Science Communication (NISCOM) and the Department of Indian System of Medicine and Homeopathy (ISM & H) would collaborate to establish a Traditional Knowledge Digital Library (TKDL). The Traditional Knowledge Resource Classification (TKRC) is an innovative, structured classification system that has been designed to facilitate the systematic arrangement, dissemination and retrieval of the information in TKDL. The TKRC is based on the International Patent Classification system (IPC), with the information classified under section, class, subclass, group and subgroup for the convenience of its use by the international patent examiners. More than 150 experts in various fields of traditional medicine, law and computer science were involved in arranging and classifying the TKDL. The vast database includes 54 authoritative textbooks on ayurvedic medicine, nearly 1,50,000 ayurvedic, unani and siddha medicines and over 1500 physical exercises and postures in yoga. The texts were first written in Hindi, Sanskrit, Arabic, Persian and Urdu and now these have been translated into English, French, German, Japanese and Spanish.

### **CONCLUDING REMARKS**

The call for protection of TK against misuse or misappropriation raises deep policy

questions and practical challenges alike. The changing social environment and the sense of historical dislocation that currently affect many communities may actually strengthen resolve to safeguard TK for the benefit of future generations. Just as the technological value of TK is increasingly recognized and its potential realized, the challenge is to ensure that the intellectual and cultural contribution of traditional communities is appropriately recognized. This means taking greater account of the needs and expectations of TK holding communities. Its traditional qualities and frequent close linkage with the natural environment mean that traditional knowledge can form the basis of a sustainable and appropriate tool for locally based development. It also provides a potential avenue for developing countries, particularly least developed countries, to benefit from the knowledge economy.

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## **FARMERS' FOLK KNOWLEDGE ON MULTIPLE USE SYSTEM OF FRESHWATER WETLANDS OF WEST BENGAL**

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### **ABSTRACT**

Farmers of West Bengal have their own traditional knowledge and perceptions on wetlands which they consider as an important and useful resource. They have developed multiple use systems (MUS) of wetlands in relation to agri-pisciculture. In agriculture sector, farmers utilize wetlands primarily for irrigation, while in pisciculture, these are used for both capture and culture fishery purpose. Besides harvesting fishes, shrimps and freshwater snails from wetlands the local people as a source of protein, attempt to culture freshwater pearl was also made by the Fisheries Department, Government of West Bengal. In agriculture sector, farmers have also developed innovative approaches to use wetland bed for cultivating crops (*boro* cultivation and jute cultivation) and paddy nurseries (*bijjala*) and wetlands for *hogla*, *paniphal* and lotus cultivation, jute retting, silt mining to manure the paddy field, etc. Local farmers also utilize wetlands for duck keeping and cattle grazing, collecting amaranthus (*kachu*, *kalmi*, *hinchha*, *sushni*, *saluk*, etc.), pith plant (*shola*), fodder and aquatic weeds for various purposes. They are also found to grow kitchen garden overhanging the small pond (*doba*) in their homestead land. However, there is a need for economic evaluation of various functions of multiple use systems of wetlands for conservation and management action in West Bengal.

### **INTRODUCTION**

Freshwater wetlands, such as, ponds, lakes, *dighi*, *beels*, *baors*, etc., abound in West Bengal (Nandi *et al.*, 1993-2007; Bhattacharya *et al.*, 2000). These are invaluable components of environment and biodiversity of the State. Several larger wetlands often serve as sanctuary for fish and birds (NEWS, 1998). Farmers of this State have profound traditional folk knowledge about these freshwater ecosystems, developed through generations. They utilize their traditional knowledge in both agriculture and pisciculture. Their knowledge and perceptions about resource utilization of wetlands

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have developed out of necessity and long association with wetland ecosystems which they consider as an important and useful resource. They have developed multiple use systems (MUS) of wetlands in relation to agri-pisciculture. In India, researches on MUS have recently been initiated with respect to both use and non-use values of wetlands. Das *et al.* (2002) estimated the economic value of ten wetlands in Bardhaman district of West Bengal. Chattopadhyay (2002) estimated the potential losses due to conversion of 1500 ha of East Calcutta Wetlands. Mukherjee (2008) made a valuable study on the wetland economic benefits from multiple uses, namely, wetland cultivation, irrigation, fisheries, jute retting, and fodder collection of Kalobaur beel in Bardhaman district of West Bengal. However, in the present paper the farmers' perception and utilization scenario of freshwater wetlands of West Bengal are communicated based on our own observations from different parts of the state.

### BASELINE INFORMATION

The state is endowed with varied types of freshwater habitats, such as, ponds, tanks, lakes, marshes, swamps, reservoirs, rivers and streams. Among the rivers of West Bengal, Bhagirathi-Hooghly is the major river. There are many important rivers like Tista, Mahananda, Jaldhaka, Jalangi, Churni, Dwarakeswar, Ajay, Damodar, Rupnarayan, Haldi, etc., which keep Bhagirathi-Hooghly river alive. These tributaries are important sources of lotic freshwater in West Bengal. Such rivers, water bodies or wetlands have been estimated at 3, 11,192.52 hectares in West Bengal. The district-wise distribution of these resources is presented in Table 1 which reveals that highest and lowest running water resource is located in the districts of Murshidabad (36,283.23 ha) and Haora (1007.36 ha.) respectively while highest and lowest standing water resource is located in 24-Parganas (36,815.13 ha.) and Medinipur (9170.08 ha) respectively. There are about 220.00 ha of water bodies in Kolkata which is not reflected in the table. However, according to the data of the Institute of Wetland Management and Ecological Design (IWMED), West Bengal has 6049 wetlands of size 2.2. ha and above covering a total area of 1438.56 sq km.

**Table 1.** District-wise distribution of freshwater wetland ecosystems of West Bengal (in ha)

District	River/Stream	Canal/Khal	Beel/Baor	Reservoir	Total
Kolkata	NA	NA	NA	NA	–
Haora	1007.36	2,019.82	118.28	–	3,145.46
24 Parganas (North & South)	32,003.98	22,204.47	14,610.66	–	68,819.11
Medinipur (Purba & Paschim)	12,774.12	8,766.07	404.01	–	22044.20
Hooghly	4,358.74	3,714.94	3,884.76	–	11,958.44
Nadia	4,191.28	2771.75	4,271.61	–	11,234.64
Burdwan	11,316.64	5,991.36	1,939.91	–	19,247.91

Table 1. contd.

District	River/Stream	Canal/Khal	Beel/Baor	Reservoir	Total
Birbhum	7,995.00	5,695.85	632.16	13,138.80	27,461.81
Bankura	15,930.15	11,711.04	1673.00	3,600.00	32,914.19
Purulia	3,707.29	NA	NA	–	3,707.29
Murshidabad	36,283.23	10,013.88	3,790.69	–	50,087.80
Malda	6,497.60	2,511.42	4,551.55	–	13,560.57
West Dinajpur	4,023.08	1,774.30	3,548.59	–	9,345.97
Jalpaiguri	16,006.44	562.29	504.38	–	17,073.11
Coochbehar	13,095.82	1,664.58	1,168.11	–	15,928.51
Darjeeling	3,395.63	683.94	683.94	–	4,763.51
<b>Total</b>	<b>1,72,586.36</b>	<b>80,085.71</b>	<b>41,781.65</b>	<b>16,738.80</b>	<b>3,111,92.52</b>

**Source:** Directorate of Fisheries, Government of West Bengal; NA = Not available

### FARMERS' FOLK KNOWLEDGE

Farmers' folk knowledge on resource utilization of freshwater wetlands is profound in respect of both agriculture and pisciculture. They have developed such knowledge generation after generation and through their own experience and observation out of necessity. They have also developed multiple use systems (MUS) of this ecosystem in relation to agri-pisciculture. In agriculture sector, farmers utilize wetlands primarily for irrigation, while in pisciculture, these are used for both capture and culture fishery purpose.

#### *About agricultural usage*

In agriculture sector, farmers utilize wetlands primarily for irrigation. In agriculture, farmers have developed innovative approaches to use wetlands in a variety of ways. They use floodplain areas to cultivate crops (*kharif* in wet season and *boro* crop in winter season). The low lying areas are used for jute cultivation, while wetland beds are converted into paddy nurseries (*bijjala*). Farmers and local people also use wetlands for *hogla*, *paniphal* and lotus cultivation, jute retting, silt mining to manure the paddy field, etc. The uses of wetlands are dynamic as the type of use varies with season and space, *i.e.*, across different ecological zones. For example, freshwater wetlands in the Gangetic floodplain of West Bengal are mostly used for irrigation (*e.g.*, Bardhaman and Nadia district), whereas brackishwater wetlands are mostly used for shrimp culture because of sea water interface (*e.g.*, South 24-Parganas and Medinipur districts of West Bengal). Uses of wetlands also change across years depending on the interest of the dominant stakeholders and the social pressures. For example, a tank which is predominantly used for irrigation in a normal rainfall year, might be used for fisheries purpose as well in a very wet year when the tank inflows become large (Mukherjee, 2008).

As per definition and attributes of wetlands and according to Directory of Asian Wetlands (IUCN, 1989), paddy cultivation areas constitute one of the important wetland types. In this respect, the vast paddy cultivated fields throughout West Bengal can be considered as wetlands. But, it is worth mentioning that the farmers of West Bengal plains have their innovative approaches and skill to grow deep water *aman* paddy crops (broadcasted floating rice harvested in November) during the summer-rainy season in wetland areas. These wetland areas are sometimes mixed with short duration *aus* rice which is harvested in June. But with the introduction of irrigation, shallow tube wells and high yielding rice varieties, the cropping pattern have changed. *Boro* rice got preference over broadcast *aman* and *aus* varieties. *Boro* is winter rice planted in November and December and harvested before the onset of monsoon. The name *boro* comes from *baors*, indicating a lowland crop. Farmers of West Bengal also use temporary wetlands like *nayanjuli*, *doba*, ditches, pond shore, *beel* and *baor* boundary lowlands mainly for paddy nurseries (*bijjala*) and / or growing paddies.

Jute (White Jute, *Corchorus capsularis* and Tossa Jute, *Corchorus olitorius*) is the major commercial crop in the Gangetic floodplains in West Bengal. Jute sticks (*pat kathi*) are mostly used for house walling, as bio-fuel, and for various religious purposes. The low lying waterlogged lands are often chosen by the farmers for jute cultivation in southern Bengal. Availability of water bodies is an added advantage, which helps farmers in jute retting. Wetlands especially road-side *nullahs* are favourite sites for jute retting in West Bengal. There are several methods of jute retting, e.g., chemical, biological, etc.; however, biological jute retting in waterbodies is mostly practiced due to cost efficiency (Mukherjee, 2008). Jute growers have their indigenous knowledge and skills for low cost biological retting of jute in these wetlands putting bundles of dressed jute plants immersed in water for a stipulated time period, using many small, compact and neatly cut grassy soil chunks, weeds, etc., as weights for the purpose.

Besides agricultural crops, local farmers particularly of Hugli and Haora districts have their indigenous knowledge to grow lotus, *hogla* (*Typha* spp.) and *paniphal* (*Trapa* sp.) for sale in the local as well as Kolkata markets. There are several farmers/cultivators involved in this exercise. They not only take care and collect these marketable items from wetlands but also sow these aquatic plant species for planned vegetative propagation, taking seasonal lease from wetland owners. Agricultural farmers and marginalised peasants were found busy in silt mining from drying up ponds to manure their paddy fields. Earlier, even in 1960s carrying semi-dried silt on bullock or buffalo cart had been a common sight in summer periods in rural West Bengal.

#### ***About piscicultural usage***

In pisciculture, wetlands are used for both capture and culture fishery purpose. Fishermen and fisherwomen, by caste and/ or occupation, owners or lease holders as well as non-owner local inhabitants, regularly catch fishes and prawns from local freshwater wetlands using different types of nets and traps. In larger waterbodies

fishermen use boats for setting nets and keeping catch in the holds of the boat. Non-owner local inhabitants collect small fishes and shellfishes as it is not restricted to the owners or lease holders only. Mukherjee (2008) estimated that local households yearly collect considerable amount of small fishes and shellfishes from Kalobaur beel in Bardhaman district during rainy season for a period of six months from which they save Rs.120 to Rs.900 per household per month with a monthly average of Rs. 317.

The ricefield wetlands are suitable spawning grounds of small fishes and shellfishes. Diverse fishing methods are adopted by the farmers in the flood plain rice fields of the state. Earlier farmers had used their innovative approaches of catching air-breathing fishes in *laphas* (small jumping pit on ricefield embankment) attracting them with aquatic weeds and taking advantage of their jumping habits. It has also been noted in different parts of lower Bengal that, besides nets and traps, some fishermen are quite apt in mud fishing in shallow waterbodies even with bare hand. The intensity of fishing varies inversely with the amount of water in the beels. Many poor fisherwomen are found to maintain their family by catching fish minnows, weed fishes and shrimps from local ponds and rivers using small mesh-sized hand nets in southern West Bengal. Fisherwomen also collect freshwater snails for domestic consumption and sale in the local markets. Besides harvesting fishes, shrimps and freshwater snails from wetlands as a source of protein the local people as well as fishermen engage themselves in culture of carp varieties, *pangas tengra*, hybrid *magur*, *gloda chingri*, etc., in freshwater ecosystems all over West Bengal. They are also found to involve themselves in hill stream or *jhora* fishery in Darjiling district of West Bengal. It may be mentioned that attempt to culture freshwater pearl was also made by the Fisheries Department, Government of West Bengal.

#### ***About domestic usage***

Domestic usages of local wetlands are mainly bathing and washing of clothes and utensils, though the freshwater wetlands are also used for socio-religious ceremonies. These are also used for the purpose of defaecation and afterwash in urban and rural West Bengal (Mukherji *et al.*, 1998; Nandi, 2000). Rural farmers often collect water hyacinth (*Eichhornia crassipes*) and other aquatic weeds to supplement fodder to reduce cost of feeding of domestic cattle and buffaloes. Local farmers also utilize wetlands for duck keeping and cattle grazing and collecting amaranthus (*kachu*, *kalmi*, *hincha*, *sushni*, *saluk*, etc.) and pith plant (*shola*) for sale in the local markets or for domestic consumption. Duck keeping in local ponds is a regular practice of the rural agricultural households in a small scale to entertain relatives on emergency with egg curry. These ducks feed not only in the local wetlands but also are given feed at dawn before these are released to the neighbouring pond and in the evening after they return to the house. In the past, during postmonsoon/ post harvest season in 1950s, rural agricultural farmers of southern West Bengal were found to collect *phumdi*-like compact and thicket mass of aquatic weeds locally called *dal* to dry up in the sun and used as biofuel for paddy steaming at the household level. They are also found to grow kitchen garden overhanging the small pond (*doba*) in their homestead land.

### ***About multiple use system (MUS)***

Farmers have developed multiple use systems (MUS) in relation to agriculture, pisciculture, domestic usages, etc. They do appreciate, utilize and/ or enjoy aesthetic and recreational values of wetlands in their neighbourhood often more than the urban dwellers. Farmers of rural West Bengal are found to use the same wetland ecosystem in multiple dimensions depending on ecosystem goods and services available from the wetlands (Nandi and Roy, 2007). They use wetland soil for gardening, earthen road repairing, vegetable growing and earth filling of wetland embankment especially in places where bamboo, banana, etc., are grown. They resort to various conventional and non-conventional economic pursuits, such as, sand and silt mining, duck keeping and cattle grazing, and to collect amaranthus (*kachu, kalmi, hinchha, sushni, saluk, etc.*, for sale or domestic consumption), pith plant (*shola* for marketing), fodder (for domestic cattle), *phumdi*-like compact and thicket mass of aquatic weeds (locally called *dal* to dry up in the sun and used as biofuel for paddy steaming) as and when needed, and even they are found to grow kitchen garden overhanging the small pond (*doba*) in their homestead land. In Pandua areas of Hugli district in West Bengal, pond ecosystem develops from sand mining as well, while in Darakeswar and Damodar river system regular sand mining is a common practice. Duck keeping is usually a small scale domestic enterprise in ponds, beels and baors especially for rural households of southern West Bengal. All the above domestic and agri-piscicultural activities are held by the farmers and local indigenous people in various combinations which reflect their site and situation subjected folk knowledge of commendable and innovative importance.

### **DISCUSSION**

Folk knowledge acquired through experiences often serves as an important tool for resource utilization and management. But, due to socio-economic reasons and anthropogenic stresses wetlands and also folk knowledge are fast disappearing. As a result, fisheries which are one of the prime uses of wetlands are suffering most in the state as well as in the country. It is worth mentioning that nowadays economic valuations of wetlands have been initiated in different parts of India with respect to both use and non-use values. Das *et al.* (2002) estimated the economic value of ten wetlands, varying from 10 ha to 275 ha in area in Bardhaman district of West Bengal and estimated that the economic benefit from fisheries operation varied from Rs. 500 to Rs. 16,000 per ha per year, while average irrigation benefit was Rs. 3,543 with a maximum of Rs. 16,000. Average benefit of using wetland for jute retting was Rs. 200 per ha per year with a maximum of Rs. 625 per ha per year. Average benefit from fisheries operation was Rs. 2,484 per household per year irrigation benefit Rs. 1,105 per acre and jute retting Rs. 483 per household per year. Chattopadhyay *et al.* (2002) estimated the potential losses due to conversion of 1500 ha of East Calcutta Wetlands in the year of 1999-2000 as Rs. 338.90 million. The willingness to pay by the stakeholders to conserve the East Calcutta Wetland, the amount varies from Rs. 60/per household/year to Rs. 1200/per household/year, with an average of Rs. 380/per

household/year. Mukherjee (2008) studied the wetland economic benefits from multiple uses of Kalobaur beel in Barddhaman district, which showed that the major economic benefits derived by people living in the surrounding area were from wetland cultivation, direct irrigation, jute retting and fisheries. The most important benefit was from fisheries, followed by wetland cultivation and jute retting. The irrigation benefits were found to be low due to larger distance of the land from the wetland and the easy access to shallow groundwater in the region.

### **CONCLUDING REMARKS**

Socio-economic and ecological functions of MUS undergo critical changes over time and space. These dynamic aspects of MUS are usually not fully appreciated. Attempts to classify wetlands according to their uses across ecological zones and to do their economic valuation are very limited. In recent times, though multiple use systems are essential at the community level, wetlands are mainly increasingly converted into single use system at the individual owners requirement. As such, a comprehensive understanding of folk knowledge and economic evaluation of various functions of multiple use systems of wetlands is needed towards cost-benefit analysis and to develop a database and formulate strategies for conservation and management action in West Bengal.

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## **INDIGENOUS HILL FARMING SYSTEMS SUPPORTING BIODIVERSITY CONSERVATION IN NORTHEAST INDIA**

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### **ABSTRACT**

The northeastern part of India has rich traditional knowledge systems associated with biodiversity which have been acquired by the local communities and tribals, living in and around the forests and agroecosystems. Little of this knowledge has been properly documented, coupled with deviation of younger generation from traditional lifestyle posing threat to gradual erosion of this knowledge. The tribal communities of northeast India have age-old practice of paddy-cum-fish culture along with shifting cultivation (Jhum). The Apatanis of Arunachal Pradesh have developed highly evolved valley cultivation of paddy which use a combination of paddy and fish together with millets on the bunds separating different plots. This agroecosystem is dependent upon nutrient washout from hill slopes and both paddy and fishes are produced by proper management of rainwater. In 'Jhum' or shifting cultivation a forest patch on hill slope is first cleared, the dried up vegetation is burnt, the ashes are added as nutrients in the soil and different crops are grown on the cleared land. After crop harvesting the cultivated site is abandoned and the 'jhumias' shift to other forest sites. They successively move from one site to other and use to return to the former site after 20 -25 years. This sort of farming was an ecologically sound, economically viable and biodiversity-friendly system. This paper briefly presents an understanding of these two traditional practices, their beneficial effects and scope for redevelopment with additional scientific inputs.

### **INTRODUCTION**

The traditional knowledge may be referred to as a body of wisdom developed through experience built up by a group of people living in close contact with the nature. It evolves a system of self management through a set of empirical observations that governs resource use. The salient features of traditional knowledge include: i) formation over a long period of time in which the idea passed down from generation to generation; ii) continuous improvement of knowledge as newer understanding is integrated into the existing one and iii) both innovation and improvement of knowledge

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become a group effort. Traditional knowledge systems are often quite different from western, science based knowledge systems but these have many aspects that can complement science.

There are about 5000 different indigenous or tribal peoples living in about 70 countries (Emery, 2000) and they have varied practices and principles of resource utilization. The cultural diversity in the northeastern part of India has a rich tradition that reflects close relationship between the human life and nature including biodiversity therein. The indigenous or tribal peoples have evolved subsistence patterns, agricultural systems and management of forests around them in a manner that is environmentally sound and economically viable. These practices are the outcome of their close association with the nature over ages and down through generations. They have evolved sedentary system of farming like wet-rice cultivation in valley lands and shifting cultivation in hill slopes. These are often energy efficient and provide substantial economic returns to the farmers. The farming systems helped substantially in preserving floral and faunal richness in the area through time. The account drawn here is based mainly on the observations and experience by one of the authors (TKP) in Arunachal Pradesh in 1980s and '90s.

### **PADDY-CUM-FISH CULTURE**

#### ***Surrounding and broad principle***

Apatani valley in Lower Subansiri district of Arunachal Pradesh, between two rivers, viz, Panyor and Kale at an altitude of 1572 m covers an area of about 32 sq km and is surrounded by gradually sloping hills. June and July are the rainiest months and the area receives heavy precipitation ranging annually from 224 cm to 291 cm. The minimum and maximum temperature range from 6.3° C to 28.1° C during summer and from 1.0° C to 18.4° C during winter (Nimachow *et al.*, 2010). The valley bears mountainous soil bed with substantial water retention capacity. The Apatanis of Arunachal Pradesh evolved only sedentary agriculture in the form of paddy-cum-fish farming in the valley land (Fig.1) to meet requirements of both rice and fish as important components of their diet. They have linked this farming system with land and water management plus animal husbandry in an excellent manner. This land and resource utilization system is economically efficient and essentially different from all



Fig. 1. Landscape of Apatani valley, Arunachal Pradesh and paddy cultivation fields.

other tribal peoples of the State. The Apatanis reside around the Ziro valley which is one of the most populous area in the State and population density is more than 72 folds than that of the State's population density, and only 0.3 per cent area holds at least 2.26 per cent population of the State (Table 1). Perhaps the fertility of the valley land and higher population density influenced the Apatanis to evolve a cultivation system in which the same land gives sustained yield year after year. Their rice field ('aji') is used in combination with fish ('ngiyi') together with millets ('sarse') on the bunds ('agher').

**Table 1.** Demographic pattern of Apatani of Ziro valley in relation to State population

Year	Apatani population	Apatani population density (per sq km)	Arunachal Pradesh		Relative size of Apatani population (percent to State)
			Total population	Population density (per sq km)	
1961	10,793	415	3,36,588	4	3.21
1971	12,888	496	4,68,511	6	2.75
1981	16,580	638	6,31,839	8	2.62
1991	22,526	866	8,64,558	10	2.61
2001	24,650	948	10,91,117	13	2.26

Source: Census of India, Govt. of India.

### ***Operational methods***

Earlier Ziro valley had seven villages (Hong, Bila, Dutta, Hija, Hari, Mudang-Tage and Michi-Bamin) around valley land and paddy fields are spread over in slow terraces, one after one, in continued succession. Cultivable plots are distributed in size ranging from 235 sq m to 2740 sq m among marginal, small, medium and large landholding farmers with bunds separating each plot. Paddy fields are classified on the basis of availability of natural and irrigated water supply: field fully dependent upon irrigated water and field receives enough natural water. The cultivation practice is relying fully upon human labourers and no animal support is involved. The land is prepared by spades and no ploughing is done. A long trench is dug in the middle of the paddy field plot. When there is sufficient water in monsoon and the fields are submerged, the fishes move freely in the submerged field. When there is scarcity of water and water is completely drained out from the paddy field, fishes come to the trenches and thrive. For retaining water in fields dykes or bunds are made up of soil and supported by bamboo or wooden clips at base. The width of bunds ranges from 0.6 m to 1.4 m and height varies from 0.2 m to 0.6 m depending on gradient of land and size of the terraces. The Apatanis have developed an efficient water management device, taken care of by a group of farmers led by 'Bogo Ahtoh', for proper supply and rational sharing of water to each plot. The streams originating from the surrounding hills are diverted into a

single channel at the upper level of the valley to which each field is connected with bamboo or wooden pipe (Fig. 2). The streams are first trapped into a single major channel and then redistributed to a number of secondary and tertiary channels to each plot. The water is passed from one terrace to its lower terrace through ducts or bamboo pipes put above 15-25 cm of the bed to maintain proper water level. These ducts ('huburs') can be opened or closed as per need (Fig. 3). Bio-fencing and boulders are

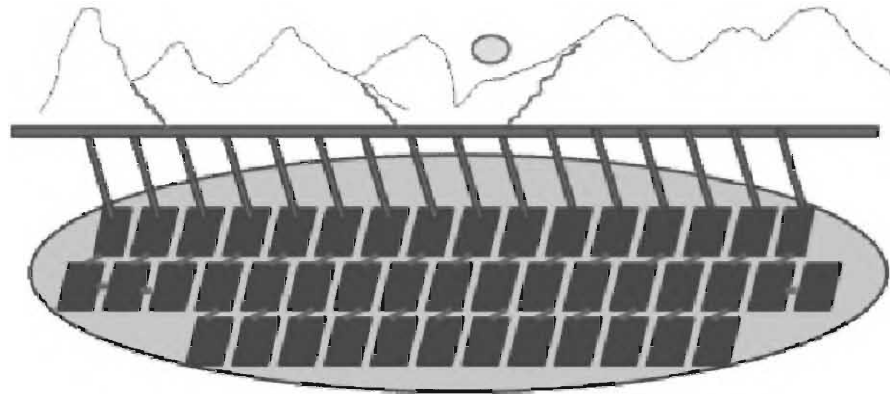


Fig. 2. Scheme of irrigation channels in paddy fields of Apatani valley for aquaculture practice installed alongside the main channel for checking soil erosion. This cultivation system is dependent upon nutrient washout from hill slopes. Human residences are located

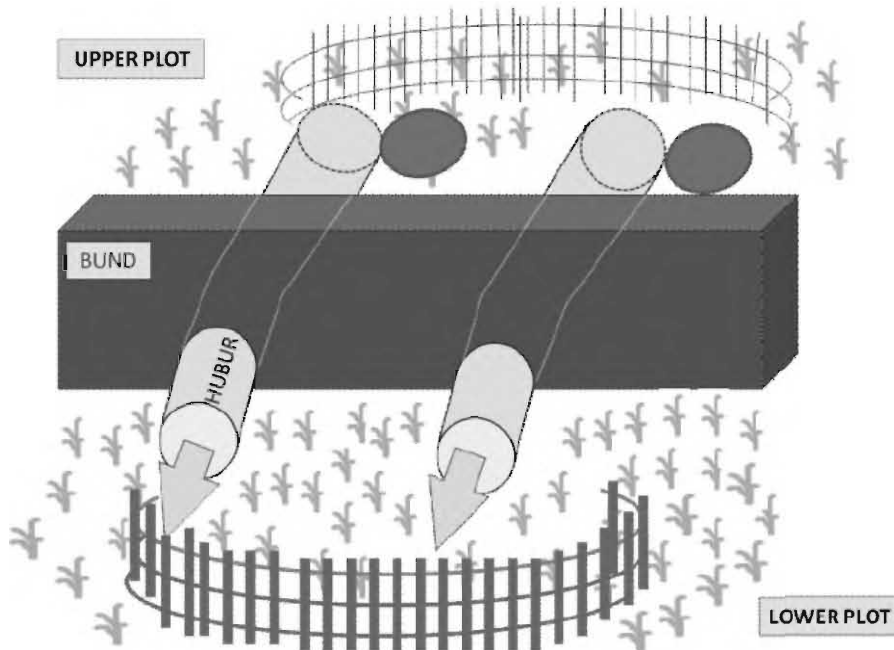


Fig. 3. Water management device for paddy-cum-fish culture in Apatani valley.

at higher level and hence household wastes and decomposed substances are drained into the irrigation channels and serve as good source of manure in the paddy fields. Soil nutrients are enhanced also through recycling of crop residues and use of organic wastes from the villages. Cattle grazing for organic manuring of the field is allowed after harvesting of crop. During spring and winter seasons, from end of harvest till next plantation time, Apatani men and women carry organic wastes, animal droppings, etc., to heap on their fields for enhancing fertility.

Riverine fishes are plentiful in Apatani valley area. The naturally available species include *Channa* spp. (tali ngiyi), *Puntius* spp. (papi ngiyi), eels (tabu ngiyi), *Scizothorax* spp. (ngilyang ngiyi), *Nemacheilus* spp. (ribu), weed fish (ngiyi papi), etc. Earlier, Apatanis used local madge gear, viz., tajer, takhung and bajru for sufficient catch, and by diverting river water into other ditches during swelling of rivers in heavy monsoon. The first batch of fish is stocked during March and early April before sowing of paddy saplings which is harvested by June. The second batch of fish is released during July and harvested by September. In softer fields (zebi aji) pyapin variety of paddy (*Oryza sativa*) is cultivated and less number of carps are allowed to grow once in a year. Only one batch of fish is reared in these fields because the fishes may cause root damage of paddy plantation due to softer soil. The fish species exploited (Fig. 4) in this system of culture are suitable to tolerate turbidity, low oxygen level and shallow water table.



Fig. 4. Apatani women catching grown fishes from paddy fields in Apatani valley.

Different indigenous varieties of paddy are grown, viz., ampo, mipya, layi, misang among, etc. In average, 500 fingerlings of fishes per hectare are reared comprising of

surface feeder, column feeder and bottom feeder species. The average weight attained by the fingerlings during harvest varies from 130-400 gm and a hectare of land yield at least 200 kg of fish in average (Nimachow *et al.*, 2010).

### ***Merits of paddy-cum-fish culture***

There are certain benefits when paddy and fish grown together (rizipisciculture) and Coche (1967) considered the practice as an almost ideal method of land use. The benefits in short are as follows :

- (i) Excellent efficiency of fish growth despite substantial mortality of fingerlings.
- (ii) Support even small farmers having small plots of lands for crop production, in maintaining a few herds of livestock and waste management-cum-economization.
- (iii) Support naturally occurring fish species to grow further.
- (iv) Contributed towards conservation of indigenous varieties of paddy through generations.
- (v) Fishes act as biological suppressors against troublesome mosquitoes and insects, worms and mollusks. They also act against algal and weed growth.
- (vi) As fishes move for food and shelter in mud the surface layer of mud is turned. It helps in aeration of the microhabitats for paddy and growth of various microbes.

**Remarks :** It is estimated that at least 80 million hectare of land are used for rice cultivation in the world, and fish and rice production coexist at some level together in almost all places where rice is grown (Coche, 1967; Jhingran, 1975). Cultivation of fish in paddy field is said to be as old as the paddy culture itself (Jhingran, 1975; Kutty, 1976). Whenever water is stagnated within bunds for paddy culture, fishes which naturally occur in the water courses, neighbouring pools and lakes and enter the paddy fields during floods and grow there along with paddy until harvest. It is considered that practice of fish culture in paddy field moved from India to southeast Asia about 1500 years ago, where it is best developed (Tamura, 1961; Coche, 1967; Huet, 1967; Vincke, 1979). The aquaculturists and agriculturists can, therefore, work together for optimization of the practice in our set up.

## **SHIFTING CULTIVATION (JHUM)**

### ***Surrounding and broad principle***

Shifting cultivation or slash and burn agriculture has been the prevalent form of farming in the hills in northeast India (Table 2) having high rain fall, moderate temperature and steep slopes. The difficult topography, inhospitable terrain, incessant rains and harsh climate had influenced the people to adopt this age-old practice (Gupta, 2005). This cultivation has evolved in response to the difficulties in establishing an agroecosystem that is characterized by generally poor acidic soils providing few

*Indigenous hill farming systems supporting biodiversity...*

nutrients and a diverse flora and fauna leading to many potential competitor species for the food crops (Warner, 1991). The hilly tracts in Arunachal Pradesh are mainly cultivated with cereal crops like, rice, maize, *etc.*; oil seed crops like, mustard, rape seed; cash crops like, potato, and several vegetables. Upland rice is often intercropped or mixed cropped with maize and millets. Jhum is a major occupation of a large section of people, largely self-reliant and ritually accepted way of life. Jhum cultivation is time-

**Table 2.** Shifting cultivation scenario in north-eastern States of India

State	Area under shifting cultivation (sq km)	Fallow period	Extent of area under shifting cultivation (sq km)	Families practiced shifting cultivation
Arunachal Pradesh	700	3-10	2100	54,000
Assam	696	2-10	1392	58,000
Manipur	900	4-7	3600	70,000
Meghalaya	530	5-7	2650	52,290
Mizoram	630	3-4	1890	50,000
Nagaland	190	5-8	1913	1,16,046
Tripura	223	5-9	1115	43,000

Source : Report of Task Force on shifting cultivation, Ministry of Agriculture, Govt. of India (1983)

tested, evolved indigenously, relying upon traditional knowledge and a sustainable landuse method in the hilly terrain. The inhabitants of the hills have traditionally been preserving forest tracts for jhuming, collection of household material, food and hunting of animals. The cultivation practice has engraved in the psyche of the hill tribes.

***Operational methods***

The shifting cultivation involves selection of a forest patch and clearing of the vegetation during the winter months (Fig. 5); then burning of the dried vegetation is



Fig. 5. Cleared forest patch for shifting cultivation in Arunachal Pradesh.

done during February-March. Subsequently, ash is mixed with soil which serves as fertilizer and neutralizer of soil acidity. Seeds of cereals, vegetables, pulses and oil seeds are sown with the onset of monsoon. Rice and maize seeds are dibbled with bamboo sticks. Terracing of steep slopes are done with old logs, twigs, *etc.*, to check run off and to retain soil humus. Other crops, *viz.*, cucumber, pumpkin, ginger chillies, beans, tapioca, yam and leafy vegetables are mixed and sown randomly. Various tubers are sown along the boundaries of jhum plots in occasions to check browsing animals like, cattle and goats. Weeding operation and clearing of undergrowths are carried out in July-August and August-September (known locally as 'eang' and 'rakbe'). Leafy vegetables and cucurbits become ready for harvest by July. Harvesting of first matured grains (known as 'amchi') is done during October and harvesting process is continued till December. After 2-3 years of cropping, the farmers shift to another forest patch for cultivation as the current land loses its fertility. The vegetation in the fallow land regenerates during the period of non-use. The farmers again come back to the initial site for farming after few years. Long back, the cycle was about 25 years or so, which has been shortened to about 3-5 years in recent times for limitation of land and growth of population.

#### ***Merits of shifting cultivation***

- (i) The cultivation practice ensures optimum utilization of space where as many as fifty varieties of crops can be cultivated together in a plot.
- (ii) The practice produces enough crops without the use of chemical fertilizers and pesticides. So the produced foods become free from toxic chemical residues and soil remains free from toxic chemicals.
- (iii) Rainwater and natural water drainage of the hills supports the crops, and hence no artificial water storage system and irrigation are needed.
- (iv) No capital investments except labour and seeds are required that come from household.
- (v) Fallowing of land after cultivation helps in conservation of soil moisture, soil structure and least disturbance of top soil.
- (vi) Deserted jhum field provides feeding ground for many wild animals, birds and insects. It helps in growth of soil microbial biomass.
- (vii) Mixed crop and varietal vegetation prevents ecological destruction caused from monoculture and narrow genetic base.
- (viii) Traditional cultivation contributed towards conservation of agrobiodiversity and germ plasm of native crops.
- (ix) Agriculture amidst forest creates scope of plant breeding between the field crops and wild varieties in nature's laboratory.

**Remarks** : Jhum is an ecologically sound and viable cultivation practice suitable for the subsistence economy of the hill tribes and supports their society to live in partnership with the nature. This is not a miracle cultivation promising limitless growth, but it is production within the limits of the nature (Chakma, 1994).

## CONCLUSION

The northeastern States of India comprise about 64-95 per cent tribal population (see 1991 Census). It is considered that the tribal areas are biodiversity-rich but farmers do not have rich resources. These genetic storehouses including land races and varieties of crops bear many novel genes controlling important nutrients, cooking patterns, and resistance to natural and biotic stresses. Arunachalam (2001) indicated that such novel genes express high values of the traits in tribal habitats under the traditional and site-specific cultivation practices in which the genotypes were evolved. Indigenous farming practices however have limitations of growth. Now the issue, is there any scope for strengthening tribal indigenous knowledge of farming for maximizing benefits? To find answer to the question scientific knowledge synergized with traditional knowledge would be an area to be seen. We also need to understand the science behind the tradition.

Indigenous knowledge is primarily local in its factual information, while science carries out new studies to verify the same information that is already present in the indigenous knowledge system. Science often has a short term base of information that it uses, while the indigenous knowledge is built up on a very long term information base. Thus, there would surely be benefit if the two knowledge systems work together. Both the sets of knowledge systems have ingredients like, information, trial, understanding, formulated theory and application. The outcome or success of the systems is expressed in reality. One would like to improve this reality through cohesion of the two systems. Traditional knowledge is generally inductive and inference is governed by past experience, age-old practice and strong unquestioned belief. Contrastingly, scientific knowledge is deductive and inference is led by analysis of experiments, evaluation of current practices, detection of weaknesses and improvement of agronomic practices. Hence, experimental trials of formal cultivation practices by participation of traditional farmers in their own fields, with scientific inputs would be the desired option. Enhanced benefit through participatory trial would gradually convince the farmers to develop a productive synergy between tradition and science.

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## PLANTS AND ANIMALS OF ETHNOMEDICINAL VALUES OF SINGHBHUM PLATEAU, JHARKHAND, INDIA

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### ABSTRACT

Ethnic people mainly depend on forests and prepare a medicine for a specific ailment mixing a whole animal or parts of an animal or animal products with a plant parts or the whole plant or with their products. During the present study 31 species each of plants and animals, used as medicine by the ethnic people of Singhbhum plateau, Jharkhand, India were documented. This paper deals with these plants and animals along with their scientific and local names, families, medicinal use and the parts used as medicine. Some of these plants and animals used in ethnic medicines recorded during the present study are – *Acacia catechu* Willd., *A. nilotica* Delile, *Acalypha indica* L, *Achyranthes aspera* L, *Azadirachta indica* A. Juss., *Bacopa monnieri* (L.) Pennell., *Bambusa arundinacea* (Retz.) Willd., *Cyperus rotundus*, *Ipomea indica* (Burm.) Merr., *Pterocarpus marsupium* Roxb., *Terminalia chebula* Retz., *Ocimum sanctum* L, *Ricinus communis* L., *Schleichera oleosa* (Lour.) Oken, *Vitex negundo* L. *Urginea indica* (Roxb.) Kunth, *Withania somnifera* (L.) Dunal, *Woodfordia fruticosa* (L.) Kurz, *Ziziphus oenoplia* (L.) Mill., and *Limnodrillus* sp., *Muscus* sp, House spiders (*Artema* and *Crossophriza* sp.), Fresh water mussels (*Lamellidens* spp.), *Clarias batrachus* (L), *Heteropneustes fossilis* (Bloch), *Channa punctatus*, *Kachuga tecta* (Gray), *Kachuga kachuga* (Gray), *Crocodylus palustris* Lesson, *Varanus bengalensis* (Daudin), *V. flavescens* (Hard & Gray), *Columba livia intermedia* Strickland and *Sus scrofa cristatus* Wagner respectively.

**Key words :** *Ethnic, medicinal plants, animals, remedy, indigenous people.*

### INTRODUCTION

Whatever account of the plants and animals used as medicines by the ethnic people of Singhbhum plateau (situated in between 21° 58' N to 23° 38' N and 85° 0' E to 86° 54' E, approximately) is available in literature is because of efforts of Mahata and

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Mohanta (2003, 2004) and Mahata (2007). A varied form of plants and animals and their products are used as ethnomedicines to cure different types of diseases and ailments (Ferrington, 1834; Bodding, 1925, 1927; Pal and Jain, 1998, WHO, 2009). The plants or the animals or their products are used alone or in a mixed form with plant parts and animal parts or plant products and animal products. Many chronic ailments which are not cured by the allopathic medicines, are cured by the ethnic medicines. Ethnic medicines are in use since the dawn of human civilization. With the advent of the modern era of European medicines, the age old ethnomedicinal practices have been pushed to the path of disappearance, because allopathic medicines have been accepted by the ethnic people. In view of this, the present work has been taken up to identify and enlist the plants, animals and their products used in ethnic medicines and to save and popularize the system of treatment for the betterment of mankind.

### **MATERIAL AND METHODS**

The present investigation was carried out from March, 2008 onwards (till March 2011) by visiting different rural areas including inaccessible and accessible parts of the plateau. Information on the plants, animals, plant products and animal products used in ethnic medicines were collected from the ethnic people (aboriginals, allied aboriginals and semi-hindu aboriginals) and local practioners (Ojha, Gunia, Haturi doctors, Laya, Kabiraj) including Village head men by interrogation followed up by field observations on the practioners of ethnomedicine. Information was also gathered from literature. During field study photographs of some plant and animal species and, their products were taken for ascertaining authenticity of the work. The identification of the concered plants and animals was done with the help of standard literature.

### **RESULTS AND DISCUSSION**

The plants and animals and their products used in ethnomedicine as recorded during the present course of investigation are presented in Table 1.

The present study documents in total 31 species each of plants and animals used in ethniomedicine. However, there are many more species of plants and animals, which are used in the ethniomedicines. In due course of further study on this aspect their information on ethnomedicinal use will be collected and listed for record and knowledge for the persons interested and carrying out researches in other parts of the country on this aspect.

The species listed in the text both for plants and animals are also used in the ethnic medicine of Kaptipada Sub-division by the ethnic people of Mayurbhanjh district of Orissa (Mahata *et al.*, 2003) and Singhbhum plateau, Jharkhand (Mahata and Mohanta, 2004; Mahata, 2007). Many animals and plants species as recorded by us in the present study are found to be mentioned in the study of Majumdar and Dey (2005, 2007) and Dey (2007) in the Sundarban area, West Bengal, India. Mazumder (1987, 2004) and, Majumdar and Mirdha (2004) have also reported some spider species

**Table 1.** Plants, animals and their products used in ethnomedicines

Scientific, common and local names of plants/animals	Parts used as medicine	Medicinal use/property
<b>PLANTS :</b>		
<b>Fam: Mimosaceae</b>		
1. <i>Acacia catechu</i> L.f. Wild (Cutch tree/ Khair)	Bark of the tree	In cough and diarrhoea. Also applied externally to ulcers, boils and eruption of skin.
2. <i>Acacia nilotica</i> Delile (Indian gum/Arabic tree/ Babul)	Bark and leaves	Bark used as a gargle in sore throat and toothache. Infusion of tender leaves used as remedy for diarrhoea and dysentery.
<b>Fam: Euphorbiaceae L.</b>		
3. <i>Acalypha indica</i> L. (Indian acalypha/ Kuppi/ Muktajhuri)	Plant, leaves and roots	Decoction of the plant useful for tooth and ear ache and in bronchitis, pneumonia and asthma. Fresh leaf juice useful in rheumatoid arthritis and skin affections.
<b>Fam: Amaranthaceae</b>		
4. <i>Achyranthes aspera</i> L. (Prickly chaff flower / Chirchiti)	Whole plants, the roots and seeds	The root extract used in rheumatism, its paste applied to wounds and also useful in cancer. Aqueous extracts of roots used for expulsion of stones from the bladder.
<b>Fam: Meliaceae</b>		
5. <i>Azadirachta indica</i> A.Juss. (Neem Tree/ Nimbah)	Barks, leaves, flowers, seeds, oil	Multiple use
6. <i>Bacopa monnieri</i> (L) Pennell. (Thyme leaved gratiola/ Brahmi/ Jalnim)	Whole plant	Useful in cough, constipation, asthma, bronchitis, skin diseases, leprosy and general debility.
<b>Fam: Bambusaceae</b>		
7. <i>Bambusa arundinacea</i> (Retz). Wild.	Roots, leaves sprouts, and bamboo manna or Banslochan	Roots useful in leprosy, skin diseases, and in burning sensation. Leaves useful in diarrhoea, wounds, skin diseases and fever. Sprouts useful in ulcers, wounds, nausea and intestinal worms. Bamboo manna or Banslochan useful in jaundice, cardiac diseases and leprosy.
<b>Fam: Cyperaceae</b>		
8. <i>Cyperus rotundus</i> L. (Nut Gass/ Mutha)	Rhizomes	Useful in irregular menstruation, dyspepsia, diarrhoea and vomiting.
<b>Fam: Convolvulaceae</b>		
9. <i>Ipomoea indica</i> (Burm) Merr.	Roots and leaves	Applied as poultice to backaches and sore muscles.

Table 1. contd.

Scientific common and local names of plants/animals	Parts used as medicine	Medicinal use/property
<b>Fam: Fabaceae</b>		
10. <i>Pterocarpus marsupium</i> Raxb. (Indian Kino tree/ Bijasal)	Heartwood, leaves, flowers and gum	Heartwood useful in diabetes, leprosy, skin diseases, diarrhoea, dysentery, rheumatoid arthritis, and asthma. Leaves useful in boils, sores and skin diseases. Flowers useful in pitta and fevers. Gum is useful in pitta, boils, diarrhoea, wounds, ulcers and fever.
<b>Fam: Combretaceae</b>		
11. <i>Terminalia arjuna</i> Wight & Arn. (Arjun)	Bark	Useful in diabetes, asthma, bronchitis, dysentery, liver disease and hypertension.
12. <i>T. bellirica</i> (Gnertn) Roxb.	Bark and fruits	Useful in cough, bronchitis, phanjangitis, dropsy, vomiting, haemorrhages, skin diseases, leprosy, diarrhoea and dysentery.
13. <i>T. chebula</i> Retz. (Chebulic myrobalan/ Haritaki)	Matured and immature fruits	Useful in tridosa, wounds, ulcers, gastropathy, helminthiasis, jaundice, cough, epilepsy, skin diseases, leprosy, intermittent fever, cardiac disorders and stomatitis.
14. <i>T. crenulata</i> Roth. (Black murdah/ Asaina)	Bark	Useful in cardiopathy, wound, ulcers, haemoptysis, diarrhoea, dysentery, cough, bronchitis, veminosis, leucorrhoea, gonorrhoea and burning sensation.
<b>Fam: Lamiaceae</b>		
15. <i>Ocimum americanum</i> (Hary basil/ Vantulsi)	Leave and seeds	Useful in dysentery, leprosy, vomiting, poisonous affections, malaria and fever.
16. <i>Ocimum basilicum</i> L. (Sweet basil/ common basil/ babui tulsi)	Leaves	Useful in malarial fever.
17. <i>Ocimum gratissimum</i> L. (Tulsi)	Whole plant	Useful in treating sunstroke, headache and influenza.
18. <i>Ocimum sanctum</i> L.	Whole plant	Useful in cardiopathy, leucoderma, asthma, bronchitis, vomiting, genito-urinary disorder.
<b>Fam: Apocynaceae</b>		
19. <i>Rauvolfia serpentina</i> (L). (Serpentine root/ Sarpagendha)	Roots	Useful for patients of chronic mental illness, for reducing blood pressure and as an antidote to snake bite.

Table 1. contd.

Scientific common and local names of plants/animals	Parts used as medicine	Medicinal use/property
<p><b>Fam: Euphorbiaceae</b> 20. <i>Ricinus communis L.</i> (Castor Bean/ Bheranda)</p>	Bark	Bark used to treat skin inflammations and rashes. A drink of the juice in water taken to treat breast tumours and boils.
<p><b>Fam: Caesalpiniaceae</b> 21. <i>Sacra asoca</i> (Roxb.) (Ashoka/ Asok)</p>	Bark, leaves, flowers, seeds	Barks useful in colic, ulcers and pimples. Leaf-juice used in stomachgia. Flowers used as uterine tonic, in syphilis, and in inflammation. Dried flowers used in diabetes, hemorrhagic dysentery and seeds used for treating bone fractures.
<p><b>Fam: Sapindaceae</b> 22. <i>Schleichera oleosa</i> (Lour) Oken (Lac Tree/ Kusum)</p>	Bark and oil	Bark treating useful in ripening boils, malaria and ulcers. Seed oil useful in burns, dematopathy, ulcers, cephalalgia, and in vatta.
<p><b>Fam: Liliaceae</b> 23. <i>Urginea indica</i> (Raxb.) (Indian squill/ jungle piyaz/ ban piyaz)</p>	Bulbs	Useful in asthma, ailments of heart, cough and bronchitis, paralytic affection, diuretic, in rheumatism, used as cardiac tonic. Squill used chiefly in chronic bronchitis and asthma.
<p><b>Fam: Urticaceae</b> 24. <i>Urtica dioica L.</i> (Nettle/ Bichku booti)</p>	Root	Root extracts used for increasing breast milk secretion and for reducing enlarged prostate.
<p><b>Fam: Verbenaceae</b> 25. <i>Vitex negundo L.</i> (Five leaved chaste tree/ Nirgandi)</p>	Barks, root leaves and flowers	Useful in arthritis, colic, dysentery, uropathy, wounds, ulcers, bronchitis, malarial fever, dermatopathy and leprosy. Leaves useful in gout and ulcers. Bark useful in vatta and verminosis. Flowers useful in diarrhoea, cholera, fever and cardiac disorders.
<p><b>Fam: Solanaceae</b> 26. <i>Withania somnifera (L)</i> Dunal. (Winter cherry/ Asgandha)</p>	Roots and leaves	Tuberous roots useful in leucoderma, constipation, insomnia, nervous breakdown. Leaves recommended in fever, painful swellings and ophthalmitis.

Table 1. contd.

Scientific common and local names of plants/animals	Parts used as medicine	Medicinal use/property
<b>Fam: Lythraceae</b> 27. <i>Woodfordia fruticosa</i> (L) Kurz.	Flowers	Useful in kapha, pitta, leprosy, skin diseases, burning sensation, haemorrhages, menorrhagia, leucorrhoea, haemoptysis, diarrhoea, dysentery, foul ulcers, diabetes, bilious fever and verminosis. Also valued as a stimulant in pregnancy.
<b>Fam: Zingibeceac</b> 28. <i>Zingiber officinale</i> Rose.	Rhizome	Useful in dropsy, asthma, cough, colic, diarrhoea, cholera, nausea, vomiting, elephantiasis and inflammations.
<b>Fam: Rhamnaceae</b> 29. <i>Ziziphus mauritiana</i> Lam. (Indian jujuba/ Ber)	Bark, leaves and fruits	Useful in dysentery, diarrhoea, gingivitis and boils. Leaves useful in stomatitis, syphilitic ulcers, asthma, typhoid fever, diarrhoea and obesity. Fruits useful in vitiated condition of pitta, vomiting, constipation nausea, leprosy and skin diseases.
30. <i>Ziziphus oenoplia</i> (L) Mill (Jackel jujubee)	Roots	Bark useful in hyperacidity, ascariis infection, stomachagia and healing of wounds.
31. <i>Z. spinosa</i> Hu. (Spiny Chinese date)	Seeds	Useful in neurasthenia, insomnia, absent mindedness and palpitations.
<b>ANIMALS :</b> <b>Invertebrates :</b> <b>Insecta</b> <b>Fam: Muscidae</b> 1. <i>Muscus nebula</i> (L) (Flies) <b>Aranae</b> <b>Fam: Pholcidae</b> 2. <i>Artema</i> sp. (House spider) 3. <i>Crossoplriza</i> sp. <b>Mollusca</b> <b>A.Gastropoda</b> <b>Fam: Viviparidae</b> 4. <i>Bellamyia</i> sp.	Whole animal excluding wings  Whole animal excluding the legs As above  Whole animal kept in clean water for overnight	Useful in conjunctivitis with house spider and vermilion and pure mustard oil or cow ghee.  As mentioned above. As mentioned above.  Supernatent fluid or fluid drops from the animal useful in conjunctivitis.

Table 1. contd.

Scientific common and local names of plants/animals	Parts used as medicine	Medicinal use/property
<b>B.Bivalvia</b> <b>Fam: Unionidae</b> 5. <i>Lamellidens corrianus</i> (Lea). (Unio)	Flesh	Useful in impotency. Dried animal with aquatic earthworms ( <i>Limnodrilus spp</i> ) and bark of <i>Achyranthus asper</i> (L), rice washed water and Piper nigrum (all items in equal amount are mixed)
6. <i>L. marginalis</i> (Lamarck) (Unio)	Flesh	Cooked flesh eaten to regain health from various illness.
<b>Annelida</b> <b>Oligochacta</b> <b>Fam: Tubificidae or Clapridae</b> 7. <i>Limnodrilus spp.</i> ( <i>L. hoffmeisteri</i> ) (Aquatic earthworm)	Flesh	As above.
<b>Vertebrates</b> <b>Fishes</b> <b>Fam: Claridae</b> 8. <i>Clarias batrachus</i> L. (Magur)	Arborescent organ (accessory respiratory organ)	Useful in infertility of women. Cooked flesh if eaten, after a typhoid fever helpful to regain health. Also consumed in cold, cough and fever.
9. <i>Heteropneustus fossilis</i> (Bloch) (Singhi)	Accessory respiratory organs.	As above.
<b>Fam: Channidae</b> 10. <i>Channa punctatus</i> Bloch (Snakehead/ Cheng)	Arborescent organs	To regain the lost sexual power of human male
<b>Reptilia</b> <b>Fam: Testudidae (Bataguridae)</b> 11. <i>Kachuga kuchuga</i> (Gray) (Freshwater tortoise) (or Red brown roofed turtle)	Carapace and plastron	Useful to remove the patches of small pox and chicken pox.
12. <i>K. tecta</i> (Gray) (Indian roofed turtle)	As above	As stated above.
<b>Fam: Crocodylidae</b> 13. <i>Crocodylus palustris</i> (Lesson) (Mugger or Marsh crocodile)	External bony plates ( <i>scutes</i> )	As above and tied in the waist of children to get rid of evil sprits and witches.

Table 1. contd.

Scientific common and local names of plants/animals	Parts used as medicine	Medicinal use/property
<b>Fam: Varanidae</b>		
14. <i>Varanus bengalensis</i> (Daudin) (Indian Monitor/ Gosamnp)	Fat	Hot fat useful as massage oil for varied aches. Also used in impotency.
15. <i>V. fluvscens</i> (Gray) (Indian Yellow monitor)	As above	As mentioned above.
<b>Fam: Boidae</b>		
16. <i>Python morulus</i> (L) (Python/ Ajgar)	Fat	Slightly warmed fat useful to cure cracked skin and in rheumatism.
<b>Fam: Elapidae</b>		
17. <i>Naja naja</i> (L) (Cobra)	Head portion (Dried and powdered)	Useful to kill rodent pests and some insect pests.
<b>Aves</b>		
<b>Fam: Ploceidae</b>		
18. <i>Passer domesticus indicus</i> Jardine and Selby (Sparrow)	Flesh	Cooked flesh useful to regain the lost male sexual power.
<b>Fam: Columbidae</b>		
19. <i>Columba livia intermedia</i> Strickland (Pigeon)	Flesh and faecal matter of the animal	Cooked flesh useful to regain the lost health after typhoid and also after cough and cold. Faecal matter of the bird mixed with lentil paste of useful to ripen boils.
20. <i>Crocopus phoenicopterus</i> (Latham) (Green pigeon/ Hardial)	Flesh	Cooked flesh useful to regain the lost sexual desire in both man and women.
21. <i>Chaleophaps indica indica</i> (L) (Dove)	As above	Cooked flesh useful as health food.
<b>Fam: Phasianidae</b>		
22. <i>Gallus gallus murghi</i> (Robinson & Kloss) (Jungle hen or cock)	Flesh and fat	Cooked flesh useful to restore health after long period of suffering from fevers (Typhoid or malaria). Warmed fat useful as massage to get rid of aches and rheumatism.
<b>Mammalia</b>		
<b>Fam: Leparidae</b>		
23. <i>Lepus sp.</i> (Hare/ Kherra)	Flesh	Cooked flesh useful to regain the sound health after typhoid and malarial fever.

Plants and animals of ethnomedicinal values of Singhbhum....

Table 1. contd.

Scientific common and local names of plants/animals	Parts used as medicine	Medicinal use/property
<b>Fam: Elephantidae</b> 24. <i>Elephas indicus</i> (Cuvier) (Elephant/ Hatti)	Tusk	Tusk powder with honey useful in impotency.
<b>Fam: Cervidae</b> 25. <i>Muntiacus muntijack vaginatis</i> (Boddaert) (Barking deer/ Kutra)	Horn	Horn powder useful to stop irregular flow of urine.
<b>Fam: Suidae</b> 26. <i>Sus crofa cristatus</i> (Wagner) (Indian wild boar/ Jungle suwar)	Fat	Slightly warmed fat useful for massaging to cure chronic rheumatism. Cooked flesh useful in treatment of many skin diseases.
27. <i>Sus domesticus L.</i> (Domestic pigs/ Suwar)	As stated above	As stated above.
<b>Fam: Manidae</b> 28. <i>Manis crassicaudata</i> Gray. (Indian Scally ant eater/ Bajrakit)	Scutes	Scutes tied in the waist of children with the help thin silken thread to get rid of witchcrafts and evil sprits.
<b>Fam: Ursidae</b> 29. <i>Mclursus ursinus</i> <i>ursinus</i> (Shaw) (Indian black bear/ Bhallu)	Fat and hairs	Useful in chronic rheumatism. Hairs kept within a Talisman or amulet, sealed and tied to the forearm with help of black sieken thread.
<b>Fam: Hystridae</b> 30. <i>Hystrix indica indica</i> Kerr. (Porcupine/ Sayi)	Flesh	Cooked flesh useful in asthma and respiratory troubles.
<b>Fam: Pteropodidae</b> 31. <i>Pteropus giganteus</i> <i>giganteus</i> (Bruennich) (Bat / Badur)	Flesh, bones and wings	Cooked flesh useful in asthma and bronchitis. Bones burnt and powdered and mixed with root powder of Gurmar ( <i>Gymnea sylvestres</i> Retz.) and given orally to cure dyspnoea. Wings roasted, powdered and mixed with paste of leaves of sunflower ( <i>Helianthus annus L.</i> ) and applied externally to cure bone fracture.

belonging to the family Clubionidae, Lycosidae and Araneidae used as ethnic medicines. Savorary (1935) stated that in rural areas of Europe jaundice and constipation are treated by ingesting up Tarantula spider (family Lycosidae). In some areas of Europe and America, gout, rheumatism are also treated by rubbing up theridiid spiders (Gertch,1979). Pathy and Mohanty (2003) have discussed the importance of "Tribal medicine" in Gender Dimension in Tribal Health Care Tradition in Orissa in which they stated that Tribal communities in Orissa use products out of plants, animals and other naturally available materials to get cured from several ailments. In Tribal societies the treatment is often assisted by music and mysticism. Jena and Sceland (2003) reported some mammals, birds and reptiles used in ethnic medicines by the Kutia Kondh and Gond tribes of Orissa. Many of these reported animals by Jena and Seeland (2003) are also used as medicines by the aboriginals, allied aboriginals and semi-hinduized aboriginals of the Singhbhum plateau.

The ethnic medicine system is the traditional medicine system, evolved through countless trial and error methods of experiments. Our knowledge of therapeutical agents and remedial measures of ailments dates back to the time of Harappan civilization (2300-1700 BC), which was in practice in the form of ritualistic magical healings conducted by "Shamans" (medicine men). This was performed through ecstatic dance, musical flight, the use of potents herbs, animals, their products and amulets, the reciting incantations and exorcism. This type of treatment of ailments is the traditional system of treatment, evolved and spreaded among early mankind. However, accurate picture of growth and development of medicine is still unknown.

The traditional system of medicine is, now-a-days, less important and less popular, because of easy availability of allopathic medicines in the markets without any problem or difficulty although these medicines are more costly than those of traditional medicines and have side effects. In spite of such demerits all sections of people now-a-days prefer allopathic medicines for a ailments because traditional medicines are time taking to cure an ailment while an allopathic medicine is less time taking and sure sort to cure an ailment. The traditional medicines have no side effect as informed by the practioners of such medicines.

The traditional medicine is value based, no matter how diverse it is in differential social setting and cultural contexts. There are growth positive, growth negative, and growth neutral values in every society associated with traditional health care. Such tips would contribute immensely to any development in traditional healthcare front, in the integration or synthesis with any other recognized system of medicine.

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medicinal plants of ethnomedicine as well as in recording the information about some invertebrates used in ethnomedicine.

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## MEDICINAL USES OF SOME EPIPHYTIC PLANTS USED BY SANTAL AND OTHER TRIBES OF KAPTIPADA (UDALA) SUB-DIVISION IN MAYURBHANJ DISTRICT, Odisha, INDIA

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### ABSTRACT

During the studies undertaken on the drug plants of Mayurbhanj Plateau, Odisha from 2002 to 2005, a total of nine epiphytic plants and flowers of one host plant (*Pterospermum acerifolium* Willd.) were found to be used as medicine by the Santal and other tribal communities (e.g., Bhumij, Munda, Ho, Kol, Bathudi, Sabar, Khadia and Pahadia, etc.) of the Kaptipada (Udala) subdivision (lying between 21° 17' to 21° 30' N and 86° 30' to 86° 50' E, approximately) and also by some people of other communities. The epiphytic plants are locally known as Madanga (in Oriya) or Bondha (in Santali or Alchiki). These are documented in the present communication along with their medical uses. The epiphytic plants grow on other plants like – *Madhuca indica*, *Mangifera indica*, *Diospyros melanoxylon*, *Grewia tillifolia*, *Dalbergia rubiginosa*, *Azdirachia indica*, *Annona squamosa*, *Vitex nigunda*, *Ficus religiosa* and *Pterospermum acerifolium*. Medicinal uses of epiphytic plants by Tribal communities in the Kaptipada (Udala) subdivision have been recorded for the first time by the present authors.

**Key words :** *Medicinal uses, epiphytic plants, Santal and other tribes, Mayurbhanj, Odisha.*

### INTRODUCTION

Udala is the administrative sub-divisional Headquarters under Mayurbhanj district in the state of Odisha and lies between 21° 17' to 21° 30' N and 86° 30' to 86° 50' E approximately. The region is inhabited by the people of different communities but the tribal population constitutes about 60 percent of total population of the area. The prominent tribal communities residing in the area from remote past are Bhumij, Munda, Kol, Ho, Santal, Bathudi, Sabar, Kharia, Paharia, etc. However, Santhals are more in percentage than that of other tribal communities of the sub-division, constituting nearly 25% of the total population. The tribal's like Sabar, Paharia and Kharia reside in remote, hilly and inaccessible areas in the dense forests whereas Santhal, Bhumij, Ho, Munda, Kol and Bathudi reside in rural, semi urbanized and in the areas under forest coverage. Their population in semi urbanized places is very low. All the tribes of the sub-division

have been living in their own way of life for centuries with old traditions and customs and even in this modern age of ultra medicine the tribal communities of this sub-division like other parts of the country have been continuing their methods of treatment to such ailments for which they are ear marked in forests. They believe mostly in “Singbonga” (God) and that diseases are caused by evil spirits.

However, the ethnomedicobotanical studies on the tribes of Kaptipada sub-division have so far remained unattended by any survey team or any scientist. So, the authors while surveying the drug plants of Mayurbhanj plateau (since April 2001) for the first time recorded nine trees with the help of local “Santhal Baidyas”, on which medicinally important epiphytic plants grow naturally. The epiphytic plants have been in use as medicine among the tribal communities of the sub-division before the “Aryan invasion” in the Indian subcontinent. A brief account of the trees on which the epiphytic plants grow and the medicinal uses of the plants epiphytic on them have been presented in this work.

### OBSERVATIONS AND DISCUSSION

The following is the account of medicinal uses of the epiphytic plants along with the respective host plants (Table 1). The epiphytic plants are dried and powdered and are prescribed to consume with water or honey or a small part of the epiphytic plants is tied with thread on the upper part of the forearms or in the waist for the remedy of various ailments like troubles related to delivery, digestion and urination, menstruation, attacks from witch crafts, evil spirits, ghosts, hypnotism, kidney stone, arthritis, contraception, clearing of choked throat and piles.

**Table 1.** Medicinal uses of epiphytic plants of Kaptipada (Udala) subdivision, Mayurbhanj district, Odisha.

Botanical names of trees on which epiphytic plants grow	Vernacular names of the trees on which the epiphytic plants grow	Vernacular names of the epiphytic plants or it's parts in the sub-division	Medicinal uses of epiphytic plants or it's parts
1. <i>Madhuca indica</i> Mackbrid. (Fam.: Sapotaceae)	Mahula (Oriya)	Mahula Madango (Oriya); Mahula bondha (Santhali)	Used for comfortable delivery
2. <i>Mangifera indica</i> Linn. (Fam.: Anacardiaceae)	Amba (Oriya)	Amba Madango (Oriya); Amba-bandha (Santhali)	Used as pain killer during menstruation
3. <i>Diospyros melanoxylon</i> Willd. (Fig. 3, Plate 1) (Fam. : Ebenaceae)	Kendu (Oriya)	Kendu Madango (Oriya); Tnil bondha (Santhali)	A bit of epiphytic plant is tied on the wrist or on the waist with the help of a black thread to get rid of Witch Crafts, Evil spirits, Ghosts and also as protective measure for bad looks (sight) of evil persons

Medicinal uses of some epiphytic plants used by Santal and other tribes....

Table 1. contd.

Botanical names of trees on which epiphytic plants grow	Vernacular names of the trees on which the epiphytic plants grow	Vernacular names of the epiphytic plants or it's parts in the sub-division	Medicinal uses of epiphytic plants or it's parts
4. <i>Grewia tilliafolia</i> Vahl. (Fam.: Tilliaceae)	Linsha (Oriya)	Linsha Madango (Oriya); Dhela bondha (Santhali)	Used for hypnotizing the evil persons or any other persons
5. <i>Dalbergia rubiginosa</i> Roxb. (Fam: Fabaceae)	Kankuli (Oriya)	Kankuli Madango (Oriya); Kankuli bondha (Santhali)	Used as remedial element from the bad intention or wishes and incantations of Evil sprits/persons/Witchcrafts
6. <i>Azadirachta indica</i> A.Juss. (Fam.: Meliaceae)	Nimbi (Oriya)	Nimbi Madango (Oriya); Nim bondha (Santhali)	Used for relief from kidney stones, other urinary troubles arthritis and piles
7. <i>Annona squamosa</i> Linn. (Fam.: Annonaceae)	Madar or Atta (Oriya)	Madar Modango (Oriya); Madar bondha (Santhali)	Used for cure of hoof diseases or infection in the cattle's
8. <i>Vitex negundo</i> Linn. (Fam.: Verbenaceae)	Begunia (Oriya)	Begunia Madango (Oriya); Sinduribondha (Santhali)	Used to stop pregnancy (in human beings)
9. <i>Ficus religiosa</i> Linn. (Fam.: Moraceae)	Asastha (Oriya)	Asastha Modango (Oriya); Hensa bondha (Santhali)	Used in powder form with mild hot water to cure choked throat for clearing the voice and also used for other throat infections/ troubles.
10. <i>Pterospermum acerifolium</i> Willd. (Fam.: Sterculiaceae)	Muchkund (Oriya)	Muchkund ful (Oriya and Santhali)	10-20 gm powdered flowers mixed with mild hot water drink for remedy of menstrual pain and also used for normal menstruation

The above mentioned epiphytic plants and flowers of *Pterospermum acerifolium* Willd are exclusively used as medicine by Santal and other tribes as well as allied to tribal communities of the Kaptipada subdivision (Mayurbhanj, Odisha). The allied to tribal communities, who have cultural similarities with the tribal communities, use the epiphytic plants as medicine in a similar fashion as the tribes practise. A perusal of literature reveals that in India medicinal plants are well documented (Chopra *et al.*, 1956; Kirtikar and Basu, 1996) but the uses of epiphytic plants as medicine need much attention all over India. However, the trees on which the epiphytic plants grow

are also used as medicine for various ailments by the tribal and other communities of the sub-division (Mohanta, 2002). The uses of the epiphytic plants as medicine by the tribal communities of the Kaptipada (Udala) sub-division have been recorded for the first time by the authors themselves.

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## ETHNOMEDICINAL PLANTS OF BANKURA DISTRICT, WEST BENGAL

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### ABSTRACT

The present work deals with the survey and documentation of ethnomedicinal plants used by folk communities of Bankura district, West Bengal. Information was collected from the local traditional practitioners. Here as many as 32 plant species belonging to 20 families have been documented along with their vernacular names, family, medicinal property, plant parts used, and mode of preparation. This is also an endeavour to draw attention for the indepth study on the concerned medicinal plants, the result of which could provide novel, better and efficient remedies for many dreadful diseases. This study may prove useful for the protection of intellectual property right (IPR).

**Key words :** *Ethnomedicinal plants, folk community, taxonomic documentation.*

### INTRODUCTION

Bankura, one of the seven districts of Burdwan Division in the Indian state of West Bengal located between 22°38' N and 23°38' N latitudes and between 86°36' E and 87°46' E longitudes, covers an area of 6881 sq km and serves as the connecting link between the plains of West Bengal on the east and Chota Nagpur plateau on the west. The district sustains a tribal population (335,047) which is over 10 percent of the total population (3,191,822) according to Census report of 2001. The district is inhabited by Santhals, Oraons, Koras, Bhumij, Mech, Mahali, Bedia and Mundas. The proportion of rural population is also very high being 2,956,558 (*i.e.*, >90%). All these demographic attributes of the district speak of its indigenous knowledge potential of distinction, especially regarding medicinal uses of plants. However, the efforts to document the ethnomedicinal information are inadequate and very fragmentary (Choudhuri *et al.*, 1982; Ghosh, 2002, 2003, 2008; Ghosh *et al.*, 1996; Kar, 1999; Mukherjee and Namhata, 1988; Namhata and Mukherjee, 1988, 1989). The present work is thus aimed to contribute towards ethnomedicinal compendium of the district.

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## MATERIAL AND METHODS

The work was based mainly on ethnobotanical field work in Jayrambati, Shihar, Tajpur, Baital, etc., in Bankura district. The indigenous knowledge about 32 species of medicinal plants was documented by taking structured questionnaire (Rao, 1989) based interviews of the medicine men, local healers, village headmen and old experienced, knowledgeable men and middle aged women mainly of the tribal communities (Santals, Oraons, Koras, Bhumij, Mech, Mahali, Bedia, Bhumij and Mundas). The medicinal values of the concerned plants were ascertained through cross checking and subsequently documented using appropriate medical terms. These plants were observed initially in the Bishalakshmi Vesaj Udyan of Ramakrishna Vivekananda Mission, Jayrambati. Plant specimens of each species were dissected and worked out taxonomically for confirming identification and some of them were processed for herbarium preservation. The plant species were enumerated giving their family and local names, parts used, medicinal property and use (Table 1).

## RESULTS AND DISCUSSION

During field work indigenous knowledge about medicinal uses of as many as 32 plant species belonging to 20 families have been documented along with their local and family names, plant parts used, medicinal property as well as mode of preparation (Table 1). These plants were found to be used in curing 28 types of diseases. Interestingly all the medicines recorded here involve a single herb in each case. The ethnomedicinal practices appear to be very simple and effective. Some of the uses recorded here appear to be novel, e.g., use of *Gymnema sylvestre* as cardiac stimulant, *Andrographis paniculata*, *Asparagus adscendens*, *Bryophyllum pinnatum* and *Desmodium motorium* in diabetes, *Mimosa pudica* in rheumatism, *Bryophyllum pinnatum* and *Tinospora cordifolia* in jaundice, *Coleus amboinicus* in epilepsy, both *Plumbago zeylanica* and *P. indica* in leprosy and *Abelmoschus moschatus* in renal problems, etc. The findings are thus likely to draw the attention for the in depth study on the concerned medicinal plants, the result of which can hand over novel and better remedies against dreadful diseases like diabetes, rheumatism, asthma, cardiac diseases and jaundice.

**Table 1.** Medicinal plants and their uses as documented from Bankura District.

Family and Scientific name	Local name	Part (s) used	Disease treated	How medicine used
<b>Acanthaceae</b>				
1. <i>Hygrophila schulli</i>	Kulekhara	Stem, leaf	Anaemia	Young shoots are boiled and taken in.
2. <i>Andrographis paniculata</i>	Kalmegh	Leaf	Dysentery, diabetes, blood purification	Used in tablet form or pill.
3. <i>Phlogacanthus thyrsiflorus</i>	Rambasak	Leaf	Bronchitis, cough, asthma	Used by boiling leaf juice in water.
<b>Asparagaceae</b>				
4. <i>Asparagus adscendens</i>	Satamul	Leaf	Diabetes, dysentery	Dried root powder orally taken.

Table 1. contd.

Family and Scientific name	Local name	Part (s) used	Disease treated	How medicine used
<b>Apocynaceae</b> 5. <i>Rauwolfia serpentina</i>	Sarpagandha	Roots, seeds	Rheumatism, pneumonia	Dried root dust used in form of pills.
<b>Araceae</b> 6. <i>Acorus calamus</i>	Bach	Rhizome, root	Skin disease, cough, bronchitis	By decoction of rhizome and root dust; one tea spoonful twice daily for 4-5 days.
<b>Asclepiadaceae</b> 7. <i>Gymnema sylvestre</i>	Gurmar	Leaf	Cardiac stimulant, diabetes	Dried stem powder ½ tea spoon taken daily for 7- 15 days in empty stomach.
<b>Apiaceae</b> 8. <i>Centella asiatica</i>	Thankuni	Leaf	Weakness, indigestion, loss of memory, ulcer	Fresh leaves dried and powdered, one tea spoonful taken once daily for 3-5 days.
<b>Compositae</b> 9. <i>Eupatorium triplinerve</i>	Ayapan	Full body	Dysentery, anaemia	Leaf juice is boiled and one tea spoonful in empty stomach for 2-3 days.
10. <i>Wedalia calendulacea</i>	Vringaraj	Leaf, stem	Cough, dysentery	Fried leaves taken with daily meal for 3-5 days.
11. <i>Mimosa pudica</i>	Swet lajjabati	Root	Rheumatism, piles	Taken as decoction for 5 to 7 days.
<b>Crassulaceae</b> 12. <i>Bryopyllum pinnatum</i>	Pathar kuchi	Leaf	Diabetes, jaundice	Fresh leaf juice boiled and one tea spoonful taken daily for 7-15 days.
<b>Combrataceae</b> 13. <i>Terminalia chebula</i>	Haritaki	Fruit	Dysentery	Crushed fruits with jaggary taken one tea spoonful daily.
14. <i>Terminalia bellirica</i>	Bahera	Fruit	Diarrhoea, dysentery	Used by crushing fruits with jagary and one teaspoon ful taken daily.

Table 1. contd.

Family and Scientific name	Local name	Part (s) used	Disease treated	How medicine used
<b>Euphorbiaceae</b> 15. <i>Emblica officinales</i>	Amlaki	Fruit	Anaemia	Taken as soft drink prepared by mixing seed powder in water.
<b>Fabaceae</b> 16. <i>Desmodium motorium</i>	Bancharal	Seed, fruit	Diabetes, piles	Leachate prepared after soaking 20 seeds for over night and taken daily for 7-15 days.
<b>Lamiaceae</b> 17. <i>Ocimum tenuiflorum</i>	Krishna tulsi	Full body	Bronchitis, fever, cough	Leaf juice one tea spoonful taken for 3-5 days.
18. <i>Ocimum sanctum</i>	Radhatulsi	Leaf, root	Bronchitis, hairfall	Firstly 1600 ml water taken and 400 gm oil mixed, to which leaves added and then mixture cooled and the mixture massaged on chest and back.
19. <i>Ocimum gratissimum</i>	Ramtulsi	Full body	Cough, fever	Paste prepared from fresh leaf, one teaspoonful taken with equal amount of honey for 5-7 days.
20. <i>Ocimum kilimandscharicum</i>	Karpur tulsi	Leaf, root	Cold, cough, bronchitis	Leaves mixed with boiled water and taken as drink.
21. <i>Mentha spicata</i>	Pudina	Leaf, twig	Fever	Soft drink prepared by boiling the leaves in water and a cup of it taken daily for 3-5 days.
22. <i>Coleus amboinicus</i>	Parnojowan	Leaf	Indigestion, asthma, epilepsy	Soft drink prepared by boiling leaves in water and a cup of it taken daily for 3-5 days.

Table 1. contd.

Family and Scientific name	Local name	Part (s) used	Disease treated	How medicine used
<b>Menispermaceae</b> 23. <i>Stephania japonica</i>	Akangi	Root, leaf	Dyspepsia, diarrhoea, fever	100 gm crude drug immersed in 250 ml water for overnight and the leachate taken in the morning.
24. <i>Tinospora cordifolia</i>	Gulanha	Leaf	Jaundice, diabetes, fever, cough	Leaf juice taken daily for a week.
<b>Malvaceae</b> 25. <i>Abelmoschus moschatus</i> seed	Latakasturi	Seed	Kidney problems	One tea spoonful dust taken in empty stomach for a month.
<b>Piperaceae</b> 26. <i>Piper longum</i>	Pipul	Leaf, fruit	Indigestion, fever	One teaspoon full of powdered drug taken with jagary after meals.
<b>Plumbaginaceae</b> 27. <i>Plumbago indica</i>	Lalchita	Full plant	Gynaecological disorder, leprosy	Leaf dust (one tea spoon) taken once daily for a month.
28. <i>Plumbago zeylanica</i>	Swet- chita	Root	Gynaecological disorder, ulcers, leprosy	Leaf dust (one tea spoon) taken daily for a week.
<b>Serophulariaceae</b> 29. <i>Bacopa monnieri</i>	Brahmi	Full plant	Improvement of memory and intelligence	Fried leaves taken with rice.
<b>Vitaceae</b> 30. <i>Cissus quadrangularis</i>	Harjora	Stem, leaf	Bone fracture	Leaves smashed and the paste used to cover the broken part.
<b>Zingiberaceae</b> 31. <i>Curcuma longa</i>	Holud	Rhizome	Jaundice	1-2 gm chewed raw.
<b>Liliaceae</b> 32. <i>Aloe vera</i>	Ghrita kumari	Leaf	Piles, skin, eczema	Jelly of leaves taken with rice.

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## **SOME MEDICINAL PLANTS AS DOCUMENTED FROM TRIBAL DOMINATED AREAS OF AYODHYA HILLS (PURULIA : WEST BENGAL) AND VICINITY**

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### **ABSTRACT**

The present work brings to light as many as 25 plant species belonging to 19 families of angiosperms having medicinal value which are often used by the aboriginal people of Ayodhya hill for preventive and curative purposes. The information thus presented is totally based on primary sources, *i.e.*, the knowledgeable informants and medicine men and collected during field surveys undertaken since 2009 in different seasons covering five villages, *viz.*, Ranga, Purudih, Banbhuti, Birsa and Chorida. Scientific and family names of concerned plants along with their local names, parts used, mode of applications and ailments cured by them are inventorised. Documentation of all these ethnomedicinal information is emphasized to be followed by therapeutic proving for human welfare.

**Key words:** *Ethnomedicine, Ayodhya hill, tribal people*

### **INTRODUCTION**

The revolutionary change in outlook of the people all round the globe has given herbal medicines a special consideration for health and longevity. Scientists have also realized their importance as one of the components of the life sustaining systems in vogue. As such, a section of modern scientists have shifted their field of interests to the nature where still reside people with enormous knowledge about herbal medicines and other bioresources. Documentation of such knowledge backed up by validation through pharmacological screening and therapeutic proving has been the major thrust areas of present day scientific research.

As per 2001 Census, 72.90% of Indian population lives in villages. Although the rural people, especially those living in contact with or proximity of forests, are very rich in traditional knowledge about sustainable use of phytoresources, especially medicinal plants, most of them are still economically very backward. Documentation of the traditional knowledge for provision of good health to all must be considered collaterally important with protection of intellectual property right, promotion of economic welfare of the concerned indigenous communities and popularization of

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herbal medicines especially in urban areas at least for primary health care. In consideration of this, the present work was undertaken in such an area as Ayodhya hill range which is rich in tribal settlements as well as biodiversity with the objective to document the traditional knowledge about the curative properties of plants used by them in encountering their common ailments so that the information, thus documented, might prove useful in contributing patient friendly remedial sources to the modern system of medicine.

### **STUDY SITE**

Ayodhya hill range is located in Purulia district situated in the south western corner of West Bengal and is rich in the flora of medicinal plants from its top to bottom. This hilly area is also reputed as anthropological laboratory for having accommodated many indigenous communities like *Santhal, Munda, Birhore, Lodha, Sabar, Paharia* and many others.

Some ethnobotanical work on Purulia district covering various aspects and different tribes was made by Basu and Mukherjee (1993, 1994, 1995, 1996, 1997, 1998, 1999). The medicinal uses of plants by tribal communities were revealed from Purulia district by Mondal and Mukherjee (2008), and study of Ethnomedicine of Ayodhya hills, Purulia district was also done by Sur *et al.* (1992). This work is based on ethnobotanical field work with the consent of the head of the community and herbal practitioners of the area.

### **MATERIALS AND METHODS**

During field survey undertaken since 2009 in different seasons in five villages adhered to Ayodhya hills, *viz.*, Ranga, Purudih, Banbhuti, Birsa and Chorida standard ethnobotanical method (Rao, 1989) was followed. Specimens of 25 plant species were collected along with their medicinal uses after establishing cordial contact with the medicine men, knowledgeable persons and middle aged housewives belonging to different ethnic communities. This work is in conformity with the earlier work of the first author on the Sikari tribe settled in Ayodhya hills (Chanda, 2010).

### **RESULTS AND DISCUSSION**

As many as 25 plant species belonging to 19 families of angiosperms have been recorded along with respective local name, plant parts used, name of ailments cured and mode of use (Table 1). These are used to treat as many as 40 types of ailments and two cases of casualty in different forms of preparation, such as, infusion, decoction, paste, juice, powder, tablet, medicated massage oil, balm at specific dosages according to age and body weight. An analysis of drug materials procured from these 25 species of plants for preparation of medicine reveals use of roots of 20 species, leaves of 14 species, seeds of 9, stem of 8 and fruits of 2 species as well as glandular hair and whole plant of one species each. Unorganized drugs in form of latex and gum are obtained from one species each. Interestingly five veterinary remedies have also been documented in this work since rearing of cattle is a common practice of the ethnic communities which is intimately associated with their health. Further validation of the medicinal

Some medicinal plants as documented from tribal....

uses especially those against cardiac diseases, asthma, rheumatism, diabetes, etc., is necessary through biochemical analysis, pharmacological evaluation and therapeutic proving which may hand over new medicines to mankind.

**Table1.** Medicinal uses of certain plants as documented from Ayodhya hills in Purulia district, West Bengal.

Botanical name (Family)	Local name	Useful plant part(s)	Ailments cured (Sl. no. of part[s] used)	Mode of use
1. <i>Abutilon indicum</i> L. (Malvaceae)	Mirubaha/ Petari	1. Leaf, 2. Seed	Migraine (1); Cardiac problem (1+2); Scabies (2). and in combination as indicated.	Paste, juice, oil, powder. Applied both singly
2. <i>Achyranthes aspera</i> L. (Acanthaceae)	Apang/ Chirchiti	1. Root, 2. Stem, 3. Seed	Dog bite (1+2); Burning sensation during urination (1+2); Piles (3); Antiseptic and body pain (1+2); Gynecological disorder (1); Tuberculosis (1+2).	Paste, infusion. Applied both singly and in combination as indicated.
3. <i>Aegle marmelos</i> Corr. (Rutaceae)	Bel	1. Root 2. Fruit 3. Leaf	Liver pain (1); Dysentery (1+3); Cough & cold (1) Constipation (2).	Juice, powder, decoction. Applied both singly and in combination as indicated.
4. <i>Andrographis paniculata</i> (Burm.f.) Wall.ex Nees (Acanthaceae)	Kalmegh	1. Root 2. Leaf	Fever(1);Colic pain, (2); Itch (2); Jaundice (2)	Juice, paste, decoction. Applied singly.
5. <i>Aristolochia indica</i> L. (Aristolochiaceae)	Iswarmul	1. Root, 2. Stem bark 3. Dried seed	Snake bite (1); Dry cough (3); Allergy (2); Dyspepsia of cattle (2)	Paste, powder, decoction. Applied singly.
6. <i>Artemisia nilagarica</i> L. (Asteraceae)	Nagdmoni/ Nagdona	1. Root 2. Stem 3. Leaf	Asthma (3); Headache (1); Menstruation problem (1+3);Itch.(2+3)	Juice, paste. Applied both singly and in combination as indicated.
7. <i>Asparagus racemosus</i> Willd. (Asparagaceae)	Mahasatabari/ Satamuli	Root	Dysentery, general weakness, sun stroke, reduced eye sight, gynecological problem,	Powder, infusion, decoction. Applied singly.
8. <i>Bacopa monnieri</i> Wettst. (Scrophulariaceae)	Brahmi	Whole plant	Rheumatism, cough & cold.	Juice. Applied singly.
9. <i>Calotropis gigantea</i> (L.) R. Br. ex Ait. (Asclepiadaceae)	Akanda	1. Root, 2. Milky latex, 3. Leaf	Curc pain after delivery (1); Thyroid problem, Ring worm infestation(2); Abdominal tumours (3); Asthma(3);Septic wound of cattle(2)	Decoction, powder, poultice. Applied singly.

Table 1. contd.

Botanical name (Family)	Local name	Useful plant part(s)	Ailments cured (Sl. no. of part[s] used)	Mode of use
10. <i>Cassia fistula</i> L. (Caesalpinaceae)	Banar lathi	1. Stem bark, 2. Young leaf, 3. Seed pulp.	Night blindness (2); Jaundice (3); Diabetes, (1+3); Skin disease (1).	Decoction.  Applied both singly and in combination as indicated.
11. <i>Clerodendrum viscosum</i> Vent. (Verbenaceae)	Ghetu	1. Root 2. Leaf	Asthma (1);Septic wound (1); Snake venom(2)	Powder, decoction. Applied both singly and in combination as indicated.
12. <i>Cyperous rotundus</i> L. (Cyperaceae)	Mutha/ Muthar bolon	Root-stock	Blood purifier, epilepsy, urinary infection, diarrhoea	Decoction, juice. Applied singly.
13. <i>Datura metel</i> L. (Solanaceae)	Dhutura	1. Root 2. leaf 3. fruit	Asthma, (2); Rheumatism, (1+2); Toothache, (3)	Juice, powder. Applied both singly and in combination as indicated.
14. <i>Elephantopus scaber</i> L. (Asteraceae)	Mejurjhuti	1. Root	Dysentery(1); Eczema (1); Nausea and vomiting (1)	Paste, powder. Applied singly.
15. <i>Eupatorium triplinerve</i> Vahl. L. (Acanthaceae)	Bisallakarani	1. Leaf 2. Root	Hemorrhage(1); Colic pain (1+2); High blood pressure(1+2)	Decoction. Applied together.
16. <i>Flemingia strobilifera</i> L. (Fabaceae)	Durgadak	1. Root 2. Leaf	Epilepsy (1+2); Hysteria (1+2).	Decoction. Applied both singly and in combination as indicated.
17. <i>Leonotis nepetifolia</i> (L.) R. Br. (Lamiaceae)	Sidho	1. Root 2. Seed	Skin disease (1+2); Intestinal worm infestation (2)	Paste, infusion, powder, ash. Applied together.
18. <i>Mallotus philippinensis</i> (Lam.) Muess. (Euphorbiaceae)	Kamala/ Sindur	1. Red glandular hairs of fruit, 2. Root bark 3. Seed	Rheumatic swelling (2); Gall bladder stone (1); Cuts and wounds (3)	Paste, decoction, powder. Applied singly.
19. <i>Plumbago zeylanica</i> L. Chitrak (Plumbaginaceae)	Swetchita/	1. Root 2. Stem bark	Fever(1); Rheumatism(1) Paralysis (1+2);Snake bite (1);Body pain, (1)	Decoction, paste. Applied both singly and in combination as indicated.
20. <i>Pterocarpus marsupium</i> Roxb. (Fabaceae)	Piyasal	1. Leaf 2. Seed, 3. Stem bark, 4. Gum	Diarrhoea(3+1); Diabetes (1+3);Toothache (4); Skin disease (3+2)	Decoction, juice. Applied both singly and in combination as indicated.

Some medicinal plants as documented from tribal....

Table 1. contd.

Botanical name (Family)	Local name	Useful plant part(s)	Ailments cured (Sl. no. of part[s] used)	Mode of use
21. <i>Rauwolfia serpentina</i> . Benth (Apocynaceae)	Sarpagandha	1. Root 2. Leaf	Dysentery (1) Pneumonia (1+2) Snake bite (1) High blood pressure.(1)	Decoction, paste. Applied both singly and in combination as indicated.
22. <i>Ricinus communis</i> L. (Euphorbiaceae)	Rerhi/Jara	1. Root 2. Leaf 3. Seed	Migraine (2) Arthritis (3) Inflammation on gum (3). Septic wound of cattle (1+2)	Decoction, paste, powder, poultice. Applied both singly and in combination as indicated.
23. <i>Smilax perfoliata</i> Lour. (Smilacaceae)	Ram-datun	1. Root 2. Seed	Blood dysentery (1); Coughs (1); Urinary infection (2); Small pox. (1+2)	Paste, decoction. Applied both singly and in combination as indicated.
24. <i>Symplocos racemosa</i> Roxb. (Symplocaceae)	Lodh/ Ranjani	1. Stem bark, 2. Root	Abdominal pain after abortion(1); Liver dysfunction (1+2); Miscarriage in cattle (1+2)	Decoction, infusion. Applied both singly and in combination as indicated.
25. <i>Vitex negundo</i> L. (Verbenaceae)	Nisinda	1. Root, 2. leaf, 3. stem bark	Cough(3); Asthma(2); Small pox (2); Wounds(2); Arthritis (2+3); Septic wound of cattle (1+2)	Decoction. Applied both singly and in combination as indicated.

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## COMMON FOLKLORIC MEDICINAL PRACTICES AMONG KORA-MUDI TRIBE OF PASCHIM MEDINIPUR, WEST BENGAL

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### ABSTRACT

An ethno-medico-botanical survey was undertaken to identify the indigenous knowledge of traditional healing, using plants among the Kora-Mudi tribe of Paschim Medinipur, West Bengal. The study reveals that these people have unique knowledge to cure several human diseases and disorders. In this paper the common folkloric medicines were identified against the regular use of synthetic heroic drugs among the metropolis.

Methodologies include weekly regular visits and documentation of information of ethno-medicine through open ended questionnaires from the tribal herbalists. Cross interviews of healers were made to verify the information. A total of 18 plant species are commonly used as febrifuge, expectorant, carminative, stomachic, vermifuge, abortifacient, *etc.* These are either employed as a sole drug in the form of powder, oil, paste, decoction, latex or in combination to treat the ailments. The dosages, method of preparation and preservation are documented along with botanical and local names of these ethnomedicinal plants. There is an urgent need to protect these plants which are dwindling in number due to rapid urbanization and also motivate the young generation towards the ethnomedical recipes.

**Key words:** *Folklore, ethnomedicinal plants, Kora-Mudi, Paschim Medinipur, West Bengal*

### INTRODUCTION

In the last few decades the documentation, identification and recognition of traditional medicines have been substantially carried out in India (Kamble *et al.*, 2010; Muthu *et al.*, 2006; Sajem and Gosai, 2006) as well as West Bengal (Ghosh, 2003; Bhakat and Sen, 2008; Pal and Jain, 1998; Kar, 1999). Investigation of traditional medicines is very important for treatment of diseases in the urban and rural areas. The traditional system of medicine, *i.e.*, Ayurveda, Homoeopathy, Unani, Siddha, Amchi and others

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in India is based on herbal drugs (Mukherjee and Wahile, 2006). In India, it is reported that traditional healers use 2500 plant species and 100 species of plants serve as regular sources of medicine (Pei, 2001). In Indian Materia Medica there are nearly 2000 natural drugs mentioned that have various pharmacological activities and out of these, 1600 are of plant origin (Mukherjee, 2008). The World Health Organization (WHO, 2009) estimates that about 80% of the population still depend upon these herbal medicines for treatment of diseases due to easy availability, economic nature and less side effects when compared to allopathic system of medicines.

Paschim Medinipur is one of tribal rich (33% of total population) districts in India. The groups like *Lodha*, *Kheria (Sabar)*, *Munda*, *Santal*, *Kohl*, *Oraon*, *Mahali* and *Bhumij* are primitive tribes of Medinipur. Tribal people in this district generally use plant extracts for curing different systemic and superficial infections. Their medicinal system has been extensively studied by Pal and Jain (1998). *Kora* is the fifth largest tribal community in West Bengal. According to the latest census, the total population of *Kora* is 1,42,789, constituting 3.2 % of the total tribal population of the state. *Kora-Mudis* speak the *Kora* tongue, which belongs to Austro-Asiatic language family. It has been well documented that more than 90 % of the *Kora* people reside in rural areas of the country. They are distributed in three eastern provinces of India, viz., West Bengal, Orissa and Bihar. The majority of the *Koras* in West Bengal are found in the districts of Bankura, Bardhaman, Birbhum, Hugli, Puruliya and Paschim Medinipur. *Koras* engage them mainly in earth digging. They have four endogamous groups, viz., Mudi *Kora*, Kurmi *Kora*, Nagbanshi *Kora*, Dhangar or Orang *Kora*. *Mudi-Kora*, a genetically homogeneous group, was considered for the present study. Their literacy status is poor as only 43.3 % of the *Kora* children aged 5 -14 years have been attending educational institution (Bisai and Mallick, 2011). The vast majority (70-80%) of people belonging to *Kora-Mudi* tribe in Medinipur district consult traditional medical practitioners (TMPs) for healthcare.

In this scenario, an ethno-medico-botanical survey was undertaken to record the indigenous knowledge of traditional healing using plants among the *Kora-Mudi* tribes of Paschim Medinipur, West Bengal. The study reveals that these people have unique knowledge to cure several human diseases or disorders. In this paper the common folkloric medicines were identified against the regular use of synthetic heroic drugs among the metropolis in future.

## MATERIALS AND METHODS

Field surveys were conducted for one year during April 2010 and March 2011. Paschim Medinipur is lying in between 21°36'35" N - 22°57'10" N and 86°35'50" E - 88°12'40" E and located 23 meters above the sea-level. The study sites in Paschim Medinipur were restricted to two villages of Krishnanagar and Jamunaparh near Gokulpur. The data were collected weekly by regular visits and the information of ethno-medicine was gathered in standard open ended questionnaire from the tribal herbalists and confirmed through cross interviews of healers. Individuals who are indicated to know and practice at least one medicinal plant species were considered as traditional healers or traditional medical practitioners (TMPs) in this study. The ages of the TMPs ranged from 35 to 60 years. The questionnaires covered all parameters

essential for documentation of traditional knowledge (TK). The plants were collected from concerned areas and voucher specimens were preserved in the department of Botany, Vidyasagar University for future reference.

## RESULTS AND DISCUSSION

The information on traditional medicine, particularly method of preparation, dosages, and preservation is documented along with the botanical and local names of medicinal plants in Table 1.

**Table 1.** Details of medicinal plants used by the Kora-Mudi tribe:

Family and Botanical name	Local name	Ailment(s)/ purpose	Part(s) used	Mode of administration/ application
<b>Tiliaceae</b> 1. <i>Microcos paniculata</i>	<i>Asar</i>	Dyspepsia	Leaf juice (can be preserved for 3 days in earthen pot).	½ cup juice drunk twice a day.
<b>Lamiaceae</b> 2. <i>Ocimum gratissimum</i>	<i>Ram tulsi</i>	Fever with cough	Hot water extract of leaf or direct leaf-juice.	Hot water extract used for gargling and 3 spoonfuls of leaf extract taken early morning and before bed.
<b>Asclepiadaceae</b> 3. <i>Calotropis gigantea</i>	<i>Akondo</i>	Loss of appetite	Sun dried flower	Consumed with jaggery before meal.
<b>Apocynaceae</b> 4. <i>Alstonia scholaris</i>	<i>Chattim</i>	Dysentery, gastric trouble	Dried stem bark made into powder (can be preserved for a month)	2 spoonful powder mixed in water consumed in morning and evening. In stomach ache, boiled with ginger to get best effects.
<b>Sterculiaceae</b> 5. <i>Ambroma augusta</i>	<i>Chakma / Ulatkambal</i>	Irregular menses and pain, dysmenorrhoea	Fresh viscous juice of the root-bark; roots and petioles.	Bark juice taken in morning; roots and petioles soaked in hot water overnight to be consumed in the next day.
<b>Fabaceae</b> 6. <i>Abrus precatorius</i>	<i>Kunch</i>	Insomnia, Anodyne, Induction of abortion	Dried seeds & paste of the root	Small amount of seed powder acts as a sedative drug. Root paste taken once as an oral contraceptive.
7. <i>Acacia nilotica</i>	<i>Babla</i>	Stomatitis, dysentery, cough, dental caries.	Bark and gum	Hot water extract used in throat infection, dental caries, stomatitis and cough.
8. <i>Butea monosperma</i>	<i>Palash</i>	Stimulant, urinary troubles, blood purification	Young leaves and stem bark	Chewing of young leaf acting as a stimulant; sun dried stem bark ground, and consumed with water, helping as a blood purifier.

Table 1. contd

Family and Botanical name	Local name	Ailment(s)/ purpose	Part(s) used	Mode of administration/ application
9. <i>Clitoria ternatea</i>	<i>Aparajita</i>	Leucorrhoea	Roots	Root crushed and soaked in water, and then the filtered water taken once a day.
<b>Moringaceae</b>				
10. <i>Moringa oleifera</i>	<i>Shojne</i>	Diarrhoea, dysentery, common cold, toothache,	Leaves, barks, roots, flowers, pods	Leaves and flowers partially cooked and eaten during diarrhoea, dysentery; boiled leaves taken during common cold and fever. Bark used during tooth ache.
<b>Euphorbiaceae</b>				
11. <i>Euphorbia neriifolia</i>	<i>Fani Manasa / Mansasij</i>	Sexual debility debility in males, urine retention, bronchial congestion	Whole plant	Latex mixed with cow milk and kept under sun for the whole day and externally used as an aphrodisiac substance. Boiled leaf taken as a diuretic substance. Latex used as an expectorant.
<b>Acanthaceae</b>				
12. <i>Justicia adhatoda</i>	<i>Basah</i>	Cough and cold	Leaves	Leaf extract taken once in early morning.
13. <i>Andro-graphis paniculata</i>	<i>Kalmeg</i>	Cold, cough, fever, worm infestation	Whole plant	A cup of plant juice taken early morning to get rid of worms. Plant juice consumed twice a day to get relief from cold, cough and fever.
<b>Rutaceae</b>				
14. <i>Aegle marmelos</i>	<i>Bael</i>	Dysentery and indigestion	Fruits and roots	Green and ripe fruit juice taken during dysentery and dried powdered root consumed during indigestion.
<b>Asparagaceae</b>				
15. <i>Asparagus racemosus</i>	<i>Sathamuli</i>	Urine retention/ scanty debility	Roots	Root acting as diuretic and to increase appetite, which honey mixed with root extract acting as a tonic.
<b>Caricaceae</b>				
16. <i>Carica papaya</i>	<i>Pepe</i>	Induction of abortion	Fruits	Latex of the young fruit mixed with goat milk and taken once a day.
<b>Moraceae</b>				
17. <i>Ficus religiosa</i>	<i>Aswattha</i>	Body pain	Leaves	Dried leaf powder mixed with water to get relief from body pain.
<b>Convolvulaceae</b>				
18. <i>Ipomoea sepiaria</i>	<i>Bon- kalmi</i>	Low blood pressure	Leaves	Juice of the leaf taken once a day for 15 days.

In this study, we focused mainly on plant species which are commonly used by the *Kora-Mudi* tribe of Medinipur. Analysis of data reveals that 18 medicinal plants belonging to 14 families are used for the treatment of common human diseases and disorders like dyspepsia, fever, cough and cold, dysentery, dysmenorrhoea, leucorrhoea and used as vermifuge, abortifacient and analgesic. These folklore medicinal plants are enumerated in Table 1 with their botanical and local names, family, ailments/purpose, parts used, mode of administration/application.

These documented plants are easily available and used against the common ailments. Among the 18 identified plants, three plants are widely used for fever, cold and cough which are *Ocimum gratissimum* (Ram tulsi), *Justicia adhatoda* (Basak) and *Andrographis paniculata* (Kalmeg). Against stomach problems 5 plants are commonly used. They are *Microcos paniculata* (Asar), *Alstonia scholaris* (Chattim), *Acacia nilotica* (Babla), *Moringa oleifera* (Shojne) and *Aegle marmelos* (Bael). *Abrus precatorius* (Kunch) and *Carica papaya* (Pepe) are used as oral contraceptives. The plants recorded in this work are also widely used against several ailments by the tribes of other regions. Latex of *Carica papaya* is used for induction of abortion (Kamble *et al.*, 2010). The plant *Euphorbia neriifolia* (Phani Mansa or Mansasij) of Euphorbiaceae is most frequently used for the treatment of different diseases in Kancheepuram district of Tamil Nadu (Muthu *et al.*, 2006), and as an anti-cancer drug (Sharma *et al.*, 2011). It is used to uproot skin warts, ameliorate earache and arthritis (Kirtikar and Basu, 1996). It is also reported that *Euphorbia nerifolia* is useful in abdominal troubles, bronchitis, tumors, leucoderma, piles, inflammation, enlargement of spleen, anemia, ulcers and in chronic respiratory troubles (Nadkarni, 1954). The present authors observed *Kora-Mudi* tribe to use *Euphorbia neriifolia* as aphrodisiac, diuretic and expectorant.

According to Fahey (2005), *Moringa oleifera* is anti-helminthic, anti-hypertensive and anti-skin cancer. Here we identified that *M. oleifera* is used for the treatment of diarrhoea, dysentery, common cold and toothache. Roots of *Asparagus racemosus* (Asparagaceae) is reported to be used as diuretic and tonic by *Kora-Mudi*. Similar observations on *Asparagus* sp. were recorded to cure stomachache and urinary disorders by Sajem and Gosai (2006); and for increasing lactation by Kamble *et al.* (2010) and antibacterial efficacy against various strains by Mandal *et al.* (2000). In Assam root decoction is used as health tonic, diuretic, ophthalmic, galactagogue, aphrodisiac and carminative (Sharma and Pegu, 2011). Dried leaf powder of *Ficus religiosa* is mixed with water to get relief from body pain (as analgesic) as recorded in the present study; whereas Kamble *et al.* (2010) have found its use as antifertility and contraceptive agent. The *Kora-Mudi* tribe use the juice of the leaves of *Justicia adhatoda* in early morning to get relief from cough and cold whereas its fresh flowers and leaf decoction are used by Jaintia tribes to cure nose bleeding, dysentery and blood vomiting (Sajem and Gosai, 2006). Roots of *Clitoria ternatea* are reported here to be used for leucorrhoea and for menstrual problems by *Bhilla* tribes (Kamble *et al.*, 2010). *Ocimum* sp. is used for dysentery (Kamble *et al.*, 2010) as compared to febrifuge here. Bhakat and Sen (2008) reported *Abrus precatorius* to be a substitute of liquorice; and to cure body pain, skin diseases; and *Andrographis paniculata* is used to cure dysentery, worm infection and as liver tonic.

Kora-Mudi tribes dwell in the remote areas and are mostly below the poverty level. Due to poor quality of food and unhygienic conditions there is prevalence of common diseases like fever, cough cold, stomach disorder, dysentery, wounds, etc. The tribes do not get proper treatment in time even for common diseases. As such they mostly rely on easily available herbal medicines. Local traditional healers commonly use plants to treat more number of diseases, such as, jaundice, diabetes, fertility problem, asthma, anaemia, etc. The ethnopharmacy and application need further study as their prescribed dose and mode of administration vary among the herbalists.

It is evident from the interviews conducted in different villages that the knowledge of medicinal plants is confined to traditional healers, herbalists and elderly persons who are living in rural areas. This study also points out that certain species of medicinal plants are over exploited by the local residents who are unaware of their ecological importance. It is of great essence to preserve the knowledge of medicinal plants used by the tribal people and exploit the knowledge to treat various diseases. The phyto-medicinal treatments are free from side effects and are cost effective. Traditional medicine is important not only because of its potential to discover new treatments, but also because of its socioeconomic, conservationist and cultural components. There has been a continuous growth of demand for herbal medicines globally (Srivastava, 2000). The loss of medicinal plant species has also been aggravated by the erosion of the age old accumulated indigenous knowledge on traditional use and management of these plants as its transfer system is widely known to be poor (Addis *et al.*, 2001). Given the increased use of traditional medicines, possibilities that would ensure its successful integration into a public health framework should be explored (Alves and Rosa, 2007).

### **CONCLUSION**

The survey indicated that the study area has plenty of medicinal plant resources which hold tremendous values as pharmaceutical products and to treat a wide spectrum of human diseases. The fragile ecosystem of both Paschim and Purba Medinipur districts needs urgent care and sensitive handling as some of the taxa are over exploited due to lack of sustainable harvesting methods, inadequate knowledge and rapid urbanization. However, the knowledge of indigenous medicinal plant use is declining among the younger generation, which could be attributed to the low interest of the younger generation to inherit and use ethnomedicinal knowledge. Still, the reliance of people on ethnomedicine has been for reasons of cost-effectiveness, acceptability, biomedical benefits and accessibility. The phyto-chemical and pharmacological studies on information generated from the present study regarding medicinal plants are an urgent need to understand the mechanism of traditional treatment, moreover the standardization of dose is required.

Due to the growing importance of ethno-botanical studies, it is necessary to collect the information about the knowledge of folklore medicinal plants, preserved in local communities of various parts of Medinipur before it is permanently lost. Simultaneously, attention should also be made on proper exploitation and utilization of these medicinal plants. Therefore, there is an urgent need to protect these plants which are dwindling in number due to rapid urbanization and also motivate the young generation towards the ethno-medical recipes.

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## ETHNOMEDICINAL USES OF PLANTS BY TRIBAL AND NON-TRIBAL PEOPLE OF BOLPUR SUB-DIVISION OF BIRBHUM DISTRICT, WEST BENGAL

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### ABSTRACT

Present paper deals with traditional therapeutic uses of plants by the tribal and non-tribal people of Bolpur sub-division of Birbhum district, West Bengal, India. The common people of this area usually depend upon the locally available plant resources for their primary health care. Altogether 25 plants were recorded from the study area, which are used in preparation of 20 different types of ethnomedicines that are administered for curing different types of diseases and ailments. Among the 20 ethnomedicinal uses, 15 are administered in the form of single drug to cure wound, ulcer, fresh cut, sore, cold and cough, sinus problem, high fever, etc. In 5 cases, compound drug preparations are used in treatment of cold and cough, boils, itches, sore, ulcer (suppuration), etc. The recorded 25 plant species cover 24 species of flowering plants belonging to 24 genera and 21 families and 1 species of pteridophyte. These findings have been documented with botanical and tribal names of the plants, their occurrence, parts used, mode of administration, ailments and diseases, cured, etc. Some noteworthy medicinal plants thus recorded are – *Achyranthes aspera* L., *Argemone mexicana* L., *Artemisia nilagirica* (C.B.Clarke) Pamp., *Cascabela thevetia*(L.)Lippold, *Curcuma longa* L., *Eclipta prostrata* (L.)L., *Musa paradisiaca* L., *Ocimum sanctum* L., *Vitex negundo* L. and *Lygodium pinnatifidum* (L.) Sw.. This traditional knowledge of ethnomedicine should be validated immediately so as to convey the benevolence to mankind.

**Key words :** *Ethnobotanical uses, tribal and non-tribal people, Bolpur sub-division, Birbhum*

### INTRODUCTION

Nature has created plants in the world for every ailment and there is a cure for every disease; man has to find it out. In recent years, however, there has been a reawakened scientific interest in medicinal plant- research. Ethnomedicine is a sub-discipline of ethnobotany which involves the study of plants used by various ethnic communities for therapeutic purposes. Many ethnomedicinal plants have been proved to be potential source of crude drugs for modern medicines. Only a

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small part of these ethnomedicinal plants has been scientifically evaluated till date. As such, there is an urgent need to document and conserve the traditional herbal knowledge before it gets lost.

In India, organized studies in ethnobotany during the last few decades have progressed along various lines like ethnobotany of specific tribes, of certain regions, of particular plant groups or diseases and on sub- interdisciplinary aspects (Jain,1981, 1987, 1991, 1997 ; Mandal and Yonzone,1988; Majee *et al.*, 1997; Rahaman and Mandal, 1998; Singh and Pandey, 1998; Maheshwari, 2000; Pullaiah and Mohammed, 2000; Pal and Jain, 2001; Trivedi and Sharma, 2004; Patil and Patil, 2006). The present investigation documents the significant information regarding the ethnomedicinal uses of certain plants by the tribal and non-tribal people of Bolpur sub-division of Birbhum district, West Bengal. Most of the information recorded in this study are new to the existing of Indian ethno-medicinal record. This study is in conformity with the earlier works on the district (Mondal, 1988 ; Mondal *et al.*, 1998 ; Banerjee, 2000 ; Rahaman *et al.*, 2007, 2008, 2009; Das *et al.*, 2009; Rahaman and Pradhan, (in press); Ghosh *et al.*, 2011) and likely to contribute to the preparation of an ethnomedicinal data-base of the district.

### STUDY AREA

The study area includes various parts of Bolpur sub-division of Birbhum district

(Fig. 1). This sub-division Bolpur is located in southeastern part of the district with a total area of 1173.5 sq km. It is extended from 23°32'30" to 23°53'00" North latitude and 87°23'30" to 87°57'30" East longitudes. This subdivision comprises 4 police stations, viz., Bolpur (333.6 sq km), Illambazar (259.5 sq km), Labhpur (333.6 sq km), and Nanoor (309.2 sq km).

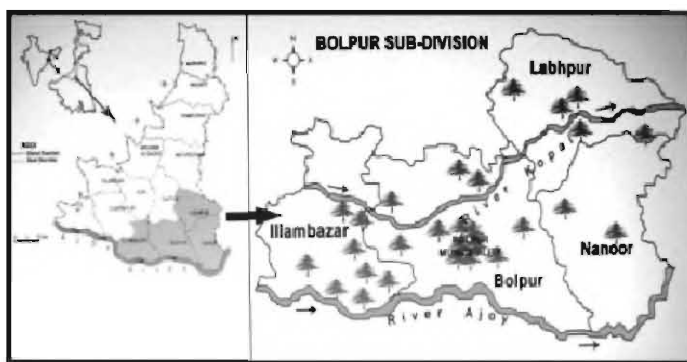


Fig. 1. Location of Study site

### MATERIALS AND METHODS

The present ethnomedicinal investigation was conducted for a period of one year (October 2008 – September 2009) to collect the information regarding ethnomedicinal uses of plants by interviewing various tribal and non-tribal medicine men and other knowledgeable persons of the study areas following standard methods (Jain, 1987; Jain and Mudgal, 1999). The informants were taken to the field individually to identify the plants that they use to cure the ailments. The collected plant specimens have been carefully identified with the help of different Floras (Varma, 1981; Guha Bakshi, 1984; Sanyal, 1994; Pullaiah and Mohammad, 2000) and have been processed for herbarium preservation following standard herbarium techniques (Jain and Rao,

1977). These specimens have been preserved in the Visva-Bharati Herbarium (VBH), Department of Botany, Visva- Bharati, Santiniketan for future reference. In case of plant part used as crude drug is a well known commercial commodity, the herbarium specimens were not prepared.

## RESULTS AND DISCUSSION

Altogether 25 plants were recorded (Figs. 2-10) from the study area which are used by the local people in formulation of 20 types of medicine that cure 10 different types of diseases and ailments. It is found that 15 preparations which are, administered in the form of single herb, are curing wound of naval cord, sore in tongue, sinusitis, cold and cough, etc., and 5 preparations prepared from multiple herbs are used to treat cough and cold, sore in male genitals, boils, etc. The recorded plant taxa spread over 25 species, 25 genera and 22 families (Table 1). Among

**Table-1.** Taxonomic analysis of the documented plants

Taxa	Monocotyledonous plant		Dicotyledonous plant		Pteridophytes	
	Total No.	%	Total No.	%	Total No.	%
Family	2	9.09	19	86.36	1	4.54
Genus	2	8	22	88	1	4
Species	2	8	22	88	1	4

these only one is a pteridophyte and rest are angiosperms. Habitually these plants are grouped into - trees (7 plant species), shrubs (5 plant species), herbs (9 plant species), and climbers (4 plant species). Various plant parts like leaves, roots, rhizomes, stems, flowers, fruits, latex, whole plants, etc. are used in preparation of ethnomedicine and their number along with their percentage are presented (Table 2). All the concerned taxa have been enumerated along with their scientific name, tribal and local name, parts used, name of diseases, mode of administration, etc., under two groups, mono- and poly-herbal preparations (Table 3). The data recorded in this investigation have been compared with standard literature on ethnobotany of West Bengal as well as India and it is revealed that many of these ethnomedicinal preparations are new in different aspects as they have not been reported earlier from the district

**Table-2.** Percentage contribution of the plant parts towards the documented medicines.

Plant parts used	Number of preparations	Contribution (%)
Leaves	13	43.33
Roots & rhizomes	4	13.33
Stems	2	6.67
Flowers	2	6.67
Fruits	6	20
Latex	2	6.67
Whole plant	1	3.33

Birbhum (Rahaman *et al.*, 2008; Das *et al.*, 2009; Mondal *et al.*, 2010; Rahaman *et al.*, 2010; Ghosh *et al.*, 2011).

Out of 20, six formulations like 5(i) & (ii), 9, 16(i) & (ii), 17 are found to be exclusively new in respect of ingredients used and mode of administration in curing cold and cough, cold fever (1-2 month baby), cuts and wound, itches, ulcer (suppuration), sore on male genitals. Stem of *Musa paradisiaca* is used to cure several diseases (premature ejaculation and male impotency, diarrhoea, intestinal

Figs. 2-10. List of some ethnomedicinal plants from the study areas



Fig. 2. *Argemon mexicana* Linn.



Fig. 3. *Chinnamomum tamala*  
Nees & Eberm.



Fig. 4. *Artemisia nilagirica*  
(C. B. Clarke) Pamp.



Fig. 5. *Eclipta prostrata* (L.) Linn.



Fig. 6. *Tamarindus indica* L.



Fig. 7. *Lygodium pinnatifidum*  
(L.) Sw.



Fig. 8. *Paederia scandens* (Lour.)  
Merrill



Fig. 9. *Piper nigrum* Linn.



Fig. 10. *Cascabela thevetia*  
(L.) Lippold.

**Table- 3.** Enumeration of the investigated plants and their ethnomedicinal uses.

Formulation No.	Scientific name with family and habit	Local/Tribal name+occurrence	Parts used	Disease cured/ treated	Mode of administration
1.	<b>Monoherbal preparation</b> <i>Achyranthes aspera</i> Linn. [Amaranthaceae] (Herb)	Apang-Abundant	Whole plant	Any kind of wound	Whole plant made into paste and applied to the wound part of the body.
2.	<i>Aegle marmelos</i> L. [Rutaceae] (Tree)	Bel-Common	Root	High fever	Root paste along with one spoonful of honey administered orally once a day for 3 to 4 days.
3.	<i>Aerva lanata</i> (L.) Juss. [Amaranthaceae] (Herb)	Chaldhowa / Doekhoe-Abundant	Flower	Sore in tongue	Dried flower powder mixed with coconut oil and applied on tongue twice a day for seven days.
4.	<i>Argemon mexicana</i> Linn. [Papaveraceae] (Herb)	Kalukanta Sealkanta-Very common	Stem latex	Sore, ulcer	Stem latex mixed with coconut oil and applied on the affected portion.
5. (i) Stem or root powder	<i>Artemisia nilagirica</i> (C. B. Clarke) Pamp. [Asteraceae] (Shrub)		Nagdona-Rare		Stem/ root Cold & cough poured in amulet and tied on the upper part of left arm.
			Leaves	Cold fever (1-2 month baby)	(ii) Leaf paste mixed with mustard oil and applied on the head once a day.
6.	<i>Bacopa monnieri</i> (L.) Wettst. [Scrophulariaceae] (Herb)	Bramhi-Very common	Leaves	Cold & cough	Leaf juice boiled with clarified butter (ghee) and taken in empty stomach in the morning.
7.	<i>Barleria lupulina</i> Lindl. [Acanthaceae] (Shrub)	Kanta Bishalyakarani-Planted	Leaves	Ulcer, fresh cuts	Fresh leaves made into paste and applied on the fresh cut, wound and also on the ulcer as haemostatic agent.

Table 4. contd.

Formulation No.	Scientific name with family and Habit	Local/Tribal name+occurrence	Parts used	Disease cured/treated	Mode of administration
8.	<i>Calotropis gigantea</i> (L.) R. Br. [Asclepiadaceae] (Shrub)	Akanda/Ahauna-Very common	Leaves	Sinus problem	Leaf smeared with clarified butter (ghee), warmed and placed on the chest. This practice done daily before going to sleep.
9.	<i>Capsicum frutescens</i> L. [Solanaceae] (Shrub)	Lanka-Commonly cultivated	Fruits	Cuts & wound	Fruit made into paste along with salt and applied on fresh cut.
10.	<i>Cissus quadrangularis</i> Linn. [Vitaceae] (Climber)	Harjora-Rare	Latex / Leaves	Wound	Latex or leaf juice administered on the wound as a haemostatic agent.
11.	<i>Eclipta prostrata</i> (L.) Linn. [Asteraceae] (Herb)	Keshuti / Lal Keshari-Very common	Leaves	Wound of naval cord	Leaves made into paste, sun heated and administered on the naval cord.
12.	<i>Musa paradisiaca</i> L. [Musaceae] (Herb)	Kala-Cultivated	Stem	Ulcer (suppuration)	Small pieces of stem completely burnt, the ash mixed with coconut oil and applied on the ulcer.
13.	<i>Paederia scandens</i> (Lour.) Merrill [Rubiaceae] (Climber)	Ghandal / gandhabhadul-Common	Leaves	Cough & cold	Leaf decoction is taken as hot soup.
14.	<i>Vitex negundo</i> L. [Verbenaceae] (Shrub/small tree)	Nishinda / Sinduari- Common	Leaves	Head ache	Fresh young leaves made into paste, administered in warm condition on the fore head.

Table 4. contd.

Formulation No.	Scientific name with family and Habit	Local/Tribal name+occurrence	Parts used	Disease cured/treated	Mode of administration
15.	<b>Polyherbal preparations</b> <i>Cinnamomum tamala</i> Nees & Eberm. [Lauraceae] (Tree) <i>Ocimum sanctum</i> Linn. [Lamiaceae] (Shrub) <i>Piper nigrum</i> Linn. [Piperaceae] (Climber) <i>Syzygium aromaticum</i> (L.) Merrill. & Perry [Myrtaceae] (Tree) <i>Zingiber officinale</i> Rose. [Zingiberaceae] (Herb)	Tej pata-Cultivated Radha tulsii-Common Golmorich-Cultivated Lovanga-Cultivated Ada/ Adi-Cultivated	Leaves Leaves Fruits Flower buds Rhizomes	Cough and cold	Leaves of <i>Ocimum</i> and <i>Cinnamomum</i> boiled along with <i>Piper</i> , <i>Syzygium</i> and <i>Zingiber</i> ; then the lukewarm syrup taken orally twice a day for few days.
16.	<i>Areca catechu</i> Linn. [Palmae] (Tree) <i>Cascabela thevetia</i> (L.) Lippold = <i>Thevetia peruviana</i> (Pers.) Merrill [Apocynaceae] (Small tree)	Supari-Cultivated Kalkey Phool/ Berenjo-Common	Fruits Leaves	(i) Itches  (ii) Ulcer (open sore discharging pus)	(i) Three leaves of <i>Cascabela</i> , one spoiled <i>Areca</i> , little sulphur are made into paste, warmed along with mustard oil in a tin can, then applied on affected part of body.  (ii) 3 leaves of <i>Cascabela</i> , 1 gm of sulphur, 1 <i>Areca</i> nut, few drops of nitric acid, 150 gm of mustard oil made into paste and heated in a tin can, then administered on affected part.

Table 4. contd.

Formulation No.	Scientific name with family and Habit	Local/Tribal name+occurrence	Parts used	Disease cured/ treated	Mode of administration
17.	<i>Lygodium pinnatifidum</i> (L.) Sw. [Schizacaceae] (Climber fern)  <i>Trachyspermum ammi</i> (L.) Sprague [Umbelliferae] (Herb)	Berajal/Durgajhap-Rare  Jowan-Cultivated	Leaves  Fruits	Sore on male genitals	Leaves of <i>Lygodium</i> - (100 gm ), grains of <i>Trachyspermum</i> , rock salt- (10-15 gm) ground into paste and mixed with 5-7 eggs of black hen. Tablets made from it. 2-3 dried tablets administered daily in the first month and 1 tablet daily in the next 2 months.
18.	<i>Tamarindus indica</i> L. [Caesalpiaceae] (Tree)  <i>Curcuma longa</i> L. [Zingiberaceae] (Herb)	Tentul-Common  Halud / Haldi-Cultivated	Fruits  Rhizome	Boils	White ashes of cow dung cake, rhizome of <i>Curcuma</i> , fruits of <i>Tamarindus</i> are made into paste, mixed with soil and applied as poultice on boils.

disorder, hypertension, etc.) as reported in earlier literature but here, formulation No.12 is applied to cure ulcer (suppuration) by mixing the ash of *Musa* stem with coconut oil which is very much new in respect of mode of administration and disease cured. Formulation Nos. 8 and 18 are found new in respect of their mode of administration. The preparations 2, 4, 11 and 14 are found new ones in respect of plant parts used which are administered for curing high fever, sore and ulcer, wound of naval cord and headache. From the literature survey it is revealed that *Cinnamomum tamala*, *Ocimum sanctum*, *Piper nigrum*, *Syzygium aromaticum* and *Zingiber officinale* are used usually as monoherbal drug in case of cough and cold. But here all are used as ingredients of a polyherbal drug (formulation No.- 15) administered for cough and cold which is reported for the first time (Kirtikar and Basu, 1935; Chopra *et al.*, 1956; Jain, 1981; Tarafder, 1983, 1984; Mandal, 1988; Mondal *et al.*, 1997, 1998; Maheswari, 2000; Trivedi and Sharma, 2004; Patil and Patil, 2006; Rahaman *et al.*, 2007, 2008, 2009; Ghosh *et al.*, 2011).

The traditional herbal knowledge still persists effectively in primary health care system of different ethnic communities in our country, which needs proper documentation before it gets lost in near future due to progressive modernization of the tribal society. The data documented in this work will provide the basic information for further evaluation for novel drug development.

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## **PHYTORESOURCES AS DOCUMENTED FROM GARKELLA-KHEROBARI AND GOURANGAPUR FOREST AREAS UNDER DURGAPUR FOREST RANGE, BURDWAN DISTRICT, WEST BENGAL**

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### **ABSTRACT**

The present work is based on extensive systematic exploration of phytoresources carried out in different parts of Garkella-Kherobari and Gourangapur Forest areas under Shibpur beat of Durgapur Forest Range, Burdwan District. In these areas, the tribal people depend mainly upon the forest flora for their livelihood. The present document encompasses 72 plant species belonging to 66 genera of 41 families which are used by the local communities to meet their day-to-day needs implicated also to their social and religious activities.

**Key words:** *Phytoresources, forest flora, livelihood, tribal people, social, Religious activities.*

### **INTRODUCTION**

India has a landmass of 3029 million hectares, of which 75.81 million hectares are under the cover of forests composed by about 45000 plant species. Of these, 17000 species are vascular plants which include 15000 species of angiosperms represented by 2563 species of trees. Presently destruction of nature has become a usual event in our civilized life style. Of different natural resources, phytoresources have been exploited most for which many species are under threat of extinction. Considering stock-taking of phytoresources and assessment of their use pattern very important, the present work was undertaken to document the phytoresources existing in different parts of Garkella-Kherobari and Gourangapur Forest areas under Shibpur beat of Durgapur Forest Range, Burdwan District, West Bengal.

### **MATERIALS AND METHODS**

Field surveys were carried out for two years since 2009 in the forested areas of Garkella-Kherobari and Gourangapur under Shibpur beat of Durgapur Forest Range, Burdwan District, West Bengal to collect the primary data pertaining to phytodiversity and phytoresources more or less following the standard methodology used for ethnobotanical studies (Rao,1989). During field studies the species were

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provisionally identified and their identification was confirmed with the help of authentic specimens and literature (Bentham and Hooker, 1862-1883 Prain, 1903; Guha Bakshi, 1984; Bennet, 1987). Voucher specimens have been preserved in the Ecotaxonomy laboratory of Botany Department of Burdwan University.

### STUDY SITE

Burdwan is one of the western districts of West Bengal lying between 22°56' N and 23°53' N latitudes and between 86°48' E and 88°25' E longitudes covering an area of 7024 sq km. Garkella-Kherobari and Gourangapur Forest areas are located between the rivers Ajoy in the north and Kunur in the south, under Shibpur beat of Durgapur Forest Range, Burdwan district. These villages being in the proximity of and in conformity with forests are rich in biodiversity (Bhattacharya and Mukherjee 2006). In these areas, the tribal people (Santhals) depend mainly upon the forest for their livelihood. The soil is lateritic in nature and the temperature ranges from 20.1°C to 44°C during summer and from 6°C to 26.2°C during winter. Annual rainfall is more or less 1500mm.

### RESULTS AND DISCUSSION

This work records 72 plant species of angiosperms (Table 1) belonging to 41 families and 66 genera. The floristic analysis shows that the dicot and monocot ratio is 60:12. Habit analysis shows that the ligneous: non-ligneous: climber compose the forest in the ratio of 38: 24: 10 respectively.

An analysis of the ethnic use of phytoresources in Garkella-Kherobari and Gourangapur forest areas (Table 1) revealed that there are at least fifteen type

**Table 1.** An enumeration of the angiospermic species and their utilitarian prospectives

Sl. No.	Scientific name	Family	Lignification category	Use category
1.	<i>Abrus precatorius</i> L.	Fabaceae	Ligneous	M
2.	<i>Acacia arabica</i> Willd.	Mimosaceae	Ligneous	Ts
3.	<i>Acacia catechu</i> Willd.	Mimosaceae	Ligneous	C, Dy
4.	<i>Achyranthes aspera</i> L.	Amaranthaceae	Non-ligneous	M
5.	<i>Alangium salvifolium</i> L.f.	Alangiaceae	Ligneous	M, E, F
6.	<i>Alstonia scholaris</i> (L.) R. Br.	Apocynaceae	Ligneous	M
7.	<i>Aristida adscensionis</i> L.	Poaceae	Non-ligneous	SB
8.	<i>Bambusa arundinaceae</i> (Retz.) Willd.	Poaceae	Ligneous	T, E
9.	<i>Barringtonia acutangula</i> (L.) Gaertn	Lecythidaceae	Ligneous	M
10.	<i>Butea superba</i> Roxb.	Fabaceae	Ligneous	Dy, C
11.	<i>Caesalpinia pulcherrima</i> (L.) Sw.	Caesalpinaceae	Ligneous	T, O

Table 1. contd.

Sl. No.	Scientific name	Family	Lignification category	Use category
12.	<i>Cardiospermum halicacabum</i> L.	Sapindaceae	Non-ligneous	M
13.	<i>Cassia occidentalis</i> L.	Caesalpiniaceae	Ligneous	M
14.	<i>Cassia sophera</i> L.	Caesalpiniaceae	Ligneous	M
15.	<i>Cassia tora</i> L.	Caesalpiniaceae	Non-ligneous	M, E
16.	<i>Centella asiatica</i> L.	Apiaceae	Non-ligneous	M, E
17.	<i>Centratherum anthelminticum</i> O. Kuntze.	Asteraceae	Non-ligneous	M, F
18.	<i>Coldenia procumbens</i> L.	Boraginaceae	Non-ligneous	M, SB
19.	<i>Combretum decandrum</i> Roxb	Combretaceae	Ligneous	F
20.	<i>Cordia myxa</i> Roxb.	Boraginaceae	Ligneous	M
21.	<i>Croton oblongifolia</i> Roxb.	Euphorbiaceae	Ligneous	M
22.	<i>Cryptolepis buchanani</i> Roem. & Schult.	Asclepiadaceae	Climber	M
23.	<i>Curculigo orchioides</i> Gaertn	Hypoxidaceae	Non-ligneous	M
24.	<i>Curcuma caesia</i> Roxb.	Zingiberaceae	Non-ligneous	M, C
25.	<i>Dalbergia sissoo</i> Roxb. Ex. DC.	Fabaceae	Ligneous	T
26.	<i>Desmodium gangeticum</i> DC.	Fabaceae	Ligneous	M
27.	<i>Dioscorea tomentosa</i> Koenig	Dioscoreaceae	Climber	E
28.	<i>Elephantopus scaber</i> L.	Asteraceae	Non-ligneous	M, ALP
29.	<i>Eragrostis. coarctata</i> Stapf	Poaceae	Non-ligneous	SB
30.	<i>Eragrostis tremula</i> L.	Poaceae	Non-ligneous	SB
31.	<i>Ficus hispida</i> L.f.	Moraceae	Ligneous	M
32.	<i>Ficus religiosa</i> L.	Moraceae	Ligneous	E, C
33.	<i>Fimbristylis ovata</i> (Burm.f.) Kern	Cyperaceae	Non-ligneous	M
34.	<i>Gloriosa superba</i> L.	Liliaceae	Climber	M
35.	<i>Glycosmis pentaphylla</i> Corr.	Rutaceae	Non-ligneous	M
36.	<i>Grewia asiatica</i> L.	Tiliaceae	Ligneous	M

Table 1. contd.

Sl. No.	Scientific name	Family	Lignification category	Use category
37.	<i>Gymnema sylvestre</i> R. Br.	Asclepiadaceae	Ligneous	M
38.	<i>Hemidesmus indicus</i> R. Br.	Asclepiadaceae	Climber	M
39.	<i>Holoptelea integrifolia</i> Planch.	Ulmaceae	Ligneous	M, E
40.	<i>Hybanthus enneaspermus</i> (L.) F. V. Muell.	Violaceae	Non-ligneous	SB
41.	<i>Ichnocarpus frutescens</i> R.Br.	Apocynaceae	Climber	M
42.	<i>Ipomoea pestigridis</i> L.	Convolvulaceae	Climber	E, O
43.	<i>Jatropha gossypifolia</i> L.	Euphorbiaceae	Ligneous	Oy
44.	<i>Lippia javanica</i> (Burm.f.) Spreng.	Verbenaceae	Non-ligneous	M
45.	<i>Madhuca indica</i> Koeing	Sapotaceae	Ligneous	CL, C, E
46.	<i>Mallotus philippinensis</i> Muell. Arg	Euphorbiaceae	Ligneous	M, Dy
47.	<i>Melia azadirachta</i> L.	Melastomaceae	Ligneous	Oy, Pes, Ts, E
48.	<i>Melochia corchorifolia</i> L.	Sterculiaceae	Non-ligneous	E, M
49.	<i>Merremia emerginata</i> Hallier f.	Convolvulaceae	Non-ligneous	M
50.	<i>Merremia. hederacea</i> Hallier f.	Convolvulaceae	Non-ligneous	M
51.	<i>Mitragyna purviflora</i> (Roxb.) Korth	Rubiaceae	Ligneous	C, T
52.	<i>Morinda citrifolia</i> L.	Rubiaceae	Ligneous	M, E
53.	<i>Ocimum americanam</i> L.	Lamiaceae	Non-ligneous	M, C
54.	<i>Phyllanthus niruri</i> L.	Euphorbiaceae	Non-ligneous	M
55.	<i>Physalis minima</i> L.	Solanaceae	Non-ligneous	M
56.	<i>Randia uliginosa</i> DC.	Rubiaceae	Ligneous	F
57.	<i>Ricinus communis</i> L.	Euphorbiaceae	Ligneous	Oy, M
58.	<i>Saccharum munja</i> L.	Poaceae	Non-ligneous	SB, Th
59.	<i>Schleichera trijuga</i> Willd.	Sapindaceae	Ligneous	Oy
60.	<i>Scilla indica</i> Bak.	Liliaceae	Non-ligneous	M
61.	<i>Semecarpus anacardium</i> L.f.	Anacardiaceae	Ligneous	M, E

Table 1. contd.

Sl. No.	Scientific name	Family	Lignification category	Use category
62.	<i>Shorea robusta</i> Gaertn.f.	Dipterocarpaceae	Ligneous	C, T, Pl, Ts
63.	<i>Smilax zeylanica</i> L.	Smilacaceae	Climber	E, M
64.	<i>Strychnos potatorum</i> L.f.	Loganiaceae	Ligneous	M
65.	<i>Syzygium cumini</i> (L.) DC	Myrtaceae	Ligneous	E
66.	<i>Tinospora cordifolia</i> (Willd.) Miers	Menispermaceae	Climber	M
67.	<i>Trewia nudiflora</i> L.	Euphorbiaceae	Ligneous	M, T
68.	<i>Triumfetta rhomboidea</i> Jacq.	Tiliaceae	Ligneous	M
69.	<i>Tylophora indica</i> (Burm.f.) Merrill.	Asclepiadaceae	Climber	M
70.	<i>Vangueria spinosa</i> Roxb.	Rubiaceae	Ligneous	M, F
71.	<i>Vitis reticulatus</i> L.	Vitaceae	Climber	E
72.	<i>Ziziphus oenoplia</i> (L.) Mill.	Rhamnaceae	Ligneous	E,F

**Abbreviations used:** M – medicinal ; E – edible ; F – fuel ; T – timber ; C – cultural; Pl – plate making ; O – ornamental ; Oy – oil yielding ; SB – soil binding ; Th – thatching; Ts – tooth stick ; Pes – pesticidal ; CL – country liquor ; ALP – additive in liquor processing ; Dy – dye yielding.

of use categories of the plant species (Table 2). The first three mostly used categories are medicinal, edible and cultural with 47, 16 and 8 species respectively.

**Table 2.** Analysis of the use potential of plant species

Sl. No.	Use category	Total No. of species used	Commercial prospect
1.	Medicinal	47	+
2.	Tooth stick	3	-
3.	Timber	6	+
4.	Soil binding	6	-
5.	Edible	16	+
6.	Fuel	6	-
7.	Dye yielding	3	+
8.	Ornamental	2	-
9.	Oil yielding	4	+
10.	Cultural	8	-
11.	Country liquor	1	-
12.	Plate making	1	+
13.	Thatching	1	-
14.	Pesticidal	1	+
15.	Additive in liquor processing	1	-

The commercial prospect of many of the medicinal plants and those used as sources of dye, oil and pesticide could be detected which, however, should be used after value addition in a sustainable manner. The nutritive values of wild edible plants also need to be evaluated along with their detrimental effects, if any. Use of leaves of *Shorea robusta* for making plates is noteworthy. Sustainable and profitable uses of non timber forest produce, if promoted and augmented is certain to safeguard the existence of the forest area under study.

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## **CRUSTACEAN BIORESOURCES OF ETHNOMEDICINAL VALUE**

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### **ABSTRACT**

In the present paper, ethnomedicinal values of 36 species of crustaceans collected from available literature are documented for awareness and further biomedical research. These species relate to 22 species of brachyuran crabs, 6 species of prawns, two species of hermit crabs, two species of stomatopods and one species of isopod. These species were collated from various parts of the world including India, Nepal and Brazil, etc. Crabs are mostly used for diseases like whooping cough, bronchitis, pneumonia, asthma, osteoporosis, wounds, boils, womb disorders, tuberculosis, earache, burns and epilepsy, while prawns for anemia, tuberculosis as well as in dental treatment and hermit crabs for earache, urethritis, malaria, stomach pain, jaundice and other liver disorders. In traditional medicine system, animals and animal derived products are mostly used by the tribal communities but these need to be revalidated through biochemical investigation and develop strategies for sustainable exploitation of these natural resources.

### **INTRODUCTION**

Use of biological resources (plants and animals) obtained from nature in the treatment of various ailments and thereby improving health is known to man since ancient time. These resources still continue to play an important role in world health care. According to an estimate, about 80% of rural population of the developing countries depends on traditional medicines for their primary health care needs (WHO, 2002).

Animal based medicines are in use to cure human diseases since antiquity. One of the earliest records of animal based medicine can be found in Tobias' Book (Catholic Bible) in which Raphael, the Angel prescribed the use of fish's live content for the treatment of ophthalmic problems. In ancient Indian literature, there are mentions of 380 types of animal substances in Charaka Samhita, the oldest available Ayurvedic classic. Mahawar and Jaroli (2007) reported 109 animal species and their 270 uses in traditional medicine from different parts of India. More than 500 species of insects, mites and spiders are used as medicine in the treatment of both common and complicated diseases in Chhattishgarh, India (Oudhia, 1995) while 25 species of insects, 14 species of spiders, 3 species of crustaceans, 5 species of fishes, 6 species of reptiles, 7 species of birds and 6 species of mammals have been reported to be used by the tribals of

Sundarbans (Mazumder and Dey, 2005, 2007). Joseph (1988, 1990) made valuable contribution from Madhya Pradesh on ethnozoological aspects.

So far as ethnomedicinal use of crustaceans are concerned, some sporadic information is available in different publications of a very few authors (Costa-Neto and Marques, 1995; Alves and Alves, 2011; Lawal and Banjo, 2007; Mahawar and Jaroli, 2007; Mazumder and Dey, 2007; Jamir and Lal, 2005; Padmanabhan and Sujana, 2008 and Lohani, 2011). This paucity of information has necessitated to undertake this work. In the present paper, ethnomedicinal values of 36 species of crustaceans collected from available literature is documented for awareness and for further biomedical research.

## RESULT

Perusal of literature reveals that the following 36 species of crustaceans belonging to three orders, *viz.*, Stomatopoda, Isopoda and Decapoda are used to cure various human diseases man (Table 1-3). Ethnomedical documentation of these crustacean species is based on their medicinal use in various parts of the world including India, Nepal, Bangladesh and Brazil. Concerned scientific references on these use of each species is shown in Table 1. These crustacean species belong to six broad group as shown in Table 2. Disease-wise list of these crustaceans has been presented in Table 3 which includes 53 diseases.

Crabs are mostly used for diseases like whooping cough, bronchitis, pneumonia, asthma, osteoporosis, wounds, boils, womb disorders, tuberculosis, earache, burns and

**Table 1.** List of crustacean species and their traditional ethnomedicinal therapeutic uses

Sl. No.	English/Local name	Zoological name	Family	Therapeutic uses	References
<b>Brachyura</b>					
1.	Ocellate box crab	<i>Calappa ocellata</i> Holthuis, 1958	Calappidae	Asthma, Osteoporosis	Alves & Alves (2011)
2.	Freshwater crab	<i>Barytelphusa lugubris</i> (Wood-Mason, 1871)	Gecarcinucidae	Increase of memory power	Lohani (2011)
3.	Freshwater crab	<i>Himalayapotamon atkinsonianum</i> (Wood-Mason, 1871)	Potamidae	Enuresis, Gastritis, soup believed to increase memory power	Lohani (2011)
4.	Freshwater crab	<i>Sartoriana spinigera</i> (Wood-Mason, 1871)	Gecarcinucidae	Anemia, Vitamin deficiencies, Asthma, Cancer	Rahaman <i>et al.</i> (2008); Besra <i>et al.</i> (2009)
5.	Freshwater crab	<i>Spiralothelphusa hydrodroma</i>	Gecarcinucidae	Cold, Baldness	Chopra (1935); Moses (1924)
6.	Blue Land Crab	<i>Cardisoma guanhumi</i> Latreille, 1825	Gecarcinidae	Asthma, Bronchitis, wounds, boils	Costa-Neto & Marques (2000); Alves & Alves (2011)

Crustacean bioresources of ethnomedicinal value....

Table 1. contd.

Sl. No.	English/Local name	Zoological name	Family	Therapeutic	References
7.	Mangrove Root Crab/ "aratu do mangue"	<i>Goniopsis cruentata</i> (Latreille, 1802)	Grapsidae	Epilepsy, Veneral disease	Alves & Rosa (2005); Alves & Alves (2011)
8.	Tidal Spring Crab	<i>Plagusia depressa</i> (Fabricius, 1775)	Plagusiidae	Epilepsy	Alves & Alves (2011)
9.	Ghost Crab "Maria farinha"	<i>Ocypode quadrata</i> (Fabricius, 1787)	Ocypodidae	Asthma, Haemorrhage in women	Costa-Neto & Marques (2005); Alves & Rosa (2005); Alves & Alves (2011)
10.	Ghost crab "Pal Nandu"	<i>Ocypode platytarsis</i>	Ocypodidae	Pneumonia, Postnatal nutrition for women, Diarrhea, Dysentery	Moses (1924); Kariathil <i>et al.</i> (2010)
11.	Fiddler crab/ "maracoanii"	<i>Uca maracoani</i>	Ocypodidae	Asthma, Whooping cough	Alves & Rosa (2005); Alves & Alves (2011)
12.	Fiddler crab "Othaikalnandu"	<i>Uca annulipes</i>	Ocypodidae	Earache	Moses (1924)
13.	Ball crab	<i>Dotilla</i> spp.	Dotillidae	Nervous debility and other weakness	Moses (1924)
14.	Pea crab	<i>Pinnotheres</i> spp.	Pinnotheridae	Nervous debility and other weakness	Moses (1924)
15.	Swamp Land Crab	<i>Ucides cordatus</i> (Linnaeus, 1763)	Ucididae	Asthma, Bronchitis, Cough, Tuberculosis, Osteoporosis, Arthrosis, Haemorrhage in women, Incontinence urinary	Costa-Neto & Marques (2000); Alves & Rosa (2005); Alves & Alves (2011)
16.	Coral Clinging Crab	<i>Mithrax hispidus</i> (Herbst, 1790)	Majidae	Burns	Alves & Alves (2011)
17.	Bocourt Swimming Crab	<i>Callinectes bocourti</i> A. Milne Edwards, 1879	Portunidae	Unspecified	Alves & Alves (2011)
18.	Rugose Swimming Crab	<i>Callinectes exasperatus</i> (Gerstaecker, 1856)	Portunidae	Unspecified	Alves & Alves (2011)

Table 1. contd.

Sl. No.	English/Local name	Zoological name	Family	Therapeutic	References
19.	Mud crab	<i>Scylla serrata</i> (Forskål, 1775)	Portunidae	Pulmonary tuberculosis, Bronchitis, Asthma, Rheumatism, Dropsy, Body Swelling, Stomatitis, Abdominal pain, Boils, Burns, Ulcer, Wound, Gynecological problem, Epilepsy, Uterine hemorrhage and haemoptysis, Insomnia, Ophthalmia and copious lachrymation, Measles, Convulsion, Rickets, Urticaria, Convulsion, Bone fracture, Dysentery, Malaria, Typhoid	Mazumder & Dey (2007)
20.	Swimming crab	<i>Portunus</i> sp.	Portunidae	Dysentery, Malaria, Typhoid	Chopra (1924)
21.	Mangrove Crab	<i>Aratus pisoni</i> H. Milne Edwards, 1837	Sesarmidae	Epilepsy	Alves & Rosa (2005); Alves & Alves (2011)
22.	Brown crab	<i>Cancer pagurus</i> Linnaeus, 1758	Cancridae	Urethrus, Malaria, Cough, Earache, Stomach pain	Kakati & Doulo (2002)
23.	Jelly fish crab "Caranguejo-da-água-viva"	?	?	Asthma	Costa-Neto & Marques (2000)
<b>Dendrobranchiata</b>					
24.	"Bagda"	<i>Penaeus (Penaeus) monodon</i> (Fabricius, 1798)	Penaeidae	Cold, Cough, Genito-urinary disorder, Dandruff, Renal diseases, Typanitis, Diabetes Mellitus, Contraceptive, Body weakness, Birth control of mother having recent delivery	Mazumder & Dey (2007)
25.	Atlantic seabob	<i>Xiphopenaeus kroyeri</i> (Heller)	Penaeidae	Irritation when milk teeth are erupting, Skin spots	Alves & Alves (2011)

Crustacean bioresources of ethnomedicinal value...

Table 1. contd.

Sl. No.	English/Local name	Zoological name	Family	Therapeutic	References
26.	Southern white shrimp	<i>Xiphopenaeus schmitti</i> = <i>Litopenaeus schmitti</i> Burkenroad	Penaeidae	Irritation when milk teeth are erupting, Skin spots	Alves & Rosa (2005); Alves & Alves (2011)
<b>Pleocyemata</b>					
27.	Jhinga Machchi	<i>Macrobrachium malcomsonii</i> (H. Mlne Edwards, 1844)	Palaemonidae	Tuberculosis	Mahawar & Jaroli (2007)
28.	Prawn	<i>Macrobrachium rosenbergii</i> (De Man, 1879)	Palaemonidae	Lumbago, Rheumatism, Allergy, Hay Fever, Leucorrhoea, Spermatorrhoea, Menorrhagia, Bone fracture	Mazumder & Dey (2007)
29.	Big claw river shrimp/Paintal river prawn	<i>Macrobrachium carcinus</i> (Linnaeus, 1758)	Palaemonidae	Amnesia	Alves & Alves (2011)
30.	Cinnamon river shrimp	<i>Macrobrachium acanthurus</i> (Wiegmann, 1836)	Palaemonidae	Irritation when milk teeth are erupting	Alves & Rosa (2005); Alves & Alves (2011)
31.	Freshwater shrimp/ Camarão de água doce	<i>Macrobrachium Borelli</i>	Palaemonidae	Irritation when milk teeth are erupting	Alves & Rosa (2005); Alves & Alves (2011)
<b>Anomura</b>					
32.	Puerto Rican sand crab	<i>Emerita portoricensis</i> Schmitt, 1935	Hippidae	Earache	Alves & Alves (2011)
33.	Hermit crab "Caranguejo-emitaio"	?	?	Women's hemorrhage	Costa-Neto & Marques (2000)
<b>Stomatopoda</b>					
34.	Crayfish "Ede"	<i>Chloridopsis dubia</i>	Pseudosquillidae	Asthma, Skin disease and blood diseases in humans	Lawal & Banjo (2007); Alves & Alves (2011)
35.	Mantis shrimp "Siriboia", "Tamburutaca"	<i>Squilla</i> sp.	Squillidae	—	—
<b>Isopoda</b>					
36.	Pillbug	<i>Armadillium vulgare</i> Latreille, 1804	Armadilliidae	Asthma	Alves & Alves (2011)

**Table 2.** Group-wise distribution of crustacean species of ethnomedicinal value

Group	No. of family	No. of species
Stomatopoda	1	2
Isopoda	1	1
Dendrobranchiata	1	3
Pleocyemata	1	5
Anomura	2	2
Brachyura	11	23
Total	17	36

**Table 3.** Disease-wise-list of crustacean species used in traditional medicine system

Sl. No. disease	Crustacean species
<b>Brachyura</b>	
1. Cold	<i>Spiralothelphusa hydrodroma</i> , <i>Penaeus (Penaeus) monodon</i>
2. Cough	<i>Ucides cordatus</i> , <i>Cancer pagurus</i> , <i>Penaeus (Penaeus) monodon</i>
3. Whooping cough	<i>Uca maracoani</i>
4. Bronchitis	<i>Scylla serrata</i> , <i>Cardisoma guanhumi</i> , <i>Ucides cordatus</i>
5. Pneumonia	<i>Ocypode platytarsis</i>
6. Asthma	<i>Calappa ocellata</i> , <i>Scylla serrata</i> , <i>Uca maracoani</i> , <i>Ocypode quadrata</i> , <i>Ucides cordatus</i> , <i>Cardisoma guanhumi</i> , <i>Chloridopsis dubia</i> , <i>Armadilium vulgare</i>
7. Osteoporosis	<i>Calappa ocellata</i> , <i>Ucides cordatus</i>
8. Epilepsy	<i>Scylla serrata</i> , <i>Goniopsis cruentata</i> , <i>Plagusia depressa</i> , <i>Aratus pisoni</i>
9. Venereal disease	<i>Goniopsis cruentata</i>
10. Malaria	<i>Scylla serrata</i> , <i>Cancer pagurus</i>
12. Enuresis	<i>Himalayapotamon atkinsonianum</i>
13. Tuberculosis	<i>Scylla serrata</i> , <i>Ucides cordatus</i> , <i>Macrobrachium malcomsonii</i>
14. Stomach pain	<i>Cancer pagurus</i>
15. Urethrus	<i>Cancer pagurus</i>
16. Baldness	<i>Spiralothelphusa hydrodroma</i>
17. Dental disease	<i>Macrobrachium acanthurus</i> , <i>Macrobrachium borelli</i> , <i>Xiphopenaeus kroyeri</i> , <i>Xiphopenaeus schitti</i>
18. Wounds	<i>Cardisoma guanhumi</i>
19. Boils	<i>Scylla serrata</i> , <i>Cardisoma guanhumi</i>
20. Gastritis	<i>Himalayapotamon atkinsonianum</i>
21. Increase of memory power	<i>Barytelphusa lugubris</i> , <i>Himalayapotamon atkinsonianum</i>
22. Nervous disease	<i>Dotilla sp.</i> , <i>Pinnotheres sp.</i>
23. Arthrosis	<i>Ucides cordatus</i>
24. Amnesia	<i>Sartoriana spinigera</i> , <i>Macrobrachium carcinus</i>
25. Womb disorder	<i>Ucides cordatus</i>
26. Burns	<i>Scylla serrata</i> , <i>Mithrax hispidus</i>
27. Women's hemorrhage	<i>Ocypode quadrata</i> , <i>Ucides cordatus</i>
28. Skin disease	<i>Chloridopsis dubia</i>

Table 3. contd.

Sl. No. disease	Crustacean species
29. Diarrhoea	<i>Ocypode platytarsis</i>
30. Dysentery	<i>Ocypode platytarsis, Scylla serrata, Portunus sp.</i>
31. Typhoid	<i>Scylla serrata, Portunus sp.</i>
32. Lumbago	<i>Macrobrachium rosenbergii</i>
33. Rheumatism	<i>Scylla serrata, Macrobrachium rosenbergii</i>
34. Rickets	<i>Scylla serrata</i>
35. Measles	<i>Scylla serrata</i>
36. Insomania	<i>Scylla serrata</i>
37. Convulsion	<i>Scylla serrata</i>
38. Ophthalmia and Copius lachrymation	<i>Scylla serrata</i>
39. Bone fracture	<i>Scylla serrata, Macrobrachium rosenbergii</i>
40. Dropsy	<i>Scylla serrata</i>
41. Allergy	<i>Macrobrachium rosenbergii</i>
42. Hay fever	<i>Macrobrachium rosenbergii</i>
43. Leucorrhoea	<i>Macrobrachium rosenbergii</i>
44. Spermatorrhoea	<i>Macrobrachium rosenbergii</i>
45. Menorrhagia	<i>Macrobrachium rosenbergii</i>
46. Diabetes mellitus	<i>Penaeus (Penaeus) monodon</i>
47. Utricularia	<i>Scylla serrata</i>
48. Dandruff	<i>Penaeus (Penaeus) monodon</i>
49. Contraceptive	<i>Penaeus (Penaeus) monodon</i>
50. Renal diseases	<i>Penaeus (Penaeus) monodon</i>
51. Genito-urinary disorder	<i>Penaeus (Penaeus) monodon</i>
52. Skin spots	<i>Litopenaeus schmitti, Xiphopenaeus kroyeri</i>
53. Skin disease	<i>Chloridopsis dubia</i>

epilepsy, while prawns for anemia, tuberculosis, and dental treatment and hermit crabs for earache, urethritis, malaria, stomach pain, jaundice and other liver disorders. In India, crab meat is believed to have medicinal value. In the Ayurvedic system of medicine, crab curries are prescribed in cases of fevers. Chopra (1935) mentioned about the use of crab curry as a cure for asthma in Bombay region and South India. Reddy (1936) also referred to the medicinal uses of crab meat in South India for the cure of asthma, chronic fevers and several other ailments. Soup made from the crab, *Paratelphusa* is believed to cure cold. Similarly, soup made from crabs of the genera *Scylla*. and *Portunus* are commonly used in India after recovery from malaria which is supposed to act as a tonic. Paniyans of Malabar and Wynad districts eat land crabs in plenty to get rid of baldness and to prevent the hair from turning grey. Pliny recommended river crabs to be cut into pieces and to drink as antidote to any poison (Moses, 1924).

Extracts of discarded crustacean shells, namely, crabs, shrimps and lobsters contains biopolymer substances, such as, chitin, chitosan and glucosamine. These are used to

combat cholesterol and obesity, regenerate cartilage and burnt tissues (Nagueira, 1999) and in the fabrication of contact lenses (Goodman, 1989). Chitin is also used as anticoagulant. Powdered crab shells in infusions are reported to have anti-asthmatic property (Lages-Filhol, 1934). The pharmacological investigation of crabs has shown the presence of anti-inflammatory, antibacterial and anti-tumor substances in their bodies (Croft, 1985).

### **DISCUSSION**

Medicinal uses of animals vary much from place to place and country to country. Studies conducted by Alves and Alves (2011) revealed that 584 animals in 13 taxonomic categories (Cnidaria, Mollusca (Gastropoda and Bivalvia), Arthropodea (Crustacea, Insecta and Arachnida), Echinodermata, Pisces, Amphibia, Aves, Reptilia, Mammalia, Annelida) belonging to 215 families are in use in Brazilian traditional medicine. In Traditional Chinese Medicine (TCM), more than 1500 animal species are recorded to have medicinal use. In India, about 15-20% of the Ayurvedic medicine is based on animal derived substances (Unnikrishnan, 1998). Even in the unnnani system of medicines, nearly 200 drugs of animal origin are used in the treatment of various diseases.

The problem with the drugs of animal origin is that the active ingredient is either not tested as yet or insufficiently clarified in most of the cases. The drugs of animal origin have been prescribed either from ancient medical texts or from formulas handed down from generation to generation within a family, a tribe or an ethnic group since it is considered as the trade secret of traditionalists and traders, etc.

The importance of animal-based medicine can not be ignored in the light of recent researches. Currently, a number of pharmaceutical companies have come forward, showing keen interest and supporting various research programmes on marine animal-derived compounds for use in medicine directly and as new chemical structures which could be turned into remedies.

### **CONCLUDING REMARKS**

A good number of crustaceans species of ethnomedicinal importance have been occurring elsewhere but their allied species though occur in India are not properly inventorised so far and thoroughly studied for their efficacy against diseases, if any.

In the Traditional medicine system, animals and animal derived products are mostly used by the tribal communities. But efficacy of such use of these species and their parts requires revalidation through biochemical/biomedical investigation. Furthermore, strategies for sustainable exploitation of these natural resources also need to be developed for future purposes which in turn will create avenue for a reliable source of medicine, food, income and other benefits.

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## **ENTHNO-MEDICINAL USAGE OF ANIMALS AS DRUGS AMONG THE TRIBALS OF SUNDARBAN, WEST BENGAL, INDIA**

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### **ABSTRACT**

The study area in Sundarban includes only the inhabited zone under two districts, *viz.*, North and South 24- Parganas, West Bengal, India. Mainly three types of tribal population live in the inhabited zone of Sundarban, namely, Munda, Oraon and Santhal. Surveys were carried out mainly in these inhabited areas to collect the data of ethno medicinal uses of animals by these tribal peoples. Ethno medicinal studies found that about 70 species of animals are used as medicine by the tribal people. These animals include 16 species of arachnids (14 spiders and 2 scorpions), 25 insects (Hymenoptera 10, Coleoptera 6, Hemiptera 4, Orthoptera 1, Diptera 2, Odonata 1, Anopleura 1), 4 Crustacea, 5 fishes, reptiles 7; birds 7 and mammals 6. It was observed that sometime only one species used as medicine; or more than one species mixed together and uses as medicine; or a number of species mixed with some medicinal plants and other substances and used as medicine.

It was observed that in some cases only the animal part was used as medicine whereas in other cases the animal part used with medicinal plant and their products as medicine.

It was also observed that drug prepared from one species used as successful remedy of one disease or in some cases more than one disease. It was also noted that Rheumatism and heart troubles treated successfully with poisonous animal species.

**Key words :** *Ethnomedical uses animals, Sundarban.*

### **INTRODUCTION**

Sundarban is comprised of a group of islands covering the area from the mouth of river Hooghly on the west and extends up to the river Meghna in the east lying between 21.31'- 22.30' North latitude and 87.51'- 89.30' east longitudes occupying an area of 16706 sq. km. of which 7529 sq. km, is within the Indian jurisdiction. The study area in Sundarban includes only the inhabited zone under two districts North and South 24-Parganas, West Bengal, India. Mainly three types of tribal population live in the inhabited zone of Sundarban, namely, Munda, Oraon and Santhal. Altogether approximately 81,000 tribal populations inhabited in the Sundarban inhabited zones. The survey was carried out mainly in these inhabited areas to collect the data on ethno medicinal uses of animals

by these tribal peoples. No consolidated work has been available yet on ethno medicinal uses of animals excepting some fragmentary contributions dealing with the medicinal arachnids and insect with some ethnomedicinal notes outside of Indian territory.

In this context the present paper deals with medicinal importance of 70 species of animals and their uses as drug by the tribal of Sundarban.

### MATERIAL AND METHOD

Surveys were undertaken in different tribal areas of Sundarban in different times. Information was collected from all these tribal peoples in data sheets containing information of the animals used for medicine, collected areas, method of preparation of medicine and the uses and the symptoms and remedies of diseases at different times. The similar information was also collected from the local B.D.O. office and nearby health centers and compared.

The medicinal information was generally collected from Baidyaraj or Hakim of a particular area who are very knowledgeable on medicinal use of animals and sometimes apply animal based medicines to cure various diseases of the local people. All the medicinal applications were generally collected from the Ethnomedicinal man of the tribal people.

### OBSERVATION, RESULTS AND DISCUSSION

During the ethnomedicinal studies it has been found that altogether 491 medicinal applications of 70 species of animals are commonly made by the tribal people of Sundarbans. Out of these, 16 species were arachnids (14 species of spider and 2 species of scorpion), 25 insects (Coleoptera 6, Hymenoptera 10, Hemiptera 4, Orthoptera 1, Diptera 2, Odonata 1, Anopleura 1 ), 4 Crustacea, 5 fishes, 7 reptiles, 6 birds and 5 mammals (Table 1). Data were collected from 3 tribes of Sundarbans, viz., Munda, Oraon and Santhal belonging to two districts of West Bengal, India.

**Table 1:** Showing the vernacular and scientific names of animals and their number of medicinal applications.

Sl. No.	Common Name	Scientific Name	No of medicinal applications	Applies for no of diseases
1.	Spider	<i>Argiope pulchella</i> Thorell	04	05
2.	Spider	<i>Nephila maculata</i> (Fabricus)	04	04
3.	Spider	<i>Neoscona mukerjei</i> Tikader	04	04
4.	Spider	<i>Cyrtophora cleatrosa</i> (Stoliczka)	04	04
5.	Spider	<i>Cheiracanthium malanostoma</i> Thorell	04	04
6.	Spider	<i>Cheiracanthium himalayensis</i> Gravely	04	05
7.	Spider	<i>Pardosa birmanica</i> Simon	04	05
8.	Spider	<i>Lycosa choudhuryi</i> Tolader	04	04
9.	Spider	<i>Heteropoda venatoria</i> (Linnaeus)	04	04
10.	Spider	<i>Sparriolenus tigris</i> Simon	05	04

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Sl. No.	CommonName	Scientific Name	No of medicinal applications	Applies for no of diseases
11.	Spider	<i>Phidippus bengalensis</i> Tikader	04	06
12.	Spider	<i>Marpissa bengalensis</i> Tikader	04	09
13.	Spider	<i>Crossoprhiza lyoni</i> (Blackwall)	04	05
14.	Spider	<i>Artema atlenta</i> Walekenaer	04	04
15.	Scorpion	<i>Heterometrus (H.) bengalensis</i> (Koch)	03	03
16.	Scorpion	<i>H. (Srilankametrus) servatus</i> (Pocock)	03	04
17.	Coleoptera	<i>Coccinella transversalis</i> Fabricus	04	04
18.	Coleoptera	<i>Harmonia arcuata</i> Fabricus	04	06
19.	Coleoptera	<i>Microaspis discolor</i> (Fabricus)	04	04
20.	Coleoptera	<i>Mylabris phalerata</i> (Pallas)	04	05
21.	Coleoptera	<i>Mylabris pustulata</i> (Thumberg)	05	05
22.	Coleoptera	<i>Luciola sp.</i>	03	06
23.	Hymenoptera	<i>Ocecophylla smaragdina</i> (Fabricus)	04	05
24.	Hymenoptera	<i>Tetraponera rufonigra</i> (Jerdon)	04	07
25.	Hymenoptera	<i>Camponatus compressus</i> (Fabricus)	04	05
26.	Hymenoptera	<i>Solenopsis geminate</i> (Smith)	04	06
27.	Hymenoptera	<i>Vespa (Vespa) basalis</i> (Smith)	04	04
28.	Hymenoptera	<i>Vespa (V.) bicolor</i> Fabricus	04	07
29.	Hymenoptera	<i>Vespa (V.) orientalis</i> Linnaeus	04	09
30.	Hymenoptera	<i>Vespa (V.) tropica tropica</i> (Linnaeus)	04	05
31.	Hymenoptera	<i>Apis indica</i> Fabricus	05	10
32.	Hymenoptera	<i>Apis drosata</i> Fabricus	05	07
33.	Hemiptera	<i>Chrysocoris perpureus</i> (Westwood)	04	05
34.	Hemiptera	<i>Cimes talectulaia</i> Linnaeus	04	07
35.	Hemiptera	<i>C. macrocephalus</i> Fabricus	03	06
36.	Hemiptera	<i>Clovia punctata</i> Fabricus	04	04
37.	Diptera	<i>Lucilia cuprina</i> Wiedemann	04	07
38.	Diptera	<i>Chrysomya megacephala</i> (Fabricus)	04	07
39.	Odonata	<i>Ceriagrion coromandelanum</i> (Fabricus)	04	04
40.	Anopleura	<i>Pediculus humanus capitis</i>	03	06
41.	Orthoptera	<i>Blata orientalis</i> Linnaeus	04	04
42.	Prawn	<i>Macrobrachium rosenbergii</i> (De Man)	07	08
43.	Bagda	<i>Penaeus monodon</i> Fabricus	06	06
44.	Mud Crab	<i>Scylla serrata</i> (Forskol)	20	17
45.	King Crab	<i>Carcinocorpius rotundicoda</i> ( Latreille)	05	05
46.	Shark	<i>Scoliodon sorrakowah</i> (Cuvier)	06	06
47.	Rohu	<i>Labeo rohita</i> (Hamilton)	04	04

Sl. No.	Common Name	Scientific Name	No of medicinal applications	Applies for no of diseases
48.	Singhi	<i>Heteropneustes fossilis</i> (Bloch)	04	03
49.	Magur	<i>Clarias batrachus</i> (Linnaeus)	05	04
50.	Anabus	<i>Anabas testudineus</i> (Bloch)	03	03
51.	Lizzard	<i>Calotes versicolor</i> Daduin	10	10
52.	Common Indian Monitor	<i>Varanus bengalensis</i> (Daubin)	27	26
53.	Indian water Monitor	<i>Varanus solvator</i> (Laurenti)	11	10
54.	Non poisonous snakes	<i>Xenochrophis piscator</i> (Schneider)	04	04
55.	Common smooth water snakes	<i>Endydris enhydris</i> (Schneider)	05	05
56.	Estuarine Crocodile	<i>Crocodylus porosus</i> (Schneider)	05	04
57.	Indian soft shell Turtle	<i>Aspideretes gangeticus</i> Cuvier	18	17
58.	Crane	<i>Bubulcas ibis coromandus</i> (Boddaert)	18	18
59.	Pariah kite/ Cheel	<i>Milvus migrans govinda</i> Sykes	08	08
60.	Hen/Murghi	<i>Gallus gallus</i> (Linnaeus)	29	27
61.	Pigeon/Payara	<i>Columbia livida intermedia</i> Strickland	18	18
62.	Common Maina/ Salik	<i>Acridotheres tristis tristis</i> (Linnaeus)	05	05
63.	Indian house Crow	<i>Corvus splendens splendens</i> Viellot	10	10
64.	Jungle Crow/ Bankuya	<i>Corvus macrorhynchos leuillanti</i> Lesson	21	20
65.	Bat/Badur	<i>Pteopus giganteus giganteus</i> (Bruennich)	10	09
66.	Tiger / Bagh	<i>Panthera tigris tigris</i> (Linnaeus)	09	08
67.	Wildbore / Buno Suor	<i>Sus scrofa cristatus</i> Wagner	10	10
68.	Spotted Deer	<i>Axis axis axis</i> (Erleben)	10	09
69.	Cow	<i>Bos gaurus</i> Smith	20	15
70.	Goat	<i>Carpa</i> sp.	22	18

**Source :** Majumder and Dey, 2005, 2007; Majumder and Mridha, 2004.

Among these 491 medicinal applications, 63 medicinal applications were made from arachnids (57 from spider and 6 from scorpion), 100 from insects, 38 from crustaceans, 22 from fishes, 80 from reptiles, 107 from birds and 81 from mammals (Table 2). Some of these were applied locally and some of them orally for the cure of diseases. Among the medicinal applications of spiders local applications are generally made for the cure of

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toothache, rheumatism, recurring gout, urticaria, allergy, paralysis of limbs, skin eruption, Ring worm, carbuncles and numbness of hands. The oral applications of spiders are made for the cure of Hydrophobia, nerve debility, Gastritis and loss of appetite, asthma, dyspepsia, constipation, renal calculi, dysuria, hiccough, haemoptysis, dysentery, retention of urine, impotency, ulcerative colitis, dysmenorrhoea, emphysema, burns, night blindness, obesity, gall stone and nasal obstruction. Local medicinal applications of scorpions helped for the cure of insect and snake bites, paralysis, rheumatism, sciatica. The oral applications helped for the cure of burning mixturation, cardiac troubles (Angina pectoris and Myocardial infection) treated successfully.

**Table 2:** Showing animal groups, number of species, used for number of diseases and the number of medical applications among the tribal of Sunderbans.

Group of Animals		Number of species	Applied for diseases	Number of medicinal applications
Arachnids- 16	Spider	14	37	57
	Scorpion	02	06	06
Insects-25	Hymenoptera	10	33	42
	Coleoptera	06	22	24
	Hemiptera	04	14	15
	Diptera	02	9	8
	Orthoptera	01	4	4
	Odonata	01	4	4
	Anopleura	01	4	3
	Crustacea		04	28
Fishes		05	18	22
Reptiles		07	38	80
Birds		07	42	107
Mammals		06	51	81
Total		70	-	491

**Source :** Majumder and Dey, 2005, 2007; Majumder and Mridha, 2004.

Among the medicinal applications of insects, local applications are used for the cure of boils, carbuncles, epilepsy, foul ulcer, hysteria, insect bite, insanity, tuberculosis, newly cutting wound, numbness of hands, oedema, painful bleeding piles, paralysis of different parts of the body and sciatica. The oral applications are made for the cure of acrid leucorrhoea, cardiac troubles (Angina Pectoris and Myocardial infection), constipation, diarrhoea, eczema, eye troubles, headache, whooping cough, night blindness, ophthalmia, pruritus vulva, renal calculi, ringworm, suppression of urine, and tuberculosis.

Among the medicinal applications of crustacea, local applications used for the cure of bone fractures, boils, burns, convulsion, dandruff, haemorrhoids, measles, typanitis, ulcers, wounds, and urticaria, whereas the oral applications are made for the cure of allergy and hay fever, bronchitis, contraceptives, epileptic fit, genio-urinary disorder,

haemoptysis, Insomnia, Intestinal colic, leucorrhoea, menorrhagia, pulmonary tuberculosis, spermatorrhoea, spondylosis, stomatitis and abdominal pain.

Among the medicinal applications of fishes, the oral applications for the cure of allergic skin diseases, anaemia, bacillary dysentery, bronchitis, fever, haemorrhage, intestinal colic, insomnia, pneumonia, renal colic, sterility of males and typanitis. The local applications are for cure of bronchial spam, burns, carbuncles, cervical spondylitis, conjunctivitis, corns, insect bites, leprosy, otorrhoea, syphilis, ulcers and warts on palm.

Among the medicinal applications of reptiles the oral applications are made for the cure of cough and cold, constipation, enlargement of liver and spleen, epistaxis, eczema, filaria, impotency, kala-azar, oedema, renal calculi, sterility of female, tuberculosis, vertigo. The local applications are made for cure of asthma, boils, bleeding of piles, carbuncles, dandruff, eczema, epileptic fit, erysipelas, eye infection, general weakness, haemorrhage and Sepsis, hysteria, iritis, ichthyosis, leucoderma, lumbago, obesity, oedema, ophthalmia, osteo-arthritis, paralysis, pemphigus, poisoning ulcers, polio, psoriasis, rachitis, rheumatism, ringworm, sciatica, scabies, sexual weakness, tuberculosis, urticaria.

Among the medicinal applications of birds the oral applications are made for the cure of abdominal colic, allergy, asthma, cough, chicken pox, constipation, dyspepsia, gastric ulcer, general weakness, granular conjunctivitis, hay fever, headache, hypochondriasis, loss of appetite, measles, mastitis, pneumonia, tape worm infection, tuberculosis, urino-genital disorder, urticaria, vomiting. The local applications are made for cure of acne-rosacea, alopecia, boils, breast tumors, ophthalmia, carbuncles, deafness, drowsiness, eczema, elephantiasis, enuresis, epididymitis, gangrenous ulcer, haemorrhoids, hemicrania, hydrocele, hypertrophy of liver, leprosy, leucorrhoea, lupus, mastitis, migraine, muscular pain, oedema, ophthalmia, otorrhoea, paralysis, pharyngitis, poisonous insect bites, pruritus vulva, psoriasis, rheumatism, rheumatoid-arthritis, sciatica, syphilitic ulcer, tonsillitis, uvulitis, warts, wounds.

Among the medicinal applications of mammals the oral applications are made for the cure of abortion, anaemia, asthma, birth control, bronchitis, burns, chronic gleet, diabetes mellius, dysentery, dyspnoea, endocarditis, epistaxis, enlargement of gall bladder and spleen, gall stone, haemoptysis, headache, hepatitis B, high blood pressure, hydrophobia, hypochondriasis, impotency, intermittent fever, Jaundice, myocarditis, night blindness, rheumatic pain, rickets, renal stone, to prevent pregnancy, tuberculosis. The local applications are made for cure of alopecia, anal fistula, bleeding of piles, bronchial asthma, bedsore, birth control, boils, bone fracture, breast tumors, carbuncles, chicken pox, chronic Ulcers, conjunctivitis, dermatitis, dysentery, dyspnoea, enlargement of gall bladder and spleen, epileptic fit, gout, haemoptysis, impotency, intermittent fever, leprosy, leucoderma, paralysis of limbs, pharyngitis, psoriasis, rachitis, ringworm, rheumatism, synovitis, urticaria, wart.

The diseases like asthma, bronchitis, dropsy, haemorrhoids, rheumatism, urticaria have been treated by medicines prepared from all the groups of animals. Alopecia, boils, epilepsy, insect bites, leprosy, ringworm are treated by the medicines prepared from fishes, reptiles, birds and mammals. Diseases like carbuncles, chicken pox, epistaxis,

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haemoptysis, otorrhoea, ophthalmia, psoriasis, sciatica have been cured by the medicines prepared from reptiles, birds and mammals. The disease like anal fistula, bone fracture, breast tumors, chronic fever, gall stone, impotency, leucorrhoea, leucoderma, mastitis, obesity are treated by the medicines prepared from birds and mammals.

It was observed that the drug prepared from one animal species was used successfully for the remedy of one disease and in other cases it was used for more than one disease. It was also observed that Rheumatism and heart troubles were treated successfully with poisonous animal species.

It was also observed that in some cases only the animal part was used as medicine whereas in other cases the animal part along with medicinal plant was used as medicine. It was also observed that sometimes only one species and sometime more than one species mixed together and used as medicine. In some cases a number of species mixed with some medicinal plants and other substances were used as medicine.

Ferrington (1834) made taxonomic and ethnomedicinal studies of 10 species of spiders, 2 species of Hymenoptera, 1 species of Coleoptera and 1 species of Hemiptera, 4 species of Crustacea, 2 species of fishes, 3 species of reptiles, 1 species of bird and 2 species of mammal and recorded their uses among the people of rural areas of America. He established the uses of these species in the homoeopathic system of medicine. Now a days these drugs have been established in the homoeopathic system of Indian Pharmacopia and still used as glorious drug in the modern society. Bingham (1903) reported that in the rural areas of Europe neuralgic or nerve debility were treated by biting up of some bees and wasp (Hymenoptera). Savoray (1935) stated that in rural areas of Europe and America various types of pulmonary troubles are treated by injecting scorpion's blood. Gertch (1945) reported Gout and Rheumatism were also treated by rubbing up theridiid spiders in some areas of Europe and America and silk of certain spiders (*Aranea diadema*, Family Araneidae) was used to stop the blood of cutting wound. Ioyrish (1974) reported that gastric ulcer and various types of wounds were also treated by honeybee's product (Hymenoptra) in some areas of Soviet Russia. Newlands and Akinson (1988) worked on some spider venom from South Africa.

Tikadar (1968, 1987) made taxonomic studies on some mygalomorph spiders which posses venom and reported some phidippus spiders posses lethal venom. But this venom is not harmful to human being. Majumder (1987) reported 12 species of arachnids which are used as drug in the homoeopathic system of medicine. Joseph (1988) reported some ethnomedicinal studies on crustacean, reptiles, birds and mammals from Orissa and Madhya Pradesh. Joseph(1990) made an extensive ethnomedicinal observations on reptiles and birds from Madhya Pradesh. Majumder and Mridha (2004) reported two medicinal spiders and their usage as drugs among the tribal inhabited zone of Sundarban, West Bengal. Majumder and Dey (2005, 2007) made an extensive study on ethnomedicinal uses of animals by the tribal people of Sundarban.

From the above account it is found that the traditional animal- drugs are much more relevant today than earlier because the great majority of the people in developing countries cannot afford allopathic treatment, especially in complicated and serious cases, owing to the prohibitive cost. Ethnomedicinal system has also an added advantage when

compared to the allopathic system as its efficacy has been tested through generations and these medicines have practically, no side effects.

To get the maximum advantage of animal based traditional drugs and their medical applications a few training and research centers are required to be established. Once this is achieved and proper talent is attracted, the system will establish itself. The prime handicap of these work is the scarcity of required animal species. Moreover once the efficacy of the medicine is proved, the animals would be rare because of their rampant use. But the advantage of such studies is that unlike the allopathic doctors, persons trained in the traditional system of medicine will be happy to stay among the villagers, from where they can also be drawn for training.

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## **BIODIVERSITY AS RECORDED FROM INDIGENOUS SOCIETIES OF NABAGRAM GRAM PANCHAYAT AREA, BURDWAN DISTRICT, WEST BENGAL**

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### **ABSTRACT**

It is a scientific realization that the indigenous societies are sources of enormous knowledge in natural science which undergoes intergenerational oral transmission. There is an immediate need to document it, lest the uncared knowledge would become extinct. As such, the present work was undertaken in eight villages constituting Nabagram Gram Panchayat under Pandabeswar Panchayat Samiti of Burdwan district, West Bengal. Information about floral and faunal biodiversity of the area and their uses was recorded from local knowledgeable informants. A total of 94 species of angiosperm belonging to 45 families were documented along with their use, *i.e.*, as sources of medicine (28 species), food (26 species), fuel (28 species), timber (15 species), and fodder (9 species) and for decorative/religious/cultural purposes (21 species).

As many as 113 species of animals were also documented along with their local names and uses. Faunal analysis reveals 76 species of vertebrates, seven of Mollusca, 27 of Arthropoda, one of Nematoda and two of Platyhelminthes. The vertebrates include Mammalia (13 species), Aves (27 species), Reptilia (14 species), Amphibia (3 species) and Pisces (19 species). Analysis of use potential reveals that 20 are harmful, nine are pests, three parasites and four vectors. Interestingly, 20 species are edible, 19 are used in pest control and 9 species in rodent control. While 6 species are elegant pollinators, six have concern with ecological balance. In addition, seven species of birds help in seed dispersal, one in scavenging environment and four in sustaining wetlands.

**Key words:** *Resources, biodiversity, indigenous society, use potential, ecological balance*

### **INTRODUCTION**

Mega diverse country like India is unique having enormous biotic resources in the surroundings of the densely populated human localities in addition to those in the forested areas. Those biological resources have harmonious coexistence with the human population from the time immemorial. But, in present time, biodiversity is gradually dwindling with the increasing developmental activities, mining, overexploitation, etc.

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Still there are resources in profusion in some areas collaterally with ethnic people having loads of knowledge about their associated biodiversities and their uses. So, this is high time to document the knowledge of the village people about their surrounding biodiversities. From such documents, data can be retrieved pertaining to the status of past history of the biodiversity and its impact on the life and livelihood of the people in association. The data can address issues related to sustainable use of both phyto- and animal- resources for economic benevolence of the local people or ecological welfare through conservation and optimization.

### MATERIALS AND METHODS

Nabagram Gram Panchayat area was surveyed during the post-monsoon period of 2009. All the eight villages of the Nabagram Panchayat area were surveyed to document floral and faunal biodiversity and their use following the guidelines printed by Gadgil (2005) in his PBR Manual. A large number of people of diverse professions were interrogated during the survey. Among them there were farmers, colliery-workers, school children and teachers, traditional medicine practitioner, common villagers, fishermen, small traders, etc. Gram Panchayat authorities were also consulted as and when required.

The indigenous knowledge was recorded eventual to confirmation by authors through field survey and scientific inputs. Consultation of literature was necessary for identification of species of plants (Prain, 1996; Anon, 1997) and animals (Prater, 2005; Kazmierczak, 2006).

### RESULT AND DISCUSSION

The present work records of 94 species of angiosperm plants belonging to 45 families from Nabagram area (Table 1). In view of this the present work was undertaken in the eight villages composing the above Gram Panchayat to document the common/local names of these plants and their uses. It is found that among these species, 28 are of medicinal use, 26 edible, 28 sources of fuel, 15 timber, nine for fodder and 21 of them are used in rituals (Table 2).

**Table 1.** An account of the plant diversity as recorded from Nabagram and their uses

Sl. No.	Scientific Name	Common Name	Family	Use
1.	<i>Andrographis paniculata</i> Nees.	Creat, Kariyat, Indian Echinacea, Kalmegh	Acanthaceae	Medicinal
2.	<i>Hygrophila schulli</i> Almeida	Marsh Barbel, Gokula kanta, Kokilakshi, Kule khara	Acanthaceae	Medicinal
3.	<i>Justicia adhatoda</i> L.	Bakash, Basak	Acanthaceae	Medicinal
4.	<i>Alangium sylvifolium</i> L.	Sage leaved alangium, Ashphal	Alangiaceae	Edible and fuel
5.	<i>Amaranthus spinosus</i> L.	Spiny amaranth, Kanta notey	Amaranthaceae	Edible
6.	<i>Polyanthia longifolia</i> Sonn.	Debdaru	Annonaceae	Decorative

Biodiversity as recorded from indigenous societies of Nabagram gram panchayat area....

Table 1. contd.

Sl. No.	Scientific Name	Common Name	Family	Use
7.	<i>Mangifera indica</i> L.	Mango, Am	Anacardiaceae	Edible
8.	<i>Spondias mombin</i>	Amra, Ambadal	Anacardiaceae	Edible
9.	<i>Ervatamia coronaria</i>	Tagar	Apocynaceae	Decorative and cultural
10.	<i>Catharanthus roseus</i>	Madagascar periwinkle, Nayan tara	Apocynaceae	Religious and decoeative
11.	<i>Alstonia scholaris</i> L.	Indian Devil tree, Chatim	Apocynaceae	Shade/Ecological
12.	<i>Phoenix sylvestris</i> (L.) Roxb.	Silver date palm	Arecaceae	Edible
13.	<i>Areca catechio</i>	Betel Nut Palm, Supari	Arecaceae	Edible
14.	<i>Cocos nusifera</i> L.	Coconut Palm	Arecaceae	Edible
15.	<i>Borassus flabellifer</i> L.	Sugar Palm, Taal	Arecaceae	Edible
16.	<i>Amorphophallus campanulatus</i>	Corpse plant, Titan Arum, Ol	Araceae	Edible
17.	<i>Colocasia esculenta</i> (L.) Schott.	Elephant ear, Coco yam, Kochu	Araceae	Edible
18.	<i>Calotropis procera</i>	Akanda, Mudar	Asclepiadaceae	Medicinal
19.	<i>Eclipta alba</i> (L.) Hasskart	Kesuti	Asteraceae	Medicinal
20.	<i>Tagetes patula</i>	Marigold, ganda	Asteraceae	Religious and decorative
21.	<i>Chrysanthemum indicum</i> .	Chrysanthemum, Chandra mallika	Asteraceae	Horticultural and decorative
22.	<i>Bombax ceiba</i> L.	Bombax, Red silk cotton tree, Simul	Bombacaceae	Commercial
23.	<i>Heliotropium indicum</i> L.	Heliotrope, Hati shur	Boraginaceae	Medicinal
24.	<i>Tamarindus indica</i> L.	Tamarind	Caesalpiniaceae	Edible, timber and fuel
25.	<i>Bauhinia acuminata</i> L.	Dwarf White Bauhinia, Kanchan	Caesalpiniaceae	Religious, decorative and fuel
26.	<i>Canna indica</i>	Sarbajaya	Cannaceae	Religious and decoeative
27.	<i>Carica papaya</i> L.	Papaya, Pepey	Caricaceae	Edible and medicinal
28.	<i>Terminalia arjuna</i> Roxb.	Arjun	Combretaceae	Timber and fuel
29.	<i>Ipomoea carnia</i> Martius ex Choisy	Bush Morning Glory, Dhol kolmi	Convolvulaceae	Commercial
30.	<i>Ipomoea aquaticus</i> Frossk.	Kangkong, water spinach, Kolmi sak	Convolvulaceae	Edible
31.	<i>Cephalandra indica</i> Naud.	Ivy Gourd; Scarlet fruit ivy gourd, Telakuncho	Cucurbitaceae	Medicinal

Table 1. contd.

Sl. No.	Scientific Name	Common Name	Family	Use
32.	<i>Cyperus iria</i> L.	Rice flat sedge	Cyperaceae	Fodder
33.	<i>Fimbristylis ovata</i>	Flatspike sedge	Cyperaceae	Fodder
34.	<i>Trewia nudiflora</i> Linn.	Pitali, Pitari	Euphorbiaceae	Fuel
35.	<i>Jatropha gossypifolia</i> L.	Bellyache bush, Gab bherenda	Euphorbiaceae	Medicinal and commercial
36.	<i>Jatropha curcas</i> L.	Arandi, physic nut, Barbados nut, purging nut,	Euphorbiaceae	Medicinal and commercial
37.	<i>Croton bonplandianum</i> Baill	Ban tulsi	Euphorbiaceae	Medicinal
38.	<i>Dalbergia sissoo</i> Rox.	Indian Rosewood, Sisu	Fabaceae	Timber and fuel
39.	<i>Pithecellobium dulce</i> (Roxb.) Benth	Monkeypod, Jilipi phal	Fabaceae	Edible and fuel
40.	<i>Pongamia pinnata</i> (L.) Pierre	Indian Beech, Poongam Oil Tree, Karanja	Fabaceae	Medicinal, timber and fuel
41.	<i>Clitoria ternate</i> L.	Butterfly pea, Aparajita	Fabaceae	Religious and decorative
42.	<i>Abruspreca torias</i> L.	Rosary Pea, Kunch	Fabaceae	Medicinal
43.	<i>Aeschynomene aspera</i>	Sola, Sola Pith Plant	Fabaceae	Commercial
44.	<i>Ocimum sanctum</i> L.	Tulsi	Lamiaceae	Medicinal
45.	<i>Lemna perpusilla</i> Torrey	Minute Duckweed, Choto pana	Lemnaceae	Ecological
46.	<i>Polianthes tuberosa</i>	Tuberose, Rajani gandha	Liliaceae	Religious and decoeative
47.	<i>Hibiscus rosa sinensis</i> L.	Hibiscus, Joba	Malvaceae	Religious and decoeative
48.	<i>Marsilea Minuta</i> L.	Dwarf waterclover, Small waterclover, Chaupatira, Susni sak	Marsileaceae	Medicinal
49.	<i>Azadirachta indica</i> A. Jus.	Neem	Meliaceae	Commercial and medicinal
50.	<i>Melia azadarach</i> Linn.	Mahaneem	Meliaceae	Timber
51.	<i>Swietenia macrophylla</i> King.	Big Leaf Mahogany, Mehogini	Meliaceae	Timber
52.	<i>Albizia lebbeck</i> (L.) Benth	Siris tree	Mimosaceae	Timber and fuel
53.	<i>Samanea saman</i> (Jacq.) Merr.	Rain tree, Bilati Siris	Mimosaceae	Fuel
54.	<i>Acacia auriculoformis</i> Benth.	Ear leaf acacia, Sonajhuri	Mimosaceae	Timber and fuel
55.	<i>Mimosa pudica</i>	Sensitive plant, Lajjabati	Mimosaceae	Medicinal
56.	<i>Centella asiatica</i> L.	Thankuni	Mimosaceae	Medicinal

Biodiversity as recorded from indigenous societies of Nabagram gram panchayat area....

Table 1. contd.

Sl. No.	Scientific Name	Common Name	Family	Use
57.	<i>Ficus benghalensis</i> L.	Banyan tree, Bot	Moraceae light timber	Fodder amd fuel
58.	<i>Ficus religiosa</i> Linn.	Peepul tree, Aswatha	Moraceae	Fodder, fuel and light timber
59.	<i>Ficus hispida</i> L.f.	Fig, Dumur	Moraceae	Edible and fuel
60.	<i>Atrocarpus heterophyllus</i> Lam.	Jackfruit, Kanthal	Moraceae	Edible and timber
61.	<i>Streblus aspar</i> Lour.	Siamese rough bush, Khoi, Toothbrush tree	Moraceae	Fuel
62.	<i>Moringa oleifera</i> Lamk.	Horse Radish tree, Drumstick tree, Sojne	Moringaceae	Edible
63.	<i>Musa sapientum</i> L.	French plantain banana, Kala	Musaceae	Edible
64.	<i>Musa balbisiana</i> L.	Banana, Kala	Musaceae	Edible and medicinal
65.	<i>Psidium guajava</i> L.	Guava, Peyara	Myrtaceae	Edible and medicinal
66.	<i>Eucalyptus globules</i>	Blue Gum	Myrtaceae	Timber and fuel
67.	<i>Syzygium cumini</i> Skeels	Java Plum, Kalo jam	Myrtaceae	Edible and cedical
68.	<i>Miribilis jalapa</i>	Four'O Clocks, Marvel of Peru	Nyctaginaceae	Religious and decoeative
69.	<i>Nynphaea nouchali</i>	Water lili, Saluk	Nymphaeaceae	Medicinal
70.	<i>Jasminum officinale</i> L.	Jui, Jasmine	Oleaceae	Religious, decoeative and fuel
71.	<i>Nyctanthes arbortristis</i>	Night Jasmine, Coral Jasmine, Seuli	Oleaceae	Religious and decorative
72.	<i>Bambusa tulda</i>	Bamboo, Bans	Poaceae	Commercial
73.	<i>Cynodom dactylon</i> Pers.	Couch Grass, Durba	Poaceae	Fodder, religious and medicinal
74.	<i>Echinochloa crussgalli</i> P. Beauv.	Barnyard grass, Cockspur, Barnyard millet	Poaceae	Fodder
75.	<i>Saccharum spontaneum</i> L.	Wild Sugarcane, Kash	Poaceae	Religious, fuel and fodder
76.	<i>Eragrostis tenella</i>	Stinkgrass, Candy grass, Sursuri ghas	Poaceae	Religious, fuel and fodder
77.	<i>Chrysopogon aciculatus</i> (Retz.) Trin.	Golden false beardgrass, Mackie's Pest, Chorkanta	Poaceae	Religious, fuel and fodder
78.	<i>Vetiveria zizanoides</i>	Bena ghas	Poaceae	Commercial
79.	<i>Eichhornia crassipes</i> (Martius) Solams-Laubach	Common water hyacinth, Kochuri pana	Pontedariaceae	Ecological and commercial
80.	<i>Zyziphus mauritiana</i> Lamk.	Indian Plum, Indian Jujube, Kul	Rhamnaceae	Edible, timber and fuel

Table 1. contd.

Sl. No.	Scientific Name	Common Name	Family	Use
81.	<i>Rosa centifolia</i> L.	Red Rose, Golap	Rosaceae	Religious and decorative
82.	<i>Anthocephalus cadamba</i> (Roxb.) Miq.	Common bur-flower, Kadam	Rubiaceae	Decorative, light timber and fuel
83.	<i>Aegle marmelos</i> L.	Bilva, Bel	Rutaceae	Medicinal and commercial
84.	<i>Limonia acidissima</i>	Koth bel, Wood Apple	Rutaceae	Edible
85.	<i>Citrus maxima</i> Merr.	Pomelo tree, Batabi lebu	Rutaceae	Cultural, edible and medicinal
86.	<i>Citrus aurantifolia</i> (Christ.) Swingle	Lime, Common lime, Sour lime, Lebu	Rutaceae	Edible
87.	<i>Murraya paniculata</i> L.	Orange Jasmine, Kamini	Rutaceae	Religious, decorative and fuel
88.	<i>Mimusops elengi</i> L.	Bokul	Sapotaceae	Edible and shade
89.	<i>Anemopsis californica</i>	Mansa, Yerba mansa, Bear Root	Saururaceae	Medicinal
90.	<i>Solanum xanthocarpum</i>	Black Night Shade, Kak machi	Solanaceae	Medicinal
91.	<i>Tectona grandis</i> L.	Teak, Segun	Verbinaceae	Timber and fuel
92.	<i>Clerodendrum viscosum</i> Vent.	Glorybower, Bagflower and bleeding-heart, Ghentu	Verbinaceae	Medicinal
93.	<i>Lantana camara</i>	Lantana, Largeleaf lantana, Shrub verbena	Verbenaceae	Fuel
94.	<i>Curcuma aromatica</i> Salisb.	Wild turmeric, Bon holud	Zingiberaceae	Medicinal

Of the listed plants 29% are used as fuel wood, 29% are known to be with medicinal values, 28% are edible, 16% are used as timber 9% are used as fodder and 22% are used as decorative, religious and cultural purposes (Table 2) by the indigenous people of Nabagram.

**Table 2.** Use categories of phytoresources as recorded from study site

Sl. No.	Use category	No. of species	% of species
1	Edible	26	28
2	Medicinal	28	29
3	Timber	15	16
4	Fuel wood	28	29
5	Fodder	09	9
6	Decoative/Religious/Cultural	21	22

*Biodiversity as recorded from indigenous societies of Nabagram gram panchayat area....*

The faunal composition shows 113 species of animals, out of which seven are mollusks, 27 arthropods, one nematode, two platyhelminthes and 76 species are vertebrates. These vertebrates include 13 species of mammals, 27 species of aves, 14 species of reptiles, 3 species of amphibians and 19 species of fishes (Table 3).

**Table 3.** Animal diversity with their taxonomic positions and use as recorded from Nabagram Gram Panchayet area

Sl No.	Funal group	Scientific Name	Common Name	Use
1.	Mollusca	<i>Pila globosa</i>	Apple snail	Edible
2.	Mollusca	<i>Achatina fulica</i>	Giant African snail	Harmful for farmers
3.	Mollusca	<i>Bellamyia bengalensis</i>	Trapdoor snail	Edible
4.	Mollusca	<i>Indoplanorbis exustus</i>	Pond snail	Not known, may be edible
5.	Mollusca	<i>Georissa pyxis</i>	Land snail	Not known
6.	Mollusca	<i>Lymnaea luteola</i>	Great Pond snail	Not known, may be edible
7.	Mollusca	<i>Lamellidens marginalis</i>	Freshwater mussel	Edible
8.	Nematoda	<i>Ascaris lumbricoides</i>	Common Roundworm	Harmful to humans
9.	Platyhelminthes	<i>Taenia solium</i>	Pork Tapeworm	Harmful to humans
10.	Platyhelminthes	<i>Fasciola hepatica</i>	Liver Fluke	Harmful to crabs
11.	Arthropoda	<i>Julus londinensis</i>	Millipede	Helps in ecological decaying
12.	Arthropoda	<i>Heterometrus bengalensis</i>	Scorpion	Harmful when bites
13.	Arthropoda	<i>Scolopendra subspinipes</i>	Centipede	Harmful when bites
14.	Arthropoda	<i>Sartoriana spinigera</i>	Crab	Edible
15.	Arthropoda	<i>Ixodes ricinus</i>	Ticks	Ectoparasitic to animals
16.	Arthropoda	<i>Pediculus capitis</i>	Head Lice	Human ectoparasite
17.	Arthropoda	<i>Anopheles stephensi</i>	Mosquito	Vector
18.	Arthropoda	<i>Aedes aegypti</i>	Mosquito	Vector
19.	Arthropoda	<i>Cimex pipiens fatigans</i>	Bedbug	Ectoparasite
20.	Arthropoda	<i>Odontotermes obesus</i>	Termite	Harmful to humans
21.	Arthropoda	<i>Leptocorisa acuta</i>	Paddy Bug	Pest to Rice grain
22.	Arthropoda	<i>Lamprophorus tenebrosus</i>	Firefly	Ecologically important
23.	Arthropoda	<i>Myzus persicae</i>	Aphid	Pest to Mustard plant
24.	Arthropoda	<i>Nephotettix virescens</i>	Green rice leafhopper	Pest to crops
25.	Arthropoda	<i>Tryporyza incertulus</i>	Rice pest	Pest to Rice grain

Table 1. contd.

Sl No.	Funal group	Scientific Name	Common Name	Use
26.	Arthropoda	<i>Sitophilus oryzae</i>	Rice weevil	Stored grain pest
27.	Arthropoda	<i>Pheidole watsoni</i>	Red Ant	Ecological cleaner
28.	Arthropoda	<i>Diacamma rugosum</i>	Black Ant	Not known
29.	Arthropoda	<i>Apis dorsata</i>	Honey Bee	Pollinator,commercial
30.	Arthropoda	<i>Campsomeriella collaris</i>	Wasp	Not known
31.	Arthropoda	<i>Discolia fichteli</i>	Scoliawasp	Pollinator
32.	Arthropoda	<i>Musca domestica</i>	House fly	Vector
33.	Arthropoda	<i>Calliphora vomitoria</i>	Blue bottle fly	Vector
34.	Arthropoda	<i>Gryllus campestris</i>	House Cricket	Harmful for vegetables
35.	Arthropoda	<i>Periplaneta americana</i>	Cockroach	Harmful for stored grain
36.	Arthropoda	<i>Peucetia viridana</i>	Green Spider	Insect pest control
37.	Arthropoda	<i>Araneus diadematus</i>	Garden Spider	Insect pest control
38.	Mammalia	<i>Herpestes edwardsii</i>	Common Grey Mongoose	Control pest
39.	Mammalia	<i>Funambulus pennantii</i>	Five Striped Palm Squirrel	Control pest, destroy crops
40.	Mammalia	<i>Felis chaus</i>	Jungle Cat	Not known
41.	Mammalia	<i>Suncus murinus</i>	House shrew	Control pest
42.	Mammalia	<i>Canis aureus</i>	Jackle	Harmful to farmers
43.	Mammalia	<i>Vulpus bengalensis</i>	Fox	Harmful to farmers
44.	Mammalia	<i>Presbytis entellus</i>	Hanuman Langur	Destroys crops and fruits
45.	Mammalia	<i>Bandicota bengalensis</i>	Indian Mole Rat	Destroys crops, Pest
46.	Mammalia	<i>Mus musculus</i>	House Mouse	Harmful to humans
47.	Mammalia	<i>Rattus rattus</i>	Black Rat/House Rat	Destroys crops and fruits, Pest
48.	Mammalia	<i>Pteropus giganteus</i>	Indian Fruit Bat	Destroys orchards, Pollinator
49.	Mammalia	<i>Cynopterus sphinx</i>	Short Nose Fruit Bat	Destroys orchards, Pollinator
50.	Mammalia	<i>Pipistrellus mimus</i>	Indian Pygmy Pipistrelle	Control pest
51.	Aves	<i>Dinopium benghalensis</i>	Black Rumped Flame back wood pecker	In pest control
52.	Aves	<i>Megalaima haemacephala</i>	Copper smith Barbet	In pest control
53.	Aves	<i>Halcyon smyrnensis</i>	White breasted kingfisher	Not known

Biodiversity as recorded from indigenous societies of Nabagram gram panchayat area....

Sl No.	Funal group	Scientific Name	Common Name	Use
54	Aves	<i>Eudynamys scolopacea</i>	Asian koyel	Not known
55	Aves	<i>Centropus bengalensis</i>	Lesser Coucal	Not known
56	Aves	<i>Psittacula krameri</i>	Rose ringed Parakeet	In seed dispersal
57	Aves	<i>Tyto alba</i>	Barn owl	In rodent control
58	Aves	<i>Athene brama</i>	Spotted Owlet	In rodent control
59	Aves	<i>Columba livia</i>	Rock pigeon	In seed dispersal
60	Aves	<i>Streptopelia chinensis</i>	Spotted dove	In seed dispersal
61	Aves	<i>Amaurornis phoenicurus</i>	White breasted waterhen	Wetland maintenance
62	Aves	<i>Metopidius indicus</i>	Bronze winged Jacana	Wetland maintenance
63	Aves	<i>Milvus migrans</i>	Black kite	Wetland maintenance
64	Aves	<i>Phalacrocorax niger</i>	Little Cormorant	Wetland maintenance
65	Aves	<i>Egretta garzetta</i>	Little Egret	In pest control
66	Aves	<i>Ardeola grayii</i>	Pond heron	Not known
67	Aves	<i>Bubulcus ibis</i>	Catte Egret	In pest control
68	Aves	<i>Dendrocitta vegabunda</i>	Rufous treepie	Seed dispersal
69	Aves	<i>Corvus splendense</i>	House crow	Environmental, Cleaning/Scavenging
70	Aves	<i>Dicrurus macrocercus</i>	Black drongo	In pest control
71	Aves	<i>Copsychus saularis</i>	Oriental Magpie Robin	Not known
72	Aves	<i>Acridotheres tristis</i>	Common Myna	Not known
73	Aves	<i>Sturnus contra</i>	Asian Pied Starling	Not known
74	Aves	<i>Pycnonotus cafer</i>	Red vented bulbul	Seed dispersal
75	Aves	<i>Nectarinia asiatica</i>	Purple sunbird	Pollinator
76	Aves	<i>Lonchura punctulata</i>	Scally breasted munia	Pollinator, Seed dispersal
77	Aves	<i>Passer domesticus</i>	House sparrow	Seed dispersal
78.	Reptilia	<i>Naja naja naja</i>	Binocellate Cobra	Rodent control, highly poisonous
79.	Reptilia	<i>Naja kaouthia</i>	Monocled cobra	Highly poisonous
80.	Reptilia	<i>Bungarus fasciatus</i>	Banded Krait	Rodent control, highly poisonous
81.	Reptilia	<i>Vipera russelli</i>	Russell's Viper	Highly poisonous
82.	Reptilia	<i>Eryx conicus</i>	Rough scale sand boa	Nonpoisonous, Pest and rodent control
83.	Reptilia	<i>Amphiesma stolata</i>		Nonpoisonous, Pest and rodent control
84.	Reptilia	<i>Ptyas mucosus</i>	Rat snake	Nonpoisonous, Pest and rodent control

Sl No.	Funal group	Scientific Name	Common Name	Use
85.	Reptilia	<i>Xenochrophis piscator</i>	Checkered Keelback	Nonpoisonous, Pest and rodent control
86.	Reptilia	<i>Mabuya macularis</i>	Skink	Pest and rodent control
87.	Reptilia	<i>Calotes versicolor</i>	Garden Lizard	Control pest, Destroy Vegetables
88.	Reptilia	<i>Hemidactylus flaviviridis</i>	House Lizard	Pest control
89.	Reptilia	<i>Typhlops diardi</i>	Blind snake	Not known
90.	Reptilia	<i>Geoclemys hamiltonii</i>	Pond Turtle	Not known
91.	Reptilia	<i>Varanus bengalensis</i>	Water Monitor	Not known
92.	Amphibia	<i>Duttaphrynus melanostictus</i>	Toad	Pest control and ecological balance
93.	Amphibia	<i>Rana tigrina</i>	Indian Bull Frog	Pest control and ecological balance
94.	Amphibia	<i>Sphaerotheca breviceps</i>	Indian Burrong Frog	Pest control and ecological balance
95.	Pisces	<i>Macrogathus pancalus</i>	Punkal, Barred spiny Eel	Not known
96.	Pisces	<i>Monopterus cuchia</i>	Mud eel	Edible
97.	Pisces	<i>Puntius ticto</i>	Ticto Barb	Edible
98.	Pisces	<i>Puntius sarana</i>	Swamp Barb	Edible
99.	Pisces	<i>Amblypharyngodon mola</i>	Mourala	Edible
100.	Pisces	<i>Esomus danricus</i>	Flying Barb	Least edible
101.	Pisces	<i>Oreochromis mossambica</i>	Mozambique Tilapia	Edible
102.	Pisces	<i>Oreochromis niloticus</i>	Nile Tilapia	Edible
103.	Pisces	<i>Anabas testudineus</i>	Climbing Perch	Edible and nutritious
104.	Pisces	<i>Channa gachua</i>	Chang	Least edible
105.	Pisces	<i>Channa punctatus</i>	Lata	Edible
106.	Pisces	<i>Labeo rohita</i>	Rohu	Edible and nutritious
107.	Pisces	<i>Catla catla</i>	Catla	Edible and nutritious
108.	Pisces	<i>Cirrhinus mrigala</i>	Mrigel	Edible and nutritious
109.	Pisces	<i>Cyprinus carpio</i>	Grass carp	Edible
110.	Pisces	<i>Ctenopharyngodon idella</i>	Silver carp	Edible
111.	Pisces	<i>Hypophthalmichthys molitrix</i>	Common carp	Edible
112.	Pisces	<i>Clarias garripinus</i>	African sharptooth Catfish	Edible
113.	Pisces	<i>Clarias batrachus</i>	Walking Catfish	Edible and nutritious

Use categories of animal resources are presented in Table 4 shows that people have identified mostly the harmful animals but at the same time useful animals like pest control species, etc. have also been identified by them.

**Table 4.** Use categories of animal resources as recorded from the study site

Sl. no.	Use category	No. of animals
1	Edible	20
2	Harmful	20
3	Pest	9
4	Pest control	19
5	Vector	4
6	Pollinator	6
7	Seed dispersal	7
8	Ecological balance	6
9	Parasite	3
10	Rodent control	9
11	Sustaining wetland	4
12	Scavenging environment	1
13	Unknown	15

Indigenous people of Nabagram Gram Panchayat have good knowledge about the diversity of Arthropods. They have identified not less than 27 species of different group of arthropods including 19 species of insects. These are mainly either vector or pest.

People of the study site use different species of animals as their food. Some of the animals help in their food production as pollinator; some are useful in controlling pests and rodent populations. A few vectors and pest species were also detected by them.

## CONCLUSION

The present study shows that a few coal mining villages in West Bengal like those in Nabagram Gram Panchayat show signs of degraded flora and fauna. Though the villages are mainly having dry and degraded soil, still diverse life forms manage to find their niches in the existing conditions. The indigenous communities settled in the area have good knowledge of their surrounding biodiversity. They also use a good number of biological resources in their culture; some of them provide their livelihood and food resources. Many of the bioresources are used in local system of medicines. Documentation of the local and indigenous knowledge of biodiversity is likely to be a good resource for biodiversity conservation. The cultural implications of biodiversity on the local people are likely to pave the pathway to successful conservation.

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SECTION - II  
**SOCIAL PRACTICES**

*Proc. Nat. Sem. Trad. Knowl. & Soc. Prac. :*

## **CONCEPT OF BIODIVERSITY CONSERVATION IN INDIAN RELIGION**

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### **ABSTRACT**

Biodiversity is necessary for the survival of humane and nature. The social value of biodiversity refers to the manner in which bioresources are used or abused. Social condition and needs are often projected through religion. Ethical and aesthetic foundation for conservation of biodiversity is also recorded. Various icons, myths and rituals borrowed and adopted in the past aboriginal cultures have been included in the present day Hinduism. Buddhism, Jainism and Sikhism are described as different tenets of ascetic Hinduism. Traditional knowledge on biodiversity conservation in India is as diverse as 2753 communities. Traditional practices / narratives on nature conservation, mentioned in different Indian religious literatures have been documented in this communication for general awareness and revival of India's rich socio-religious practices for the motivation of people towards biodiversity conservation. Indian religions have always been a source of inspirations for nature conservation.

### **INTRODUCTION**

Since available literatures on this topic are scanty and conservation of biodiversity using indigenous knowledge is the appropriate approach and need of the hour, an attempt has been made in this communication to document information / narratives mentioned in the Indian religious literatures on conservation of nature. The purpose is to create awareness for the revival of socio-religious practices of India for motivation of people towards biodiversity conservation.

The social value of biodiversity refers to the manner in which bioresources are used or abused. Social condition and needs are always projected through religion. Customs vary with culture. India is a land where confluence of different belief systems, iconographies and mythologies from different culture has taken place in a decent way. Ethical and aesthetic foundation for conservation of biodiversity are also recorded. Though society's reliance upon biodiversity was not always understood by large section but they honoured and preserved plants and animals due to their attached values in religious books and literature.

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## INDIAN RELIGIONS AND BIODIVERSITY CONSERVATION

Like other religions of the world, Indian religions lay emphasis on environmental ethics and teach to live in harmony with nature.

### **Buddhism :**

“Ahimsa” (Non-violence) being one of the main principles, Buddhism laid values on nature by emphasizing compassion for all life forms. Principle of conquering greediness (Tris'd) helps in conservation of nature. Further some principles of Buddhism emphasises “limiting resource consumption” helping maintenance of ecological balance and thus conservation of nature. To reflect man’s harmonious relationship with surrounding biosphere, “*Jataka*” stories of Buddhism narrate how Buddha took birth in different animal forms (monkey, lion, pigeon, etc.) to work out the consequences of his action (Karma). There is description about the importance of trees and forest in Buddhist literature and planting of tree is a holy deed for Buddhist. “*Bodhi tree*” is an old sacred fig tree located in Bodh Gaya (Bihar) under which Gautam Buddha achieved enlightenment. Thus this species of tree is respected and protected by the Buddhist across the country.

### **Jainism :**

Besides “Ahimsa” all the Jain vows can be interpreted on ecological basis. For example “*Aparigraha*”, remaining aloof from material possession, is one of the root causes of present day ecological concern. “*Bramhacharya*” is sexual restraint, there by controlling population growth and enabling nature conservation. Many Jain wear mask so that while breathing and speaking, killing of invisible creature can be prevented. The advanced monks and nuns sweep their path to avoid insect killing. Tree plantation is an important activity in Jainism. While common Jains are allowed to do so, nuns and monks are not allowed because of the harm caused to the earth and earth-dwelling creatures in the digging process.

### **Sikhism :**

Sikhs believe that there is a sensitive link between human being and natural world. According to Sikhism “*Pavan Guru, Pani Pita, Maa Dharat Mahat*” which means Air is the Guru, Water the Father and Earth is the Great Mother. Thus sustainable society with sound living system for present and future is possible if air, land, forest and biodiversity are kept vibrant.

### **Hinduism :**

The Mahabharata, the Ramayana, the Vedas, the Upanishads, the Bhagvad Gita, the Puranas and the Smriti give messages for the conservation of environment and maintenance of ecological balance. These Hindu religious literatures also contain sayings /narrations to teach human being how to live in harmony with nature and to realize the presence of divinity in all living form and matter. The Bhagavad Gita teaches not to interfere with the nature otherwise irreparable damage will be caused to mankind.

## **RELIGIOUS LITERATURE AND BIODIVERSITY CONSERVATION**

The “*Aranyaka*” (subsect of Rig Veda) has been derived from the word “Aranya” or forest and reflects the importance and respect rendered to forest by the vedic people. In Hindu religious literature, such as, Puranas (Matsya Purana, Agni Purana, Varaha Purana) there is mention of tree planting and forest conservation as sacred deed. Concept of “*Abhayaranya*” (Sanctuary) and introduction of game laws were first mentioned by Chanakya in his “*Arthashastra*”. The concept of “*Ashram*” mentioned by great ancient poet Kalidas and others is a place where the balance and harmony among animals and plants could be maintained by establishing communality between man and nature. Present day Hindu societies worship and protect quite a large number of plant and animal species through their traditional socio-religious practices and belief system. Several trees mentioned in Indian mythology and folklore have got special importance in Indian legends. Thus Vedas, Puranas and Epics carry special reference on these trees. In Hindu mythology, Banyan tree (*Ficus bengalensis*) often referred as “*Bata Vriksha*” and God Siva as “*Dakshinamurthy*” is depicted sitting in silence under this tree with rishis at his feet. Thus Hindus worship and protect this tree and consider it as wish fulfilling divine tree. The Pipal tree or Ashvatha tree (*Ficus religiosa*) is also a sacred fig tree and considered as symbol of happiness, prosperity, longevity and good luck. In Bhagawat Geeta, Lord Krishna had said “among trees, I am Ashvatha”. Tulsi (*Ocimum sanctum*) is the holiest plant for Hindus and is worshipped daily as “*Brundavati*” (Tulasi Purana). The Tulasi plant is mythologically important and according to Hindu belief goddess Mahalaxmi, wife of Lord Vishnu, had once taken the form of Tulsi. In Hindu mythology, coconut tree (*Cocos nucifera*) is referred as “*Kalpa Vriksha*” or wish fulfilling tree providing all necessities of life. Coconut is the most sacred fruit and must for every Hindu rituals. Lotus (*Nelumbo nucifera*) symbolises beauty, purity and divinity and is the sitting platform of many Hindu deities. The Bel tree (*Aegle marmelos*) is an important sacred tree for Hindus. According to Skanda Purana, from the perspiration of Goddess Parvati bel tree has been created on earth and various incarnations of Goddess Parvati reside in each part of Bel tree. Asoka tree (*Saraca asoka*) is worshipped by Hindus during the celebration of “*Asokastami*”. In Ramayana, there is mention of Asoka tree as “*Asoka Vatika*” where Hanumanji first met Sita. Bamboo plant (*Dendrocalamus strictus*) is sacred for Hindus as Lord Krishna’s “*Bansuri*” is made up of bamboo. Amla plant (*Ambilica officinalis*) is also holy and thus worshipped by Hindus with immense love and respect. Banana tree (*Musa acuminata*) is considered auspicious and used during Hindu festivals and social functions. Different parts of plants, such as, fruit, leaf and flower are treated as sacred and are used in Hindu rituals. For almost every Hindu rituals, coconut (*Cocos nucifera*), betel nut (*Areca catechu*) and banana are required besides, leaves of bel, Tulsi, banana, Aam (*Mangifera indica*), Jack fruit (*Artocarpus heterophylla*) and betel (*Piper betle*). Since India is an agricultural country, most of its festivals are related to agricultural harvest [Harvest Festivals like Pongal (Tamil Nadu), Onam (Kerala), Makar sankranti (Throughout India), Baisakhi (North India, Punjab), Bhogali Bihu (Assam), Nabanna (Eastern India), Lohri (Punjab), Solung (Arunachal Pradesh), etc.]. During these occasions,

Hindus worship different Gods and Goddesses and mother nature along with crop plants and seeds [ Paddy (*Oryza sativa* ), Sugar cane (*Saccharum officinarum*), Wheat (*Triticum aestivum*), etc.]. Ayurveda, the oldest known form of health care system has been derived from Atharva veda (of Hindu religion) and is a balance between spiritualism and materialism. “Dhanvantari” is the Hindu God of Ayurveda. Specific medicinal plants and their parts (especially “The seven holy plants of Ayurveda”) prescribed in the Ayurveda texts are considered to be holy and are protected all over India.

### GOD AND GODDESS AND BIODIVERSITY CONSERVATION

Sun, the source of all energy is the focal point so far as the conservation of our living planet is concerned. Sun is worshipped as “Suryanarayana” by Hindus.

Hindu Gods and Goddesses are traditionally associated with one or the other animals there by ensuring their protection. Snake (Cobra) is worshipped by Hindus during the celebration of Naga Panchami (common in south India). Cobra (Naga) is worshiped during Manasa Puja by the descendant of Nagabansi Rajas. There are many snake shrines all over India. Since cobra is associated with Lord Siva, Snake idols are also worshipped in Siva temple. Hanuman langur (*Presbytes entellus*) enjoys full protection from the entire Hindu society with reference to Lord Hanuman (after Ramayana). Inspired by the proverbial Sacred Cow (“Kamadhenu”) of Hindu religious scripture, Hindus respect and protect cow. During “Rakhipurnima” or “Balrampuja”, cow is worshipped by the Hindus. Most of the Vedic Gods and Goddesses are associated with different animals as their “Bahanas” (carrier / means of transport ). Thus those animals are protected by Hindus on religious ground. Lord Ganesh is portrayed with the head of a elephant. For this reason elephant is considered as auspicious and is being protected. As peacock feather is associated with Lord Krishna (decorated on his turban), Hindus consider peacock (*Pavo cristatus* ) as sacred and protect it. Peacock feather is worshipped whenever Satyanarayana Puja is performed and can be seen in almost all Hindu temples. Peacock is the National bird of India.

The sacred chank (*Tubinella pyrum*) has a very special place in Indian Hindu rituals and folklore. Chank blowing is a widely practiced custom of India to announce any auspicious or religious event. Chank is blown during all Hindu religious functions and festivals including funeral rituals (as in South India). Lord Vishnu is portrayed with holding one Sinistral Chank which was obtained during “Churning of Ocean of Milk” for divine nectar. Thus Sinistral Chank (rare with anti-clock wise coiling) is worshipped by Hindu devotees. Bhagavat Gita refers to Chank in different names which were used as trumpet by Lord Krishna and Pancha Pandavas in the battle field of Kurukshetra during Mahabharat Battle. These are (1) “Pancha Janya” of Lord Krishna, (2) “Ananta Vijaya” of Yudhistira, (3) “Paundra” of Bhima, (4) “Devadatta” of Arjuna, (5) “Sughosha” of Nakula and “Manipushpak” of Sahadeva.

**Relevance with concept of Avatara :** Among Puranas “The Bhagavat Purana” is the most read and popular one. This purana narrates the story of the Lord Vishnu (the preserver) and his incarnations (“Avatara”) which refer to the descent of diety to

earth and his incarnation as a man or an animal to reestablish “Dharma” or righteousness by destroying injustice from earth. Out of ten Avataras (“Dasa avatara”) three are animals having similarities with animal evolution theory. Avatara concept has got relevance with evolution of life. As life began in aquatic ecosystem, first Avatara also appeared as an aquatic form of animal that is fish (Matsya Avatara). Subsequently tortoise (Kurma Avatara), a reptile which is found both in water and land. Then appeared in the form of a wild boar, land form animal (Varaha Avatara). Next came half evolved man/half lion half man (Narasimha Avatara), then as dwarf man (Bamana Avatara), perfect man (Rama Avatara), philosophical man (Krishna Avatara), enlightened prince (Buddha Avatara) and finally to be appeared Kalki Avatara, the mighty warrior.

**Steps against animal sacrifice practice :** Hindus were completely biased involving animal sacrifice in rituals during vedic period. It was opposed by Upanishads and in due course of time, animal sacrifice disappeared through Bhakti cult. Later through great poetic monument “Avijnan Sakuntalam” of Kalidas of medieval India, symbiotic relationship of man and nature was popularized. However, still the ugly practice has not been completely eradicated from Indian society.

**Sanskritic Hinduism and local cult :** Cultural diversity of India adheres to rich traditions of conservation and sustainable use of the local biodiversity resource base borne by the oral traditions or in scripted form. The local expression of a religious belief system differs from scripture of that religion. The traditions based on scripture and local myths foster love and respect for nature. In indigenous cultures, protection of natural habitats (forest patches, stretches of rivers, ponds and lakes ) is typically achieved by demarcating it as sacred and associating with ancestral spirits or a local deity.

### **SACRED SOCIAL PRACTICES**

Sacred groves and ponds mainly characterize the tribal villages, but the institution is also considered strong in local Hindu culture and are protected by indigenous and ethnic community with religious significance. In these fragments of forest, hunting and logging are strictly prohibited and plants are conserved in sacred groves of tribal as *in-situ* conservation of biodiversity. Fishes and terrapins (freshwater turtle) are reared in sacred ponds of temple yards on religious ground. Peacock (*Pavo cristatus*), Black buck ( *Antelope cervicapra*), spotted deer / chital / axis deer (*Axis axis*) are allowed to roam freely in village side open fields and are protected by certain communities as religious tradition.

“Bishnoi Community” in Rajasthan founded by Bhagaban Jameswarji in 15th century observe 29 (‘Bis’+‘Noi’) commandments, many of which are related to nature conservation, such as, giving full protection to the Khejri tree ( *Prosopis cineraria* ), a flowering tree of pea family and the Black buck.

About 12 % of the world’s biodiversity has been covered by ethnic people of India in many ways. In India 68 million people belonging to 227 ethnic groups and comprising of 573 tribal communities derived from 6 racial stocks, namely, Negroid,

Proto-australoid, Mongoloid, Mediterranean, West Breachy and Nordic exist in different part of the country (Pushpagandhan ). These ethnic people mostly the indigenous tribals who live close to the forest have religious sentiment towards nature conservation and they observe utmost austerity by worshiping trees (Table 1) and certain animals or as a whole nature. Since tribals and forests are closely associated and are two important components of nature conservation, conservation measures have to be formulated in the best interest of tribal and preservation of their practices.

**Table 1.** List of plants worshiped and conserved by tribals on account of magico-religious belief

Sl. No.	Local name	Vernacular name	Scientific name	Family name	Name of God & Goddesses residing in plant
1.	Aam	Amra	<i>Mangifera indica</i>	Anacardiaceae	Lord Vidyadhara
2.	Arjun	Arjun	<i>Terminalia arjuna</i> W & A	Combretaceae	Lord Brahma
3.	Bijapura	Nibu	<i>Citrus medica</i> Linnaeus	Rutaceae	Lord Brihaspati
4.	Bilva	Bel	<i>Aegle marmelos</i> Corr.	Rutaceae	Lord Shiva
5.	Nimbu	Neem	<i>Azadirachta indica</i> A.Juss	Meliaceae	Serpent King
6.	Basil	Tulsi	<i>Ocimum santum</i> Linnaeus	Lamiaceae	Goddess Laxmi
7.	Baka	Agasti	<i>Sesbania grandiflora</i> (Linn.)	Fabaceae	Lord Narayana
8.	Karavira	Karabi	<i>Nerium indicum</i> Mill	Apocynaceae	Lord Ganesh
9.	Nilapadma	Kamal	<i>Nelumbi nucifera</i> Gaertn	Nymphaeaceae	Goddesses Ambica
10.	Swetapadma	Madar	<i>Calotropis gigantean</i> (L) R.Br.	Asclepiadeceae	Lord Shiva

Plant species like sal (*Shorea robusta*), three species under genus *Ficus* (*F. religiosa*, *F. bengalensis* and *F. virens*), Jamun (*Syzygium cumini*), Mahua (*Madhuka indica*), Karam (*Adina cordifolia*), Kadamba (*Anthocephalus chinensis*), Kendu (*Dysopyros melanoxylon*), Harida (*Terminalia chebula*), Bahara (*Terminalia belerica*) and Dhela (*Anangium salvifolium*) are found in every village side holy places and even in semi-urban and urban places and worshipped by the indigenous people of Jharkhand plateau during different occasions and periods of each year. Karam (*Adina cardifolia*), Ekh (*Saccahrum officinarum*) and Paddy (*Oryza sativa*) are worshipped by them during 'Karma Puja' and 'Jitibahan Puja'. Traditionally worshipped domestic and wild animals are *Bos tauralis* and *Bubalus bubalis* during Giri-Gobardhan Puja or Saharai (in the last week of November/1st week of December) and snake [ *Naja naja naja*, *Naja naja kauthia* (Cobras) and *Ophiophagus hannah* (King cobra)] in Nagapanchami (1st. week of July/1<sup>st</sup>. week of August).

**Religious taboo :** In India on religious ground varieties of traditional restraints or religious taboos have been imposed against the exploitation of wild plants and animals resource through restricted territory (hunting restricted to particular area of forest), selective human group (particular community for hunting specific animal) and the sex and developmental stages of plant and animal (consumption of flower or fruit under certain developmental stages in a specific season is banned, hunting of pregnant animals are not allowed).

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Restriction on consumption of plant parts like fruit, flower and leaf at certain season ensure propagation by enhancing the chances of seed germination after human consumption.

Hunting taboos on animals at critical developmental stages like pregnant deer ensure growth of prey population. Fishing is prohibited from Gangotri to Haridwar, as this stretch of river is considered sacred. Similar restrictions have also been imposed along other holy rivers of India. Religious restriction on fishing and hunting at certain time of the year are traditionally observed. The Hindus of Odisha during the month of Kartik (October—November) and the Hindus of Bihar during observation of “Chat” generally do not consume fish and nonvegetarian items.

### **SOCIO-RELIGIOUS MOVEMENTS**

Several social / environmental movements to promote nature conservation and to provide sustainable livelihood for local people have been initiated in India. Local movements inspired by religious belief supported by religious institutions are also functioning in India.

WWF-India’s “Vrindavan Forest Revival Project” was initiated in 1990 for eco-restoration of Vrindavan, a holy site for Hindus. At Chamoli, Uttarakhand, ‘Navdonya’ (religion based campaign) has been working with farmers to conserve traditional crop genetic diversity through exchange of traditional crop seed varieties during religious and social ceremonies. “Badrivan Restoration Programme” was launched at Badrinath, Chamoli Gharhwal (Uttaranchal) in the Indian Central Himalayas in 1993 to restore degraded Badrinath valley through reforestation/afforestation. “Badrivan” is the ancient sacred forest of Badrinath shrine, one of the four Hindu shrines of India where Lord Vishnu is worshipped in Badrinath temple. Adi Guru Sankaracharya named this sacred forest of Badrinath as “Badrivan”. Through this programme trees are being planted successfully by organizing ritual distribution of tree seedling / plant distribution and plantation ceremonies where Chief Priest of Badrinath shrine distributes tree saplings as “Briksha Prasad” to pilgrims, Purohits and local people, etc., in the temple premises for plantation in Badrinath valley especially for the revival of “Badrivan”. This shows how cultural approaches for reforesting degraded land can work on religious ground (co-existence of science and religion) towards environmental protection and biodiversity conservation by preserving spiritual and cultural values.

Besides India, in other Buddhist countries and developed countries like U.K., U.S.A. religion based environmental movements are also being encouraged. In international level, US based ARC (Alliance of Religion and Conservation ) is currently working on about hundred conservation projects with 11 major faiths. In India ARC project includes pilgrimage sites of Vrindavan and Sri Jagannath Forests. In U.S.A, during recent decades an environmental movement based on religion, intellectual and political components has been growing which is some time called as “*Spiritual Ecology*”.

### **DISCUSSION**

Conservation of tropical biodiversity has become one of the major global thrust.

Traditional Knowledge on biodiversity conservation in India is as diverse as 2753 communities. Knowledge, Innovations and Practices (KIP) of local communities respecting, protecting and rewarding these are included under Article 8(j) of Convention on Biological Diversity (CBD).

In number of instances, 'Science' has just rediscovered what was already known in local knowledge system. 'Science' and 'Religion' play equally vital role for one's all round development. They have to progress together for the progress of the world. Our biological heritage has been eroding from the hunting and food gathering stages through agricultural to modern age of trade and commerce. Commercialization and modernization resulted in deterioration of human values and loosening of hold on religion and ethics. There is an increasing realization that we need innovative ethics and policy to conserve biodiversity and maintain ecosystem. Religion can have the most powerful influence on human attitude and motivation. Thus if India's rich socio-religious practices are revived through awareness, its biodiversity can be conserved for present and future.

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PLATE – I, Figs. 1-6. Figures of Avataras



Fig. 1. Lord Vishnu



Fig. 2. Articles portrayed with four hands of Lord Vishnu (sacred chank), chakra, Gada and Padma



Fig. 3. 1st Avatara–“Mastya Avatara” (Fish, Aquatic Form)



Fig. 4. “Dasavatara” of Lord Vishnu



Fig. 5. 2nd Avatara–“Kuruma Avatara” (Tortoise, found both in land and water)

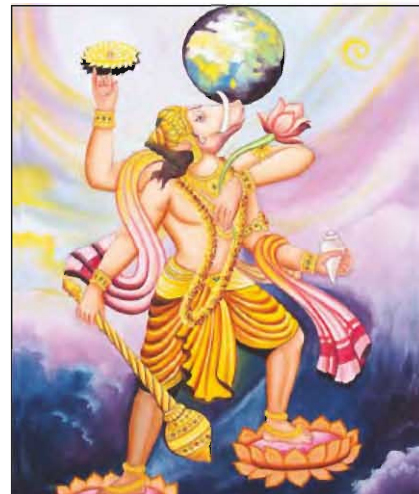


Fig. 6. 3rd Avatara–“Varaha Avatara” (Wild boar, a land animal)

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PLATE – II, Figs. 7-9. Animals associated with Hindu Gods and Goddesses as Bahanas/vehicles



Fig. 7. Mouse for Lord Ganesh



Fig. 8. Peacock for Lord Kartik



Fig. 9. Tiger for Goddesses Durga

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PLATE – III, Figs. 10-12. Worship of Animals and Tulsi plant by Hindus :

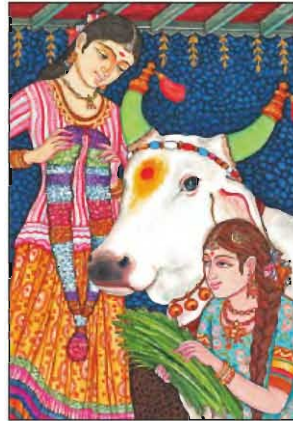


Fig. 10. Cow worship on “Rakshī Purnima”



Fig. 11. Snake worship in South India on “Naga Panchami”



Fig. 12. Tulsi Plant : Single & multiple plants worship

*Concept of biodiversity conservation in Indian religion*

PLATE – IV, Figs. 13. Socio-Religious Movement Practices



Fig. 13. Ritual distribution of plant at Badrinath (C & D) for restoration of Forest of Badrinath Valley (mainly "Badrivan"). ["Badrivan Restoration Programme"]

## TRADITIONAL NATURE-BASED CULTURE AND FOREST FESTIVALS OF CHOTANAGPUR PLATEAU AREAS, INDIA

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### ABSTRACT

Traditional cultural practices were observed for three decades at the relic patches of the lateritic Chotanagpur plateau forests and also in the urban areas resided by the migrant tribals. Trees are worshipped on the occasions of the flowering festival *baha*, plantation/ motivation for work festival *karam*, harvest *naban/sohrae/bandna*, *durga puja/nabapatrika* and *saraswati puja / vasant panchami*. Sacred trees like *ul/am/amrita-Mangifera indica* L., *amla/dhatri- Emblica officinalis* Gaertn., *bel/sinjo/sree-Aegle marmelos* (L.) Correa ex Roxb., *kanthal Artocarpus heterophyllus*, *tarop/piyal-Buchanania lanzan* Spreng, *Madhuca longifolia* (Koenig) J.F. Macbr., *Saraca asoca* (Roxb.) De Wilde, *bhela/soso-Semecarpus anacardium* L.f., *sal-Shorea robusta* Gaertn. f., *jam-Syzygium cumini* Skeels, *Neolamarckia cadamba* (Roxb.) Blosser, *haldu, karam-Haldina cordifolia* (Roxb.) Ridsdale, *Mitragyna parvifolia* (Roxb.) Korth., *Michelia champaca* L., *Mimusops elengi* L., *Butea monosperma* (Lam.) Kuntze, *Terminalia bellirica* Roxb. have wide medicinal uses.

**Key words :** *Ethnobotany, sacred trees, medicine, nature based festivals*

### INTRODUCTION

In India, worship was not always accustomed in the secluded atmosphere of temples. Ancient Indians loved the forest (*Topovan*). The cult of tree (*Ficus religiosa*) worship is borne out by a seal discovered at Mohenjodaro. The *bodhi* trees, i.e., *F. glomerata* is praised as *Vishnu /Udumbara*), *F. bengalensis* as of *Kasyap*, *Saraca asoca* as of *Vipaswi*. These *Kalpa-vriksha* represent eternal life and are grown in close proximity are *kanthal, champa, arjun, asan, chalta, piyal, dalim, ata, neem, amla, bel, palas, bivitak, haritaki* are found in *panchabati*. The Deities, *Durga, Lakhshmi, Saraswati, Krishna and Shiva* as well as the *Pongal* festivals are also based on nature protection. *Shakamvari /Navapatrika* is the symbol of goddess *Durga / mother Nature*, represented by nine plant species, viz., *Banana, Sugarcane, Colocasia, Curcuma, Jayanti, Punica granata, Saraca asoca, Oryza sativa* in front of a *Bilva* tree.

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Indian ethnic groups sustain nature-culture integrity linked to the landscape. The villagers and tribals have a fair knowledge of nature and surrounding plants. Their dependence on forest produce and change in lifestyle during the last three decades at the lateritic Chotanagpur forests were observed during the present work.

## **MATERIAL AND METHODS**

### ***Place of study and people***

Lateritic Chotanagpur plateau lies outside the Gangetic alluvial zone. Typical lateritic soil develops in climatic environment having alternating wet and dry season. Rainwater percolating through the top layer of the soil covers downward the soluble minerals in solution. During dry season the water rises to the surface and evaporates leaving the soil materials on the surface which contains compounds of iron and many other minerals. Field work was undertaken at villages of the Manbhum area which consists of undulating land with scattered hills – Baghmundi and Ajodhya range, Panchakot and hills around Jhalda, Dumka at Santhal Parganas and forest areas of Birbhum (Ilambazar, Ballavpur, Ganpur, Silpahari, Salvadra and Mallarpur).

Uni-ethnic, bi-ethnic and multi-ethnic villages with majority Santhal, Munda and Oraon, settled and marginal farmers, simple artisans Paharia, Mahli, Chik baraik and forest dweller Birhor were found in Baghmundi and other hilly tracts of Puruliya and Dumka. Following persons were consulted including medicinal practitioners : Vinod Murmu, Chakaichalan; Budhni Baski, Baghmundi; Mala Marandi, Dhundikhap; Sulekha Tudu, Charida, Baghmundi; Mongala Marandi, Jadugora; Baha Tudu, Chere Hansda, Ajodhya, Purulia; Chuku Janguru, Kubraj Hembrom, Bankajole, Ilambazar, Birbhum; Babe Murmu, Sobonpara, Kankalitala; Birbhum; Paku Hansda, Deer Park, Ballavpur; Lokhoi Murmr, Sumi Murmu, Balipara; Kali Marandi, Pearsonpalli; Mongol Murmu, Phuldanga; Santiniketan; Kusho Hembrom, Ganpur; Sri Bisnupada Guha, Dr. Surajit Sinha, ex-Vice Chancellor, Visva-Bharati University; Barka Soren, Manju Soren, Sriniketan; Kunal Deb, Mallarpur; Jaba Hansda, Chandmoni Hembrom, Labai Tudu, Bandhlodanga, Birbhum.

### ***Methodology***

Santhals are the largest ethnic group in the area. After completing a course in Santhali language following work was undertaken:

1. Ethnobotanical data collected in Jharkhand and lateritic West Bengal covering fifty tribal villages located in the suburban, afforested and natural forest areas (Guha and Banerjee, 1977; Sinha, 1977; Banerjee, 1999, 2005, 2011).
2. The non formal food and medicine resources were identified; the widely accepted practices evaluated and a comparative account was prepared to find unifying characteristics. Selected plant materials were screened for phytochemicals and radical scavenging capacities, inhibition of lipid peroxidation and DNA protection (Banerjee and De, 2005, 2011).

## **RESULTS**

Common uses of some festive trees are presented in Table 1.

**Table 1.** Common uses of some festive trees

Plant species Scientific name/ (Family)	Local name		Uses recorded during field survey
	Bengali	Santhali	
<i>Alangium salvifolium</i> (Alangiaceae)	<i>ankar</i>	<i>dhela</i>	Pasted bark used to cure <i>bandorgalli</i> (cancerous sore).
<i>Ailanthus excelsa</i> (Simarubaceae)	<i>akash neem</i>	<i>babar ote dare</i>	Pasted bark used to cure blood dysentery.
<i>Annona squamosa</i> (Annonaceae)	<i>ata</i>	<i>mandar gom</i>	Unripe fruit eaten for abortion, flowers made to inhale in epileptic fit.
<i>Azadirachta indica</i> (Meliaceae)	<i>neem</i>	<i>neem</i>	Flowers along with tender leaves are consumed as food, fried, eaten in moderate doses, consumed with boiled raw brown rice ( <i>neem dak' mandi or neem suruk'</i> ) as a ritual food connected with birth and death, carminative, applied externally (with mustard oil), mosquito repellent, spermicidal agent, in insomnia, sedative.
<i>Bauhinia acuminata</i> <i>B. purpurea</i> (fabaceae)	<i>kanchan</i>	<i>kachnar</i>	Buds and young leaves are consumed as vegetable, antidysenteric.
<i>Bombax ceiba</i> (Bombacaceae)	<i>shimul</i>	<i>aedel</i>	Calyx part is used as vegetable, laxative. Infusion of flowers is taken as contraceptive.
<i>Buchanania lanzan</i>	<i>piyal</i>	<i>tarop</i>	Tasty fruit, tonic, intestinal disorder.
<i>Butea monosperma</i>	<i>palas</i>	<i>murup</i>	Flowers are used in cough and cold, in eczema, laxative, favorite for lac, dye, fuel and fodder.
<i>Dillenia indica</i>	<i>chalta</i>	<i>chalta</i>	Ripe fruit favourite, carmine, tonic.
<i>Diospyros melanoxylon</i>	<i>Kendu</i>	<i>Tendu</i>	Fruit favourite, leaf used in <i>biri</i> industry.
<i>D. tomentosa</i>	<i>Kend</i>	<i>Kend</i>	Fruit favourite.
<i>Emblica officinalis</i>	<i>amlaki</i>	<i>amlaki</i>	Popular tonic sour fruit; leaves and deciduous flowers are also taken as food.
<i>Gmelina arborea</i>	<i>gamar</i>	<i>gamar</i>	Favourite timber, flowers and fruits taken as food.
<i>Lannea coromandelica</i>	<i>jiyal</i>	<i>dhoka</i>	Pasted bark applied on skin diseases and tumour.
<i>Madhuca longifolia</i>	<i>mahua</i>	<i>matkom</i>	Deciduous corolla ( <i>teke</i> ) is collected, dried in sun, taken as food at the time of scarcity or boiled / raw eaten with rice or wheat flour. Wine ( <i>duhlia</i> and <i>paure</i> ) from the petals. Fruits ( <i>kochra</i> ) cooked as vegetable. The santhal village <i>Matkom dihi</i> at Ajodhya is named after the beautiful tree. In marriage ceremony, the bride embraces the tree, walks round it; considered sacred in incineration.
<i>Moringa oleifera</i>	<i>sajne</i>	<i>munga</i>	Consumed as vegetable, cholagogue, diuretic, tonic, immunoprotective.

Table 1. Contd.

Plant species Scientific name/ (Family)	Local name		Uses recorded during field survey
	Bengali	Santhali	
<i>Semecarpus anacardium</i>	<i>bhela</i>	<i>soso</i>	favourite fruit.
<i>Schleichera oleosa</i>	<i>kusum</i>	<i>baru</i>	Edible fruit, young leaves cooked, lac cultivated.
<i>Shorea robusta</i>	<i>sal</i>	<i>sarjon</i>	Leaf cup and plates, fruit, seed pasted with rice and taken as tonic, resin for fumigation, tasar cultivated.
<i>Spondius pinnata</i>	<i>amra</i>	<i>amra</i>	Young fruit diuretic, tonic, sour tasty food.
<i>Terminalia arjuna</i>	<i>arjun</i>	<i>asan</i>	Favourite for tasar, medicine.
<i>T. tomentosa</i>	<i>arjun</i>	<i>asan</i>	—do—
<i>Tamarindus indica</i> ( <i>Caesilpi neaceae</i> )	<i>tentul</i>	<i>jojo</i>	Leaves, flower fruit, seed powder food, preserved, eaten raw or cooked, drink, astringent, sedative.
<i>Ziziphus jujuba</i> ( <i>Rhanhaceae</i> )	<i>kul</i>	<i>ber</i>	Sour tasty food, preserved, lac cultivated.

### Observations

The characteristic vegetation is being destroyed or changed due to urban settlements, extension of agricultural fields and appearance of exotic plants. The community is dependent on indigenous forests while residents do social forestry.

The *sal* and other indigenous trees are praised as Goddess *jahera*, the representative of Mother Nature and stones are kept below the tree representing *maranburu* (the mountain) protected by forest *jahera*. *Jaher than* /sacred groves shelter indigenous biodiversity and maintain microclimate. The typical indigenous *sal* and mixed *sal* flora is declining. The climbers and trees are :

*Asparagus racemosus*, *Bauhinia vahlii*, *Butea superba*, *Combretum decandrum*, *Celastrus paniculatus*, *Gymnema sylvestre*, *Ichnocarpus frutescens*, *Buchanania lanzan* and *Pterocarpus marsupium*.

Forest ground flora at Birbhum is with *Drosera burmandii*, *D. indica*, *Eriocaulon* sp., *Bulbostylis* sp., *Burmannia* sp., *Biophytum sensitivum*, *Cassia mimosoides*, *Cyperus* spp., *Desmodium gangeticum*, *D. triflorum*, *Evolvulus* spp., *Eulaliopsis binata*, *Hemidesmus indicus*, *Hybanthus enneaspermus*, *Ichnocarpus frutescens*, *Mimosa rubicaulis*, *Mollugo* spp., *Ocimum canum*, *Polygala* spp., *Solanum surattense*, *Lygodium pinnatifidum* and *Flacourtia indica*.

The tribal women of the area compose lyrics on sun (*sin chando*), moon (*nindo chando*), cloud (*rimil*), the undulated lateritic land, streams and rivers. A common bengali song of Birbhum is:

"Boro nadir boro ban, choto nadir choto ban, nadite jal jae re sona rupa pae, lal nil halud koto phul, sal nadi boney basa go, khoai ese kopai holo dukul bhasa, ki koribo baganer phul" (The *sal* river originated in Chotanagpur forest with wild flowers on river banks, while entering the barren *khoai*, it flooded, now what to do with garden flowers?).

*Traditional nature-based culture*

They also compose lyrics on trees of the area :

Neem-Azadirachta indica A. Juss., “*tokoa rachare toate neem...*”

Sal/sarjon- *Shorea robusta* Gaertn. f., “*Okoe koko bahaena sarjon dare ko...*”, Piyal / tarop-Buchanania lanzan Spreng., Palas/murup-Butea monosperma (Lam.) Kuntze, matkom-Madhuca latifolia (L.) Macbride, ul-Mangifera indica L., keli kadam/karam Haldina cordifolia/Mytragyna parviflora Korth., sinjo Aegle marmelos Corr., ankar/dhela-Alangium salvifolium (L.) Wang., tentul/jojo- Tamarindus indica L., kachnar-Bauhinia purpurea L., muchkunda-Pterospermum acerifolium Willd., Phyllanthus emblica Gaertn, Saraca asoca (Roxb.) De Wilde, Syzygium cumini Skeels, Terminalia spp., Ficus religiosa, kadam-Neolamarkia cadamba, Artocarpus integrifolia L., Mimusops elengi, Grewia asiatica, Annona squamosa, Ziziphus oenoplia (L.) Mill.

Females sing in chorus in festivals, while working in groups and while returning after whole day toil. Males play flute and drum accompaniments.

The common festivals are: *Hal punhya* -the beginning of ploughing; *Eroc-Seed* sowing, *Hororohoi*- paddy plantation; *Jawa /Karam*- Plantation and worship of *Haldina cordifolia* or *Mitragyna parvifolia* for well being and motivation for *karam/work*. ‘Pahan’ takes three new earthen pots and fills them with fresh water. Next morning if the water level decreases he predicts that there would be famine or less rain and if the water level is normal, that is the sign of a good rain. Girls celebrate the *Jawa* festival. The girls decorate a small basket with germinating seeds; good germination of the grains indicates prosperity. They tie friendship bands *karam der* with each other and with the tree twigs.

*Horo nawai, nawa khawa / nua khiya, horo nawakhani, naban, pous parvan*: harvest /new rice feast.

*Bandna /Sohrai* celebrated during winter. This festival is mainly for harvest and songs *Ohira* acknowledge animal’s contribution. They wash, clean, paint, decorate and feed their cows and bulls well and, put ornaments to them. Natural colour is used for decorating animals. *Jagran, Gai bandna* “*jago ma bhagawati.....*”

*Bandna* Lyrics on birds, “*serma latar latarte seraliko udaukana*’ (we are free and wandering as migratory birds).

*Pous parvan/parab: mela* at Santiniketan is the fair with songs, traditional dance, sports and feast with *pitha/* rice cakes.

*Magh parab /maghotsava*: Harvest feast with divine songs and dances.

*Naue-sakam*- leaf emergence festival with copper coloured *neem, kusum, Diospyros* leaves, young green leaves of *bhela (ankar), A. salvifolium* and traditional song: “*Tokoa rachare hipir hipir neem*”

*Baha, sarhul /dol /vasantotsav ul /nawakhani; sal* blossom festival; flowering tree worshipped as Goddess *jahera, baha* theme song “*Felling flowering branch will destroy life*”. “*Okoe koko bahaena, Sarjon dare ko...*”. *Pahan* distributes *sal* flowers to everybody. Use of *palas* flowers is restricted at Santiniketan. Use of *sal* flowers needs to be checked. *Baha* dancing is very sober, spiritual, hit heels, a bold posture as liberty on soil. Dress is simple and elegant (*panchhi parhan*).

Trees praised in *baha* parab are: *Mangifera indica*, *Buchanania lanzan*, *Semecarpus anacardium*, *Scleichera oleosa*, *Madhuca indica*, *Haldina cordifolia* *Holarrhena pubescens*, *Alangium salvifolium*, *Michelia chamapaca*, *Pterospermum acerifolium*, *Ohna squarrosa* and *Saraca asoca*. *Baha* song says “*horote chalajokhe horoe nela, bir te ruar jokhe bire nel in, chandai nel in*” (when I go to work, town people stare at me, but when I return through forest the forest trees and the moon blesses me).

The festival - *Meen mangal* protecting indigenous fishes is celebrated at Birbhum inspired by Pannalal Dasgupta and Shyamalidi (Khastagir, 2009). The *Mahli* makes bamboo fishing cage.

The hills of Ajodhya, Mathaburu, Dumka and Parasnath are worshipped as *Marangburu*. A popular santhali song says- “at Bolpur market town you have shown me around motor ride, like a bird in a cage, bought trinkets from fancy shops, took me to cinema show but my *maranburu* hill side wandering was more lovable”.

Hunting festival at Ajodhya hills is performed every year. Tourists visit there on full moon night of *Baisakh* and observe the hunting festival for three days. Santhal women keep themselves away from the hunting festival. The tribal women take major role in *karam* or plantation festival, *sohrae/ bandhna* or harvest festival and *baha* or flowering festival based on the theme of protection and conservation of nature and the biodiversity.

*Hul*, Santhal rebellion is remembered (this year whole night programme has been performed at Balipara, Santiniketan with use of loudspeakers and electric lights) but the nature based female folklores and festivals that give message for peace and harmony are neglected.

*Pata parab/Charak* is the festival between spring and summer, as the worship of *Maran buru /Bara Pahar, Shiva*. After worship in the evening, devotees take part in dynamic and vigorous *Chhau dance* with lots of gymnastic actions and mask. The main theme is *Durga/ Goddess jahera/forest deity* protects animals, peacock, owl, elephant, lion, etc. with her forces and fights against demon, the evil force.

Uses of plants are declining due to the loss of habitat and discontinuity of the chain of acquired knowledge. At present plants/traditional open air sacred grove/ *jahera* are replaced with statue worship. The neighbors are ignorant about the cultural heritage of tribals. Some tribals are proud of being in other religion or castes as if it raised her from inferior *majhen*. Some of the uprooted and migrated ethnic groups, now labours and marginal farmers, in spite of poverty and hurdles inherit and continue their traditional forest based knowledge, culture and festivals, e.g., *karam, baha/sarhul, sohrae/ bandhna* (Banerjee, 1977; 2011). In the suburban Oraon villages near Kolkata, Sodepur, Panihati, Shyamnagar and Sundarban they regularly perform these festivals with huge gathering from local and Jharkhand areas. Sibua Oraon (Sodepur), Barka Soren (Birbhum), Ramnath Murmu, Vinod Murmu (Ajodhya hills), Satyabala Sing Sardar (Dhundikhap, Baghmundi), Biswajit Mahakur, (Sundarban) were some of the best organizers.

### *Traditional nature-based culture*

Felling of flowering branches was prohibited among *santhal*, *oraon*, *munda* and many other ethnic groups. In ancient India common fruit trees mango, *amla* and *bel* were called *amrita* (anti aging life nectar), *dhatri* (nurse) and *sree* (grace giving) respectively. The aged tribal women use these in similar way. Modern tribal girls ignore traditions. The tribal children are behind the class progress and their aptitude in nature study is not appreciated in academic institutions.

Malpractices of the *ojha* with *bonga* and *dan* have been increased in villages at the outskirts of urban areas. Women are the major victims. Those who know use of plants do not practice witchcraft. The *ojha* and patients suffering from diseases for years and having no facilities for modern treatment, blame that it was the influence of *dan* or witch. Sometimes they used to rub oil on leaves of the sacred trees to concentrate mind and create atmosphere for treatment (*tel pata* or *sunum bonga*). The ruderals (e.g., *Ocimum canum*) are uprooted by women for food, fuel and medicine; still they grow in abundance every year. Some aged women (Chandmoni, Phulmoni, Sumati, Santiniketan) said that collection or removal of old plants help seed dispersal and growth of young plants.

During the present unrest and harsh situations medical centers are abandoned in forest areas of Ajodhya and many other places. Dependence on plant food and medicine was observed at Ajodhya, Baghmudi, Ilambazar, Ganpur and Dumka. Firewood, flowers, fruits, grains, woods, roots, tubers and resin are collected by village people. Forest provides major source of income during the lean period of agriculture.

## DISCUSSION

The traditional nature based festivals, eco friendly methods of collection, natural forest formation and sacred groves are important for economic and cultural stabilization of the local inhabitants and conservation of the unique biodiversity minor hot spot of India.

The women and children gather deciduous leaves, twigs and weeds for fuel and roots, rhizomes, leaves, bark, gum, flowers, fruits, mushrooms, rodents, molluscs, fishes, birds and eggs for food and medicine. Many wild indigenous plants of traditional use have food/medicine /economic value equal or even higher than the commonly available items in the market (Banerjee *et al.*, 1999, 2005, 2010, 2012).

Different cultural groups have significantly different medicinal plant traditions whereas the plant species used are unique in an area. The uses of plants are declined in recent years due to (a) lack of knowledge about herbal medicine, (b) scarcity of medicinal plants, (c) malpractices of the *ojha* who applies fake ritual methods instead of plant products, (d) urban expansion and destruction of habitats and (e) breakdown in traditional societal structures of the transmission of knowledge.

During festivals they used to decorate the area with natural dye prepared from different plants with yellow hydrolysable tannin, flavones and isoflavones, red/brown anthocyanin, condensed tannins /proanthocyanidins, anthraquinone, phlobaphene, rubiadin and tannin mordant for fabrics that improve the affinity. Such use needs recognition as sustainable alternatives to synthetic colour in food, medicine, cosmetics

and textiles. Income generation opportunities from non timber forest produces with non-destructive harvesting methods, improved methods of fruit drying and preparation of vegetable colour and dye are possible. Forest fests, folk songs, dances and eco friendly methods of collection of food and fuel by women and children are important for their cultural stabilization and conservation of the Chotanagpur plateau forest which is a unique biodiversity minor hot spot of India. It needs mention here that our field work started in 1975, covering twenty Santhal villeges near Santiniketan, the place near relic patches of Chotanagpur forests where Rabindranath Tagore taught living in harmony with Nature. He wrote about forests and trees (The message of the forests — *Bana-Bani*, songs on *Prakriti*, *Bithika*, *Mahua*) and introduced tree-planting at Santiniketan as a festival on 21st July, 1928. Many of his music and dance forms are dedicated to Nature – Soil, Water, Fire, Air and Sky. The concept of Nature and plant protection in the forest festivals and Tagore's idea to conserve forest based sustainable livelihood of peace, harmony and biodiversity, might serve as a foundation for “global living”.

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## CONSERVATION OF PLANT SPECIES THROUGH AGE-OLD RELIGIOUS AND SOCIAL PRACTICES IN SOUTHERN WEST BENGAL

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### ABSTRACT

Some traditional religious activities like Hindu pattern of worshipping (*puja*), rituals, vows (*brata*) and social practices, not directly related to religions in most of the districts of south West Bengal, involve use of a good number of plant species almost mandatorily. These practices used to be followed by Hindus for thousands of years past, and have turned to be a routine and obligatory part of their daily life. In the present work of documentation of one hundred such plants has been made observing socio-religious practices in southern West Bengal.

**Key words :** *Religious rituals, vows, social events, plants, medicinal use*

### INTRODUCTION

*Ayurveda*, the ancient method of medical treatment in the oriental part of globe, has been developed through thousands of years application, observation and research, by a great number of sincere and devoted saints like *Baidyas* (physicians) and *Acharyas* (teachers), who have recorded hundreds of plants and their medicinal use to cure a large number of diseases and ailments prevalent in the human society (CSIR, 1949-1976; Bhattacharya, 1976-1997; Kabiratna and Shastri, 2010). The science of *Ayurveda*, which was essentially thought as an innate part of peoples' religion is rather an essential and inseparable part of their lifestyle and culture. These medicinal and/or socio-religious plant species which are conserved through age-old socio-cultural practices in southern West Bengal are documented in the present communication.

### MATERIALS AND METHODS

In the present work about one hundred species of plants have been enlisted, mentioning the name of *puja* or ritual or festival they are associated to which, their local or vernacular names, and scientific names and families to which they belong. The names of diseases and ailments, against which these plants are used, are also mentioned against each plant.

**Table 1.** List of socio-religious and medicinal plant species recorded in southern West Bengal.

Sl. No.	Local name and plant part (s) used	Scientific name (family)	Disease / disorders against which used
<b>A. Geeneral category (common in most of the events)</b>			
1.	Kala : whole plant/ fruits / leaves	<i>Musa paradisiaca</i> Linn. (Musaceae)	Helminth infection, dry cough, dysentery, leucorrhoea, diabetes, vitality loss.
2.	Halud / Haridra:whole plant/ roots only	<i>Curcuma longa</i> Linn. (Zingiberaceae)	Bacterial infection, helminth, gleet, stammering, allergy, asthma, carbuncle boils, cornea infection, sprain infection
3.	Chandan : wood	<i>Santalum album</i> Linn. (Santalaceae)	High blood pressure, fever, epilepsy, pox, whooping cough and female diseases.
4.	Yav : grains	<i>Hordeum vulgare</i> Linn. (Poaceae)	Obesity and excessive fat, diabetes, gonorrhoea, heart ailments, infertility.
5.	Til : grains	<i>Sesamam indicum</i> De. (Pedaliaceae)	Chronic skin ulcers, alopecia, dysentery, urinary stricture, indigestion, boils, piles.
6.	Maskalai : grains	<i>Phaseolus radiatus</i> Linn. (Leguminosae)	Piles, chronic indigestion, lower sperm count, general weakness, suppuration of boils.
7.	Dhan / chal : grains	<i>Oryza sativa</i> Linn. (Poaceae)	Arthritis, improper urination, malnutrition, diabetes.
8.	Bel : leaves / fruits	<i>Aegle marmelos</i> (Rutaceae)	Cough and cold, constipation, memory loss, chronic dysentery, heart ailments, low sperm counts.
9.	Durbwa : leaves	<i>Cynodon dactylon</i> Linn. (Poaceae)	Leucorrhoea, female infertility, hair fall, pyorrhea, dysentery, fungal dermatitis.
10.	Tulasi : leaves	<i>Ocimum sanctum</i> Linn. (Lamiaceae)	Bacterial infection, cough, fatigueness of liver, allergy, urinary disorder, insect bites, act as blood purifier .
11.	Shaal (Dhuna) : resin	<i>Shorea robusta</i> Gaertn. (Dipterocarpaceae)	Helminth infection, gonorrhoea, blood dysentery, septic ulcers, boils.
12.	Guggool : resin	<i>Balsamodendron mukul</i> Hook. (Burseraceae)	Early aging, cough, inflated spleen, menstrual disorder, gleet, arthritis, siatica.
13.	Supari : fruit	<i>Areca catechu</i> L. (Arecaceae)	Pyorrhoea, blood dysentery.
14.	Aakh (Ikshu) : stem	<i>Saccharum officinarum</i> L. (Poaceae)	Prostratitis, ricketsia, nasal congestion.
15.	Pat : pith	<i>Corchorus capsularis</i> (Tiliaceae)	Vitamin 'A' deficiency, constipation.

Sl. No.	Local name and plant part (s) used	Scientific name (family)	Disease / disorders against which used
16.	Awasttha : wood	<i>Ficus religiosa</i> Linn (Moraceae)	Sexual disability of males, night falls, vomiting, ulcers, burns, vaginal ulcers.
17.	Siddhi : leaves	<i>Canabis sativa</i> Linn (Urticaceae)	Diarrhoea, cough, tetanus, mensrhoea, to accelerate child delivery.
18.	Haritaki : fruits	<i>Terminalia chebula</i> Retz. (Combretaceae)	Dropsy, asthma, ulcers, loss of eye sight.
19.	Amla / Amlaki : fruits	<i>Emblica officinalis</i> Gaertn. (Euphorbiaceae)	Acidity, diabetes, fever, vomiting, biliary colic.
20.	Dab / narikel : fruit	<i>Cocos nucifera</i> Linn. (Arecaceae)	Constipation, urinary stricture, prostatitis, tapeworm, lower sperm count, diabetes.
21.	Kush : leaves	<i>Desmostachya bipinnata</i> Stapf. (Poaceae)	Piles, menorrhagia, burning urination, gall stone, boils, skin ulcers.
22.	Aam : leaves	<i>Magnifera indica</i> Linn. (Anacardiaceae)	Dysentery, toothache, burns, whitlow, danfruff, menorrhagia, spleen enlargement.
23.	Pan : leaves	<i>Piper betle</i> (Piperaceae)	Ulcers on dentalgum, ring worm, pus in earpit, chilblain, whitlow.
<b>B. Durga puja (Naba Patrika)</b>			
1.	Kala : whole of the plants	<i>Musa paradisiaca</i> Linn. (Musaceae)	Please refer to Sl.. No. 1A.
2.	Halud/Haridra : whole plant	<i>Curcuma longa</i> Linn (Zingiberaceae)	Please refer to Sl.. No. 2A.
3.	Ashok : twig	<i>Saraca indica</i> Linn (Caesalpiniaceae)	Menstrual disorder of women, neural arthritis, heart ailments, all type of leucorrhoea, piles.
4.	Bel / Bilwa : twig & fruit	<i>Aegle marmelos</i> (Rutaceae)	Please refer Sl.. No. 8A.
5.	Jayanti : twig	<i>Sesbania sesban</i> Mear (Leguminosae)	Fever, diabetes, leucoderma, arthritis, pox.
6.	Man-kachu : whole plant	<i>Alocasia indica</i> schott (Araceae)	Blood purifier, dropsy, jaundice, ottifins.
7.	Dhan / Dhanya : whole plant	<i>Oryza sativa</i> (Poaceae)	Vitalizer against general weakness.

Table 1. contd.

Conservation of plant species through age-old religions.....

Sl. No.	Local name and plant part (s) used	Scientific name (family)	Disease / disorders against which used
8.	Darim / Dalim : twig	<i>Punica granatum</i> Linn (Punicaceae)	Diarrhoea, dysentery, bloody gleet, cough, flat/round worms, heart ailments, liver inflammations, nasal blood discharge.
9.	Pan kachu / kalo kachu : whole plant	<i>Colocasia esculenta</i> (Araceae)	Jaundice, dropsy, blood purifier.
10.	Aparajita lata : stem and leaves	<i>Clitoria ternatea</i> (Papilionaceae)	Memory and intelligence restorer, epilepsy.
<b>C. Durga puja (Pancha sashya)</b>			
1.	Kalai : grains	<i>Phaseolus radiatus</i> (Papilionaceae)	Heart disease, general weakness, malnutrition, lower sperm count, perkinsons disease.
2.	Chhola : grains	<i>Cicer arietinum</i> Linn. (Leguminosae)	Burning skin sensation, burning urination, skin complexion, general weakness, indigestion.
3.	Matar : grains	<i>Pisum sativum</i> (Papilionaceae)	Gonorrhoea, loss of appetite, chronic acidity, pimples, pain of knee joints.
4.	Til : grains	<i>Sesamum indicum</i> D. C. (Pedaliaceae)	Please refer Sl. No. 5A.
5.	Yav : grains	<i>Hordeum vulgare</i> Linn. (Poaceae)	Please refer Sl. No. 4A.
<b>D. Durga puja (Pancha pallav)</b>			
1.	Aam : twig	<i>Mangifera indica</i> Linn. (Anacardiaceae)	Please refer Sl. No. 22A.
2.	Jam : twig	<i>Syzygium cumini</i> Skeels. (Myrtaceae)	Diabetes, blood dysentery, vomiting, old ulcers, bloody stools, cuts
3.	Kanthal : twig	<i>Artocarpus heterophyllus</i> Lamk. (Moraceae)	Cardiac spasm, arthritis, wide range of skin diseases, inflammations
4.	Ashok : twig	<i>Saraca indica</i> Linn. (Caesalpiniaceae)	Please refer Sl. No. 3B.
5.	Bakul : twig	<i>Mimusops elengi</i> Linn. (Sapotaceae)	Lower sperm count, Leucoderma, caries, chronic dysentery.
<b>E. Durga puja (Chaner dala)</b>			
1.	Yav : grain	<i>Hordeum vulgare</i> Linn. (Poaceae)	Please refer Sl. No. 4A.

Table 1. contd.

Proc. Nat. Sem. Trad. Knowl. &amp; Soc. Prac. :

Sl. No.	Local name and plant part (s) used	Scientific name (family)	Disease / disorders against which used
1.	Til : grain	<i>Sesamam indicum</i> De. (Pedaliaceae)	Please refer Sl. No. 5A.
2.	Sarisha : grain	<i>Brassica campestris</i> (Brassicaceae)	Filaria, Madness, neural arthritis, Synovitis, mumps, skin diseases
3.	Agooru : wood extract	<i>Aquilaria agallocha</i> Roxb. (Thymelaeaceae)	Excessive fat, anaemia, asthma
4.	Chandan oil : oil	<i>Santalum album</i> Linn. (Santalaceae)	Please refer Sl. No. 3A.
<b>E. Durga puja (Sacrifice)</b>			
1.	Aakh / Ikshu : juice	<i>Saccharum officinarum</i> Linn. (Poaceae)	Please refer Sl. No. 14A.
2.	Narikel jal : endocarp water	<i>Cocos nucifera</i> Linn. (Arecaceae)	Please refer Sl. No. 20A.
3.	Mohousadhi : extract	<i>Dioscorea bulbifera</i> Linn. (Dioscoreaceae)	Syphilis, piles, old skin ulcers, inflammations.
4.	Shasha : fruit	<i>Cucumis sativa</i> Linn. (Cucurbitaceae)	Memory loss, excessive sexual excitement, urinary failure.
5.	Chal kumda : fruit	<i>Benincasa hispida</i> Cogn. (Cucurbitaceae)	Pleurisy, dialated heart, memory loss, tuberculosis.
6.	Kala : fruit	<i>Musa paradisiaca</i> Linn. (Musaceae)	Please refer Sl. No. 1A.
7.	Aakh / Ikshu : whole plant	<i>Saccharum officinarum</i> Linn. (Poaceae)	Please refer Sl. No. 14A.
<b>F. Durga puja (Hom)</b>			
1.	Apang : twig	<i>Achyranthes aspera</i> Linn. (Amaranthaceae)	Piles, vomiting, excess appetite, palpitation, itches.
2.	Akanda : flower	<i>Calotropis gigantea</i> R. Br. (Asclepiadaceae)	Asthma, acidity, leprosy, piles, eczema, biting of poisonous scorpion.
3.	Shar : stem	<i>Saccharum bengalense</i> Retz. (Poaceae)	Loss of memory, unusual thirsty, less urination.

Table 1. contd.  
Conservation of plant species through age-old religious.....

Sl. No.	Local name and plant part (s) used	Scientific name (family)	Disease / disorders against which used
4.	Palash : leaves	<i>Butea monosperma</i> Kuntze. (Papillonaceae)	Skin roughness, night sweat, helminth infection, bloody leucorrhoea, lesser sperm count.
5.	Shimul : leaves	<i>Salmalia malabaricum</i> Schott & Endl. (Bombacaceae)	Disability of males, dysentery, spleen inflammation, pimples on face.
6.	Yagna dumur : twig	<i>Ficus racemosa</i> (Moraceae)	Bleeding piles, haemoptysis, cuts and bleeding, gland inflammation, boils
7.	Khadir : twig	<i>Acacia catechu</i> (Mimosaceae)	Leucodermy, cough, excess fat, septic boils, slow poison, allergic inflammation.
8.	Shain : leaves	<i>Acacia suma</i> (Mimosaceae)	Diarrhoea, vomiting, fever, blood dysentery.
9.	Aswattha : dry wood	<i>Ficus religiosa</i> Linn. (Moraceae)	Please refer Sl. No. 16A.
<b>G. Aparajita puja</b>			
1.	Aparajita : Creeper stem	<i>Clitoria ternatea</i> (Leguminosae)	Please refer Sl. No. 10B.
<b>H. Saraswati puja</b>			
1.	Basak : flower	<i>Adhatoda vasica</i> Nees. (Acanthaceae)	Cough, any type of bleeding, asthma, itches, pyles, bacterial contamination of water, drunkers syndromes, excessive fat.
2.	Palash : flower	<i>Butea monosperma</i> Kuntze. (Papilionaceae)	Please refer Sl. No. 4F.
3.	Aam : inflorescence	<i>Magnifera indica</i> Linn. (Anacardiaceae)	Please refer Sl. No. 22A.
4.	Yav : panicle	<i>Hordeum vulgare</i> Linn. (Poaceae)	Please refer Sl. No. 4A.
5.	Shar : stem	<i>Saccharum bengalense</i> Retz. (Poaceae)	Please refer Sl. No. 3F.
6.	Kul (Jora) : fruits	<i>Zizyphus jujuba</i> Lam. (Rhamnaceae)	Cronic colitis, heart weakness, bed shore, constipation, pox, leucorrhoea, heamoptisis.
7.	Shim (Jora) : fruits	<i>Dolichos lablab</i> Linn. (Papilionaceae)	Nasal bleeding, fever, male sexual weakness.

Table 1. contd.

Proc. Nat. Sem. Trad. Knowl. &amp; Soc. Prac. :

Sl. No.	Local name and part (s) used	Scientific name (family)	Disease / disorders against which used
<b>I. Shib puja</b>			
1.	Kalke/Halud karabi : flower	<i>Thevetia peruviana</i> Merrill. (Apocynaceae)	Heart beat inhibition, leucodermy, itches, arthritis, fever.
2.	Bel : leaves & fruits	<i>Aegle marmelos</i> (Rutaceae)	Please refer Sl. No. - 8.
3.	Dhutra : flower & fruits	<i>Datura metel</i> Linn. (Solanaceae)	Madness, dog bites, alopecia, inflammation and pain.
4.	Akanda : flower	<i>Calotropis gigantea</i> R. Br. (Asclepiadaceae)	Please refer Sl. No. - 57.
5.	Kala : flower	<i>Rubia cordifolia</i> (Rubiaceae)	Blood dysentery, inflammation, conjunctivitis, insect bites, headache.
<b>J. Itu puja</b>			
1.	Kachu : whole plant	<i>Colocacia esculenta</i> (Araceae)	Jaundice, dropsy, and act as blood purifier
2.	Halud : whole plant	<i>Curcuma longa</i> (Zingiberaceae)	Please refer Sl. No. - 2.
3.	Dhan : whole plant	<i>Oryza sativa</i> (Poaceae)	Please refer Sl. No. - 7.
4.	Sushuni shak : whole plant	<i>Marsilea quadrifolia</i> Linn. (Marsileaceae)	Burning micturation, loss of remembrance, asthma, epilepsy, sleeplessness, tranquiliser
5.	Kalmi shak : whole plant	<i>Ipomoea reptans</i> Poir. (Convolvulaceae)	Lactogenic deficiency, gonorrhoea, pox, night falls, memory loss.
6.	Chhola : whole plant	<i>Cicer arietinum</i> Linn. (Leguminosae)	Burning urination, gleet, general weakness, skin glaze loss
7.	Kalai: whole plant	<i>Phaseolus radiatus</i> (Papilionaceae)	Please refer Sl. No. - 34.
<b>K. Shasti puja</b>			
1.	Bansh / Bansha : leaves	<i>Bambusa bambos</i> (Roxb.) Druce (Poaceae)	Dropsy, menstrual disorder, energy promoter, enhances lactation in cattles.
2.	Bat : leaves	<i>Ficus bengalensis</i> (Moraceae)	Toothache, nasal bleeding, loose body contour, piles of vagina, leucorrhoea, pimples.

Table 1. contd.  
Conservation of plant species through age-old religions.....

Sl. No.	Local name and plant part (s) used	Scientific name (family)	Disease / disorders against which used
<b>L. Janmastami puja</b>			
1.	Tal : fruit pulp	<i>Borassus flabellifer</i> Linn. (Arecaceae)	Renal stricture, chronic acidity, leucorrhoea, gonorrhoea.
<b>M. Ghantakarna puja</b>			
1.	Ghantakarna / Ghentu : twig & flower	<i>Clerodendrum viscosum</i> Vent. (Verbenaceae)	Intestinal helminth, malaria, all skin diseases, tumour, louse.
<b>N. Gachh puja</b>			
1.	Awasttha : entire plant	<i>Ficus religiosa</i> (Moraceae)	Please refer Sl. No. 16A.
2.	Bat : entire plant	<i>Ficus bengalensis</i> (Moraceae)	Please refer Sl. No. 2K.
3.	Manasa Gachh /Sizu Gachh : entire plant	<i>Euphorbia neri folia</i> Linn. (Euphorbiaceae)	Joint pains, gleet with urine, warts, snake bite, hooping cough, eczema, piles.
<b>N. Dak shankranti puja</b>			
1.	Shar : entire plant	<i>Saccharum bengalense</i> Retz. (Poaceae)	Please refer Sl. No. 53F.
2.	Tentul : fruit	<i>Tamarindus indica</i> Linn. (Caesalpineaceae)	Dysentery, arthritis, high cholesterol, kidney malfunction, dropsy, cough and act as rejuvenator.
3.	Karpus tula : matured fruit fibre	<i>Gossypium herbaceum</i> Linn. (Malvaceae)	Disorder in menstruation, lactogenic deficiency, joint rheumatism, gleans pus in ear holes.
Both in rural and urban areas of West Bengal, some particular days are observed as 'Baar'; which are nothing but vows. Sometimes they are called 'Brata', the Bengali term of vows. Few common such 'Bratas' together with their associated plants, are mentioned below:			
<b>O. Punyi pukur brata</b>			
1.	Bel : stem with thorns	<i>Aegle marmelos</i> (Rutaceae)	Please refer Sl. No. 8A
2.	Kolke / Halud karabi : flowers	<i>Thevetia peruviana</i> Merrill. (Apocynaceae)	Heart beat stimulator, itches, fevers, ulcers. Seeds of this plant is very much poisonous may even cause death.
<b>P. Sanjh puja brata</b>			
1.	Kash : flower	<i>Saccharum spontaneum</i> (Poaceae)	Chronic indigestion, loss of memory, loss of sex desire.

Table 1. contd.

Proc. Nat. Sem. Trad. Knowl. &amp; Soc. Prac. :

Sl. No.	Local name and plant part (s) used	Scientific name (family)	Disease / disorders against which used
2.	Tapare : flower	<i>Physalis minima</i> Linn. (Solanaceae)	Urinary disorder, dropsy, dysentery, loss of appetite indigestion.
3.	Aparajeeta : Seeds	<i>Clitoria ternatea</i> (Papilionaceae)	Please refer Sl. No. 10B.
<b>Q. Faldan brata</b>			
1.	Narikel / Daab : Fruit	<i>Cocos nucifera</i> Linn. (Arecaceae)	Please refer Sl. No. 20A.
2.	Kala : fruit	<i>Musa paradisiaca</i> Linn. (Musaceae)	Please refer Sl. No. 1A.
3.	Supari : fruit (Dry)	<i>Pinanga gracilis</i> Kurz. (Arecaceae)	Please refer Sl. No. 13A.
4.	Pan : leaves	<i>Piper betle</i> Linn. (Piperaceae)	Please refer Sl. No. 23A.
<b>R. Jai mangal baar brata</b>			
1.	Kanthal : leaves	<i>Artocarpus heterophyllus</i> Lamk. (Moraceae)	Weakness and tiredness, dropsy, skin diseases, muscular arthritis.
2.	Kala : leaves	<i>Musa paradisiaca</i> Linn. (Musaceae)	Please refer Sl. No. 1A.
3.	Yav : grains	<i>Hordeum vulgare</i> Linn. (Poaceae)	Please refer Sl. No. 4A.
4.	Dhan : grains	<i>Oryza sativa</i> (Poaceae)	Please refer Sl. No. 7A.
<b>S. Kuli mangalbar brata</b>			
1.	Kul Leaves : leaves	<i>Zizyphus jujuba</i> Lam. (Rhamnaceae)	Please refer Sl. No. 6H.
2.	Kul (paired) : fruits (paired)	<i>Z. jujuba</i> Lam.	Please refer Sl. No. 6H.
<b>T. Ashok sasthi brata</b>			
1.	Ashok : flower	<i>Saraca indica</i> Linn. (Leguminosae)	Please refer Sl. No. 3B.

Table 1. contd.  
Conservation of plant species through age-old religious.....

Sl. No.	Local name and plant part (s) used	Scientific name (family)	Disease / disorders against which used
<b>U. Bipattarini brata</b>			
This brata requires thirteen type of flowers and thirteen type of fruits; none of them from any specific plants.			
Some social customs and rituals are observed through out the year, which are not directly worship or vows, but many plants are made essential components to observe these events and customs, considering them symbol of sacredness and holiness.			
<b>AA. Bibaha (Marriage ceremony)</b>			
1.	Shola : pith	<i>Aeschynomene aspera</i> Linn. (Papilionaceae)	Allergy, excess fat, goitre.
2.	Bansh / Bansh : twig	<i>Bambusa bambos</i> (Roxb.) Druce. (Poaceae)	Please refer Sl. No. 85.
3.	Snai Babla : leaves	<i>Acacia suma</i> Buch-Ham (Mimosaceae)	Vomiting, fever, blood dysentery.
<b>BB. Upanayan (Thread ceremony)</b>			
1.	Beur Bansha : twig	<i>Bambusa spinosa</i> Roxb. (Poaceae)	Please refer Sl. No. 1K.
2.	Bel : twig	<i>Aegle marmelos</i> (Rutaceae)	Please refer Sl. No. 8A.
<b>CC. Sradha ceremony (Obsequies)</b>			
1.	Nimpata : leaves	<i>Azadirachta indica</i> Juss. (Meliaceae)	Inflated liver, acidity, jaundice, night falls, prostate inflammation, pin worms, blood purifier restorer of liver.
2.	Kala : Leaf stalk	<i>Musa paradisiaca</i> Linn. (Musaceae)	Please refer Sl. No. 1A.
<b>DD. Til tarpan</b>			
1.	Kush : leaves	<i>Desmostachya bipinnata</i> Stapf. (Poaceae)	Please refer Sl. No. 21A.
2.	Til : grains	<i>Sesamum indicum</i> De (Pedaliaceae)	Please refer Sl. No. 5A.
3.	Hartaki : fruit	<i>Terminalia chebula</i> Retz. (Combretaceae)	Please refer Sl. No. 18A.

Table 1. contd.

Proc. Nat. Sem. Trad. Knowl. &amp; Soc. Prac. :

Sl. No.	Local name and plant part (s) used	Scientific name (family)	Disease / disorders against which used
<b>EE. Naba barsha (Bengali new year)</b>			
1.	Kala : Whole plant	<i>Musa paradisiaca</i> Linn. (Musaceae)	Please refer Sl. No. 1A.
2.	Aam : leaves	<i>Mangifera indica</i> Linn. (Anacardiaceae)	Please refer Sl. No. 22A.
<b>FF. Nabanna (Festival of start to new crop consumption)</b>			
1.	Kala : fruits & leaves	<i>Musa paradisiaca</i> Linn. (Musaceae)	Please refer Sl. No. 1A.
2.	Aakh / Ikshu : stem	<i>Saccharum officinarum</i> Linn. (Poaceae)	Please refer Sl. No. 14A.
3.	Narikel : fruit	<i>Cocos nucifera</i> Linn. (Areaceae)	Please refer Sl. No. 20A.
<b>GG. Makar Sankranti</b>			
1.	Sarisha : flower	<i>Brassica campestris</i> (Brassicaceae)	Leprosy, filaria, insanity, mumps, synovitis.
2.	Mula : flower	<i>Raphanus sativus</i> (Brassicaceae)	Inflammation, dysentery, urinary blockage, urinary bladder stone, ear hole irritation.
<b>HH. Bhatri dwitiya</b>			
1.	Jnhati ful : flower	<i>Barleria prionitis</i> (Acanthaceae)	Cough and cold, old age weakness, inflammation due to thrashing, toothache.
<b>II. Aradhana</b>			
1.	Manasha / sizu : Stem	<i>Euphorbia nerifolia</i> Linn. (Euphorbiaceae)	Joint pains, gleet with urine, snake bite, hooping cough, eczema, piles, warts.
2.	Sheora : twig	<i>Streblus asper</i> Lour. (Moraceae)	Piles, constipation, asthma, filaria, leucodromy.
In Bengal the twigs of these plants are inserted on the roofs of huts in the belief, this would protect the home against storm of Norwester.			
<b>JJ. At the time of delivery of new calf</b>			
1.	Dhan (1) :grains	<i>Oryza sativa</i> Linn. (Poaceae)	Please refer Sl. No. 7A.

Table 1. contd.  
Conservation of plant species through age-old religious.....

Sl. No.	Local name and plant part (s) used	Scientific name (family)	Disease / disorders against which used
2.	Kukur Shonka (1) : entire plant	<i>Blumera lacera</i> De. (Asteraceae)	Chronic dysentery, oedema, eye infection.
3.	Bansh (1) : leaves	<i>Bambusa bambos</i> (Roxb) Druce (Poaceae)	Please refer Sl. No. 1K.
4.	Goale Gneroh (2) : entire creeper plant	<i>Vitis trifolia</i> (Vitaceae)	Fatigue liver, epilepsy, dementia hysteria.
<p>1. Just after delivery of calf, the mother cow is being fed with crude paddy, bamboo leaf and blumera plants for smooth discharge of placenta and enhance lactation.</p> <p>2. The mother cow is provided hot massage, using these creepers (as mentioned in Sl. No. 4JJ) after delivery.</p>			
<b>KK. 'Choudda Shak' (A combination of 14 types of foliages/shak, cooked and consumed.)</b>			
1.	Ol : Stem and foliages	<i>Amarphophallus campanulatus</i> (Araceae)	Dropsy, joint pains, piles, drunker's syndrome.
2.	Kneu / Kemuk : foliage and stem	<i>Costus speciosus</i> Sm. (Zingiberaceae)	Gleet, nettle rash, ring worm, loss of skin glaze.
3.	Beto : leaves	<i>Chenopodium album</i> (Chenopodiaceae)	Fatigue liver, dysentery, dropsy, bloody piles.
4.	Kal Kashunde : leaves	<i>Cassia sophera</i> (Leguminosae)	Cough, acidity, fistula, skin rash, asthma, diarrhoea.
5.	Sarisha : leaves	<i>Brassica campestris</i> (Brassicaceae)	Filaria, neural arthritis, madness, gum injury, mumps, chilblain urine purifier.
6.	Nim : leaves	<i>Azadirachta indica</i> (Meliaceae)	Fatigue liver, night falls, blood sugar, acidity, jaundice, prostatitis, pin worms.
7.	Jayanti : leaves	<i>Sesbania sesban</i> (Leguminosae)	Please refer Sl. No. 5B.
8.	Salincha / Shanche : leaves	<i>Alternanthera sessilis</i> R. Br. (Amaranthaceae)	Cough, vomiting, arthritis, pox.
9.	Guduchi / Gulancha : stem and leaves	<i>Tinospora cardifolia</i> (Menispermaceae)	Bile disorder, boils, haemoptysis.
10.	Palta / Patol : leaves	<i>Tricosanthes dioica</i> (Cucurbitaceae)	Bile disorder, boils, haemoptysis.

Table 1. contd.

Proc. Nat. Sem. Trad. Knowl. &amp; Soc. Prac. :

Sl. No.	Local name and plant part (s) used	Scientific name (family)	Disease / disorders against which used
11.	Sheluka / Shulfa : leaves	<i>Anethum sowa</i> Kurz. (Umbelliferae) (Apiaceae)	Loss of appetite, spleen enlargement, conjunctivitis, reduced lactation.
12.	Hingche / Helencha : leaves & stems	<i>Enydra fluctuans</i> Lour. (Asteraceae)	Skin diseases, indigestion, arthritis, prickly - heat, wormsing and sleep inducing.
13.	Ghentu / Bhnat : leaves	<i>Clerodendrum infortunatum</i> (Verbenaceae)	Please refer Sl. No. 1M.
14.	Sushunee : leaves	<i>Marsilea quadrifolia</i> Linn. (Marsileaceae)	Please refer Sl. No. 4J.

Table 1. contd.

Conservation of plant species through age-old religious.....

The occasions of festivals or rituals are arranged in three categories; 1<sup>st</sup> worshipping or *pujas*, 2<sup>nd</sup> vows or *bratas* and 3<sup>rd</sup> social customs.

### RESULTS AID DISCUSSIONS

The plants, which served as the people's saviour at the time of their distress and diseases, and thought to be sacred in southern West Bengal (Table 1), had won some religious sentiments of godliness and holiness to get attached with their conscience, conservation and maintenance over the years. They range from monocot to dicot and even up to ferns. Interestingly, almost all of the plants are having medicinal properties and are useful for curing different diseases, ailments or physiological disorders, among the people, not only of the region, but also for people, living in other parts of world too (CSIR, 1949-1976; Chopra *et al.*, 1956; Kirtikar and Basu, 1975; Ross, 1999; Sharma, 2003). The names of ailments or diseases, treated with these plants are also recorded against each of the plants (Table 1). The great *Acharyas* with their far sightness made many of these plants an indispensable part of their religious rituals and vows. Till date, many plants serve as mandatory and essential components of their *pujas*, vows and social customs, etc. Though these religious rituals are performed in the southern part of West Bengal, viz., districts of Murshidabad, Birbhum, Bardhaman, Bankura, Hooghly, Nadia, Howrah and Medinipur, but in reality these types of practices are being performed in other parts of Bengal and India too, almost with same type of procedural details.

### CONCLUSION

In the process of summing up the records, this may be inferred that the ancient '*Acharyas*', monks and sages and learned priests, who were associated with either '*Ayurveda*', or different religious rituals, were enough intelligent, prudent and far sighted to integrate these valuable plants as essential components for some religious or holy events. As a result some sense and sentiments of religion and holiness were attached with these invaluable plants, which ultimately had served, to conserve and protect these plants for the past hundreds of years.

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## PLANT AND ANIMAL SPECIES WORSHIPPED IN TRADITIONAL FESTIVALS OF JHARKHAND PLATEAU, INDIA

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### ABSTRACT

In the Jharkhand plateau, the indigenous people worships some plant species found in the holy places of each and every village, semi urban and urban areas in each year in a specific date of a particular month. These holy-places are locally known as *Sarnasthal* or *Gramthan* or *Jahirthan* (village deity), *Duwardsini Devithan* or *Vana-Thakuranithan* or *Vana-Devi-Devatathan*, *Vansinghthan* and *Butmangalathan* (jungle deity). The trees which are recorded in these sacred places and are worshiped as Gods and Goddesses for well-being of the society, include *Shorea robusta* (Sal), *Ficus benghalensis* (Bot), *Ficus religiosa* (Peepol), *Ficus virens* (Pakoor), *Aegle marmelos* (Bel), *Azadirachta indica* (Neem), *Syzygium cumini* (Jamun), *Madhuca indica* (Mahuwa), *Haldina cordifolia* (Karam), *Anthocephalus chinensis* (Kadamba), *Disopyros melanoxylon* (Kendu), *Terminalia chebula* (Harida), *T. bellerica* (Bahra) and *Alangium salvifolium* (Dhela). Worships of these tree species take place every year from mid-June to mid-July at the village deities while in Jungle deity such practices take place year round by offering a stone piece when one passes through the deity places or sacrifice a male goat or male sheep (*Capra* sp.) to the village deity or to the Jungle deity.

The domestic and wild animals which are worshipped in the special occasions comprise of *Bos indicus*, *Bos taurilis*, *Bubalus bubalis*, *Naja naja naja*, *Naja naja kauthia* and *Ophiophagus hannah* during *Giri-Gobardhan puja* or *Badna* or *Saharai* (in the last week of November or in the first week of December or in the last week January or in the first week of February) and in *Naga panchami* day (in the last week of July or in the first week of August) every year respectively. The Nags are worshiped especially by the descendant of Nagabanshi Rajas and in the *Mansa puja*.

Some other plant and animal species recorded during the traditional worships

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during *Karma puja*, *Jitbahan puja* and *Laxmi puja* are *Haldina cordifolia*, *Saccharum officinarum* and *Oryza sativa* respectively.

**Key words :** *Traditional, plant species, animal species, than (holy places), worships*

## INTRODUCTION

Unique places of deities as well as some traditional festivals are celebrated in which animals (*e.g.*, he goats or he sheeps or pigs or ducks or even a air breathing fish - Magur) are sacrificed during their worships in the Jharkhand plateau, India lying approximately between 21° 5' N to 24° 8' N and 82° 20' E to 84° 45' E. The deity places are commonly found under the sky without any shed or roof. These deity places are locally known as *Sarnasthal* or *Gramthan* or *Jhahirthan* or *Gram-Devi-Devasthan* or *Gaon-Gram*, located within 500 m to 1000 m distance of each and every villages and semi urban areas while in the towns and cities these places are located inside the human habitation zones. The similar type of deity places located on the road sides of deep forests are - *Duvarsinni* or *Vansinghthan* or *Butmangla* or *Jungle-Dev-Devithan*.

In the above mentioned deity places some trees are found which are regarded as Gods and Goddesses and are worshipped by the early settlers (mostly indigenous or aboriginals or allied aboriginals and semi-hinduized aboriginals) in specific date(s) of a particular month in each year since the time of their settlement in the plateau probably 3000 - 2500 years. ago. Some times during worships some edible animals are sacrificed to the deities by devotees. The worships in these places are performed by the local priests known as *Laya* or *Naya* or *Deori* or *Pahan*.

Worships of some plants and animals alike to that of deity places are also found during the indigenous traditional festivals celebration on particular date(s) of a particular month in each year in the Jharkhand plateau. These indigenous traditional festivals are *Sarhul parav*, *Karma puja*, *Jitbahan puja*, *Ma Mansa puja* (worship of Snake's diety), *Naga puja*, *Girigobardhan* or *Go Puja* or *Bandna* or *Saharai* and *Laxmi puja*.

Moreover, accounts on the plants and animals which are worshipped during the above named specific occasions are not available or are very scanty or fragmentary. Therefore, the authors sought to take up this research work for identifying, listing and to put them on record as well as to find out the significance of such worships and sacrifices of animals during the celebration of the mentioned occasions.

## MATERIALS AND METHODS

Many of the deity places of the Jharkhand plateau located at different villages, semi urban areas, towns and cities were visited since last few decades whenever time was available and the plant species occurred in the deity places were recorded and identified with the help of standard literature. Information on the plant species of the deity places and the animal sacrificed during worships of the deity places were collected from the indigenous and other people of the villages, urban areas, town and cities. However, the animals (edible) sacrificed were recorded in the field during celebration in the deity places.

The indigenous traditional festivals celebrated in the plateau were also recorded after visiting places of celebrations of different such festivals in different date(s) in different month of a year. Information on this regards was also collected through questioning the people who celebrate these festivals as well as from local news papers, magazines, district gazettes, senior citizens (above eighty years of age), priests (locally known as Naya or Pahan, or Deori or Pujari) and village headman.

## RESULTS AND DISCUSSION

The plant species of different deity places as well as the plant species worshipped during the celebrations and worships in different indigenous traditional festivals recorded are furnished in tables below. Moreover, the names of the animals (edible) sacrificed during the worships of the deities in the deity places were collected from the priests of a particular type of deity place are also listed in Table 2.

**Table 1.** Sacred places and their plant species worshipped regarded as Gods and Goddesses

Name of the sacred places and time of worship	Location of sacred places	Plant species recorded in the sacred places	Edible animals sacrificed, if any
1. Sarnasthal or Gramthan or Jahirthan or Gram -Dev-Devi-than or Goan Gram. (On or after 30 <sup>th</sup> June but before 15 <sup>th</sup> July, each year).	Less than 500 - 1000 m distances in villages, semi urban areas and less than 100 m of human habitation in towns and cities	1) <i>Shorea robusta</i> Gaertn f. (Fam: Dipterocarpaceae) (The Sal trees, a very common plant in the Sarnasthal and alike named places). 2) <i>Ficus benghalensis</i> L. (Fam: Moraceac) The Banyan tree rarely found in the	Male goats, and male sheeps are often sacrificed on the Gramthan and in alike Thans, (near the base of the tree(s) present in such Thans). Sometimes male pigs are sacrificed by the Schedule cast communities and by Santhal tribes.

Table 1. contd.

Name of the sacred places and time of worship	Location of sacred places	Plant species recorded in the sacred places	Edible animals sacrificed, if any
		<p>Sarnasthal and alike named places.</p> <p>3) <i>Ficus religiosa</i> L. (Fam: Moraceac) - The Peepal / Asasthwa Tree - rarely found.</p> <p>4) <i>Ficus virens</i> Ait (Fom: Moraceae) - Pakur or Pakar tree - rarely found.</p> <p>5) <i>Aegle marmelos</i> (L) (Fam: Rutaceae) The Bael tree – uncommon.</p> <p>6) <i>Alangium salvifolium</i> (Fam: Alangiaceae) - Dhela or Kanta tree - rarely found.</p> <p>7) <i>Azadirachta indica</i> A.Juss (Fam: Meliaceae) Neem tree-unknown.</p> <p>8) <i>Mudhuca longifolia</i> (Koenig) Macbride (Fam: Sapotaceae) - Butter tree or Mahuwa tree - scarcely found.</p> <p>9) <i>Syzygium caryophyllifolium</i> (Fom: Myrtaceae) Chota Jamun tree - scarcely found.</p> <p>10) <i>Syzygium cumini</i> (L). (Fam: Myrtaceae) Jamu tree-scarcely found.</p> <p>11) <i>S. fruticosum</i> D.C. (Fam:</p>	

*Plant and animal species worshipped in traditional festivals...*

Table 1. contd.

Name of the sacred places and time of worship	Location of sacred places	Plant species recorded in the sacred places	Edible animals sacrificed, if any
		<p>Myrtaceae) Bhalu-Jamun tree- scarcely found.</p> <p>12) <i>Haldina cordifolia</i> (Fam : Rubiaceae) Karam tree - scarcely found.</p> <p>13) <i>Anthocephalus chinensis</i> (Lam.), (Fam: Argostemma), Kadamba tree- rarely found.</p> <p>14) <i>Strebulus asper</i> Lour., (Fam: Utricaceae)- Siamese rough bush or Saheda tree- scarcely found.</p> <p>15) <i>Mangifera indica</i> L. (Fam: Anacardiaceae) the Mango tree - uncommon).</p>	
<p>2. Duwarsini or Vansingthan or Butmanglathan (No specific time. A devotee when passes through Duwarsini offers a piece of stone as a taken of respect according to traditional customes. Now-a-days passers</p>	<p>Several km distance from villages, or semi urban places or town or cities. Situated on the road side of deep and dense forests.</p>	<p>1) <i>Shorea robusta</i> Guertn f. (Fam: Dipterocarpaceae) Sal tree - commonly found.</p> <p>2) <i>Terminalia tomentosa</i> Roxb. (ex D.C.) (Fam: Combretaceae) commonly found.</p> <p>3) <i>T. bellerica</i> (Guertn) (Fam: Combretaceae), scarcely found.</p> <p>4) <i>T. chebula</i> Retz. (Fam:</p>	<p>Rarely male goats or male sheeps are sacrificed by the devotees.</p>

Table 1. contd.

Name of the sacred places and time of worship	Location of sacred places	Plant species recorded in the sacred places	Edible animals sacrificed, if any
through Duwarsini offer prices. Sometimes devotees worship. offering and sacrificing a male goat or male sheep. This practice is now-a-day on the path of vanishing.)		<p><i>Combretaceae</i>) Belleric Myrobalam/ Bahada, scarcely found.</p> <p>5) <i>Madhuca longifolia</i> (Fam: Sapotaceae) Butter tree, rarely found.</p> <p>6) <i>Syzygium curmini</i> (L), (Fam: Myrtaceae) Jamu tree - rarely found.</p> <p>7) <i>Aegle marmelos</i> (L) (Fam: Rutaceae) Bael tree, rarely found.</p>	
3. Dobati (When a person of a village or few persons are suffered by witchcrafts a black hen or cock is sacrificed in the Dobati.)	At the end of the village.	<p>1) <i>Ficus religiosa</i> Ait (Fam: Moraceae) Bael tree, rarely found.</p> <p>2) <i>Ficus benghalensis</i> (Fam: Moraceae) Banyan or Bodhi tree, - rarely found.</p>	There is no tradition of sacrificing of animals.
4. Place of Holy Basil. (Tulasi Manch or Dhip) (During Mansha Puja on 16 <sup>th</sup> - 22 <sup>nd</sup> August, each year and during worship of Goddess Kali.)	In front of residential house (i.e., in Angan of residential house).	<p>1) <i>Ocimum sanctum</i> (Fam: Lamiaceae), Sacred Basil or White Basil. -very common</p> <p>2) <i>O. basilicum</i> L. (Fam: Lamiaceae) - Sweet Basil or Common Basil or Kali Tulsi - very common.</p>	Male goats or male sheep are sacrificed in front of the place of holy basil during the worship of Goddess Kali (Kali puja).

*Plant and animal species worshipped in traditional festivals...*

Table 1. contd.

<b>Name of the sacred places and time of worship</b>	<b>Location of sacred places</b>	<b>Plant species recorded in the sacred places</b>	<b>Edible animals sacrificed, if any</b>
5. Kramthan (During Sarhul festival in the last week of March or first week of April, each year).	Nearby forest of a village (500 m or more in distance)	1) <i>Haldina cordifolia</i> (Fam: Rubiaceae). Very common.	There is no tradition of sacrificing of animals.

**Table 2.** Indigenous traditional festival, animal and plant species worshipped in these festivals as well as edible animal species sacrificed in festivals

<b>Name of the festival and time of festival</b>	<b>Places of the Festival</b>	<b>Animal/Plant species worshipped in the festival</b>	<b>Animal species sacrificed in the festival</b>
1. Nagpanchammi (In last week of July, each year).	In front of the place of Holy Basils of the residential house or in the temple of Lord Shiva.	1) <i>Naja naja</i> (L) Cobra. 2) <i>Naja hannah</i> (Cantor) King Cobra.	Cow milk offered. Some descendants of Nagbanshi Rajas of the plateau perform the worship.
2. Karma Puja (In last week of August or in first of September, each year).	In the mid part of Angan of the residential house of the village Headman or in the house of Laya or Pahan or Deori. A branch of plant is planted in the mid part of the Angan.	1) <i>Adina cordifolia</i> Hook (Fam: Rubiaceae). Karam tree.	No animals are sacrificed in this festival. It is some how related to Raksha Bandhan. Sisters tied a thread on the wrist of brothers for their protection after Karma puja (found in many communities).
3. Jitahan Puja/ Jitwa Puja (After mid-September, each year).	As above	1) <i>Saccharum officinarum</i> L. (Fam : Poaceae) - Sugarcane) 2) <i>Oryza sativa</i> (L). (Fam: poaceae). Paddy plant.	As above. But the festival is celebrated for betterment of son(s). No thread is tied on the wrist in the occasion.

Table 2. contd.

Name of the festival and time of festival	Places of the festival	Animal/Plant species worshipped in the festival	Animal species sacrificed in the festival
4. Ma Mansha Puja (Worship of Serpent deity) (On or after 16 <sup>th</sup> August to 22 <sup>nd</sup> August, each year).	In front of place of holy basils, or In front of image of Ma Mansha with statue of Cobra and other poisonous snakes.	1) <i>Naja naja</i> (L). (Common Cobra). 2) <i>Naja hannah</i> (Cantor) (King Cobra). 3) <i>Bungarus fasciatus</i> (Schneider) - (Banded Krait).	A male duck, (domesticated one) <i>Anas indicus</i> (Latham), <i>Anas platyrhynchos</i> (Linn.) or a air breathing fish <i>Clarias batrachus</i> (L) are sacrificed.
5. (a) Girigobardhan Puja or (b) Kali Puja or (c) Bandna (30 <sup>th</sup> October to first week of November, each year. Santhals celebrate the festival after mid February, each year).	(a) Inside the house where cows and Bullocks or Buffalos are kept. (b) In front of the place of holy basil or in the Kali temple or Than. (c) In the adjacent field or ground and on middle of the road passes through a village.	1) <i>Bos indicus</i> (L). 2) <i>Bubalus bubalis</i> (L). 3) <i>Oryza sativa</i> (L).	A male goat ( <i>Capra sp.</i> ) or a male sheep is sacrificed in the Kalithan or Kali temple.
6. Laxmi Puja (After mid-November or first week to 15 <sup>th</sup> Nov., each year).	Inside residential house before or after paddy harvesting. that time domesticated elephants are brought by their owners for begging from door to door in villages.	11) <i>Elephus maximus indicus</i> (Cuvier). 12) <i>Tyto alba</i> (Scopeli). (Barn owl).	No animals are sacrificed.

*Plant and animal species worshipped in traditional festivals...*

The above account of varied types of deities and their worships gave us the information regarding their faiths and beliefs on Gods and Goddesses and their omni presence. The Gods and Goddesses of the plateau are mainly represented symbolically by the trees like *Shorea robusta* in the Sarasthal or Gramthan or Jahirthan or Gram-Dev-Devithan or Gaon-Gramthan and the *Terminalia tomentosa* in the Duwarini or Vansingthan or Butmangala-than. Other trees which are sometimes present in and around the deity places are mentioned in Table 1. In the indigenous traditional festival of the plateau some plant and animal species are worshipped. A list of such plants and animals are furnished in Table 2. Moreover, some edible animals during the worships are sacrificed to satisfy the deities. Their names are also furnished alongwith the specific festivals in the tables.

The worship of the village deities are performed for protection and welfare of the villagers and to keep them free from all type of diseases and ailments as well as for good rain and good crop-yield each year whereas the worships of jungle deities are performed for self protection from wild beasts and accidents as well as for welfare of family members, self, kith and kin.

Worship of Ma Mansha (Goddess of Serpents) is celebrated to get rid of snake bites. To satisfy Goddess male ducks or sometime a fish *Clarias batrachus* are sacrificed. The worships of Goddess Kali is performed for protection from witchcrafts, ghosts and evil spirits and for such worship male goat or male sheep sacrificed to keep the Goddess happy. All such indigenous traditional festivals are celebrated year round in the plateau for better living, to keep the surrounding environment healthy as well as for perpetuation of future generation in better and safe ways.

Cutting and felling of trees of deity-places as well as trees worshiped during the traditional festival are never done by the indigenous people since these trees are their symbolic Gods and Goddesses. Such worships to trees provide us a knowledge of traditional conservation of forests since dawn of human civilization.

The settlers after the invasion of East India Company in the plateau are mostly outsiders. There was also infiltration of people from other places before and after independence, who have settled and were not aware of the significances of these trees of the sacred places. These people have destroyed the forests to a greater extent and have polluted the environment.

The sacred places and traditional festivals are deep rooted religious occasions of the very early settlers (indigenous people) of the plateau but in the recent time these are in the path of fading or vanishing on account of changing forest policies and forest rights taken over by the State and Central Governments. The other most important factors in this regard are the adoption of customs and culture of those people who have settled in the plateau after the set up of East India Company probably after 1837 and pre and post independence periods of the country. The cultural identity of people of a region is the only unique important and significant feature of a region. Hence particular customs and cultures should be kept alive till the human beings survive on the Earth. Further, the forest policies and the

right of forest should be made in such a way that the worship of trees of the sacred places especially during the traditional festivals be kept alive for the entire span of human civilization for eco-balancing or optimizing the environment.

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## PAKSHITIRTHAM-PILGRIMAGE AND CONCERN FOR CONSERVATION OF BIRDS

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### ABSTRACT

*Pakshitirtham* or Eagle Rock temple, also called Sri Vedhagirishwar temple of Thirukazhukundram is one of the important pilgrimages in the famous Kanchipuram district of Tamil Nadu. The presiding deity here is Siva. But it is famous for two 'eagles' that fly here every day at 11.30-12.00 noon to receive ceremonial feeding 'prasadam' offered by the priest of the temple. It is said that they come from Benaras (now Varanasi) to stop over for ceremonial feeding and fly to Rameshwaram. Many people believe that two sages assume the shape of the two eagles. Some have other ideas. Some people say these two birds are kites not eagles. Ornithologists have confirmed the identity of the species as Egyptian Vulture, *Neophron* sp., belonging to the family Accipitridae, which needs to be taken care of. The birds belonging to this family includes Brahminy kite, Marsh Harrier, etc., which are fast declining and under threat of extinction.

**Key words** : *Pakshitirtham, birds, ceremonial feeding, conservation*

### INTRODUCTION

India is a magical land of saints and temples. There are many priests and presiding deities in innumerable temples of this great country. There are also so many animals associated with the deities and temples as well as temple ponds where fish and turtles are reverently reared. The Hindus all over India consider *Matsya* (Fish), *Kurma* (Turtle), *Baraha* (Boar/Pig) as *Avatars* and cow as highly sacred animal. Most of the deities in India are adorned with their animal *bahan* that carry them. As such, many wild mammals, such as, tigers, lions, elephants and birds, such as, peacock, owl, swan, etc., have been revered as vehicles of gods and goddesses and worshipped. Such belief and practices continue in one form or another even today in certain sections of Indian society. Many tribal people believe that hunting during the mating season is unethical and killing of animals at the time of mating is sin. Hunters belonging to various communities of Northeastern parts of India do not kill deer during March and May, when pregnant females present in the herd. However, Eagle Rock Temple and

the legends relating to ceremonial feeding of ‘eagles’ everyday is unique in the world.

**Site: Pakshirtham**

The Eagle Rock temple, English version of Thirukazhukundram, is located on the highway between Chennai and Kalpakkam. It can be reached from Chengalpattu.



Fig. 1. Route map of Eagle Rock Temple.

From Chengalpattu, a Taluk Headquarters in the famous Kanchipuram district, its distance is about 15 km (Fig. 1). It is about 16 km from Mahabalipuram, 49 km from Kanchipuram and 70 km from Chennai. The 160 m hilltop of Thirukazhukundram Temple can be reached by ascending 562 well-laid stone slabs. On the way, there are small *mandapams* for pilgrims to rest. Those who are unable to climb can take the help of *dholis*, which will be carried by two people, for a nominal charge. The temple has four *gopurams*, the tallest one is with nine tiers on the southern side, and the other three with seven tiers. This hill top is also called Vedagiri. The temple is also

known as Vedagiriswarar temple (Fig. 2). Another popular name for this temple is *Kazhugu koil* (Eagle temple). Even the whole town is popularly named as *Pakshi Theertham*, meaning Birds’ Holy Place. Interestingly, all these names given are not relating to a special bird species but a pair of birds only. Near the temple, *Sanku Theertham*, a sacred tank is located opposite to the temple, extending to 1,000 square yards area, with wide steps on all sides. According to *Sthalapuram*, this tank is the most sacred one, and all the sacred waters in India meet here once in 12 years when *Guru* (Jupiter) enters *Kanya rasi*. This event is celebrated as *angu Thirtha Pushkara Mela* which is attended by large crowds of people.



Fig. 2. Eagle Rock Temple ( Sri Vedhagirishwar Temple).

### **Etymology**

As stated earlier, *Pakshirtham* is located at hill-top of Vedagiri of Thirukazhukundram. The word Thirukazhukundram comes from the Tamil words *Thiru* (respectful), *Kazhugu* (eagle), *Kundram* (mount). It was known as “Thirukazhugukundram” in ancient times, which was changed to Thirukazhukundram in more recent times. As the English men could not pronounce the Tamil Words, for their convenience, it was also “pet named” Eagle Rock temple.

### **Legend**

From time immemorial, two eagles have been visiting the Eagle Rock Temple of Thirukazhukundram between 11.30 am and 12.00 noon everyday (till 1998) to receive the *Prasadam*, fed to the birds by the Temple Priest. Thousands of pilgrims congregate at the nearby shed to watch this unique feature. They are not considered as normal birds but as representatives of mythical “eight sages” or *Asthavasus*. In Indian mythology, *Asthavasus* were guards to the eight points of the compass. But they did penance for which Hindu Lord *Shiva* was angry and cursed them to turn into vultures. When they asked for forgiveness, Lord Siva directed them to the temple of Vedagiri Ishwara where they would be fed and worshiped. They remained there in the temple. In the last three *yugams* (epoch), three pairs died leaving the last couple surviving in this epoch. Legend also says that the birds will not come if there are sinners in the crowd which assemble at the temple. Legend has it the “eagles” (or vultures) represent eight sages who were punished by Shiva <<http://en.wikipedia.org/wiki/Shiva>> with two of them leaving in each of a series of epochs. According to the legend the two birds fly every day from Varanasi in Uttar Pradesh on the Ganges (Northern India) to this temple flying about two thousand miles, arriving at noon. They attend ceremonial feeding here and then fly to the southern most point of India, to Rameswaram. They then fly north up the coast to Chidambaram, go to sleep, and in the morning they fly back to Varanasi for a bath in the Ganges. Then they fly to Thirukazhukundram again.

### **Ceremonial feeding**

Two “eagles” that have reportedly been visiting the site for “centuries” are traditionally fed by the temple priests. These two birds (Fig. 3) arrive before noon to feed on offerings (*prasadam*) made from rice, wheat, ghee and sugar. The *prasadam* is called “Sarkarai Pongal” in Tamil language (sweetened rice). They eat the sweet *prasadam* and after cleaning their beaks in the water kept in a small vessel nearby, they take off, circle around the tower again and fly off. Not known the exactly time line, but there is a century long tradition in the Vedagiriswarar temple to feed a pair of eagle like bird every



Fig. 3. Ceremonial feeding of Eagles

day. The pair of birds has been fed by many generations of priests counting years to many centuries.

### ***Sightings***

These two birds used to visit the hill-top of Vedagiri of Thirukazhukundram almost every day up to 1980. These were fed by the temple priests till late 1990s. Before 1998, the mystical bird pair used to appear every day at noon at Thirukazhukundram. But one day they stopped coming and no sightings were reported after in 1998. For the local people it is a bad omen and attributed to the presence of “sinners” among the onlookers. For more than a decade now, no mythical birds have visited the temple although the ritual is practised by the temple priest in the hope that they eventually will turn up some day. Unfortunately the faith of the temple priest may remain stay just in hope for future.

### ***Species identity***

Some people say these two birds are kites not eagles. The research by Zoologists reveals that these birds were not eagles but a vulture species. Ornithologists have confirmed the identity of the species as Egyptian Vulture, *Neophron* sp. Newsletter for the Birdwatchers 17(6): 1-4 (1977) referred them as *Neophron* vultures. Other birds observed in the area include Pariah kite.

### ***The puzzle***

It is still a real puzzle for the scientists in view of:

- Why unusual sightings of only two vultures?
- Why only two birds - as they are fond of gathering in good number to feast on corpse?
- How many generations of vultures are involved?
- How such tradition of regular arrival of vultures continued?
- How such tradition is transmitted to young ones?

As the tradition continued for centuries, many generations of vultures must have been involved in the fair, passing on the tradition, perhaps from mother to son, or husband to wife. Zoologists define this culture as an imitation of patterns of behaviors of one animal by another. Viewed from this perspective, the vultures of Thirukazhkundram certainly qualified as rather unusual animals of high culture.

## **VULTURE CRISIS**

Vultures died in hundreds and thousands in mid 1990s with unknown causes at that time. It was as late as 2004, when scientists in the United States identified the cause: the drug Diclofenac. Diclofenac, an anti-inflammatory agent, has been deployed successfully in human medicine for decades. In most EU countries medication

containing Diclofenac is only approved for treatment of humans. In India, Pakistan and Nepal it has been deployed in veterinary medicine as well since the 90s, in particular for livestock. When vultures feed on cattle carcasses, they too ingest the drug. The drug acts as a fatal poison to the vultures and they die from kidney failure. Though the cause was discovered in 2004, it took the Government of India and also Pakistan and Nepal two years to ban the medicine. In May 2006, the medicine was banned, but by that time almost 97% of the total vulture population was wiped out. Moreover, due to other obvious reasons like habitat loss, etc., the vulture populations kept on declining in the Indian subcontinent. Now it is estimated that almost 99% of the vulture population vanished from nature in just 15 years.

### **CONSERVATION MEASURES**

The RSPB (BirdLife in the UK) and Bombay Natural History Society (BNHS, BirdLife in India) are pioneers in creating awareness on this critically endangered bird. They have set up vulture breeding centres in northern India, West Bengal and Assam and also have been working on a campaign “Saving Asia’s Vultures from Extinction (SAVE)” across all three countries, India, Nepal and Pakistan. Some Government initiatives have been also started and many centers across the country are opened in recent years. SAVE which is in place for more than five years now is the last hope for the vultures.

SAVE’s breeding program has contributed a lot in last few years. In 2008 the program was successful to breed vultures artificially in captivity. But the artificial program is not that efficient. So the scientists looked into artificial hatching in incubators. 2010 brought success in this sector too. But it is unfortunate that there are still some reported news of mass vulture deaths in recent time. On the first week of March, 2011 death of 20 vultures was reported at a paddy field in Goalpara district of Assam, North-East India.

### **CONCLUDING REMARKS**

Culturally vultures are always considered as symbol of death and something like bad omen in India. But, vultures play very important role in the ecosystem. They keep our environment clean and hygienic. In spite of that they are neglected and just disappearing unnoticed. In this context, it is mentioned here that even in the recent past certain orthodox and spiritual elders around Pakshitirtham had not taken food till the visiting eagles are ceremonially fed. It seems, therefore, that drastic awareness measures need to be taken to sensitize socio-religious sentiments which may help in the conservation of avian or eagle-kite-vulture community and also help to create awareness among pilgrims and people to conserve avian species, including Brahminy kite, Marsh Harrier, etc., belonging to the family Accipitridae, which are under threat of extinction.

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## School students campaign to save sparrows

THE TIMES NEWS NETWORK

**Kolkata:** On the occasion of the 10th birth anniversary of His Holiness Dr Syedna Mohammed Bahadur (MBS), spiritual leader of the Bahura community, MBS Education Institute, Kolkata recently organised an awareness walk, Save Our Sparrows (SOS). The walk started from the school premises and ended at the Armenian Sports Club, Walkkrowa football and the present reach of West Bengal Shabbir Ali flag off the event.



Around 200 students and 300 parents from MBSI walk off along with 300 people from the Bahura community. Nearly 50 students and 10 teachers from Sathee Hall also participated in the walk.

Chief of honour Farhan Alam, deputy mayor BMC and Indraji Raygashiri of Kolkata, granted the noble endeavour and were presented with bird feeders.

A host of activities like photography, poster-making, distribution of bird feeders and pamphlets and exhibition of colourful effigies, was held to promote the preservation of the diminutive bird. Sparrow paraphernalia which included stickers, book



480 students participated in the awareness walk

marks, paper bags, juicelogs and envelopes were also sold.

A well researched booklet, a collector's souvenir on sparrows, was also released and distributed among parents and circulated in libraries.

The students walked out buscarily in specially designed T-shirts, paperbags bearing the SOS logo, placards with catchy slogans, flags, giant models of sparrows and bird feeders.

They also enacted 100 skits to

spread the message on the declining number of sparrows and to shower love and care on them which was followed by a poem in Hindi.

Farhan Alam said, "I thoroughly loved the small children performing skits. Our chief minister Mamata Banerjee's agenda too is to initiate rural and metro schools then it comes up with such projects like this."

The sheriff of Kolkata said, "SOS also stands for Save Our Soil and one

should respect and stop degrading the environment. It is great that the children have realized and are taking such initiatives."

The MBSI students will be visiting schools like St James The Heritage among others to spread awareness and will also be presenting bird feeders to celebrities in the next two months. SOS campaigns will also be conducted in UK, Resorts Lodge High School, Wimbledon, and Al Amanin, Dubai, as part of the school's endeavour to achieve the International School Award ISA.

"Child plays at birds, were always a part of our growing up days. People did not care that the number of sparrows had declined but nobody had the time to care therefore the distribution of bird feeders will help us once the sparrows identify this source of food, they will keep coming back and bring other birds as well. It's time to reflect on how our lifestyles have an impact on the environment," said Mohammad Sabir, head of the MBSI institute.

The event came to a close with the prize distribution for its academic year 2010-11. Medalists crowned with sparrows were given to students for a good academic performance. The winners of photography and poster competitions were felicitated with medals. Twenty-one bird feeders were distributed to winners of the lucky draw.

## World Sparrow Day celebrated

THE TIMES NEWS NETWORK

**Patna:** The World House Sparrow Day was celebrated by the Eco Task Force (ETF) of Patna Women's College (PWC) here on Saturday.

ETF members participated in a big way in this international initiative undertaken by the Nature Forever Society in collaboration with Bombay Natural History Society (Mumbai), Cornell Lab of Ornithology (US), Eco Sys Artline Foundation (France), Avon Wildlife Trust (UK) and many more national and international organization across the world.

According to ETF vice president Shobha Yasmin, the day threw light on the problems faced by the house sparrows in its daily struggle for survival.

The moot highlighted reasons for decline of sparrows which included shortage of nesting sites, food, effects of pesticides and microwave pollution caused by mobile towers.

"These sparrows being one of the bio indicators is a grim reminder of polluted environment in which not only the house



Students of Patna Women's College hold an awareness rally in the city on Saturday

sparrows, but also the other common birds got depleted.

ETF members through placards, banners and appeals to the common people through handbills spread the message of the World House Sparrow Day. ETF president Sister Doris D' Souza also urged the students to help the birds by feeding them and providing them nesting sites.

These are few pictures from The Times of India newspaper for creating awareness among common people.

## PEOPLE'S ROLE ON CONSERVATION OF NESTING HABITAT OF MEROPID BIRDS IN SANDY RIVER BANK SOIL

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### ABSTRACT

Blue-tailed bee-eater birds, *Merops philippinus* Linn. (Family Meropidae) are swift flying partially migratory birds which occur in large flocks and make numerous nests on the sandy soil of river bank. These meropid birds rest on the river-side bushes or telegraph wires and forage mostly on flying hymenopterid insects from trees and bushes. Bee-eaters are, thus, protectors of field crops. They prefer rather clean river banks for nesting. Their habitat selection for nesting virtually predicts that the agriculture field run-offs have less or no effective pesticide loads. The other cues responsible for their habitat selection include availability of their foraging resources also. All these secondarily confirm the conservation friendly attitude of the village people. It happened on the bank of the rivulet Shibai connected to river Ajay. The rivulet passes by the village Belun, near Katwa, district Bardhaman, West Bengal. It is a typical agriculture based Bengal village established century ago. Nearest narrow gauge railway station is 'Shiblun'. More than 30% of the agricultural fields get inundated during monsoon or post-monsoon release of water from river Damodar, via Ajay and Shibai water channels. Village people have formed an NGO (iREBEL) and regularly remove the silt from the river bank, so that the meropids can build their nest tunnels.

**Key words :** *Blue-tailed bee-eater, village Belun, sandy soil of river bank, rivulet Shibai, nest tunnels*

### INTRODUCTION

In this era of biodiversity change, India is among the top ten mega diverse countries. A vast majority of one million species of biodiversity are not yet properly understood. Conservation of diversity essentiate the role of people in the biodiversity rich areas. The role is considered in two ways; firstly, people as agents of change, and secondly, people as allies in biodiversity conservation (Bawa, 2010). In the present context, attention is paid on the attitude of the people of the area to

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conserve the nature. The Blue-tailed bee-eater birds' habitat selection (Fry, 2001) for nesting on river-bank sandy soil is applied here as a parameter of testing how friendly is the nature there.

The study was primarily conducted to observe the environmental values practised at the village Belun, under Nabagram Panchayat near Katwa, District Bardhaman, West Bengal. Eco-friendly activities developed by a team of boys (initially three in number) became news in the Bengali daily, the Anandabazar Patrika, Kolkata, dated October 26, 2008 and subsequently, in the Times of India, Kolkata, dated February 12, 2009.

### **METHOD OF STUDY**

Surveillance is the fundamental method of study. Regular visit and intimate contact with the village people are the initial basis. Further is the keen observation and analysis of the observations. Endeavour and co-operation of the NGO, iREBEL (Institute for Research on Ecology and Biodiversity to Enunciate our Liability) hastened the study.

### **OBSERVATIONS**

#### ***Study area***

Belun is a typical agriculture based Bengal village established century ago, by the side of the rivulet Shibai connected to river Ajay (Figs. 1,2). Nearest narrow gauge

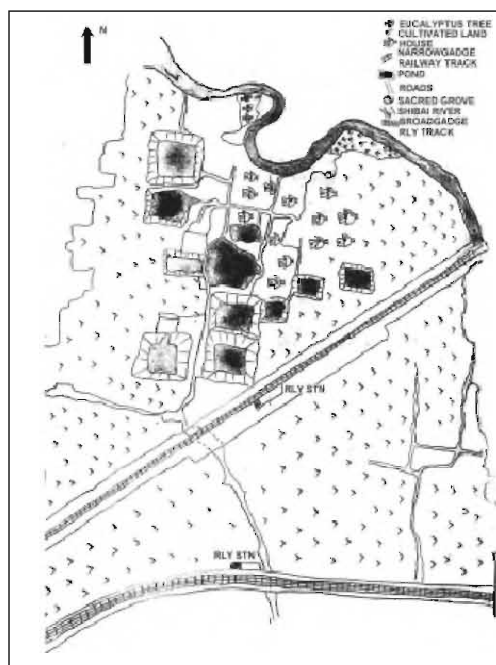


Fig. 1. Map of the study area (not to scale)

*People's role on conservation of nesting habitat....*

railway station is 'Shiblun'. Literacy level of village people, including postgraduates and professionals, is about 93%; while their general economic condition is assessed to be not very odd. More than 30% of the agricultural fields get inundated during monsoon or post-monsoon release of water from river Damodar *via* Ajay and Shibai water channels. A cluster of boys has formed a non-government organization (NGO), working for a period of more than a decade. They convinced the village people to maintain agriculture and other related activities without regular chemical pesticides and not to kill animals like foxes for losing one or two hens and, therefore, they have been able to achieve the impact of eco-friendly practices. As a result, many snakes, birds, non-conventional fishes and non-domesticated mammals are also observed there. From their water bodies gharials and dolphins are also reported.

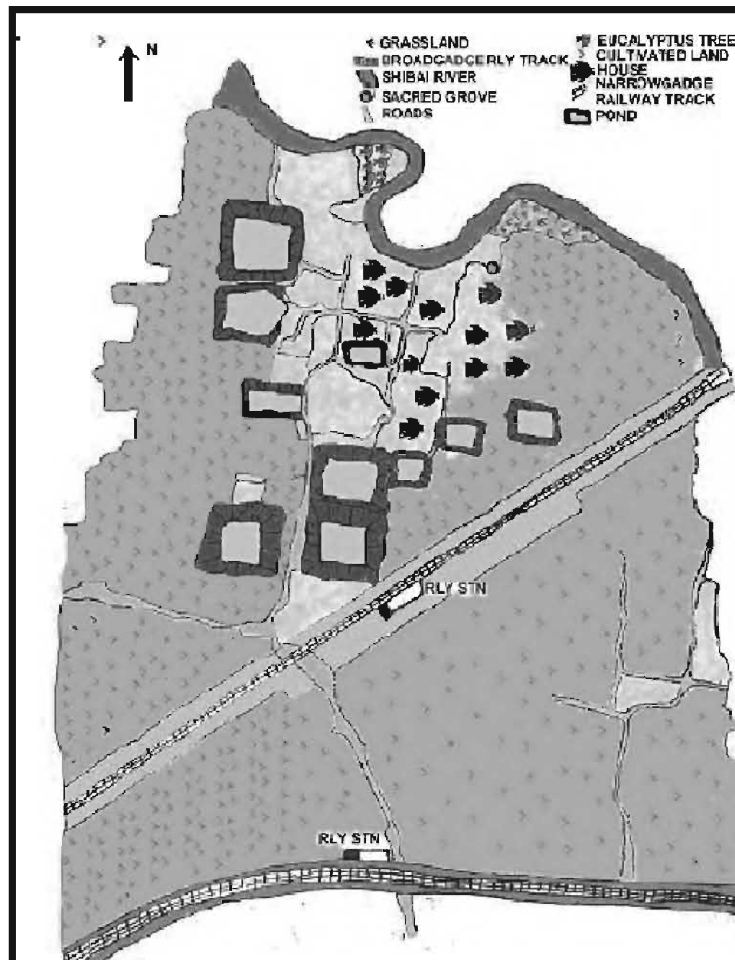


Fig. 2. Spatial landscape of village Belun

***Study of habitat selection by the birds***

Blue-tailed bee-eaters, *Merops philippinus* Linn. (Family Meropidae) are blue

colored medium sized birds. They have long bills; both the bills are curved and sharp. Nostrils are partly hidden by short bristles. Wings are proportionately long and colorful. Tail is long and broad; its color gives the name. Central tail feathers are generally elongated. In their legs - tarsi are short, toes long. Two exterior toes are emitted to middle. Hind toes are provided with a pad beneath. These swift flying partially migratory birds occur in large flocks and make numerous nests on the sandy soil of the bank of the rivulet Shibai Figs. 3-5.

The Blue-tailed bee-eaters nest in small colonies like other bee-eaters. They chose a bare sandy flat ground covered with low vegetation in scrubs and tuft (Fig. 4). On level ground, the tunnel slopes down sharply, levels off and may then rise slightly upwards again. They tunnel out a nest and prefer light sandy soil that allows good drainage (Figs. 3,5).



Fig. 3. Tunnels on riverbank      Fig. 4. A couple of Bee eater      Fig. 5. Mouth of a tunnel nest

The nests of these birds are long tunnels having depth about one meter and with a chamber at the end. Their eggs are milky white, polished, 17 mm x 22 mm in size, laid 4 to 5 in number during the month of March - April. These meropid birds rest on the river-side bushes or telegraph wires and forage mostly on flying hymenopterid insects from the trees and bushes. In that way, these bee-eaters are protectors of field crops. Furthermore, they prefer rather clean riverbanks for nests where agricultural field run-offs have less or no effective pesticide loads. The other cues responsible for their habitat selection include availability of their foraging resources also. Thus habitat selection by these meropid birds secondarily confirms the impact of eco-friendly attitude of the village.

## DISCUSSION

Meropids prefer arid lands on river banks for nesting. Compared to abundance/biomass, size of habitat / ecosystem occupied is disproportionately large. It is like other keystone species, *Merops apiaster*, the European bee-eater (Casas-Crivillé and Valera, 2005). Some meropids, White fronted bee-eater, *M. bullockoides*, has been studied for their reproductive behavior - 'father's harrassment to son's breeding' - by which the colony gains (Gadagkar, 1998).

Meropids are viewed as allogenic ecosystem engineers (Jones *et al.*, 1994).

Present findings about the description of the birds satisfy the century old description (Murray, 1985). These birds are partially responsible for collapse of the sandy cliffs next to monsoon. By nest building they enhance bioturbation of the soil (Datta and Saha, 2010a). These nests, if left, provide secondary nest for other animals and thus enhance biodiversity. These bee-eaters are protectors of field crops (Datta and Saha, 2010b). The blue-tailed bee-eaters nest in small colonies (Saha and Datta, 2010). Village people being motivated by the NGO, iREBEL, take part to recover the river bank and, consequently, restore the habitat for nesting of the bee-eaters. The village has the practice of maintaining sacred grove also.

### **ACKNOWLEDGEMENTS**

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## **PEOPLE'S ROLE IN MAINTAINING MICRO ORGANISMS IN A METROPOLITAN CANAL**

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### **ABSTRACT**

A major metropolitan canal of north Kolkata, the Bagjola canal, discharges a daily liquid waste of an area of 164 sq.km from five important municipalities. Some organisms, which are usually ignored, get their birth here, play important role in partial purification of water, inspection and assimilation of carcasses and save the slum dwellers. Sometimes those organisms are noted as biomarkers for quality monitoring and to convert degraded water productive for agricultural purposes. Though they are inferior at the rank of important flora and fauna but they should be protected from total abolishment by destroying their population. Local people are unknowingly encouraging their growth.

**Key words** : *Bagjola canal, biomarkers, productive*

### **INTRODUCTION**

Biodiversity is a great natural resource for mankind. To confirm humans' survivality, we are to keep these diversity healthy on this earth. Those organisms which start to become endangered and threatened or those which have any essentialities (medicine, food, laboratory, etc.) for human society, get priority at the conservation list. But some organisms those are originated by the law of nature and usually ignored without active nourishment by us and do a lot silently should also be protected. The present work deals with these organisms.

Bagjola, a renowned canal of north Kolkata, discharges a daily liquid waste of an area of 164 sq km without having a proper maintenance but still the water quality of the canal is not so much degraded as thought by initial look. Habitat is not critically harmful for the dwellers of its sides, as compared with Love Canal history. Some microorganisms play significant role in purification and enhancement of nutrients of this canal and their presence indicate that its water is mesosaprobic in nature. Many of the technical aspects of this study are though already communicated

else where present article emphasizes on the ignorant activities of the denizens in the vicinity of the canal that promulgates the habitat change.

### MATERIAL AND METHODS

The present study area around Bagjola canal is located under south DumDum municipal area. An army camp is situated at the one side of the canal and on the other side some unhealthy dairy farm, residence of poor families and some small scale industries, for example, colour fabrication like industries are present.

Water and soil samples of this canal were analyzed by standard methods and physico-chemical data were recorded.

Macrophytes (*Eichhornia* sp.), planktons and other organisms were collected manually by suitable techniques. Specimens were examined properly even with compound microscopes, as and when applicable. Identification of the specimens was done by the help of Botanical Survey of India (BSI) and Zoological Survey of India (ZSI). Role played by them were assessed by chemical parameters.

### RESULTS AND DISCUSSION

Observation and identification revealed that reported organisms were *Oscillatoria*, *Spirogyra*, Springtail, *Paramecium* (Chakraborty *et al.*, 2009), *Nostoc*, *Anabaena*, and huge amount of water hyacinth (Chakraborty and Datta, 2009).

*Oscillatoria* is an unbranched, filamentous, cyanobacteria. Members of this genus need high temperature for growth and can not grow when pH value is less than five. For nutrition of this cyanobacteria, nitrogen is essential. Nitrate and ammonia are used as a source of nitrogen by them. Members of the genus *Spirogyra* need bright light and good hydrogen-ion concentration for their reproduction (Coyne 1999). These generally occur in water with wide pH range between five to eight. Sulphur and magnesium are two essential elements for its growth and photosynthetic pigments formation. *Spirogyra* can not grow in calcium carbonate rich hard water, because this chemical disturbs their physiological activities. Members of this genus store oil as their energy source. So, oil is an essential factor for their growth.

*Paramecium*, a protozoan genus, usually multiplies in the pond water containing dead or decaying vegetation within two to three days. Sodium, potassium and calcium are essential for them. Magnesium is also essential for their electron transport. They use small living organisms, like bacteria, as their food material. *Paramecium* can live in temperature between 24°C and 28°C. Generally they prefer stagnant, organic matter containing water. Springtail is a soil-arthropod under the class Insecta and order Collembola. Collembolans are generally considered to be fungivore with occasional ingestion of other animals, decomposing plant or animal residue or fecal material. They need heavy organic matter in soil and moist condition. Some essential elements, which are necessary for its growth are carbon, oxygen, nitrogen, hydrogen, phosphorus, sulphur, potassium, calcium, magnesium, iron (Stephen, 1997).

So, above mentioned criteria for growth and reproduction of these organisms help us to predict the water quality and adjacent soil quality of that water body before any kind of chemical assessment. Thus, they act as biomarkers and help us from undertaking long chemical-critical, time taken procedure.

Both *Anabaena* and *Nostoc* are filamentous, cyanophycean algae and well known for their nitrogen fixing capacity. They make unfertile soil fertile to hold N P K at the field and increase productivity. *Eichornia* is a well known hydrophytes for reducing the quantity of heavy metals (lead, arsenic, copper, cobalt, etc) through the procedure of bioaccumulation and biofiltration from waste water (Kamble and Patil, 2001). Water hyacinth is also famous for its toxin removal capacity, such as, cyanides (Ebel, 2007). So, this macrophyte also plays a vital role for water quality monitoring.

It is worth mentioning here that all the referred organisms are born and procure nourishment from materials getting influx due to ignorance of the local people. Casual throwing of cow dung, dead bodies of animals and skin of vegetables release a heavy amount of organic substances which increase acidity of water and subsequent soil. This acidic nature is one of the most important conditions for survivability of these organisms. Release of domestic effluent, detergent substances and effluents from small scale industries act as a good source for supply of metallic, nonmetallic and mineral substances. These, along with oil products, act as nutrients for these organisms. Further, such untreated and degraded water body is suitable for growth of bacteria (Saha *et al.*, 2001) which is a major food material for *Paramecium* like organisms. Unwantedly and without any proper scientific knowledge of conservation, traditionally local people are playing a vital role for biodiversity conservation and, in turn, getting its benefit from these ignorable organisms.

#### **ACKNOWLEDGEMENT**

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## **WORSHIP OF *EUPHORBIA NERIIFOLIA* LINN. (FAMILY: EUPHORBIACEAE) IN HOOGHLY AND HOWRAH DISTRICTS OF WEST BENGAL**

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### **ABSTRACT**

This paper intends to document the traditional knowledge and beliefs regarding the worship of the Indian spurge tree (Manasa plant), *Euphorbia neriifolia* Linn. (family Euphorbiaceae) in Hooghly and Howrah Districts of West Bengal. During the study it has been found that little more than 50% of the families who originally belonged to the then East Bengal worship this plant. A clear declining trend of Manasa plant worship was observed amongst families of higher educational and economic status.

**Key words :** *Plant worship, Manasa plant, Euphorbia neriifolia*

### **INTRODUCTION**

Hinduism, as a religion, has always an environmentally sensitive philosophy which lays much emphasis on environmental ethics. The Mahabharata, the Ramayana, Vedas, Upanishads, the Bhagavad Gita, Puranas and Smriti contain the earliest messages for conservation of environment and ecological balance. These great literature taught man to live in harmony with nature and recognize that divinity prevails in all elements including plants and animals. The Bhagavad Gita advises us not to try to change the environment, to improve it or wrestle with it. Harmony with the natural world receives strong emphasis as a pervasive element in Indian spiritual beliefs and rituals (Sorman, 2001). Evergreen trees were regarded as symbols of eternal life and cutting them down was to invite the wrath of the Gods. Groves in forests were looked upon as habitations of the Gods. Ecology is an

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inherent part of a spiritual world view in Hinduism which differs according to the available floral and faunal population and diversity of the specific region.

### MATERIAL AND METHODS

In India, tree worshipping became quite common in the third or fourth millennium B.C., when there was a highly evolved Harappan culture (Bhatla *et al.*,1984). As a case study, a survey work has been done in Konnagar, Hindmotor and Uttarpara of Hooghly district and, Bally and Belur of Howrah district of West Bengal to study traditional knowledge and beliefs regarding this plant worship prevailing among the people of these districts.

Frequent visits during the months of Shrabana and Bhadra of Bengali Calendar year 1418, (Mid July to mid September, 2011) to 437 families of these districts were executed. Their responses were recorded and critically analyzed. Besides, the socio-economic status and educational background of these families were also critically documented.

### RESULTS AND DISCUSSION

One of the most diverse taxa of flowering plants belongs to the genus *Euphorbia* under the family Euphorbiaceae. Approximately 195 species of *Euphorbia* are found in India, among which the most common one in South Bengal is the Indian spurge tree (Manasa plant), *Euphorbia neriifolia* Linn. (Aditya, 2010).

Basically this particular Manasa plant is worshiped for Goddess Manasa in the months of Shrabana and Bhadra of Bengali Calendar year, even though very few families worshiped this plant throughout the year for its medicinal use. Among 437 families surveyed, 189 families were found to worship this plant (Table 1). The economic and educational status of these families are shown in Tables 2 and 3. It needs mention here that amongst the total number of families surveyed, 209 families originally belonged to the then East Bengal (now Bangladesh) and the remaining 228 families belong to West Bengal.

**Table 1.** List of Bengalee families where the Manasa plant - *Euphorbia neriifolia* worshiped

Family type	No. of family surveyed	No. of family where the plant is worshiped	% of families worshiped plant
East Bengal families	209	106	50.72
West Bengal families	228	83	36.40
Total	437	189	43.25

Table 1 shows that more than 50% of the East Bengal families worshiped the Manasa plant whereas in only 36.40% of West Bengal families worshiped this plant.

**Table 2.** Economic status of the families where the Manasa plant worshiped

Economic status	East Bengal families			West Bengal families		
	No. of families surveyed	No. of plants worshiped	% of families worshiped plant	No. of families surveyed	No. of plants worshiped	% of families worshiped plant
Upper economic class	58	20	34.48	62	11	17.74
Middle economic class	73	35	47.95	77	32	41.56
Lower economic class	78	51	65.38	89	40	44.94
Total	209	106	50.72	228	83	Average 34.74

It is evident from the data given in Table 2 that much more % of families of lower economic class worshiped Mansa plant than that of upper and middle economic classes amongst East Bengal families. It may either be a family tradition in West Bengal or there may be other sociocultural reason.

**Table 3.** Educational status of the families where the Manasa plant - *Euphorbia neriifolia* worshiped

Family	F & M PG	F/M PG MF Gr	F & M Gr	F/M Gr M/F MP/HS	F & M MP/HS	F/M MP/HS M/F VIII
East Bengal family surveyed	08	31	69	63	25	13
Plant worship in EB family	02	10	34	35	16	9
% of worship in EB family	25.0	32.26	49.28	55.56	64.0	69.23
West Bengal family surveyed	19	44	73	67	18	7
Plant worship in WB family	4	14	27	26	8	4
% of worship in WB family	21.05	31.82	36.99	38.81	44.44	57.14

Abbreviations : F: Father/Adult Male member of the family, M: Mother/Adult Female member of the family, PG: Postgraduate, Gr: Graduate, MP: Madhyamik pass, HS: Higher Secondary pass, VIII: VIII pass, EB: East Bengal, WB: West Bengal

A clear declining trend of Manasa plant worship according to the enhancement of educational status of the family members is clearly depicted in Table 3. It is because some of the family members of upper educational strata consider this worship as mere superstition.

Although the Manasa plant - *Euphorbia neriifolia* Linn. is worshiped for Goddess Manasa, but in very few families this particular plant is cultured and maintained for its medicinal use. Different parts of this Manasa plant are used to treat gout, urinary problem, snake bite, hooping cough, redness of eyes, eczema, piles, hair-loss problem and for the preparation of the traditional eye liner materials (Bhattacharjee, 1959). Thus it sums that there are economic and educational issues in the worship of plants besides socio-cultural values associated with it. But hardly there is an ecological and/or environmental issue related with the worship of this particular manasa plant.

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## ELEPHANT REJUVENATION PROGRAMME OF GURUVAYUR TEMPLE TRUST, KERALA

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### ABSTRACT

*Srikrishna* temple at Guruvayur, popularly known as Guruvayur temple is located at 32 km from Trichur in Kerala. Legend says Viswakarma founded this famed temple. The temple trust is well known to house 63 elephants (*Elephas maximus*), the largest stock of captive elephants in the world, at its sprawling Punnathur Kotta compound. Since mid 1980s the Guruvayur Temple Trust initiated *Sukhachikista* (rejuvenation therapy) along with ayurvedic and allopathic treatment for rejuvenation of the captive elephant herd. Complete rest is given and, special food used to be prepared for this purpose during monsoon time (July) for Guruvayur jumbos for a month. During the *Sukhachikitsa* period, the elephants are put on a high protein diet of different grams, iron tonic, minerals, turmeric powder and salt, including ayurvedic formulations like *chyavanprasad* and *ashtachoornam* under the supervision of veterinarians and specialists. Each elephant usually gains 300-500 kg weight during the rejuvenation programmes, which has now a days become an annual feature. People and even ministers take blessings of this pious species. This idea of *Sukhachikitsa* to elephants may help in captive rearing and *ex-situ* conservation of elephants.

### INTRODUCTION

Asian Elephant, *Elephas maximus*, is the prime animal during festivals and *pujas* in Kerala. This species is known as the vehicle of two great gods, Viswakarma and Indra from Vedic times. Perhaps for this reason Guruvayur Temple Trust houses and holds elephants with reverence. Kerala has more than 700 elephants in captivity. Most of these elephants are owned by temples and individuals. They are used for religious ceremonies in and around the temples, while a few elephants work at timber yards. These elephants are given a prestigious place in the state's culture. As the state animal, the elephant is featured on the emblem of the Government of Kerala. However, due to habitat destruction survival of this species is at stake. It seems it is high time to conserve India's elegant elephants to sustain the biodiversity. Thus the idea of rejuvenation programme by the Guruvayur Temple Trust is

communicated to create awareness generation of the people and to help promote the *ex-situ* conservation of elephants.

### **STUDY SITE**

The study site or temple is the *Srikrishna* temple at Guruvayur. It is popularly known as Guruvayur temple which is located at 32 km from Trichur in Kerala. The presiding deity here is Guruvayurappan. Legend says Viswakarma founded this famed temple. The temple trust is well known to house 63 elephants, the largest stock of captive elephants in the world. Most of these elephants are donated by devotees. They are kept and cared at its sprawling Punnathur Kotta compound. It may be mentioned that Punnathur Kotta which is located at 3 km from the temple is the world's only elephant palace to house the temple's elephants. A famous elephant named Guruvayur Kesavan belonged to this temple. Jayalalitha, the Chief Minister of Tamilnadu, had donated an elephant to Guruvayur temple after returning to power in 2001.

### **CEREMONIAL USE**

Almost all of the festivals in Kerala include at least one richly caparisoned elephant. Elephants carry the deity during annual festival processions and ceremonial functions in the temples. The temple elephants are decorated with gold plated caparisons, bells and necklaces. People mounted on the elephants hold tinsel silk parasols up high, swaying white tufts and peacock feather fans to the rhythm of the orchestra. People are often seen to pay their respects to elephants and even the ministers take blessings of this pious species.

### **REJUVENATION PROGRAMME**

The Guruvayur Temple Trust began the elephant rejuvenation camp (*Sukhachikitsa*) in 1985 in Punnathur Kotta as a way to give the elephants rest and help them regain their health after eleven months of temple duties. The spa time for Guruvayur tuskers starts once the monsoon sets in as the cool climate is best for ayurvedic treatment. The elephants are given de-worming medicine before the treatment starts. Then they are segregated by weight. This helps the staff to decide how much food to give each elephant. The senior trainer reserves the right to scrub the face, trunk and tusks of the elephant and the junior trainers scrub the back of an elephant with coconut husks before he is taken for a long bath in the pond at the Punnathur Kotta. After the therapy elephants become more active and level headed (Correspondent, Times of India, 2011).

The elephants are treated with sumptuous and highly nutritious food laced with ayurvedic and allopathic medicines, oil massage and complete rest. The elephants' medicines include haemoglobin boosters and they are given traditional treatments. The feast would be accompanied by an elephant bath and massage therapy. The

*Elephant rejuvenation programme of Guruvayur temple trust...*

animals follow a course of mild walking exercise and a diet of medicinal plants, palm leaves, sugarcane and water. The special diet includes rice, lentils, green gram, horse gram, millets, *chyavanaprasam*, *asthachoornam*, mineral mixture, turmeric powder, vitamin tonics, clarified butter and salt. Veterinary experts supervise the therapy. During the month long camp the elephants gain 300-500 kg weight. As such, this act of *Sukhachikitsa* by the Temple Trust may help in captive rearing and conservation of elephants.

## DISCUSSION

The Asian Elephant, *Elephas maximus*, is highly endangered species throughout its distributional range. It is the largest land mammal. It is included under Schedule I of Indian Wildlife (Protection) Act, 1972 and listed in the Appendix I of the Convention on International Trade in Endangered Species of Wild Flora & Fauna (CITES). The main reason of its decline in population is poaching for ivory, the second incisors which grow magnificently and is in great demand in domestic and international markets. Elephant hide has also value and high quality clothes and furnishings of elephant leather are sold in boutiques across Asia. It is for this reason Government of India launched 'Project Elephant' in 1991 for conservation of Asian Elephants in India.

In the context of *ex-situ* conservation, Tamil Nadu Forest Department owns two elephant camps, one at Annamalai and the other at Mudumalai and two months rest period is available for elephants during the months of March and April (Krishnamurthy, 1997). Forest Department of Tamil Nadu has notified certain steps in the state's gazette in October 2011 for the welfare of captive elephants. These include a 5-day working week with retirement at 60. Elephants will enjoy a 3-hour bath every day, an 'annual vacation' during the monsoon and 'sick leave' during their 'musth' period when they shall not be paraded in public places. It also states that elephants will not be used for begging and owners will be held responsible for death or injuries caused to the public by the animals. Tamil Nadu has 102 elephants in captivity. Of these, 53 are owned by temples, 42 with the Forest Department at its Mudumalai Sanctuary (23) and Anamalai Sanctuary (19) in the Western Ghats and 7 in the zoo (Sekhar, 2011). Jayalalitha government had organized an annual health camp for elephants when they would be taken to the Mudumalai forests in western Tamil Nadu and given herbal bath, oil massage, medicinal food and adequate rest. Kerala Forest Department has now been providing special rejuvenation therapy for ailing elephants with rich diet, rest and medicines (Mohan Das, 1997).

## CONCLUDING REMARKS

In India and in several other Asian countries recent trends indicate that despite legislation, the elephant is under increasing pressure from poaching, which combined with habitat fragmentation shrinkage/ destruction and habitat alteration is creating

a grim picture for the future survival of this species. It is high time to explore socio-religious practices to conserve elephants to sustain diversity of such majestic species. So, the rejuvenation programme undertaken by the Guruvayur Temple Trust is expected to create awareness generation of the pilgrims and common people to help promote the *ex-situ* conservation of elephants.

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## **STUDY OF BIODIVERSITY OF NABASTHA I GRAM PANCHAYAT, BURDWAN DISTRICT, WEST BENGAL AND ITS CONSERVATIONAL PERSPECTIVES THROUGH LOCAL RITUALS AND CULTURAL IMPLICATIONS**

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### **ABSTRACT**

Preparation of 'People's Biodiversity Register' has become a thrust area for documenting the traditional knowledge and cultural beliefs. Our country, enriched with phyto- and animal-resources, shows their use in different religious practices in different regions. The present study documents biodiversity through field surveys in 9 villages under NabasthaI Gram Panchayat under Burdwan I Block of Burdwan district, West Bengal, India. As many as 119 plant species and 104 animal species including the domesticated ones have been recorded here. By interrogating local people and through observation the present authors could document as many as 13 different ritualistic practices. A number of plant and animal parts are in use in these rituals. For translating their religious beliefs into reality and to sustain their ethics, the local people take care to protect the biodiversity. Religious faith as cultural practices, thus, appears useful in conservation of biodiversity with some very simple but mandatory practices.

**Key words :** *People's Biodiversity Register, Nabastha Gram Panchayet, ritualistic practices, method of conservation*

### **INTRODUCTION**

Presently we are much concerned with the globally impoverished biodiversity due to irrational and non-sustainable use of the natural resources. India occupies only 2.4% of the world's land area but its contribution to the world's biodiversity is approximately in form of 8% of the total number of species (Khoshoo, 1996). We

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fulfill our daily needs from exploiting the nature but we are least concerned about the replenishment of the same resource. The present study on biodiversity considers preparation of a taxonomic data base of Nabastha Gram Panchayat of Burdwan District of West Bengal concomitantly with the cultural concern of the people with the biodiversity. Subsequently a total number of 119 animal and 103 plant species was recorded through field survey (Table 1-6). Involvement of local people to secure the natural resources was the most attractive observation during the study. The local people were seen to protect the nature through ritualistic activities and faith.

### STUDY SITE

The present work was undertaken in Nabastha Gram Panchayat, under Burdwan I Block of Burdwan district, West Bengal. A total of 9 villages, viz., Nabastha, Aisa, Begut, Hairogram, Palash, Barosua, Gangua, Saligram, Chakundi were covered in this work. Of the total land mass of 6583.78 acres, as much as 4608.64 acres are used in cultivation.

### MATERIALS AND METHODS

The present biodiversity study was done through exhaustive field survey utilizing the knowledge of local people. Concerned plant and animal species were identified using authentic literature (Prain, 1903; Guha Bakshi, 1984; Gay, 2009; Kehmikar, 2008.).

### RESULTS

A total of 16 species of mammals belonging to 12 families 7 orders could be documented (Table 1). In total of 34 species of common birds belonging to 9 orders and 18 species of uncommon birds belonging to 6 orders have been also recorded (Tables 2 and 3). As many as 11 different snakes belonging to the order Squamata could be enlisted (Table 4). So far butterflies are concerned a total of 25 species could be documented (Table 5). As many as 119 species of plants from 45 different families could also enlisted in consultation with the local people (Table 6). While recording the socio-cultural activities, the present authors came across 13 indigenous rituals involving 4 animal and 12 plant parts (Table 7).

**Table 1.** List of mammals recorded from the study area

Order	Family	Common name	Scientific name
Insectivora	Soricidae	House shrew	<i>Suncus murinus</i>
Chiroptera	Pteropodidae	Indian flying fox	<i>Pteropus giganteus</i>
Primates	Cercopithecidae	Rhesus macaque	<i>Macaca mulatta</i>
		Common langur	<i>Presbytis sp.</i>

Study of biodiversity of Nabastha I gram panchayet....

Table 1. contd.

Order	Family	Common name	Scientific name
Carnivora	Canidae	Indian fox	<i>Vulpes bengalensis</i>
		Golden jackal	<i>Canis aureus</i>
	Viverridae	Small Indian civet	<i>Viverricula indica</i>
	Herpestidae	Common mongoose	<i>Herpestes edwardsii</i>
	Hyaenidae	Striped hyaena	<i>Hyaena hyaena</i>
	Felidae	Fishing cat	<i>Prionailurus viverrinus</i>
Jungle cat		<i>Felis chaus</i>	
Artiodactyla	Suidae	Indian wild boar	<i>Sus scrofa</i>
Rodentia	Sciuridae	Three striped palm squirrel	<i>Funambulus palmarum</i>
		Five striped palm squirrel	<i>Funambulus pennantia</i>
	Muridae	Indian mole rat	<i>Bandicota bengalensis</i>
Lagomorpha	Leporidae	Indian hare	<i>Lepus nigricollis</i>

Table 2. List of common birds recorded from the study area

Order	Family	Common name	Scientific name
Piciformes	Picidae	Black-rumped Flame back wood pecker	<i>Dinopium benghalensis</i>
	Megalaimidae	Copper smith Barbet	<i>Megalaima haemacephala</i>
Upupiformes	Upupidae	Common hoopoe	<i>Upupa epops</i>
Carciformes	Alcedinidae	Common kingfisher	<i>Alcedo atthis</i>
	Halcyonidae	White breasted kingfisher	<i>Halcyon smyrnensis</i>
		Stork-billed kingfisher	<i>Halcyon capensis</i>
	Cuculidae	Asian koyel	<i>Eudynamus scolopacea</i>
		Greater coucal	<i>Centropus sinensis</i>
Lesser coucal		<i>Centropus bengalensis</i>	
Psittaciformes	Psittacidae	Rose ringed parakeet	<i>Psittacula krameri</i>
Strigiformes	Tytonidae	Barn owl	<i>Tyto alba</i>
	Strigidae	Spotted owlet	<i>Athene brama</i>
Columbiformes	Columbidae	Rock pigeon	<i>Columba livia</i>
		Spotted dove	<i>Streptopelia chinensis</i>
Gruiformes	Rallidae	White breasted waterhen	<i>Amaurornis phoenicurus</i>

Table 2. contd.

Order	Family	Common name	Scientific name
Ciconiformes	Jacaniidae	Bronze winged jacana	<i>Metopidius indicus</i>
	Accipitridae	Black kite	<i>Milvus migrans</i>
	Ardeidae	Little egret	<i>Egretta garzetta</i>
		Pond heron	<i>Ardeola grayii</i>
Cattle egret		<i>Bubulcus ibis</i>	
Passeriformes	Corvidae	Rufous treepie	<i>Dendrocitta vegabunda</i>
		House crow	<i>Corvus splendense</i>
	Oriolidae	Black-headed oriole	<i>Oriolus xanthornus</i>
	Dicruridae	Black drongo	<i>Dicrurus macrocercus</i>
	Muscicapidae	Oriental Magpie Robin	<i>Copsychus saularis</i>
	Sturnidae	Common Myna	<i>Acridotheres tritis</i>
		Asian pied starling	<i>Sternus contra</i>
	Pycnonotidae	Red-whiskered bulbul	<i>Pycnonotus jocosus</i>
		Red-vented bulbul	<i>Pycnonotus cafer</i>
	Nectariniidae	Purple sunbird	<i>Nectarinia asiatica</i>
	Estrildidae	Scally-breasted munia	<i>Lonchura punctulata</i>
	Timallidae	Jungle babbler	<i>Turdoides striatus</i>
	Passeridae	House sparrow	<i>Passer domesticus</i>
Apodidae	House swift	<i>Apus affinis</i>	

Table 3. List of uncommon birds recorded from the study area

Order	Family	Common name	Scientific name
Caraciformes	Coraciidae	Indian roller	<i>Coracias benghalensis</i>
Psittaciformes	Psittacidae	Alexandrine parakeet	<i>Psittacula eupatria</i>
		Red-breasted parakeet	<i>Psittacula alexandrine</i>
Strigiformes		Eurasian eagle owl	<i>Bubo bubo</i>
Columbiformes	Columbidae	Eurasian collared dove	<i>Streptopelia decaocto</i>
Ciconiformes	Charadriidae	Red-wattled lapwing	<i>Vanellus indicus</i>
	Accipitridae	Brahmny kite	<i>Haliastur Indus</i>
		White-rumped vulture	<i>Gyps bengalensis</i>
	Threskiornithidae	Black-headed ibis	<i>Threskiornis melanocephallus</i>
		Painted storck	<i>Mycteria leucocephala</i>
Asian open bill		<i>Anastomus oscitans</i>	

Table 3. contd.

Order	Family	Common name	Scientific name
Passeriformes	Corvidae	Large billed crow	<i>Corvus macrorhyncus</i>
	Muscicapidae	Indian robin	<i>Saxicoloides fulicata</i>
	Sturnidae	Bank myna	<i>Acridotheres ginginianus</i>
	Motocillidae	Paddy-field pipit	<i>Anthus rufulus</i>
	Ploceidae	Baya weaver	<i>Ploceus phillipinus</i>
	Apopidae	Asian palm swift	<i>Cypsiurus balasiensis</i>
	Aegithinidae	Common iora	<i>Aegithina tiphia</i>

**Table 4.** List of snakes recorded from the study area

Order	Family	Common name	Scientific name
Squamata	Colubridae	Checkered keel back	<i>Xenchrophis piscator</i>
		Striped keel back	<i>Amphiesma stolatum</i>
		Banded racer	<i>Oligodon arensis</i>
		Oriental ratsnake	<i>Ptyas mucosus</i>
		Green vine snake	<i>Ahaetulla nasuta</i>
	Elapidae	Monocled cobra	<i>Naja kaouthia</i>
		Spectacled cobra	<i>Naja naja</i>
		Russel viper	<i>Daboia russelli</i>
		Banded krait	<i>Bungarus fasciatus</i>
		Common krait	<i>Bungarus caeruleus</i>
	Boidae	Common Sand boa	<i>Gongylophis conicus</i>

**Table 5.** List of Butterflies recorded from the study area

Sl. No.	Common name	Scientific name	Sl. no.	Common name	Scientific name
1	Blue tiger	<i>Tirumala limniace</i>	2	Angled coaster	<i>Ariadne merione</i>
3	Common mormon	<i>Papilio polytes</i>	4	Plain tiger	<i>Danaus chrysippus</i>
5	Common blue bottle	<i>Graphium sarpedon</i>	6	Common castor	<i>Ariadne mesione</i>
7	Common mime	<i>Chilasa clytia</i>	8	Short banded sailor	<i>Lassippa heliodore heliodore</i>
9	Tailed jay	<i>Graphium agamemnon</i>	10	Common tiny ring	<i>Tpthima baldus newboldi</i>
11	Common patriot	<i>Castalius rosimon</i>	12	Common leopard	<i>Phalanta phalanta</i>

Table 5. contd.

Sl. No.	Common name	Scientific name	Sl. no.	Common name	Scientific name
13	Dark grass blue	<i>Icaricia icarioides missionensis</i>	14	Dark band bush brown	<i>Mycalesis sirius</i>
15	Dingy line blue	<i>Liphyra brassolis</i>	16	Dingy line blue	<i>Catopyrops florin</i>
17	Gram blue	<i>Euchrysops cnejus</i>	18	Evening brown	<i>Mycalesis perseus</i>
19	Pale grass blue	<i>Pseudozizeeria maha</i>	20	Great egg fly	<i>Hypolimnas boling</i>
21	Plains cupid	<i>Chilades pandava pandava</i>	22	Grey pansy	<i>Junonia atlites</i>
23	Quaker	<i>Neopitheops zalmora</i>	24	Peacock pansy	<i>Junonia almana</i>
25	Tawny coaster	<i>Acraea violae</i>			

Table 6. List of plants recorded from study area

Family	Common name	Scientific name
Acanthaceae	Basak	<i>Justicia adhatoda</i> L.
	Kalmegh	<i>Andrographis paniculata</i> Nees.
	Kulekhara	<i>Hygrophilla schulli</i> Almeida.
Aizoaceae	Sepunne	<i>Trianthema portulacastrum</i>
Alangiaceae	Ankar	<i>Alangium alvifolium</i> L.
Apiaceae	Thankuni	<i>Centella asiatica</i> L.
Araceae	Tal	<i>Borassus flabellifer</i> L.
	Narikel	<i>Cocos nucifera</i> L.
	Buno kachu	<i>Colocasia esculanta</i> (L.)
	Khejur	<i>Phoenix sylvestris</i> (L.)Roxb.
	Bonkachu	<i>Colocasia esculenta</i> (L.) Schott.
	Buno ol	<i>Amorphophallus</i> sp.
	Topa pana	<i>Pistia stratiotes</i> L.
	Kochu	<i>Colocasia esculanta</i>
	Asclepiadaceae	Lal akondo
Asteraceae	Kesuti	<i>Eclipta alba</i>
	Sada akondo	<i>Calotropis gigantea</i>
	Stivia	<i>Stevia rebaudiana</i>
	Bhringaraj	<i>Wedelia calendulacea</i>

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Table 6. contd.

Family	Common name	Scientific name
Amaranthaceae	Kanta note	<i>Amaranthus spinosus</i> L.
	Chanchi	<i>Amaranthus sessilis</i> L.
	Kedra	<i>Alternanthera philoxeroides</i>
	Note sak	<i>Amaranthus viridis</i>
Annonaceae	Debdaru	<i>Polyalthia longifolia</i>
	Kathali champa	<i>Artabotrys hexapetalus</i>
	Ata gach	<i>Annona squamosa</i>
Anacardiaceae	Aam	<i>Mangifera indica</i> L.
Bombacaceae	Simul	<i>Bombax ceiba</i> L.
Caricaceae	Pepe	<i>Carica papaya</i>
Cannaceae	Kolabati	<i>Canna indica</i>
Caesalpiniaceae	Tetul	<i>Tamarindus indicus</i> L.
Chenopodiaceae	Beto sak	<i>Chenopodium album</i>
Combretaceae	Arjun	<i>Terminalia arjuna</i> Roxb.
	Bahera	<i>Terminalia arjuna</i>
Commelinaceae	Kanshire	<i>Commelina benghalensis</i>
	Nukha	<i>Commelina</i> sp.
Cucurbitaceae	Telekucha	<i>Cephalandra indica</i> Naud.
	Sosha	<i>Cucumis sativus</i>
	Lau	<i>Lagenaria siceraria</i>
	Jhinge	<i>Luffa actangula</i>
	Dhundul	<i>Luffa acutangula</i>
	Chalkumro	<i>Benincasa hispida</i>
	Kakrol	<i>Momordica dioica</i>
	Karola	<i>Momordica charantia</i>
	Kumro	<i>Cucurbita moschata</i>
Convolvulaceae	Kolmi sak	<i>Ipomeae aquatica</i>
	Bera kolmi	<i>Ipomoea fistulosa</i> Martius ex Choisy
Cyperaceae	Mutha gash	<i>Cyperus rotandrus</i> L.
Euphorbiaceae	Pituli	<i>Trewia nudiflora</i>
	Lal veranda	<i>Jatropha gossypifolia</i> (L)
	Sada veranda	<i>Jatropha curcas</i> (L)
	Pituli	<i>Trewia nudiflora</i> Linn.

Table 6. contd.

Family	Common name	Scientific name
Fabaceae	Sishoo	<i>Dalbergia sishoo</i> (Rox.)
	Kanchan	<i>Bauhinia acuminata</i>
	Palash	<i>Butea monosperma</i>
	Barbate	<i>Vigna catjang</i>
	Radhachura	<i>Delonix regia</i>
	Karonja	<i>Pongamia pinnata</i> (L)
	Shola	<i>Aeschynomene aspera</i>
Lemnaceae	Khudi pana	<i>Lemna perpusilla</i> Torrey
Lamiaceae	Tulshi	<i>Ocimum sanctum</i>
	Krishna tulshi	<i>O. tenuiflorum</i>
	Raktadrone	<i>Leonurus sibiricus</i>
Lentibulariaceae	Janjhi	<i>Utricularia bifida</i> L.
Marsileaceae	Sushni sak	<i>Marsilea minuta</i>
Meliaceae	Neem	<i>Azadiracta indica</i> . A. Jos
	Mehagini	<i>Sweitenia macrophylla</i>
	Mahaneem	<i>Melia azadarach</i> Linn.
	Lombu	<i>Dysoxylum costulatum</i>
	Mimosaceae	Sirish
Babla		<i>Acacia nilotica</i> (Cooke) Vagravelu and Kamble.
Bon Sirish		<i>Albizia lebbbeck</i> (L.)
Sona jhuri		<i>Acacia auriculoformis</i>
Lajjabati		<i>Mimosa pudica</i>
Musaceae		Kathali kola
	Kancha kola	<i>Musa balbisiana</i> L.
Moraceae	Aswatha	<i>Ficus religiosa</i>
	Bot	<i>Ficus benghalensis</i> (L.)
	Dumur	<i>Ficus hispida</i> (L.)
	Sheora	<i>Streblus aspur</i> (Lour.)
	Kathal	<i>Artocarpus heterophyllus</i> (Lam.)
Moringaceae	Sojne	<i>Moringa oleifera</i>

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Table 6. contd.

Family	Common name	Scientific name
Malvaceae	Simul	<i>Bombax ceiba</i>
	Bhendi	<i>Abelmoschous esculentus</i>
	Jaba	<i>Hibiscus rosa-sinensis</i>
Molluginaceae	Dime sak	<i>Glinus lotodes</i>
Myrtaceae	Peara	<i>Psidium guajava</i>
	Eucalyptus	<i>Eucalyptus globules</i>
Nymphaeaceae	Lal saluk	<i>Nymphaea pubescens</i> Gaerth
Polygonaceae	Pan morich	<i>Polygonum barbatum</i>
	Janli bon	<i>Polygonum sp.</i>
Pontedariaceae	Kachuri pana	<i>Eichhornia crassipes</i>
Portulacaceae	Nune sak	<i>Portulaca oleracea</i>
Poaceae	Shyma gansh	<i>Echinochola crusgalli</i> P.
	Durba gansh	<i>Cynodon dactylon</i>
Rhamnaceae	Desi kul	<i>Zyziphus mauritiana</i>
	Sia kul	<i>Zyziphus oenoplia</i>
Rubiaceae	Kadambo	<i>Anthocephalus chinensis</i>
	Gandal	<i>Paederia scandens</i>
	Rangan	<i>Ixora coccinea</i>
Rutaceae	Bel	<i>Aegle marmelos</i> L.
	Kaji lebu	<i>Citrus aurantifolia</i> Christ. Swingle.
	Kamini	<i>Murraya exotica</i>
	Karipata	<i>Murraya koengii</i>
	Lebu	<i>Citrus maxima</i> Merr.
	Pati lebu	<i>Citrus medica</i> L.
	Koyet bel	<i>Pheronix acideissima</i>
	Batabi lebu	<i>Citrus maxima</i> Merr.
Solanaceae	Kanta begun	<i>Solanum xanthocarpum</i> Schrad & Wendt.
	Lonka	<i>Capsicum annum</i>
	Bon begun	<i>Solanum torvum</i>
	Ashwagandha	<i>Withania somnifera</i>
	Tomato	<i>Lycopersicon esculentum</i>

Table 6. contd.

Family	Common name	Scientific name
Verbanaceae	Ghetu	<i>Clerodendrum viscosum</i> Vent.
	Segun	<i>Tectona grandis</i>
	Nishinda	<i>Vitex negundo</i>
Vitaceae	Goale pata	<i>Cayratia carsona</i>
	Harjora	<i>Cissus quadrangularis</i>
	Bon tulshi	<i>Croton bonplandianum</i> Baill.

Table 7. List of the rituals from the study area

Sl. No.	Name of the occasion	Month	Biresource use	
			Plant	Animal
1.	Prothom Megh	Baisakh	Seora tree ( <i>Streblus asper</i> )	
2.	Gajon	Jaistha		Goat ( <i>Capra capra</i> )
3.	Goal astomi	Vadro	Jhinge ( <i>Luffa acutangulus</i> )	
4.	Sarkaru	Aswin	Sarkathi ( <i>Saccharum munja</i> ) and Kash phool ( <i>Saccharum spontanum</i> )	
5.	Chaitra sankranti	Chaitra	Tal tree ( <i>Borassus flabellifer</i> )	
6.	Gach sasti		Bot ( <i>Ficus bengalensis</i> )	
7.	Matla sasti		Bamboo leaf ( <i>Bambusa tulda</i> )	
8.	Dasera	Jasthi	Lau ( <i>Lagenaria siceraria</i> )	Cow urine ( <i>Bos indicus</i> )
9.	Dhan bicheta		Rice grain ( <i>Oryza sativa</i> )	
10.	Dak sankranti	Aswin	Sarkathi ( <i>Saccharum munja</i> )	
11.	Alui	Paus	Mulo ( <i>Raphanus sativus</i> )	
12.	Badna	Paus Sankranti	Sarjam ( <i>Shorea robusta</i> )	Dak pakhi ( <i>Metopidius indicus</i> )
13.	Maghi	Magh		Hen ( <i>Gallus gallus</i> )

## DISCUSSION

Habitat loss, fragmentation and degradation are the principal causes for conveying threat to biodiversity (Kumar *et al.*, 2000). However, the ethnic and rural societies in India have been showing their age-long concern in rendering protection to nature and her creations through their religious faith and activities. The nature enshrines upon them profound sense of divinity, respect and love as a consequence of which the biodiversity ethics and values are developed in them, inspite of their poverty and modernization of high order. The overall attitude of the villages of Nabastha I Gram Panchayat was in parity with such attitudes and activities. The village people show their involvement in the act of conservation of biodiversity through fulfilment of their cultural and religious activities collaterally with sustainable use to meet their day to day needs. They also take care to protect the tree considered sacred by them. During the present study 13 indigenous rituals were recorded (Table 7) which involve the use of bioresources obtained from 4 animal and 12 plant species. Almost in every occasion cow dung and cow milk are compulsory items. The people of Santhal community use to hunt Dak pakhi (*Metopidius indicus*) as a part of the custom. Many plants and animals are considered sacred and worshipped by them. Thus, it is a very noble motto and simple life style of the villagers which have immense contribution towards conservation of the nature and its creations in their own ways. The religious practices integrating bioresources, if perpetuated, are certain to ensure conservation and protection of the concerned species in the days to come.

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## **HUMAN BEING AS ONE OF THE FACTOR FOR SURVIVAL OF LARGER MAMMALS IN THE THAR DESERT OF RAJASTHAN**

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### **ABSTRACT**

Man has always been the single most important factor in any ecosystem and to a large extent play decisive role as to what will survive in his sphere of activities. Dispersion of 21 species of larger mammals in the Thar desert was analysed in light of above and it was found that distribution of 15 species has a bearing on man and/or his activities, survival of nine species is susceptible to change in landuse pattern and five species having religious association with man have comparatively better revival prospects.

**Key words :** *Endangered species, mammals, man and environment, desert*

### **INTRODUCTION**

The Thar is the easternmost extremity of the Great Palearctic Desert which is the cradle of Old World civilization. The land of this area has witnessed many devastated wars and vagaries of climate for thousands of year. The march is still going on. Undeniably, human beings have always been the single most important factor throughout these episodes. Nevertheless, the other side of the coin is that human beings have also been a practical biologist systematizing his knowledge of plant and animals, amongst which and on some of which, he live. Consequently, they gave some of the most important crops and domestic animals to the society. However, unfortunately, as his knowledge of environment, its constituents and natural resources expand the human beings started discriminating them in terms of beneficial and non-beneficial taking only himself into the reference. Thus, human behaviour (liking and disliking) started playing a dominant role in determining the vegetation complexes as well as the range of animals that can continue to survive in his vicinity. Each species of animal and plant has to face this challenge in its own

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way. During the process, some have adapted to the changed situation, and others gradually shrink into natural habitat while the remaining either disappeared or will disappear in course of time thus, carved out a human-sphere out of biosphere. To check this process government has created various categories of protected areas, game reserves, conservation reserves, sanctuaries, national parks, etc., offering different degree of protection to animals and plants and gradually isolating natural habitats free from human interference.

In the Thar desert the concentration of wild mammals is comparatively higher outside protected areas for two reasons. Firstly, there are only two areas designated as sanctuaries constituting merely 4.3 % of total geographical area of the Thar desert and secondly, plenty of different categories of degraded land offer them alternate home. But, outside protected areas man is an important limiting factor. This paper analyse the survival prospects of 21 species of larger mammals in view of the ongoing process as explained above. An attempt has been made to correlate distribution of free living larger mammals in the Thar Desert with that of man and his cultural, religious and professional affiliations being the important factors determining human behaviour.

### **STUDY AREA**

The Indian part of the Thar Desert is delimited by the Aravalli hills in the east, the international boundary with Pakistan in the west, the grand salt marsh of Kutch in the south and arid districts of Haryana and Punjab in north and lies between 22° 30' N to 32° 05' N latitude and 68° 05' E to 75° 45' E longitude. The Great Indian Desert (India and Pakistan) covers an area of nearly half of the Arabian Desert and 1/7<sup>th</sup> of Saharan desert. The Indian part of the Thar Desert occupies about 2,78,330 sq km (12% of geographical area of the country), of which 1,96,150 sq km (70%) lies in Rajasthan, 62,180 sq km (22%) in Gujarat and 20,000 sq km (7%) in Punjab and Haryana.

The Thar Desert is mostly confined to western part of Rajasthan. This is characterized by sparse vegetation and is neither barren nor un-inhabited. It is covered with bushes and scrubs and even small trees. It is a great sandy tract with no streams and with very few seasonal river, a few rocks that protrude above the land and now covered with sand, forming immobile sand dunes. The grasses on these dunes grow in clumps indicating the availability of water just beneath the sandy soil.

### **METHODS**

As far as the mammalian diversity of the Thar Desert is concerned all together 68 species belonging to nine orders (Alfred and Agrawal, 1996) dwell in the area. These constitute about 18% of the total mammalian fauna of the country. Their size ranges from as big as Nilgai to as small as shrews. Therefore, for the purpose of convenience the desert dwelling mammals listed under Schedule I, II and III of the Wildlife (Protection) Act, 1972 have been considered larger mammals as far as the

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scope of this paper is concerned. Using this criterion a total of 21 large mammals belonging to five orders (Table 1) have been discussed here.

The author as an assignee of the project 'Status Survey of Chinkara and Desert cat in Rajasthan' had opportunities to cover entire Thar Desert under the project during different period of time. While findings of this project have been published elsewhere (Alfred *et al.*, 2001; Kankane, 1996, 2002), records kept on the distribution pattern and man animal relations of larger mammals are the foundation of this paper. While 16 out of total 21 animals (Table 1) were observed during field surveys, information regarding remaining five was collected through published literature (Kankane, 1996; Prakash, 1963; Rodgers and Panwar, 1988).

**Table 1.** Large mammals of the Thar desert and their association with men

Sl No.	Order/Species	Common name	Legal status in Schedules of WL(P) Act,1972	Kind of association			
				Human habitation	Agriculture fields	Religious	Commercial value
<b>Primates</b>							
1	<i>Macaca mulatta</i>	Rhesus macaque	II	Y		Y	
2	<i>Presbytis entellus</i>	Hanuman langur	II	Y		Y	
<b>Carnivora</b>							
3	<i>Canis lupus</i>	Wolf	I	Y			
4	<i>Canis aureus</i>	Jackal	II	Y			Y
5	<i>Vulpes vulpes</i>	Desert fox	I		Y		Y
6	<i>Vulpes bengalensis</i>	Indian fox	I		Y		Y
7	<i>Mellivora capensis</i>	Ratel	I				
8	<i>Lutra perspiciliata</i>	Otter	II				Y
9	<i>Viverricula indica</i>	Tody cat	II		Y		
10	<i>Paradoxurus hermaphroditus</i>	Small Indian civet	II		Y		
11	<i>Hyaena hyaena</i>	Hyaena	III				
12	<i>Felis chaus</i>	Junglecat	II				Y

Table 1. contd.

Sl. No.	Order/Species	Common name	Legal status in Schedules of WL(P) Act,1972	Kind of association			
				Human habitation	Agriculture fields	Religious	Commercial value
13	<i>Felis silvestris</i>	Desert cat	I		Y		Y
14	<i>Felis caracal</i>	Caracal	I				
15	<i>Panthera pardus</i>	Leopard	I	Y			Y
<b>Perissodactyala</b>							
16	<i>Equus hemionus khur</i>	Wild ass	I				
<b>Artiodactyala</b>							
17	<i>Sus scrofa</i>	Wild boar	III		Y		
18	<i>Boselaphus tragocamelus</i>	Nilgai	III		Y	Y	
19	<i>Antilope cervicapra</i>	Black buck	I	Y	Y	Y	
20	<i>Gazella bennetti</i>	Indian gazelle	I	Y	Y	Y	
<b>Pholidota</b>							
21	<i>Manis crassicaudata</i>	Indian pangolin	I				
				<b>7</b>	<b>9</b>	<b>5</b>	<b>7</b>

## RESULTS

While protected areas of the Thar Desert constitute only 4.3% of its total geographical area, the habitats suitable for wildlife, outside such protected areas still holds viable populations of number of wild animals due to various conditions, such as, low human population density, non-availability of surface water, geological and other socio-cultural features, etc.

As explained above, the main reason for this turn out is availability of lot of degraded land as habitat for wildlife, which is either not suitable for agriculture or water (surface/ underground /canal) is not available for irrigation. Hence, agricultural practices and agricultural output in this area is entirely dependent on rain. Consequently, human migration continues and the pace of human settlement and human density per sq km is comparatively lower in this area. As a result, it provides one of the best habitats to the desert fauna outside protected areas. However, such free living wild animals are exposed to number of extraordinary threats not facing

their cousins inside protected areas. Developmental activities and human beings' mind-set towards wildlife are the most important factors governing survival prospects of such populations. Their relationship is just like landlord and tenants. In this paper an attempt has been made to analyse man animal association based on their needs (Table 1) in the Thar desert of Rajasthan. Thus, the association is a two way process, *viz.*, different level of tolerance as well as commercial use to man and fulfilment of animals' need in the form of food and shelter.

1. Human habitation : Distribution of wild animals linked to human habitations, mostly for cooked food, cattle lifting, etc.
2. Agriculture : Distribution of wild animals linked to agricultural fields mostly for food (crops or rats) and shelter.
3. Religious : Distribution of wild animals tolerated in human settlements on religious ground.
4. Commercial value : Distribution of wild animals governed by their large scale commercial exploitation.

It is evident (Table 1) that distribution of fifteen out of total 21 mammalian species, has direct bearing to man or man made activities. Five of them having religious association with some sect of people are *Presbytis entellus*, *Macaca mulatta*, *Boselaphus tragocamelus*, *Antilope cervicapra* and *Gazella bennetti*. These five species are being tolerated in the human habitation including agricultural fields to such an extent that one of them has now attained the status of agriculture pest. While nine (including three of the above ) terrestrial mammals, *viz.*, *Canis lupus*, *Canis aureus*, *Vulpes vulpes*, *Vulpes bengalensis*, *Felis silvestris*, and *Hyaena hyaena* are inadvertently being acceptable in their current habitat by the land owners however, susceptible to change in the landuse to multi-crop practice once water is available through canal network being created in western and southern part of the desert. As far as commercial exploitation of wild animals is concerned seven species, *Canis aurus*, *Vulpes vulpes*, *Vulpes bengalensis*, *Lutra perspicillata*, *Felis chaus*, *Felis silvestris* and *Panthera pardus* are facing this dilemma. The problem gets further multiplied because these populations are easy target for poachers in comparison to populations inside protected areas. Thousands of skins of Desert fox, Desert cat and Jackal caught by law enforcing authorities indicates that they are being gradually removed unnoticed.

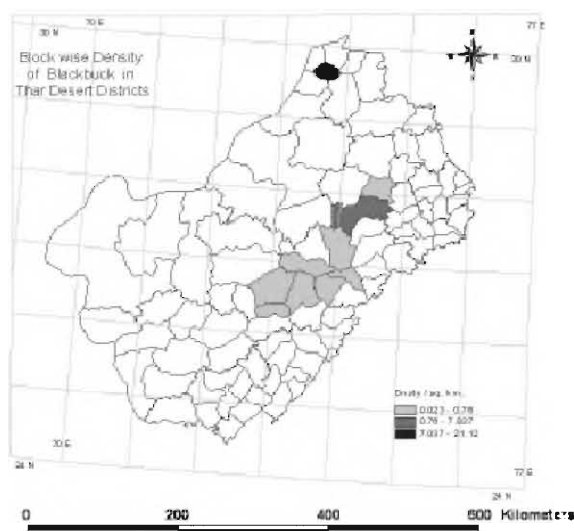
## **DISCUSSIONS**

Culturally speaking, the people of Rajasthan have over the centuries developed a dichotomous attitude towards wildlife. On one hand there were Rajputs, the princely caste and their minions, besides a number of nomadic and forest dwelling tribes, who looked upon hunting of wildlife as one of the main pastimes. On the other

extreme of the psycho social spectrum, there were the believers in absolute non-violence, particularly those belonging to business communities, Brahmins and practicing Jains and some other religious sects (Prakash, 1980). The contribution of *Vishnoi* community towards cause of wildlife in general and Black buck in particular in the States of Rajasthan and Haryana occupies a distinctive position and needs no elaboration. In the past, during the days of the princely states, it was the prerogative of the *Rajas* and nobles to hunt in the state forests, but poachers and defaulting commoners were severely punished for any violation of the rules. Their love for wildlife speaks for itself and some of their creations which are the best sanctuaries and national parks we see today. However, the situation gradually changed after we got independence and the commoners become the lord of the day. In the absence of any legislation, merciless, thoughtless and ruthless killing of all wildlife became the order of the day till the Parliament enacted Wildlife (Protection) Act in the year 1972. Nevertheless, the magnitude of impact of man and his attitude towards the wildlife has reached to such an extent that now-a-days the distribution maps of animal loving communities are become the distribution maps of wildlife, as far as the Thar desert is concerned.

### SCOPE FOR FURTHER WORK

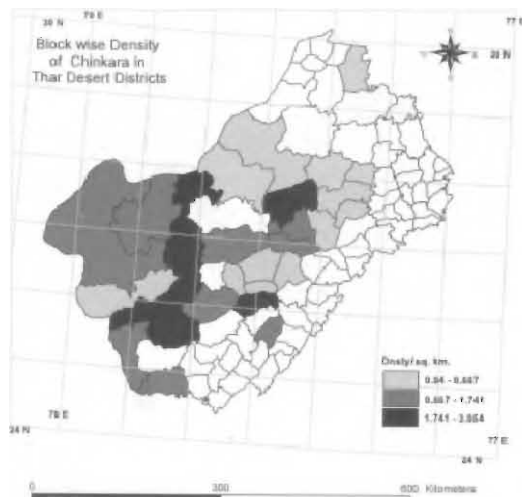
When it comes to protection and conservation of the animals in target, the foremost requirement is their present distribution This aspect is partly fulfilled by collecting information on three species, to start with, and findings are depict in the



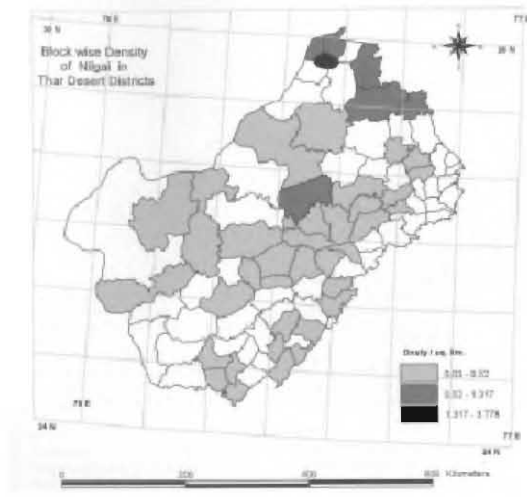
Map 1. Distribution of Blackbuck is associated with the distribution of community. (They believe Blackbuck is incarnation of their forefathers)

form of block wise presence/absence maps (Map 1-3) of Chinkara, *Gazelle bennetti*, Black buck, *Antilope cervicapra* and Nilgai, *Biselaphus tragocamelus*. However, the current state of our knowledge is still deficient. To be precise, we should have point information on distribution and population size of each species for their better management in the fast changing scenario of the desert because effective action can only be based on accuracy of information.

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Map 2. Distribution of Chinkara is associated with wasteland and rain fed single crop area. (Change in land-use is fragmenting their population)



Map 3. Distribution of Nilgai. (This is associated with the religious sentiment of local population as Nil + gai = Blue + Cow)

Hence,

1. Exact distribution and population size of these animals as mentioned in Table 1 should be immediately worked out.
2. The current landuse pattern is the major promoter for occurrence of wild animals in the free living state in the Thar desert. Hence, *status quo* on landuse should be maintained till we have details, as per point 1 above. Only then change in landuse be allowed after providing adequate arrangements of corridors for to and fro movement of animals from different pockets of concentration as well as protected areas.

The landuse change is very much offing in the Thar desert (Map 4) as canal water has now been made available through Indira Gandhi Nahar Project (IGNP).

#### **ACKNOWLEDGEMENTS**

I am thankful to the Director, Zoological Survey of India for sanctioning the project Status survey of Chinkara and Desert cat in Rajasthan which gave me an opportunity to visit Rajasthan part of the Thar Desert extensively.



Map 4. Showing command area of IGNP and protected areas in the study area. (Large scale canal irrigation system and subsequent change in landuse pattern has already eliminated Chinkara and Blackbuck from their earlier strongholds in northern part and severely fragmented the habitat of Chinkara in southwestern part of the Thar Desert. A branch of Sardar Sarovar Dam, in Gujarat, irrigates southern part of the Thar desert, not shown in map)

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