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Subsistence use of floral elements in Jainti under Buxa Tiger Reserve in West Bengal, India

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Abstract

Geographically Buxa Tiger Reserve (BTR) is lying between the latitudes of 26° 30' and 26° 55' N and the longitudes of 89° 20' and 89° 55' E. Primarily it is situated in Bhabar and Terai areas consisting of slightly undulating land. Reserve consists mainly of natural vegetation with patches of old plantations. It spreads over 760.87 sq km area with a core zone of 314.5 sq km of which 117.17 sq km is designated as Buxa National Park. Present study has been covered only the national park area of BTR, commonly known as Jainti Forest. There are two human settlements in this forest, Jainti village and Bhutia Busty Bengal Line village. People living in the fringe area Nurpur village is also dependent on this forest for commercial as well as subsistence purposes. There are 112 plant species in use by the locals of which 58 plants are for purely subsistence purpose.

Key words: BTR, Jainti, Inhabitants, Subsistence, NTFPs

INTRODUCTION

The relationship between human beings and their environment is constantly evolving and changing, and thus, provides numerous avenues for a fascinating study into this dynamic relationship. Over the time, humans learnt to use wide array of forest products for their sustenance, comfort and happiness and continued to increase their dependence on forests and other natural products. People living in forest villages are known to take care of forests for their own survival. The close interaction of local communities with the forests and their dependence on various forest products is one of the most important factors identified as contributing to the continued survival of forests (Gokhale *et al*. 2004). "Achievement of all the Millennium Development Goals will depend on maintaining the environmental goods and services that are crucial to human productivity" (Cottray *et al*. 2006).

Socio-cultural environment grew within the human society for its own survival and a separate knowledge base developed in the form of ethnobotany, ethnomedicine, etc. (Vandebroek *et al*. 2011). 'Scientific research is revealing an ever increasing number of links between biodiversity and human health, not only in terms of food resources or food security, but also with regard to materials to treat and cure diseases' (Pandey *et al*. 2010; Chakravorty *et al*. 2011). Medicinal plants, which are very important NTFPs [Non-Timber Forest Produces] - constitute the principal source of ingredients for traditional medicines (Almeida *et al*. 2006; Kumar *et al*. 2011; Machkour-M'Rabet *et al*. 2011). So far, 4,22, 000

species of flowering plants have been recognized in the world (Govaerts 2001), of which over 50,000 are used for medicinal purposes (Schippmann *et al*. 2002). In India medicinal properties have been assigned to several thousand that is around 43 % of the total flowering plants (Pushpangadan 1995). In addition to their medicinal value some plants have other utilities and plays important economic role in the local communities. Dye substances of plant origin are present in many wild and cultivated species (Guarrera 2006; Ghosh & Das 2007), and thus, dye is another very important NTFP to be considered. Approximately 450 taxa are known to yield dyes in India alone, of which 50 are considered to be the most important (Chandramouli 1995). However, dyes are one of the most important uses of the plants, as it relates with cultural practices, rituals, arts and crafts, fabrics and to satisfy personal embodiment (Gaur 2008). Excluding the above mentioned uses of NTFPs, many other uses are there *viz*. rope making, plate from leaves, collecting and selling wild mushroom and honey (Moerman 1998). People also harvest and use different fruits and nuts, vegetables, mushrooms for their subsistence (FAO 2010). Around 75,000 species of flowering plants are edible of which about 3000 are regarded as source of food (Krishnamurthy 2003; Pandit *et al*. 2004; Sarkar & Das 2012; Sarkar 2014).

Buxa Tiger Reserve (BTR) is an extension of Sub-Himalayan West Bengal with an area of 760.87 sq km and the 15th Tiger Reserve in India. This is the house of 597 floral species (Pestonjee & Dutta 1999). A considerable proportion of these species are used as NTFPs. Core area of BTR is inhabited by at least 112 species of NTFPs (Sarkar & Das 2012). This is an important place to understand the socio-ecological dimension (Das 2005; Sarkar 2014).

Study area

Geographically BTR is lying between the latitudes of 26° 30' and 26° 55' N and the longitudes of 89° 20' and 89° 55' E. The overall topography of the area is an amalgamation of plains and hills. The mountainous tract is an extension of the outer spurs of the Eastern Himalaya. Also, this is the only Tiger Reserve located in the northern part of West Bengal. This Protected Area is sharing its boundary with the international border with Bhutan on the North and the eastern boundary touches the Indian state of Assam. Western and Southern boundaries are demarcated by several Tea Estates (T.E.) within the Indian territory.

METHODOLOGY

A Socio-Economic survey was carried out to collect required information from the villagers and for which following steps were followed:

1. An initial discussion with the members of the local village *Panchayat* and other important individuals like a teacher, each from the nearest high school and the local primary school helped us to understand the general socio-economic features of the people residing in the area under present study. Socio-economic information has been accumulated using IFRI techniques (Wertime *et al*. 1999; Sarkar 2014).

2. 40 representative households have been selected from the initial list of demographic profile eliciting their forest dependence, occupation and income – using random sampling technique and a cross check have undertaken to reveal that the population parameters and sample parameters like—

    a. Occupation status;

b. Annual family income; and

c. Collection of NTFP from the forest.

3. A structured questionnaire was canvassed among the selected households to elicit information about socio-economic status of each of them and their dependence on forest products (Sarkar & Chakrabarti 2012).

4. In addition, informal discussions with villagers at local market teashops and school also carried out to gather information.

5. Specimens of the NTFP species used by the locals were collected with help of the respondents and were processed into mounted herbarium sheets (Jain & Rao 1977).

6. Specimens were identified using local floras, monographs, etc. [including Hooker 1872 – 1897; Prain 1903; Hara 1966, 1971; Ohashi 1975; Hara et al. 1978, 1979, 1982; Grierson & Long 1983 – 2001; Noltie 1994, 2000] and confirmed by matching in NBU Herbarium. Voucher specimens were deposited in the NBU Herbarium.

RESULTS AND DISCUSSION

Jainti Forest Range is administering the core area of BTR. Present study concentrates only in this area. Forests of this area is of three types – riverine, moist deciduous and evergreen. Existence of riverine forest is scanty. However, the other two types are well represented. Study has been done in plains and hilly areas close to the Indo-Bhutan border. Hilly area is quite inaccessible and this natural barrier is nicely helping this Protected Area to maintain its natural flora.

Jainti is the repository of at least 413 species of vascular plants of which 396 are angiospermic, 16 pteridophytic and only one gymnosperm species. These plants are distributed in 95 families (Sarkar 2014).

There are 112 plant species in BTR those are recorded to be collected by the locals of which 58 plants are purely for their own subsistence (Sarkar 2014) and the remaining 54 are for commercial purpose only (Sarkar & Das 2012).

SOCIAL ATTRIBUTES

Socio-economic studies were conducted in three settlements, namely Jainti, Bhutia Basty Bengal Line (BBBL) and at Nurpur. Aspects of study were mainly demography, occupation and their dependence of forests, specially related to the collection of NTFP.

Ethnobotany

People of Jainti, BBBL and Nurpur have developed a suitable relationship with their habitat, which mostly forested vegetation. This relationship has been developed from the urge for their survival in that remote and inhospitable surrounding. However, this socio-ecological linkage is very weak with Nurpur villagers compared to other two groups (Jainti and BBBL).

NTFP & Local economy

Sarkar (2014) estimated that, “Gross annual income of NTFP harvesters is around Rs.5768870.00 (Rupees Fifty seven lakh sixty eight thousand eight hundred seventy only). Monthly average income is recorded as Rs.2716.00 per family. Per capita daily income

among the NTFP harvesters from this resource is Rs.18.40." Instead of commercial use of NTFP species they harvest a considerable number of species for their subsistence. The plants and their mode of use by them for subsistence are discussed below.

Species used for subsistence

Local people use 21 trees, 6 woody climbers (Liana), 8 shrubs, 14 herbs, 7 herbaceous climbers and 2 ferns in their daily life for their own survival. Of these, people use three as broom, eighteen edible in raw, fourteen medicinal, four rope making, ten vegetables, three religious, one each as gun powder, fencing, housing, packing butter, storing drinking water and as pigs fodder. Parts of plant used by them are fruit of nineteen species, leaf of sixteen species, stem of twelve species, whole plant of four species, root of three species, bark of two species, seed, petiole and tender tip of one species each (Table 1).

Table 1. Subsistence use of plants along with the plant parts and their habit [*Abbreviations used*: T = Tree; Sh = Shrub; H = Herb; L = Liana; Cl = Herbaceous climber; F = Fern]

Plants [Family]; Voucher specimen	Vernacular Name	Altitudinal distribution (in m)	Habit	Parts used	Uses
Acacia pennata (Linnaeus) Willdenow [Leguminosae : Mimosoidae]; *Animesh & AP Das 9533*	*Arare Kanra*	upto 298	L	Stem	Dust as gun powder
Ageratum conyzoides Linnaeus [Asteraceae]; *Animesh & AP Das 9531*	*Alu jhaar*	upto 300	H	Leaf	Extract to stop bleeding & in sore
Alpinia nigra (Gaertner) Burtt [Zingiberaceae]; *Animesh & AP Das* 9542	*Churumpha*	upto 130	H	Rhizome	Vegetable
Amorphophallus bulbifer (Roxburgh) Blume [Araceae]; *Animesh & AP Das* 9553	*Gurbe*	upto 325	H	Leaf & Stem	Vegetable
Angiopteris evecta (G. Forster) Hoffmann. [Marattiaceae]; *Animesh & AP Das* 9549	*Gaikhoret*	upto 355	Fern	Petiole	Extract in cow's hoof disease
Antidesma acidum Retzius [Phyllanthaceae]; *Animesh & AP Das* 9539	*Bhotey Archal*	upto 139	T	Fruit	Edible
Bambusa tulda Roxburgh [Poaceae]; *Animesh & AP Das* 9548	*Filling Baans*	upto 298	H	Stem	Fencing
Barleria prionitis Linnaeus [Acanthaceae]; *Animesh & AP Das* 9564	*Kharate Jharoo*	upto 150	Sh	Whole plant	Broom
Benkara fasciculata (Roxburgh) Ridsdale [Rubiaceae]; *Animesh & AP Das* 9570	*Maidalu Kanra*	upto 285	T	Fruit	Edible
Boerhavia diffusa Linnaeus [Nyctaginaceae]; *Animesh & AP Das* 9540	*Lore Saag*	upto 130	H	Whole plant	Half boiled plant in anemia
Calamus erectus Roxburgh [Areacaceae]; *Animesh & AP Das* 9552	*Gouribet*	upto 120	Sh	Stem	Rope
Caryota urens Linnaeus [Areacaceae]; *Animesh & AP Das* 9586	*Kharate Jharoo*	upto 150	T	Leaf	Broom
Catunaregam longispina (Link) D.D. Tirvengadum [Rubiaceae]; *Animesh & AP Das 9532*	*Aamra*	upto 425	T	Fruit	*Chatni* & Pickle
Centella asiatica (Linnaeus) Urban [Apiaceae]; *Animesh & AP Das* 9550	*Ghortapre*	upto 345	H	Leaf	Vegetable & diarrhea
Cheilocostus speciosus (J. Koenig) C.D. Specht [Costaceae]; *Animesh & AP Das 9535*	*Bet Larang*	upto 120	L	Stem	Rope
Chloranthus elatior Link [Chloranthaceae]; *Animesh & AP Das* 9561	*Junka dabai*	upto 150	H	Leaf	Leech bite sore
Cissus repanda (Wight & Arnott) Vahl [Vitaceae]; *Animesh & AP Das* 9575	*Pani Lahara*	upto 130	L	Stem	Drink fluid in thirsty

Plants [Family]; Voucher specimen	Vernacular Name	Altitudinal distribution (in m)	Habit	Parts used	Uses
Citrus limon (Linnaeus) Osbeck [Rutaceae]; *Animesh & AP Das* 9537	*Bhimira/Junglee Limbu*	upto 150	Sh	Fruit	Edible
Citrus limon Linnaeus [Rutaceae]; *Animesh & AP Das* 9559	*Junglee Lebu*	upto 110	Sh	Fruit	Prepare juice
Clausena excavata Burman *f.* [Rutaceae]; *Animesh & AP Das* 9543	*Curry pata*	upto 150	Sh	Leaf	Spice
Codoriocalyx motorius (Houttuyn) H. Ohashi [Leguminosae]; *Animesh & AP Das* 9572	*Mohoni Jhaar*	upto 310	H	Leaf	Attract girls
Croton tiglium Linnaeus [Euphorbiaceae]; *Animesh & AP Das* 9567	*Lapche*	upto 305	T	Bark	Rope
Cynodon dactylon (Linnaeus) Persoon [Poaceae]; *Animesh & AP Das* 9538	*Dubo*	upto 185	H	Leaf	Religious
Dendrocalamus strictus (Roxburgh) Nees [Poaceae]; *Animesh & AP Das* 9569	*Makla Baans*	upto 285	T	Stem	Building house
Dillenia indica Linnaeus [Dilleniaceae]; *Animesh & AP Das* 9541	*Chalta*	upto 395	T	Fruit	Edible
Dioscorea prazeri Prain & Burkill [Dioscoreaceae]; *Animesh & AP Das* 9551	*Githa*	upto 368	Cl	Under-ground tuber	Vegetable
Diplocyclos palmatus (Linnaeus) C. Jeffrey [Cucurbitaceae]; *Animesh & AP Das* 9556	*Hati karela*	upto 210	Cl	Fruit	Vegetable
Duabanga grandiflora (de Candolle) Walpers [Lythraceae]; *Animesh & AP Das* 9581	*Rato Khirra*	upto 250	T	Bark	Local brew
Ficus hispida Linnaeus *f.* [Moraceae]; *Animesh & AP Das* 9579	*Ramgua*	upto 110	T	Nut	Edible
Ficus neriifolia Smith [Moraceae]; *Animesh & AP Das* 9568	*Latka/Kusum*	upto 130	T	Fruit	Edible
Ficus sarmentosa Buchanan–Hamilton *ex* Smith [Moraceae]; *Animesh & AP Das* 9566	*Labar larang*	upto 370	L	Stem	Rope
Ficus semicordata Buchanan–Hamilton *ex* Smith [Moraceae]; *Animesh & AP Das* 9563	*Khanyo*	upto 390	T	Fruit	Edible
Glycosmis pentaphylla (Retzius) de Candolle [Rutaceae]; *Animesh & AP Das* 9544	*Dandisko*	upto 110	Sh	Leaf	Juice in liver problem
Helminthostachys zeylanica (Linnaeus) Hooker [Ophioglossaceae]; *Animesh & AP Das* 9573	*Muzur Khutte*	upto 100	Fern	Leaf	Vegetable
Hoya linearis Wallich *ex* D. Don [Apocynaceae]; *Animesh & AP Das* 9555	*Harchul*	above 120	Cl	Stem	Fracture
Macaranga indica Wight [Euphorbiaceae]; *Animesh & AP Das* 9571	*Maledo*	upto 110	T	Leaf	Religious
Maesa chisia Buchanan-Hamilton *ex* D. Don [Primulaceae]; *Animesh & AP Das* 9547	*Dudh Seola*	upto 310	T	Leaf	Delay fermentation
Mangifera indica Linnaeus [Anacardiaceae]; *Animesh & AP Das 9530*	*Aam*	upto 370	T	Fruit	Eaten raw & cooked
Molineria capitulata (Loureiro) W. Herbert **[Hypoxidacee];** *Animesh & AP Das* 9546	*Dhotisarah*	upto 285	H	Leaf	Pack butter and religious
Paederia foetida Linnaeus [Rubiaceae]; *Animesh & AP Das* 9574	*Pad Larang*	upto 310	Cl	Leaf	Soup
Piper pedicellatum C. de Candolle [Piperaceae]; *Animesh & AP Das* 9587	*Pipla*	upto 250	H	Leaf	Religious
Piper peepuloides Roxburgh [Piperaceae]; *Animesh & AP Das* 9582	*Rukh Pipla*	upto 250	H	Fruit	Cough & cold
Polyalthia simiarum (Buchanan-Hamilton *ex* Hooker *f.* & Thomson) Bentham *ex* Hooker *f.* & Thomson [Annonaceae]; *Animesh & AP Das* 9580	*Rato Jar Ko Dabai*	upto 210	L	Stem	Local brew
Psidium guajava Linnaeus [Myrtaceae]; *Animesh & AP Das* 9578	*Pyara*	upto 130	T	Fruit	Edible

Plants [Family]; Voucher specimen	Vernacular Name	Altitudinal distribution (in m)	Habit	Parts used	Uses
Quercus obtusata Bonpland [Fagaceae]; *Animesh & AP Das* 9536	*Bhale Kattus*	upto 130	T	Fruit nut	Edible
Scoparia dulcis Linnaeus [Plantaginaceae]; *Animesh & AP Das* 9577	*Pneumonia ko Dabai*	upto 305	H	Root	Stomach pain & pneumonia
Sida acuta Burman *f.* [Malvaceae]; *Animesh & AP Das 9534*	*Ballu Jhaar*	upto 175	Sh	Whole plant	Broom
Smilax ovalifolia Roxburgh *ex* D. Don [Smilacaceae]; *Animesh & AP Das* 9565	*Kukurdyne*	upto 120	Cl	Tender tip	Vegetable
Solanum aculeatissimum Jacquin [Solanaceae]; *Animesh & AP Das* 9558	*Junglee Begun*	upto 150	Sh	Fruit	Vegetable
Stephania glabra (Roxburgh) Miers [Menispermaceae]; *Animesh & AP Das* 9585	*Tamarkey*	upto 180	Cl	Root	Edible
Stephania japonica (Thunberg) Miers [Menispermaceae]; *Animesh & AP Das* 9545	*Dherphule Lahara/Seto jar ko Dabai*	upto 315	L	Stem	Local brew
Streblus asper Loureiro [Moraceae]; *Animesh & AP Das* 9584	*Seuri*	upto 150	T	Leaf	Pig fodder
Syzygium cumini (Linnaeus) Skeels [Myrtaceae]; *Animesh & AP Das* 9557	*Jamun*	upto 150	T	Fruit	Edible
Tephrosia candida de Candolle [Leguminosae : Faboideae]; *Animesh & AP Das* 9576	*Paniel*	upto 210	T	Nut	Edible
Tinospora crispa (Linnaeus) Hooker *f.* & Thomson [Menispermaceae]; *Animesh & AP Das* 9554	*Gurjo*	upto 405	Cl	Stem	Fracture of livestock & diabetes
Typhonium trilobatum (Linnaeus) Schott [Araceae]; *Animesh & AP Das* 9562	*Karengi saag*	upto 110	H	Leaf	Vegetable
Wendlandia coriacea (Wallich) de Candolle [Rubiaceae]; *Animesh & AP Das* 9560	*Junglee Lichu*	upto 305	T	Fruit	Edible
Ziziphus jujuba Miller [Rhamnaceae]; *Animesh & AP Das* 9583	*Sanu Baer*	upto 130	T	Fruit	Edible

NTFPs used by the inhabitants in and adjacent Jainti are from six habit groups (Table 2). Mostly used products they harvest from trees (36.21 %), followed by herbs (24.14 %), shrubs (13.79 %), herbaceous climbers (12.07 %), lianas (10.34 %) and the rest 3.45 % from ferns.

Table 2. Number of NTFPs under various Habit groups

Habit	No. of NTFPs
Trees	21
Shrubs	08
Herbs	14
Lianas	06
Climbers	07
Ferns	02

They harvest these plants in whole or parts for their own uses and maximum number of use registered for edible fruits and nuts (15 plants). Instead of edible species they harvest 7 plants for vegetable and medicinal purposes followed by rope making (4 plants), making broom, prepare local brew and religious purposes (3 plants) and one each species uses for making *chatni* & pickle, delay fermentation of milk, drink fluid in thirst, dust as gun powder, cure cow's hoof disease, fencing, house building, prepare juice, making soup, spice, vegetable & diarrhea, pack butter as well as religious purposes, attract girls and pigs fodder.

Table 3. Uses of NTFPs from different Habit groups

Uses	Habit Groups					
	Trees	**Shrubs**	**Herbs**	**Lianas**	**Climbers**	**Ferns**
Attracting girls	0	0	1	0	0	0
Broom	1	2	0	0	0	0
Building house	1	0	0	0	0	0
Chatni & Pickle	1	0	0	0	0	0
Delay fermentation	1	0	0	0	0	0
Drink fluid in thirsty	0	0	0	1	0	0
Dust as gun powder	0	0	0	1	0	0
Edible	13	1	0	0	1	0
Extract in cow's hoof disease	0	0	0	0	0	1
Fencing	0	0	1	0	0	0
Local brew	1	0	0	2	0	0
Medicinal	0	1	5	0	2	0
Pack butter and religious	0	0	1	0	0	0
Pigs fodder	1	0	0	0	0	0
Prepare juice	0	1	0	0	0	0
Religious	1	0	2	0	0	0
Rope	1	1	0	2	0	0
Soup	0	0	0	0	1	0
Spice	0	1	0	0	0	0
Vegetable	0	1	3	0	3	1
Vegetable & diarrhea	0	0	1	0	0	0

Available information from the study site (Table 3) speaks that most of the used species as fruits and nuts (25.86 %). They consume all these fruits directly and the nuts by breaking the seed coat. Sometimes they roast the seed and eat nuts. Instead of edible species they harvest 13.79 % of plant species each for vegetable and medicinal purposes. They reduce their expenditure by collecting wild leaves, tuber, stems or sometimes whole plant to cook as vegetables with major meals. Medicinal use is restricted only for minor ailment or diseases require prolonged treatment like diabetes. However, the locals treat minor fracture in the locality. For cow's hoof disease they never take their animals to doctor but use the extract of *Angiopteris evecta*. They also use 6.90 % of 58 species to make rope, 5.17 % of species each for broom, religious purposes and to make local brew. Rests of the uses are dependent on single species.

Recently, since 2006, Forest Department slowly allowed collection of boulders from the Jainti River and in February 2008 the scarcity of labourer has been noted. Recently, income in most of the families has been increased many folds due to boulder lifting from the river Jainti (Rs. 500/- per day) compared to as in 2000 (Sarkar & Das 2012). A few ecotourism resorts are also providing employment to the Jainti residents. In addition, 11 self-help groups were also formed. So, the dependence of Jainti villagers on NTFPs is decreasing gradually. However, the harvesters from Nurpur area are not sparing the forest even today. They are increasing their harvest and the loss of the forest is also increasing in due to such excessive harvest of NTFPs.

CONCLUSION

Locational disadvantage taught these people to use local resources. These isolated people has developed and maintain their own economy and science (Rai *et al*. 1998). They are using a handful locally available plant species as life-saving medicines. Jharkhandis and Nepalese are mostly using these medicines. Binaries and Bengalese mostly avoid it as they don't have such ethnobotanical knowledge.

Boulder lifting has been allowed since 2006 which has reduced their dependence on NTFPs. However, Nurpur people took it as an advantage to harvest more NTFPs from the forest. To tackle this situation a special team of Forest Department may be created for Jainti. This group, with the help of Jainti villagers, can frame suitable strategies to tackle this problem.

Further research is required to understand the nutritional value and their impact on the health of local people. Estimation of the quantity of other species used by them are also very important to frame suitable conservation strategies for the area.

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