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# Living and Survival Amidst Hunger: Wild Edible Botanicals as a Prime Forest Productivity in the Rural Purulia District, West Bengal, India from Colonial to Present

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## ABSTRACT

Since time immemorial, Wild Edible Botanicals (WEBs) have been used by the human being as a dietary component. The present investigation documents plants consumed by the tribal communities such as Munda, Santhali, Oraon, Bhumij, Kharia, Ho and Mal Pahariya residing in Purulia district, West Bengal, India. By using a semi-structured questionnaire, an ethnobotanical approach was taken to interview a total number of 127 informants from the ethnic communities residing in the forests and near forest areas of the villages of 20 blocks of the district. The ethnic groups not only use such botanicals during crises and starvation, some of the plants were found to be included in their regular dietary habit. Authors have also tried to describe the socio-economic aspects and conservation practices associated with using WEBs. The possible role of using the reported WEBs as sources of pharmaceuticals and neutraceuticals and their nutrient and anti-nutrient content are also depicted from the existing literature.

**Key words:** Wild edible botanicals, ethnobotany, forest productivity, pharmaceuticals, neutraceuticals

## INTRODUCTION

India, being one of the biological hotspots of the world, houses a number of important plant species. Its rich source of biodiversity has always provided the basic needs such as food, clothes, timber, fibre, medicine and shelter to its inhabitants. India is also the abode of a number of tribal communities with different cultural and anthropological backgrounds. Plants have served as the primary food and healthcare need for a huge percentage of populations residing in the rural India. To prevent hunger and potential contamination of common foods by toxic chemicals, people are in constant search for alternative food sources (Redzic, 2006). Since the prehistoric and historic times, wild plants have been reported to be consumed by human (Kubiak-Martens, 1996; Luczaj, 2008). Wild Edible Botanicals (WEBs) are still being used by the tribal people at different parts of the world. They serve as an aid to the main food crops and have been found to be immensely useful during famine (Balemie and Kebebew, 2006), drought (Lockett and Grivetti, 2000), other environmental crises and war (Redzic, 2010).

Although, the WEBs serve as a significant dietary component, they have been neglected globally (Bharucha and Pretty, 2010). Botanicals and neutraceuticals of traditional origin have been recognized to possess therapeutic ability (Pieroni *et al*., 2004). Reduction in use of WEBs is a result of ever changing lifestyle of human being (Schunko and Vogl, 2010). Modern packed foods have also influenced this decline (Bhattarai *et al*., 2009). Due to rapid erosion of traditional knowledge, the native practice of using food plants must be studied, characterized and conserved on priority basis (Lentini and Venza, 2007). Dual role of WEBs in providing food security and combating health risks must generate consciousness and effort to promote utilization and conserve the rich but rapidly eroding plant-lore (Jeambey *et al*., 2009). Diet simplification causing many of the life style diseases can be dealt with using traditional WEBs based recipes (Batal and Hunter, 2007).

WEBs have served as a rich source of nutrition to different communities at various parts of the world and a number of WEBs have been recorded with reports on their ethnobotany, culture, traditions, biodiversity, nutritive and antinutritive content, recipes, pharmacology, phytochemistry, therapeutic ability, ecology, community dynamics, economy and perspectives on sustainable utilization and conservation (Luczaj and Szymanski, 2007; Luczaj, 2008; Liu *et al*., 2002). Earlier, a few investigations have been carried out documenting the indigenous use of medicinal plants by the tribals residing in Purulia District, West Begal, India (Chakraborty and Bhattacharjee, 2006; Dey and De, 2010a, b, 2011a, b, 2012a, b). However, so far so little has been documented regarding the use of WEBs by the ethnic groups of the district (Jain and De, 1964, 1966; De, 1969).

The primary aim of the present study is to document the well and lesser known WEBs from this remote tribal rich area of India. The lesser known WEBs were found in use during famine, starvation and related crises. The present study includes some reports from the adjoining districts and states where the same plants are used as food to reflect the widespread acceptability of certain WEBs. Secondly, with the advent of recent research on curative properties of foods in terms of neutraceuticals, the present study may provide some useful WEBs having healing potentials. During the investigations, authors have noted the application of some WEBs as widely used ethnomedicines supporting the idea. Thirdly, the authors have tried to compile a list of relevant research work incorporating the nutrient and anti-nutrient composition of some of the said plants. This reflects the usefulness of some WEBs as nutrients and opens up an area of research where some of these popular WEBs could be analyzed as significant sources of nutrients. Reports on antinutrient content and edibility related toxicity can be used to warn tribal people regarding the use of certain WEBs.

## MATERIALS AND METHODS

**Study area and people:** Purulia is the westernmost district of the state West Bengal, India representing one of the tribal dominated areas of the country (Fig. 1). The district lies between 22°51'N and 23°42'N and 85°51'E and 86°54'E covering an area of 6529 $km^2$. The range of temperature is 7-45°C and the average annual rainfall is 1240-1400 mm (Dey and De, 2010a). The district is primarily represented by its extreme climate, scanty monsoon, undulated landscape and poor agriculture and lack of industry. The district is represented by a number of ethnic communities with their own and unique cultural and traditional heritage. The major aboriginal lineages residing in the district are Munda (M), Santhali (S), Oraon (O), Bhumij (Bh), Kharia (Kh), Ho (Ho) and Mal Pahariya (MP) etc. A total number of 20 blocks are present in the district *viz*. such

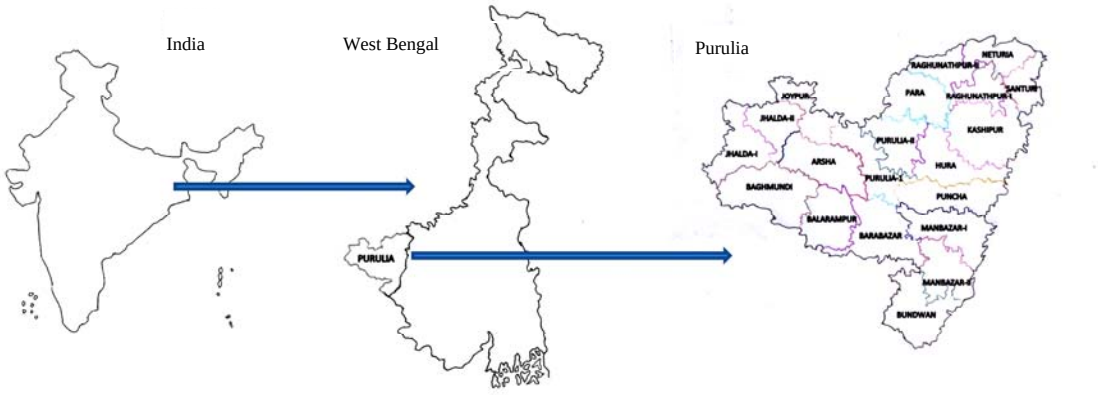


Fig. 1: Maps of India, West Bengal and Purulia (Maps are not to scale)

as Neturia, Raghunathpur I and II, Santuri, Para, Kashipur, Purulia I and II, Hura, Puncha, Manbazar I and II, Bundwan, Barabazar, Balarampur, Baghmundi, Arsha, Jhalda I and II and Joypur (Dey and De, 2012a, b). Purulia, with its characteristic topography and draught, has not been considered as a natural habitat for a number of conventional crop plants. Poor irrigation and agricultural systems in the rural parts of the district along with extreme climate and less rainfall necessitate the inhabitants to use alternative food source. Underprivileged folk communities were found to use a number of botanicals as an aid to their dietary and healthcare components.

**Survey:** In order to investigate the WEBs in the said district, preliminary surveys were conducted in the villages of different blocks. The present attempt to document the wild food plants is an endeavor of one of our investigators who have been associated with the ethnobotany and medicinal flora of the district for the last few decades. The authors, while surveying the ethnomedicinal plant lore of the district, have also documented the use of WEBs growing in this region. While interviewing the tribal villagers, same ethnobotanical approach has been taken to gather information regarding food plants consumed by the tribal people (Dey and De, 2010a, b, 2011b, 2012a, b). Previously prepared semi-structured questionnaire is used on the basis of gathered information to interview the informants (total number: 127, male: 79 and female: 48 and age group: 18-25; 11, 25-40; 21, 40-60; 78 and >60; 17) (Fig. 2 and 3) following the methods described by Dey and De (2010a, 2012a, b) with slight modifications (applicable to document the use of WEBs only). Ethnobotanical data sheets were prepared incorporating the scientific name, family habit and vernacular name of the WEBs, reporting tribe, edible plant part and method of preparation.

Interestingly, young people (age group: 18-25 years) were found to possess good knowledge regarding WEBs which could be attributed to their close association with nature from their early childhood. Tribals were found to domesticate some of the WEBs at the vicinity of their houses. The WEBs and the corresponding edible parts were photographed for documentation. Herbarium specimens were prepared and identified from Prain (1903), Sanyal (1994), Paria and Chattopadhyay (2000, 2005) and were preserved for future reference.

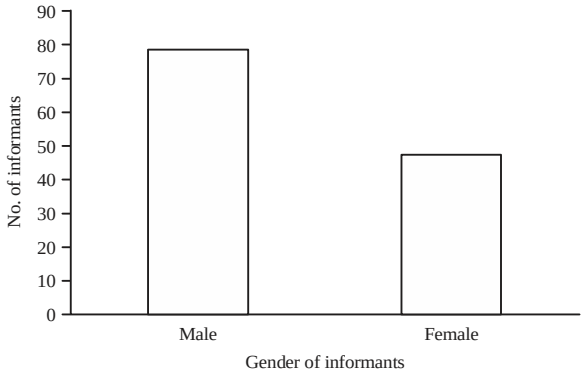


Fig. 2: Male/female ratio among the informants

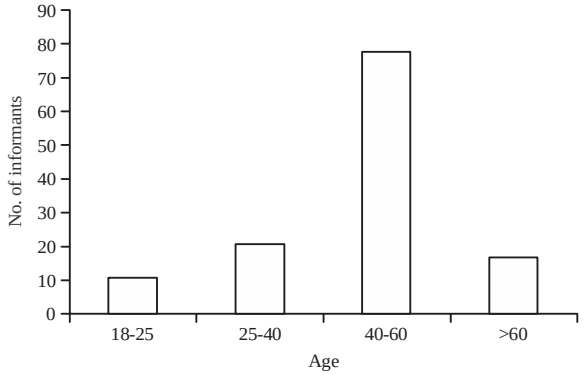


Fig. 3: Age-wise distribution of the informants

**Data analyses**

**Use Value (UV):** The UV was calculated according to the formula given by Phillips *et al.* (1994):

$$UV = \Sigma U/n$$

where, U= number of use reports for a WEB cited by each informant and n = total number of informants interviewed for a particular WEB). A higher UV indicates higher citation number of a WEB by the informants and the vice versa. Quotation Frequency (QF): was calculated on the basis of Mustafa *et al*. (2012). A WEB showing higher UV also exhibits a higher QF and the vice versa. Both UV and QF indicate a WEB's popularity and acceptability among the tribals. Lastly, data collected from the investigation was supported by the relevant literature. Reports on edibility, nutrients anti-nutrients and pharmaceutical efficacy of the said botanicals have also been mentioned.

**RESULTS**

A total number of 90 WEBs belonging to 78 genera and 42 families were documented. Table 1 represents the list of plants used by seven tribal groups residing in the rural areas of Purulia District with scientific binomials, respective plant families, habit, vernacular name(s), reporting tribe, edible part(s) and method(s) of preparation. Among the reported plants, the family fabaceae represents the most predominant one having a number of 15 plant species followed by malvaceae (8), amaranthaceae (5), rubiaceae (4) and convolvulaceae, poaceae, commelinaceae and

Table 1: A list of wild edible botanicals used by the tribals of Purulia district

| Scientific name | Family | Habit | Vernacular names | Reporting tribes | Edible parts | Methods of preparation |
|---|---|---|---|---|---|---|
| *Achyranthes aspera* L. | Amaranthaceae | Herb | Apang (Bh) | S, Bh, M, O | Young leaves | Vegetables |
| *Actinoscirpus grossus* (L.f.) Goetgh. and D.A. Simpson | Cyperaceae | Herb | Khesari (S,O) | S, M, O | Tubers | Fresh edibles |
| *Aerva lanata* (L.) Juss. ex Schult. | Amaranthaceae | Shrub | Ledra ara (M,O) | M, O | Leaves | Vegetables |
| *Amaranthus tricolor* var. *gangeticus* (L.) Fiori | Amaranthaceae | Shrub | Lal sag (S), Jenso ara (O) | S, Bh, M, O, Ho | Leaves | Vegetables |
| *Ampelocissus tomentosa* (Roth in Schult.) Planch | Vitaceae | Climber | Iotorang nari (M) | S, Bh, M, O | Fruits (berry) | Edible fruits |
| *Ardisia solanacea* Roxb. | Primulaceae | Shrub | Garha gulainchi (S), Aringudi (Bh) | S, Bh, M, O | Flowers | Vegetables |
| *Argyreia speciosa* (L. f.) Sweet | Convolvulaceae | Shrub | Kedo ara (S), Bistarak (Bh) | S, Bh | Leaves, seeds | Vegetables |
| *Atylosia scarabaeoides* (Baill.) Benth. | Fabaceae | Herb | Kando arsga (O) | S, Bh, M, O, Kh | Leaves, pods, seeds | Vegetables |
| *Bambusa vulgaris* Schrad. ex J.C. Wendl. | Poaceae | Bamboo | Hatu mad (M), Basini bans (Bh) | M, Bh | Young shoots | Vegetables |
| *Bauhinia vahlii* Villar | Fabaceae | Climber | Lamaklor (S), Bir rurung nanri (M) | S, Bh, M, O, Kh | Seeds | Fresh edibles |
| *Bombax ceiba* L. | Malvaceae | Tree | Simal (S), Edel daru (M) | S, Bh, M, O | Flowers (calyces), roots | Fresh edibles |
| *Bridelia stipularis* (L.) Blume | Phyllanthaceae | Climber | Babu janga (S) | S | Ripe fruits | Edible fruits |
| *Butea monosperma* (Lam.) Taub | Fabaceae | Tree | Palash (Bh), Morud (O) | S, Bh, M, O, Kh | Stamens (flowers), pods | Vegetables |
| *Butomopsis latifolia* (D. Don) Kunth | Alismataceae | Herb | Ludi ara (M) | S, M, O | Whole plant | Vegetables |
| *Capparis zeylanica* L. | Capparaceae | Shrub | Bagnai (S), Mari punp (O) | S, Bh, M, O, Kh | fFruits | Vegetables |
| *Careya arborea* Roxb. | Lecythedaceae | Tree | Kumbher (S), Asanda (O) | S, M, O, Kh | Fruits | Edible fruits |
| *Cassia fistula* L. | Fabaceae | Tree | Dhanbahera (Bh) | S, Bh, O, Kh | Flowers | Vegetables |
| *Catharanthus pusillus* (Murray) G. Don | Apocynaceae | Herb | Marchi ara (M), Marcha ara (O) | M, O | Leaves | Vegetables |
| *Celastrus paniculatus* Willd. | Celastraceae | Shrub | Kangui (Bh), Kanjri (Kharw) | S, Bh, M, O, Kh, MP | Unripe fruits | Edible fruits |
| *Celosia argentea* L. | Amaranthaceae | Herb | Silairi (S), Sirgit ara (M) | S, Bh, M, O | Leaves | Vegetables |
| *Chamaecrista absus* (L.) H.S. Irwin and Barneby | Fabaceae | Herb | Chaksi (S), Piri musuri ara (M) | S, M | Leaves | Vegetables |
| *Cissampelos pareira* L. | Menispermaceae | Climber | Chutu lutur (M) | S, Bh, M, O | Leaves | Vegetables |
| *Cissus repanda* Vahl | Vitaceae | Climber | Panialata (Bh) | S, Bh, M, Kh | Stem juice | Fresh edibles |
| *Cleome monophylla* L. | Cleomaceae | Herb | Hurhuria sag (S), Tota sirio (O) | S, M, O | Leaves | Vegetables |
| *Cleome viscosa* L. | Cleomaceae | Herb | Marang churamani (M), Nal sirio (O) | S, M, O | Leaves | Vegetables |
| *Combretum roxburghii* Spreng | Combretaceae | Climber | Phalando (M), Gorunda (O) | S, M, O, Kh | Flowers (petaloid bracts) | Vegetables |
| *Commelina benghalensis* L. | Commelinaceae | Herb | Kena sag(S), Kenar (O) | S, M, O | Leaves, whole plant | Vegetables |
| *Corchorus capsularis* L. | Malvaceae | Herb | Kaskomran (S), Desipat (Bh) | S, Bh | Leaves | Vegetables |
| *Corchorus olitorius* L. | Malvaceae | Herb | Bir narcha (S), Larita (M) | S, Bh, M, O, Ho | Leaves | Vegetables |
| *Cordia dichotoma* G. Forst | Boraginaceae | Tree | Buch (S), Bohari (Bh) | S, Bh, M | Ripe fruits | Edible fruits |

Table 1: Continue

| Scientific name | Family | Habit | Vernacular names | Reporting tribes | Edible parts | Methods of preparation |
|---|---|---|---|---|---|---|
| *Costus speciosus* (J. König) Sm. | Costaceae | Herb | Ote kitamuli ba (M), Keon (O) | S, Bh, M, O | Roots | Vegetables |
| *Crotalaria juncea* L. | Fabaceae | Shrub | Sanai (S), Saun (O) | S, M, O, Ho | Flowers | Vegetables |
| *Croton oblongifolius* Sieber ex Spreng. | Euphorbiaceae | Tree | Konyer (M), Potar (O) | S, Bh, M, O, Kh, MP, Kh | Young leaves | Vegetables |
| *Cyanotis axillaris* (L.) D. Don ex Sweet | Commelinaceae | Herb | Simchiru ara (M) | M, O | Tubers, roots | Fresh edibles |
| *Cyanotis tuberosa* (Roxb.) Schult. and Schult. f. | Commelinaceae | Herb | Merom chunchi (S), Naladdo (O) | S, M, O | Leaves | Vegetables |
| *Dendrocalamus strictus* (Roxb.) Nees | Poaceae | Bamboo | Karai bans (Bh), Biru mad (M) | S, Bh, M, O | Young shoots | Vegetables |
| *Digera muricata* (L.) Mart. | Amaranthaceae | Herb | Kari gandhari (S), Lata mouri (Bh) | S, Bh | Whole plant | Vegetables |
| *Diospyros embryopteris* Pers. | Ebenaceae | Tree | Makar kanda (Bh), Kend (Kharw) | S, Bh, M, O, Kh | Fruit pulp | Edible fruits |
| *Diospyros tomentosa* Poir. | Ebenaceae | Tree | Kendu (Bh), Tend (Kharw) | S, Bh, M,O, Kh | Fruit pulp | Edible fruits |
| *Dolichos biflorus* L. | Fabaceae | Herb | Horec (S) | S, Bh, M, O, Ho | Whole plant | Vegetables |
| *Ehretia laevis* Roxb. | Boraginaceae | Tree | Pusi pan (S), Bhairo (Kharw) | S, Bh, M, O, Kh | Fruits | Edible fruits |
| *Ficus benghalensis* L. | Moraceae | Tree | Bat (Bh), Barh (Kharw) | S, Bh, M, O, Kh | Ripe fruits | Edible fruits |
| *Ficus infectoria* Willd. | Moraceae | Tree | Pakare (S), Poroh (Mal Pah) | S, M, O | Leaf buds | Vegetable |
| *Flacourtia indica* (Burm. f.) Merr. | Salicaceae | Tree | Kanter (S), Merhle (M) | S, Bh, M | Ripe fruits | Edible fruits |
| *Gardenia turgida* Roxb. | Rubiaceae | Shrub | Dudri (M), Kharkar (Mal Pah) | S, Bh, M, O, Kh, MP | Shoots, fruits | Vegetables |
| *Gnaphalium polycaulon* Pers. | Asteraceae | Herb | Chandoa (M) | M | Leaves | Vegetables |
| *Grewia sapida* Roxb. ex DC. | Malvaceae | Shrub | Barsha pakar (S) | S | Fruits | Edible fruits |
| *Hibiscus cancellatus* L. | Malvaceae | Herb | Birkapas(S), Husungid(M) | S, Bh, M, O, Ho | Roots | Fresh edibles |
| *Hibiscus cannabinus* L. | Malvaceae | Herb | Safed kudrum (S), Mestapat (Bh) | S, Bh, M, O | Leaves | Vegetables |
| *Ipomoea aquatica* Forssk. | Convolvulaceae | Herb | Kalmi shak (S), Karmi ara (M) | S, Bh, M | Leaves, tender shoots | Vegetables |
| *Ipomoea muricata* (L.) Jacq. | Convolvulaceae | Herb | Korodrari (S), Kath chaeta (O) | S, M, O | Flowers | Vegetables |
| *Lagenaria vulgaris* Ser. | Cucurbitaceae | Climber | Laua, Suku (O) | S, Bh, M, O | Young fruits | Vegetables |
| *Lepidagathis fasciculata* (Retz.) Nees | Acanthaceae | Herb | Bile mata ara, Serendri dumbu (M) | M, O | Leaves | Vegetables |
| *Leucas lavandulifolia* Sm. | Lamiaceae | Herb | Guma ara (S), Guma (Bh) | S, Bh, M, O | Leaves | Vegetables |
| *Leucas mollissima* Wall. ex Benth. | Lamiaceae | Herb | Qulikhara (S), Seta drone (Bh) | S, Bh, Ho | Leaves | Vegetables |
| *Limnophila indica* (L.) Druce | Plantaginaceae | Herb | Kedo sga (S), Losod ara (M) | S, Bh, M, O | Leaves | Vegetables |
| *Melochia corchorifolia* L. | Malvaceae | Shrub | Tiki okra (Bh), Delka ara (M) | S, Bh, M | Leaves | Vegetables |
| *Mesua ferrea* L. | Calophyllaceae | Tree | Nagkesar (S), Nageswar (Bh) | S, Bh, M | Fruits | Edible fruits |
| *Meyna laxiflora* Robyns | Rubiaceae | Tree | Boibindi (S), Monphal (Kharw) | S, Bh, Kh | Young leaves and fruits | Vegetables |
| *Miliusa velutina* (Dunal) Hook. f. and Thomson | Annonaceae | Tree | Ome (O), Siarbhuka (Kharw) | S, Bh, M, O, Kh | Fruits | Edible fruits |
| *Mucuna pruriens* (L.) DC. | Fabaceae | Climber | Etka (S), Alkusa (O) | S, Bh, M, O | Young pods | Vegetables |

Table 1: Continue

| Scientific name | Family | Habit | Vernacular name(s) | Reporting tribe(s) | Edible part(s) | Method(s) of preparation |
|---|---|---|---|---|---|---|
| *Nelumbo nucifera* Gaertn. | Nelumbonaceae | Herb | Upal ba (M), Purni punp (O) | M,O | Roots, seeds | Fresh edibles |
| *Neolamarckia cadamba* (Roxb.) Bosser | Rubiaceae | Tree | Kadam (S), Kadam ba (M) | S,Bh,M,O | Fruits | Edible fruits |
| *Nyctanthes arbor-tristis* L. | Oleaceae | Tree | Kulamarshal (M) | S,Bh,M,O,Kh | Roots | Edible fruits |
| *Nymphoides indica* (L.) Kuntze | Menyanthaceae | Herb | Pan seuli (Bh), Kanna kanda (O) | Bh,M,O | Tubers | Vegetables |
| *Paspalum thunbergii* Kunth ex Steud. | Poaceae | Herb | Jane (M), Gara kode (O) | S,M,O | Grains | Cooked edibles |
| *Pithecellobium dulce* (Roxb.) Benth. | Fabaceae | Tree | Dekani tentul (Bh) | Bh | Aril (seeds) | Fresh edibles |
| *Polyalthia cerasoides* (Roxb.) Benth. Hook. f. ex Bedd. | Annonaceae | Tree | Panjon (S), Kudumi (Bh) | S,Bh,M,O | Fruits | Edible fruits |
| *Polygonum barbatum* L. | Polygonaceae | Herb | Gara ara (M), Panimarich (Bh) | S,Bh,M,O | Leaves | Vegetables |
| *Polygonum glabrum* Willd. | Polygonaceae | Herb | Sukuri pota (M) | S,M | Leaves | Vegetables |
| *Pueraria thunbergiana* Benth. | Fabaceae | Climber | Ban kumsa (S) | S,Bh,M,O | Large tuberous roots | Vegetables |
| *Sagittaria sagittifolia* L. | Alismataceae | Herb | Chotokut (Bh), Huring dumdum (M) | S,Bh,M,O | Leaves | Vegetables |
| *Scurrula atropurpurea* (Blume) Danser | Loranthaceae | Shrub | Icha sum (M), Begnar banda (S) | S,M | Ripe fruits | Edible fruits |
| *Senna occidentalis* (L.) Link | Fabaceae | Herb | Kalkasunda (Bh), Marang chakonda (M) | | S,Bh,M,O | Leaves Vegetables |
| *Sesbania grandiflora* (L.) Pers. | Fabaceae | Tree | Agasthi (S), Bakphul (Bh) | S,Bh,M | Flowers | Vegetables |
| *Sesbania sesban* var. *bicolor* (Wight and Arn.) F.W. andrews | Fabaceae | Tree | Jayanti (S), Nil daru (M) | S,Bh,M | Flowers | Vegetables |
| *Shorea robusta* Gaertn. | Dipterocarpaceae | Tree | Sal (Bh), Makka (O) | S,Bh,M,O | Seeds | Edible seeds |
| *Sida cordata* (Burm. f.) Borss. Waalk. | Malvaceae | Shrub | Barial (S), Junka (Bh) | S,Bh,M | Leaves | Vegetables |
| *Solanum nigrum* L. | Solanaceae | Herb | Makoi (Bh), Buru diang (M) | S,Bh,M,O | Fruits | Vegetables |
| *Solanum surattense* Burm. f. | Solanaceae | Herb | Rangaini janum (S), Toko bhijri (O) | S,Bh,M,O | Fruits | Vegetables |
| *Solena heterophylla* Lour. | Cucurbitaceae | Climber | Jungli kundri (S), Bir kundri (O) | S,Bh,M,O | Leaves, fruits, roots | Vegetables |
| *Spatholobus roxburghii* Benth. | Fabaceae | Climber | Bandon (Bh), Bibri (Kharw) | S,Bh,M,Kh | Seed oil | For cooking |
| *Spermacoce hispida* L. | Rubiaceae | Herb | Satgithia (S) | S,Bh,M,O | Leaves | Vegetables |
| *Sphaeranthus indicus* L. | Asteraceae | Herb | Gorakha mundi (Bh), Puru tasad (M) | S,Bh,M,O | Leaves | Vegetables |
| *Tacca pinnatifida* J.R. Forst. And G. Forst. | Dioscoreaceae | Herb | Dhai (M) | M | Tuberous roots | Eaten after much processing |
| *Trapa bispinosa* Roxb. | Lythraceae | Herb | Paniphal (Bh), Singhara (M) | Bh,M | Fruit kernels | Fresh/cooked |
| *Ventilago calyculata* Tul. | Rhamnaceae | Shrub | Deosarai (S), Tar (Kharw) | S,Bh,M,O,Kh | Seeds | Cooked edibles |
| *Vigna umbellata* (Thunb.) Ohwi and H. Ohashi | Fabaceae | Herb | Sutri (S), Mugi tasud (M) | S,M | Seeds | Cooked edibles |
| *Ziziphus oenoplia* (L.) Mill. | Rhamnaceae | Shrub | Bir janum (M) | Bh,M | Ripe fruits | Edible fruits |
| *Ziziphus xylopyrus* Willd. | Rhamnaceae | Tree | Karkat (S), Ghunt (Bh) | S,Bh,M,Kh,MP | Kernels (fruits) | Edible fruits |

rhamnaceae (3 species each) (Fig. 4). Rest of the plant families were reported to have 2 or 1 species in each. Considering the habit, herbs represents the highest percentage (44.4%) followed by Tress (25.5%), shrubs (15.5%), climbers (12.2%) and bamboos (2.2%) (Fig. 5). The tribal group Munda (81 reports) has reported the highest number of WEBs followed by Santhali (77), Oraon and Bhumij (63 each), Kharia (22), Ho (5) and Mal Pahariya (4) (Fig. 6). Among the plant part(s) used

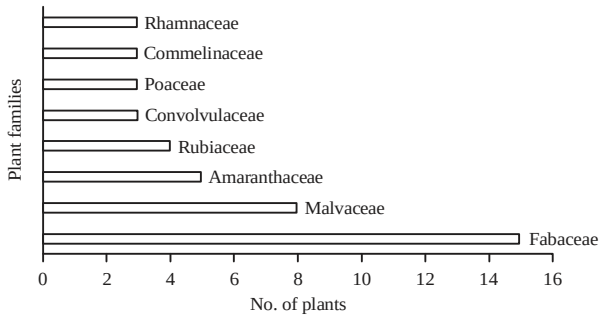


Fig. 4: Percentage distribution of predominant families of WEBs

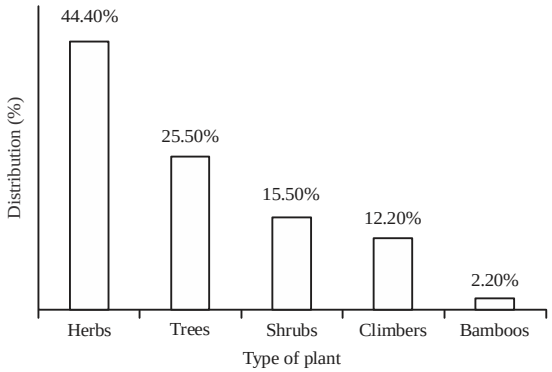


Fig. 5: Percentage distribution of habit types of the WEBs

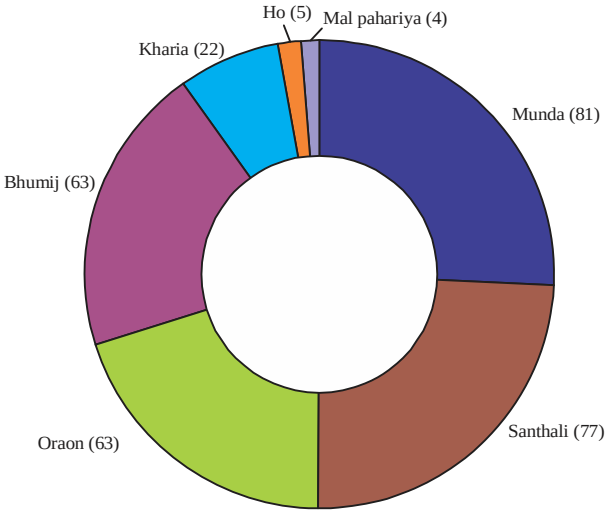


Fig. 6: No. of informants from different tribal communities

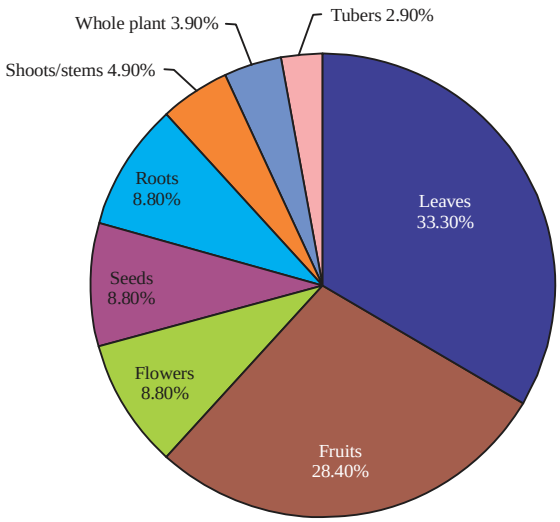


Fig. 7: Percentage distribution of different plant parts of wild edible botanicals consumed

leaves (33.3%) were found to be the most popular one followed by fruits (28.4%), flowers, seeds and roots (8.8% each), shoots/stems (4.9%), whole plant (3.9%) and tubers (2.9%) (Fig. 7). Methods of preparation include fresh/cooked vegetables, edible fruits and other plant parts as fresh/cooked. High Use Value (UV) was found for species such as *Trapa bispinosa* (0.87), *Ipomoea aquatica* (0.74), *Bambusa vulgaris* and *Ziziphus oenplia* (both 0.71), *Z. xylopyrus* and *Solanum surattense* (both 0.60), *Ficus benghalensis* (0.55), *Vigna umbellata* (0.56) and *Nelumbo nucifera* (0.51). Highest Quotation Frequency (QF) (+++) was noted for 18.9% of the total species (Table 2).

## DISCUSSION

**History of starvation and famine: from colonial to present and the role of WEBs:** Recurrent famine has been of wide occurrence since 1860s onward in this district which was previously known as Manbhum. The traditional inhabitants developed their own strategy to combat the hunger and to cope up with colonial tactics to use up forest for extending agriculture (Mahato, 2010). Deforestation, as a part of colonial strategy resulted into loss of primary forest resources for the tribals (Coupland, 1911). Since pre and post colonial periods, aboriginals have survived the odds of natural and topographical constraints prevalent in this area. Purulia is being known as one of the 250 most backwards districts in India declared by the Ministry of Panchayati Raj, India in 2006 (Anonymous, 2009). From the ancient time, poverty, hunger and famine are integral parts of livelihood of the tribals residing in this area. The economic life of the tribals is mainly determined by kinship associations and social relations among them (De, 1980). People had to search for alternative foods to reach up to their necessity. The villages are not certainly productive from agricultural point of view. Monocropped paddy is the primary source of food. Forests play a major role in providing nutrients primarily in the forms of fruits and vegetables. Wild vegetation surrounding the tribal homes is also being used for the same purpose. Although, most of the reported plants species are wild, some of these have been domesticated. Authors have noted that not only these plants are used in food scarcity but some of these are also consumed as a part of their conventional diet. The WEBs certainly hold importance in the tribal economics as they are relished at home, cherished during occasions, sold in the marker, consumed as ingredients in

Table 2: Statistical significance of uses of WEBs

| Wild edible botanicals | UV | QF |
|---|---|---|
| *Achyranthes aspera* | 0.35 | ++ |
| *Actinoscirpus grossus* | 0.39 | ++ |
| *Aerva lanata* | 0.31 | ++ |
| *Amaranthus tricolor* var. *gangeticus* | 0.44 | +++ |
| *Ampelocissus tomentosa* | 0.37 | ++ |
| *Ardisia solanacea* | 0.35 | ++ |
| *Argyreia speciosa* | 0.38 | ++ |
| *Atylosia scarabaeoides* | 0.39 | ++ |
| *Bambusa vulgaris* | 0.71 | +++ |
| *Bauhinia vahlii* | 0.35 | ++ |
| *Bombax ceiba* | 0.37 | ++ |
| *Bridelia stipularis* | 0.37 | ++ |
| *Butea monosperma* | 0.53 | +++ |
| *Butomopsis latifolia* | 0.19 | ++ |
| *Capparis zeylanica* | 0.37 | ++ |
| *Careya arborea* | 0.08 | + |
| *Cassia fistula* | 0.35 | ++ |
| *Catharanthus pusillus* | 0.05 | + |
| *Celastrus paniculatus* | 0.26 | ++ |
| *Celosia argentea* | 0.29 | ++ |
| *Chamaecrista absus* | 0.05 | + |
| *Cissampelos pareira* | 0.26 | ++ |
| *Cissus repanda* | 0.06 | + |
| *Cleome monophylla* | 0.41 | +++ |
| *Cleome viscosa* | 0.38 | ++ |
| *Combretum roxburghii* | 0.26 | ++ |
| *Commelina benghalensis* | 0.39 | ++ |
| *Corchorus capsularis* | 0.26 | ++ |
| *Corchorus olitorius* | 0.47 | +++ |
| *Cordia dichotoma* | 0.26 | ++ |
| *Costus speciosus* | 0.24 | ++ |
| *Crotalaria juncea* | 0.26 | ++ |
| *Croton oblongifolius* | 0.47 | +++ |
| *Cyanotis axillaris* | 0.09 | + |
| *Cyanotis tuberosa* | 0.05 | + |
| *Dendrocalamus strictus* | 0.31 | ++ |
| *Digera muricata* | 0.05 | + |
| *Diospyros embryopteris* | 0.26 | ++ |
| *Diospyros tomentosa* | 0.19 | ++ |
| *Dolichos biflorus* | 0.46 | +++ |
| *Ehretia laevis* | 0.24 | ++ |
| *Ficus benghalensis* | 0.55 | +++ |
| *Ficus infectoria* | 0.05 | + |
| *Flacourtia indica* | 0.35 | ++ |
| *Gardenia turgida* | 0.39 | ++ |
| *Gnaphalium polycaulon* | 0.07 | + |
| *Grewia sapida* | 0.05 | + |
| *Hibiscus cancellatus* | 0.31 | ++ |
| *Hibiscus cannabinus* | 0.38 | ++ |
| *Ipomoea aquatica* | 0.74 | +++ |
| *Ipomoea muricata* | 0.19 | ++ |
| *Lagenaria vulgaris* | 0.47 | +++ |
| *Lepidagathis fasciculata* | 0.08 | + |
| *Leucas lavandulaefolia* | 0.07 | + |
| *Leucas mollissima* | 0.08 | + |
| *Limnophila indica* | 0.37 | ++ |
| *Melochia corchorifolia* | 0.07 | + |
| *Mesua ferrea* | 0.38 | ++ |
| *Meyna laxiflora* | 0.05 | + |
| *Miliusa velutina* | 0.38 | ++ |

Table 2: Continue

| Wild edible botanicals | UV | QF |
|---|---|---|
| *Mucuna pruriens* | 0.19 | ++ |
| *Nelumbo nucifera* | 0.51 | +++ |
| *Neolamarckia cadamba* | 0.35 | ++ |
| *Nyctanthes arbor-tristis* | 0.39 | ++ |
| *Nymphoides indica* | 0.05 | + |
| *Paspalum thunbergii* | 0.05 | + |
| *Pithecellobium dulce* | 0.09 | + |
| *Polyalthia cerasoides* | 0.26 | ++ |
| *Polygonum barbatum* | 0.43 | +++ |
| *Polygonum glabrum* | 0.07 | + |
| *Pueraria thunbergiana* | 0.38 | ++ |
| *Sagittaria sagittifolia* | 0.29 | ++ |
| *Scurrula atropurpurea* | 0.09 | + |
| *Senna occidentalis* | 0.07 | + |
| *Sesbania grandiflora* | 0.31 | ++ |
| *Sesbania sesban* var. *bicolor* | 0.26 | ++ |
| *Shorea robusta* | 0.38 | ++ |
| *Sida cordata* | 0.08 | + |
| *Solanum nigrum* | 0.38 | ++ |
| *Solanum surattense* | 0.60 | +++ |
| *Solena heterophylla* | 0.35 | ++ |
| *Spatholobus roxburghii* | 0.09 | + |
| *Spermacoce hispida* | 0.29 | ++ |
| *Sphaeranthus indicus* | 0.39 | ++ |
| *Tacca pinnatifida* | 0.26 | ++ |
| *Trapa bispinosa* | 0.87 | +++ |
| *Ventilago calyculata* | 0.24 | ++ |
| *Vigna umbellata* | 0.56 | +++ |
| *Ziziphus oenoplia* | 0.71 | +++ |
| *Ziziphus xylopyrus* | 0.60 | +++ |

-: No citations, found, +: Quoted by <10% of the informants, ++: Quoted by >10% and <40% of the informants, +++: Quoted by >40% of the informants, UV: Use value, QF: Quotation frequency

alcoholic beverages and used as spices. The WEBs were found to be consumed both as salad and as cooked. Tribals use certain ingredients such as sugar, honey, pepper etc. to make food more palatable. In our present investigation, the indigenous folks especially the young people (age group: 18-25 years) were found to possess knowledge regarding wild fruits and fruiting seasons. Division of labour among men and women is also observed in these ethnic societies. Women are able to identify, collect and cook the wild vegetables as and when required. Although the ladies were found to maintain the home gardens for cultivation of common crops and vegetables, they were also found to domesticate a few wild food plants for day to day use. Women and men both were found to sell certain WEBs such as *Diospyros embryopteris*, *D. tomentosa* etc. in the markets of the neighboring towns.

**Socio-cultural aspects of WEBs:** Traditional knowledge of using WEBs was found to be transmitted both vertically and horizontally whereas traditional healers of this area were found to be very much conservative regarding the spread of their ethnobotanical knowledge. This reluctance of transmitting knowledge was found to be due to the social status enjoyed by the traditional healers among the common villages (unpublished data). The ethnic knowledge of using WEBs, in our investigation, it is also found to vary depending on the age, gender and tribal group, the idea of which has been supported by Narayanan and Kumar (2007). Advent of modern foods, rapid urbanization and globalization, erosion of traditional knowledge due to lack of interest in younger generations and loss of biodiversity are responsible for the decreased trend of using

alternative food plants. This age old knowledge of WEBs must be conserved in order to protect traditional wealth, prevent the loss of biodiversity through sustainable utilization and encourage community level participation to preserve the folklore and analyze the WEBs scientifically to find novel neutraceuticals and pharmaceuticals to alleviate human suffering from hunger and diseases. *Aegle marmelos* leaves are offered to the Lord Shiva, a common deity worshipped by the local people. The plant is protected as sacred grove as a tool for spreading knowledge regarding plant conservation. Another two trees, *Ficus benghalensis* and *F. religiosa* are also considered as having socio-religious significance and thus protected in the same way.

**WEBs eaten by non human primates and ruminants:** Interestingly, the informants reported that some of these plants are also consumed by non human primates and ruminants both wild and domesticated. Plant parts eaten by non human primates primarily include fruits whereas the parts consumed by ruminants are predominantly leaves and/or whole plants. Some existing reports have been found involving the use of such plants as a source of food for the animals. Leaves of certain WEBs were used by the tribals to feed their livestock also. Among the presently surveyed plants, dietary potential of *Pithecellobium dulce* (Chaudhary and Taparia, 1990), *Commelina benghalensis* (Lanyasunya *et al*., 2008), *Ficus infectoria* (Dey *et al*., 2008; Singh *et al*., 2011), *Pueraria thunbergiana* (Lee *et al*., 1990), *Ziziphus xylopyrus, Dolichos biflorus* (Jain and De, 1966) as fodder has been reported. Toxicity of fodder plant has also been noted. *Bambusa vulgaris* and F. *vulgaris* have been reported to cause a neurological disorder in horses (Barbosa *et al*., 2006). A few of the food plants were found to be eaten by the tribal people only during scarcity. *Dolichos biflorus* is considered as one of such inferior foods which are otherwise avoided for human use.

**Nutrient and anti-nutrient content:** Herbs are used as sources of food and medicine (Abu-Rabia, 2005). Nutritive and antinutritive content of wild edible plants has been determined in several investigations (Benson *et al*., 1973; Sotelo *et al*., 1995). Interestingly, carotenoids considered as an important aid to eye care were reported from fresh as well as cooked wild food samples (Belanger *et al*., 2010). Presence of active principles even in the cooked food seems to be encouraging since many of these WEBs are consumed after much processing and cooking. Among the reported plants, *Cleome monophylla* is reported to contain minerals higher than some conventional vegetables (Odhav *et al*., 2007). Rukmini and Deosthale (1979) have reported the defatted seed cakes of *C. viscosa* containing protein and thioglucosinolates. The seeds of *Nelumbo nucifera* were found to be rich in protein, unsaturated fatty acids and minerals (Bhat and Sridhar, 2008). The rice bean *Vigna umbellata* was reported to possess several nutritional components (Rodriguez and Mendoza, 1991). Antinutritional compounds in the seeds of *V. umbellata* were found to decrease after cooking (Saikia *et al*., 1999). Alpha-linolenic acid was detected in *Solanum nigrum* by gas chromatography (Liu *et al*., 2002). Furthermore, some of the popular edible plants have been reported to possess toxicity. In our present survey, *Senna occidentalis* has been depicted as a WEB and the plant was reported previously to cause hepatomyoencephalopathy causing fatal coma in young children in western Uttar Pradesh (Vashishtha *et al*., 2007a, b; Gupta, 2008). Tribal people practice their age old food habit without knowing the toxic effects of such plants. Moreover, toxicity may occur due to mis-identification of a plant. Consumption of *Ipomoea asarifolia* misidentified as *Ipomoea aquatica* leads to gastrointestinal disorder (Ratnatilaka *et al*., 2010).

**WEBs as possible pharmaceuticals and neutraceuticals:** The WEBs have been phytochemically and pharmacologically evaluated for nutritional components and their efficacy. Scientific analyses of these edible plants may lead to the discovery of nutritional and therapeutic efficacy of botanicals (Bhattarai *et al*., 2009). The WEBs have been investigated for alpha-glucosidase inhibitory (Mai *et al*., 2007), antioxidant, antibacterial (Xia *et al*., 2011), anticancer (Heo *et al*., 2009), neuroprotective (Kim *et al*., 2011) and anti obesity (Conforti *et al*., 2011) activities. Therefore, the pharmacological efficacy of the above mentioned food plants can be assayed for their potential as pharmaceuticals and neutraceuticals. Few of the reported WEBs such as *Achyranthes aspera*, *Ampelocissus tomentosa*, *Ardisia solanacea*, *Bombax ceiba*, *Bridelia stipularis*, *Butea monosperma*, *Capparis zeylanica*, *Cassia fistula*, *Celastrus paniculatus*, *Cissampelos pareira*, *Cissus repanda*, *Costus speciosus*, *Croton oblongifolius*, *Cyanotis axillaris*, *Dolichos biflorus*, *Ficus benghalensis*, *Nyctanthes arbor-tristis*, *Shorea robusta*, *Solanum surattense*, *Spermacoce hispida*, *Ziziphus oenoplia* have already been recorded as part of the healing system practiced by the tribals of the district along with the vernacular names and the ailments (Chakraborty and Bhattacharjee, 2006; Dey and De, 2010a, b, 2011a, b, 2012a, b). However, the ethnic people were found to consume these plants as food without knowing the possible therapeutic aspects. Therefore, scientific evaluation of these food plants may provide useful information to use these as possible neutraceutical agents.

**Traditional knowledge and conservation:** Ethnic people inherit and culture their years old traditional knowledge mostly by oral communication. In this remote district of West Bengal, the authors have noted mostly the horizontal transfer of indigenous knowledge on medicinal plants. However, the ethnic knowledge regarding the use of WEBs seemed to be a less restricted one. The senior author, being associated with the ethnobotany and floristic of the district since 1960s has noted that various tribal groups use WEBs as a part of their regular food habit. The conservation aspect applies not only to the vanishing knowledge of the folklore but it must also emphasize the conservation of the botanicals. Rapid urbanization and westernization, appearance and popularity of packed and canned foods, pollution and depletion of forests and loss of biodiversity are the major threats in this regard. Hence, proper measurements must be taken immediately before it is too late. In our earlier discussion, we have mentioned the dependence of tribal economic and food security on the natural vegetation. This ethnic knowledge and the associated botanicals can be conserved and proliferated *in situ*. The aspects of sustainable utilization of the botanicals can be discussed with the tribals and policies are to be taken in order to create a balance between resource and its utilization. Several countries have recognized the importance of indigenous knowledge as the basis of drug discovery programs and taken appropriate policies to conserve the natural wealth. In the modern era of neutraceuticals, WEBs may serve as an exciting aspect where both hunger and disease can be tackled by scientific evaluation of these age old ethnic practices.

## CONCLUSION

To prevent hunger and provide food security and to avoid the possible adverse consequences of toxicological effects of modern day foods, preservatives and adulterations, search for alternative source of edibles is of utmost importance. Rise of improved crop varieties and biotechnology are considered as important tools in this regard. Utilization of uncommon WEBs, their evaluation for nutrients, anti-nutrients, possible toxicity and prevention of hazards related to misidentification are the other aspects which are to be evaluated scientifically. Awareness programs among the rural people may prevent toxicity and misidentification related health risks. The WEBs are also

considered as a nutritious food for the ruminants and poultries. Therefore, the knowledge provided by the ethnic communities must be preserved and tested in order to find ways of sustainable utilization of plant food resources against the ever expanding problems of hunger and malnutrition.

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