

Collection and uses of ethno-ecological species among Chuktia Bhunjia tribe of Odisha, India: Examining Sustainable Livelihood through Local Knowledge

Bhubaneswar Sabar (✉ bhubansabar@gmail.com)

Maharaja Sriram Chandra Bhanja Deo University

Dipak K. Midya

Vidyasagar University

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Abstract

Introduction: Plant resources gathered from the wild are considered to be important sources of livelihood for many forest-dwelling communities who rely on these plants for food, fuelwood, medicine, agriculture and cultural purposes. This paper documents the ethno-ecological knowledge of Chuktia Bhunjia tribe of Odisha, India pertaining to collection and uses of plant species; and examines how the community people earn their livelihood sustainably by negotiating with those knowledges through various cultural beliefs.

Methods: Data for this study were collected in few selected Chuktia Bhunjia villages during 2019-2020 largely through formal interview with local people including farmers, herbalists and ethno-veterinarians of both genders. Participant observation were used to understand resource use patterns that were documented through narrative and case study method.

Results: This study documents 193 plant species used by Chuktia Bhunjia for different purposes with varied life forms: tree species (n=77) followed by shrub (38), herbs (28), climber (20) and so on. The Chuktia Bhunjia largely collect fruits (n=60) followed by leaves (35), stem (28), whole plants (25), roots (25), etc. that are used for consumption, medicine, oil extraction, house construction, agriculture and cultural purposes. Data reveals that ethno-ecological knowledge among them continue to shape their livelihood but is governed by set of customary rules with regard to collection and consumption. The cultural reproduction of ecological knowledge intertwined with institutionalised social norms, socialisation, and inherent ecological worldview are although predominantly reported; the gradual state intervention and market influence have altered their interaction with ecological resources.

Conclusion: The ethno-ecological practice among Chuktia Bhunjia is a cultural process in which culture is found to be an intermediary tool to negotiate with the local landscape for collective survival. Yet, socio-economic transformation among them because of state intervention has altered their ecological relationships and negatively impacted on knowledge, cultural diversity and identity. At policy level, given the implications of ethno-ecological species in food and medicine there is a need to screen those species to measure the medicinal potency and nutritive value for wider acceptability. Besides, non-destructive way of harvesting of ethno-ecological species can be encouraged that can possible only with the promotion of cultural diversity, although mere attempts to integrate their knowledge with scientific knowledge can add substantial benefit to the knowledge holders.

Background

The state of Odisha not only houses a number of tribal groups but also has a couple of wildlife sanctuaries and national parks harboring important flora and fauna species. With 35.54% of forest cover with deciduous nature, the state is considered as one of the representatives of Deccan Peninsular type [1] having rich species diversity most being used by local inhabitants. The population habitation of the state reveals that indigenous communities are found to reside mostly in the forest areas for long and meet their daily requirements from the surrounding forest resources which they collect from traditionally occupied knowledge popularly known as traditional ecological knowledge, local knowledge, people's science, ethnoecology, and many more that are understood as to how peoples view, use and interact with ecology to negotiate their survival [2–3]; albeit, their knowledge do vary across groups due to diversified ecology, culture, religion and beliefs. Micheal D. Warren [4]

defines those knowledge as '[...] the basis for local level decision-making in agriculture, pastoralism, food preparation, health care, natural resource management and a host of other activities in rural communities' (p. 1). Berkes [5] defines it as 'a cumulative body of knowledge and belief handed down through generation by cultural transmission, about the relationship of living being (including human) with one another and with their environment' (p. 3) and is reflected in people's social structure, beliefs, rituals, cosmology, proverbs, folklore and myth of people (6–8).

Literature reveals that there have been ethnobotanical explorations of tribal communities of Odisha living closed or interior to forest fringes covering indigenous practices of healthcare [9–15], ethnoveterinary ([16–17], agriculture and land use [18–20], biodiversity conservation [21–23] etc. Studies reveal that knowledge bases of tribals always found to support them at different livelihood domains of tribal communities [24–28]. Yet, owing to the transformation of indigenous population and subsequent disassociation with the ecological resources because of the influence of, for example, conventional agriculture, market economy, forest policies, etc.; many knowledge-based practices are under the verge of extinction [20, 29]. It is only those people who are living far flung region of the forest are assumed to possess more ecological knowledge, irrespective of age and gender, simply due to limited influence of those factors. The Chuktia Bhunjia tribe living interior to Sunabeda wildlife sanctuary can be a reference in this regard and are assumed to restore their traditional knowledge-base. There are few studies on the ethnobotanical practices of Chuktia Bhunjia living in Sunabeda wildlife sanctuary majority being about the species diversity [30–33] but study on culture-based collection and use of ethnobotanical species remain untouched that might have significance towards livelihood and biodiversity conservation. Besides, the other rationale requiring to document their ethnoecological knowledge is that recently government has declared this wildlife sanctuary as a tiger project whereby people living in the core area are expecting to be evacuated soon. As a result, their livelihood, knowledge and culture are expected to be threaten that. It necessitates to document their ethno-ecological knowledge before they assimilate to so-called mainstream culture.

On above theoretical background, this study documents the ethno-ecological knowledge of Chuktia Bhunjia of Odisha, India, residing interior to Sunabeda wildlife sanctuary and illustrates how culture-based knowledge and its associated norms, beliefs and practices concerning collection and consumption help them not only to generate livelihood but also sustainably maintain biodiversity.

Methods

The present study was conducted in Sunabeda Wildlife Sanctuary (SWS) located in Nuapada district of Odisha, India (Map 1) (1) to document the ethno-ecological knowledge of Chuktia Bhunjia tribe; (b) to comprehend the role of ethno-ecological knowledge in livelihood generation; (c) to examine how culture-based ecological behaviour contribute to biodiversity conservation. With a geographical location of 82°20" to 82°34" E. longitude to 20°24" to 24°44"N. latitude, the sanctuary is located at height of 2050 from sea level. It houses diversity of flora and fauna. It represents a pristine ecosystem of dry deciduous forest, river valley, hill and waterfalls. The total geographical area of the sanctuary is 600 Sq. Kms. The demarcated core and buffer zone of the sanctuary contain 243.60 sq. kms and 356.40 sq. kms respectively. There are 64 habitation villages housing about 20,000 human populations living in more than 5000 families [34]. The majorities of the

population are the scheduled tribes comprises of Gond, Bhunjia and Paharia. Few non-tribal groups are also settled in some villages. Recently the sanctuary has been declared as tiger project.

Data were collected in few selected Chuktia Bhunjia villages during 2019–2020 largely through formal interview with local people including farmers, herbalists and ethno-veterinarians of both genders. However, mere participation in their cultural practices and witnessing of healthcare by herbalists help us to understand resource use patterns. The ethno-ecological species were collected as per the local term and botanical names of those species were identified with the help of a trained botanist and regional flora developed by Saxena and Brahman [35].

Chuktia Bhunjia is one of the 62 tribal groups found in Odisha and identified as a particularly vulnerable tribal group (PVTG). They are also distributed in the state of Chhattisgarh and Maharashtra. In Odisha, they are highly concentration in SWS. According to a base line survey by Ota, Mohanty and Mohanty [36] their total population is 3086 (1593 male and 1493 female from 938 household). They live in 35 villages/hamlets of SWS. They belong to Dravidian language speaking group [37]. Their economic life revolves around agriculture, forest resources and wage labor. Practice of slash-burning cultivation (*dehi*) is vogue particularly among the Chuktia Bhunjia living in buffer zone. Collection of forest produces is an important economic pursuit for them but governed by customary beliefs and institutions. They are animistic in nature and worship various natural objects. Many of their festivals are related to agriculture and collection and consumption of resources but are always guided by existing village council.

Results

The Chuktia Bhunjia possess knowledge about numbers of ecological species that are collected for consumption, medicine, marketing and cultural use. This study documents 193 plant species used by Chuktia Bhunjia for different purposes (Table 1). The life forms of collected species have been represented in Fig. 1, which shows that they largely collect tree species (n = 77) followed by shrub (38), herbs (28), climber (20) and so on. The different parts of the collected species show that the Chuktia Bhunjia collect largely fruits (n = 60) followed by leaves (35), stem (28), whole plants (25), roots (25), etc. (Fig. 2). The collection practices and uses of species are coherently described. Figure 3 shows the number of plant species used for various purposes.

Table 1
Ethnobotanical plant species of Chuktia Bhunjia of Sunabeda Wildlife Sanctuary

Sl. No.	Botanical Name	Local	Habit	Part Collected	Uses
1.	<i>Acacia arabica</i> Willd.	Bamur	Tree	Stem Fruits	Firewood, Agricultural implements Marketing
2.	<i>Acacia catechu</i> Willd.	Khair	Tree	Stem Bark	House construction, firewood, Husking tool Medicinal (Dysentery)
4.	<i>Acacia torta</i> Roxb.	Kanti	Tree	Stem	Fish poisoning
5.	<i>Achyranthes aspera</i> L.	Apamarang	Shrub	Twig	Medicine (dental pain)
6.	<i>Adhatoda zeylanica</i> Nees.	Basak	Shrub	Leaves	Medicine (asthma)
7.	<i>Agaricus campestris</i> L.	Gachh-chhati	Fungi	Whole	Medicine
8.	<i>Aristolichia indica</i> L.	Indra jata	Herb	Root	Medicine (pile)
9.	<i>Artocarpus integrifolia</i> Lam.	Fanas	Tree	Fruit	Edible
10.	<i>Aegle marmelos</i> Correa	Bel	Tree	Fruits Leaves	Edible, Medicinal (Stomach disorder) Religious (Offer to Goddesses)
12.	<i>Aloe barbadensis</i> Mill.	Gheekuari	Tree	Bark	Medicine (Digestive, burnt, headache)
13.	<i>Amaranthus candatum</i> L.	Bhaji	Herb	Leaves	Edible
14.	<i>Anacardium occidentale</i> L.	Lanka Bhelwa	Tree	Fruit	Edible
15.	<i>Andrographis peniculata</i> Nees.	Bhui lim	Shrub	Whole Plant	Medicine (Malaria)

Sl. No.	Botanical Name	Local	Habit	Part Collected	Uses
16.	<i>Anogeissus latifolia</i> Wall.	Dhawra	Tree	Stem	House construction, Firewood, Agriculture
17.	<i>Anogeissus pendula</i> Edgew.	Dhokda	Tree	Bark	Medicinal (Dysentery)
				Stem	Firewood
				Leaves	Fodders
20.	<i>Anona squamosa</i> L.	Raikata/Badhal	Shrub	Fruits	Edible
				Leaves	Ethno-veterinary use
22.	<i>Anthistiria ciliata</i> L.	Gandhla	Grass	Whole Plant	Fodder, agriculture and Mulching
23.	<i>Aristida setacea</i> Retz.	Katabadhun	Grass	Whole Plant	Broom making
24.	<i>Azadirachta indica</i> A. Juss.	Lim	Tree	Fruits	Oil (use in scabies)
				Leaves	Medicinal (Malaria, Mosquito repellent)
				Bark	Medicinal (Fever)
				Twigs	Toothbrush
28.	<i>Basidio mycota</i> R.T. Moore.	Chhati	Fungi	Whole Plant	Edible
29.	<i>Bauhinia purpurea</i> L.	Keolar	Tree	Leaves	Edible
30.	<i>Bauhinia vahlii</i> W & A.	Sial	Climber	Leaves	Cup and plate making, Rope making
31.	<i>Berberis asiatica</i> Roxb.	Daruhaldi	Shrub	Root	Medicinal (gynecological)
32.	<i>Blumea fistulosa</i> (Roxb.)Kurz.	Poksunga	Herb	Root	Medicine
33.	<i>Bombax ceiba</i> L.	Semel	Tree	Fruits	Medicine (boil)
34.	<i>Boswellia serrata</i> Roxb.	Salei	Tree	Resin	Marketing

Sl. No.	Botanical Name	Local	Habit	Part Collected	Uses
35.	<i>Buchnanian lanzan</i> Roxb.	Chahar	Tree	Fruits	Edible
36.	<i>Butea monosperma</i> Lam.	Palsha	Tree	Leaves	Cup and plate making
37.	<i>Butea parviflora</i> Roxb.	Laha palsa	Climber	Whole Plant	Firewood
38.	<i>Caesalpinian cucullata</i> Roxb.	Madia	Herb (cultivated)	Seeds	Edible
39.	<i>Caesalpinia sappan</i> L.	Lalmuter	Shrub	Bark	Medicine (gynecology), homeostatic, wound
40.	<i>Cajanus cajan</i> (L.) Millsp.	Leher/ Kandul	Herb (cultivated)	Seeds Straw	Edible Firewood
41.	<i>Calotropis gigantea</i> R. Br.	Khuder	Shrub	Leaves	Medicine (ear ache), Ethnoveterinary
42.	<i>Canavalia ensiformis</i> DC.	Semi	Climber (cultivated)	Fruit	Edible
43.	<i>Capsicum annum</i> L.	Mircha	Herb (cultivated)	Fruit	Edible
44.	<i>Careya arborea</i> Roxb.	Kumbhi	Tree	Bark	Fish poisoning
45.	<i>Casearia tomentosa</i> Roxb	Tundra	Tree	Fruit	Fish poisoning
46.	<i>Cassia occidentalis</i> L.	Chakunda	Tree	Twig	Toothbrush, medicine (cut and wound)
47.	<i>Cassia tora</i> L.	Chakoda	Under Shrub	Leaves Fruit	Edible Marketing
49.	<i>Cassia fistula</i> L.	Sunari	Tree	Bark	Medicine (headache)
50.	<i>Cedrela toona</i> Roxb.	Mahalimb	Tree	Stem	Furniture, agriculture
51.	<i>Celastrus paniculata</i> Willd.	Malkagni	Tree	Root	Medicine
52.	<i>Cemacarpus anacardium</i> L.	Bhelwa	Tree	Fruit	Edible, medicine, ethnoveterinary

Sl. No.	Botanical Name	Local	Habit	Part Collected	Uses
53.	<i>Centella asiatica</i> L.	Brahmi	Tree	Leaves	Medicinal (stomach disorder, fever)
54.	<i>Chloroxylon swietiana</i> DC.	Bherua	Tree	Stem	House construction, furniture, firewood
55.	<i>Christella semisagitata</i> Roxb.	Raktabidar	Climber	Root	Medicine (gynecology)
56.	<i>Cissus quadrangularis</i> Wall.	Harsakra	Climber	Stem	Medicinal (Bone fracture)
57.	<i>Corchorus olitorus</i> L.	Kahru	Shrub (cultivated)	Bark	Rope making, firewood
58.	<i>Chlorophytum tuberosum</i> Baker.	Safed Musli	Herb	Root	Medicinal (tonic)
59.	<i>Cholorophytum arundinaceum</i> Baker.	Kanjeer	Shrub	Leaves	Edible
60.	<i>Citrus medica</i> L.	Nimbu	Tree (Cultivated)	Fruit	Edible, Medicinal (Stomach Disorder, Headache)
61.	<i>Colocasia esculenta</i> Schoot.	Saru	Herb (cultivated)	Rhizomes	Edible
62.	<i>Combretum nanun</i> Buch.	Kaikei	Shrub	Root	Medicine (headache, migraine)
63.	<i>Commelina benghalensis</i> L.	Kena	Herb	Leaves	Edible
64.	<i>Coriandrum sativum</i> L.	Dhania	Herb	Whole Plant	Edible, aromatic
65.	<i>Costus spaciosus</i> (Koenig ex Retz.) Smith	Keokanda	Herb	Root	Medicine (Tonic, stomach disorder)
66.	<i>Cucumis dipsaceus</i> L.	Kheksikanda	Climber (cultivated)	Fruit	Edible
67.	<i>Cucumis sativus</i> L.	Kaker	Climber (cultivated)	Fruits	Edible

Sl. No.	Botanical Name	Local	Habit	Part Collected	Uses
68.	<i>Curculigo orchioides</i> Gaetrn.	Kali musli	Herb	Root	Medicine (tonic and increasing sexual desire)
69.	<i>Cucurbita pepo</i> L.	Makhan	Climber	Fruits and flower	Edible
70.	<i>Curcuma angistofolia</i> Roxb.	Tikhur	Shrub	Rhizome	Medicinal (tonic)
71.	<i>Curcuma aromatica</i> L.	Banhaldi	Shrub	Root	Medicine (skin), Gynecological disorder
72.	<i>Curcuma longa</i> L.	Haldi	Herb	Whole Plant	Edible, medicine, ethno-veterinary
73.	<i>Cuscuta reflexa</i> Roxb.	Binmulia	Herb	Whole Plant	Medicine (avoiding child birth)
74.	<i>Cyamopsis tetragonoboba</i> L.	Churchutia	Shrub (cultivated)	Fruits	Edible
75.	<i>Cynodon dactylon</i> (L.) Pearson	Dub-jhar	Grass	Whole Plant	Cut and wound, Cultural
76.	<i>Datura stramonium</i> L.	Kaladudhra	Tree	Leaves	Medicine
77.	<i>Delbergia paniculata</i> Roxb.	Dhobi	Tree	Root	Medicinal
78.	<i>Dendrocalamus strictus</i> Nees.	Baus	Tree	Stem	House construction
				Shoot	Edible
80.	<i>Desmodium oojeinensis</i> Roxb. Ohashi (syn. <i>Ougeinia dalbergiodes</i>)	Bandhan	Tree	Stem	House construction, furniture
81.	<i>Dioscorea alata</i> L.	Ratalu	Herb	Rhizome	Edible, Medicinal (stomach disorder)
82.	<i>Dioscorea foetida</i> L.	Bhatlakanda	Climber	Rhizome	Edible
83.	<i>Dioscorea elephantipes</i> (L'Her) Engl.	Batudi kanda	Climber	Rhizome	Edible

Sl. No.	Botanical Name	Local	Habit	Part Collected	Uses
84.	<i>Dioscorea hispida</i> Willd.	Baichandi	Shrub	Rhizome	Medicinal
85.	<i>Dioscorea bulbifera</i> L.	Kadukand/ Pitkanda	climber	Rhizome	Edible
86.	<i>Dioscorea villosa</i> L.	Pisankanda	Climber	Rhizome	Edible
87.	<i>Diospyros melanoxylon</i> Roxb.	Kendu	Tree	Fruit	Edible (Ripe)
				Leaves	Marketing
89.	<i>Diosyros Montana</i> Roxb.	Makarkendu	Tree	Fruit	Edible
90.	<i>Eclipta prostrate</i> L.	Bhrungraj	Herb	Whole Plant	Medicine (tonic)
91.	<i>Eleusine coracana</i> (L.) Gaertz.	Mandia	Grass	Seeds	Edible (nutritious)
92.	<i>Embilica officinalis</i> L. (Phyllanthus emblica)	Oenla	Tree	Whole Plant	Edible/medicine
93.	<i>Erythrina suberosa</i> Roxb.	Baldhia	Tree	Stem	Firewood, agricultural implements
94.	<i>Erythrina variegata</i> Lam.	Raktamandar	Tree	Bark	Medicine (dysentery)
95.	<i>Euphorbia thymifolia</i> L.	Ban oela	Tree	Whole Plant	Medicine (blood in urine)
96.	<i>Euphorbia hitra</i> L.	Chitakuti	Herb	Root	Medicine (body pain and asthma)
97.	<i>Evolvulos alsinoides</i> L.	Bichhamalia	Herb	Root	Medicine (scorpion sting)
98.	<i>Ficus benghalensis</i> L.	Bargad	Tree	Fruit	Edible
				Leaves	Fodder
100.	<i>Ficus religiosa</i> L.	Peepal	Tree	Fruit	Edible, religious
				Leaves	Fodder
102.	<i>Ficus racemosa</i> Roxb.	Dumer	Tree	Fruit	Edible

Sl. No.	Botanical Name	Local	Habit	Part Collected	Uses
103.	<i>Garuga pinnata</i> Roxb.	Kekad	Tree	Stem	Agricultural implements
104.	<i>Geodorum densiflorum</i> Lam.	Kukur-muria	Shrub	Whole Plant	Medicine (dog bite)
105.	<i>Gloriosa superba</i> L.	Kalihari/ barish kanda	Tree	Root	Medicinal (Scorpion sting, Birth control)
106.	<i>Glossogyne bidens</i> Retz.	Buthi-tejraj	Herb	Root	Medicine (rheumatism)
107.	<i>Glycomis pentaphylla</i> (Retz) DC.	Chaudhua	Tree	Stem	Firewood
108.	<i>Gmelina arborea</i> Roxb.	Gambhari	Tree	Stem	Firewood, house construction
109.	<i>Grewia sapida</i> Roxb.	Bansuli	Herb	Root	Medicine (boil)
110.	<i>Gymnema sylvestre</i> (Retz.) R. Br.	Gudmari	Shrub	Root	Medicinal (diabetes)
111.	<i>Hamidesmus indicus</i> (L.) R. Br.	Anantmul	Herb	Root	Medicine (Birth control)
112.	<i>Hardwickia binata</i> Roxb.	Anjan	Shrub	Bark	Rope making
113.	<i>Helicteres isora</i> L.	Athni	Tree	Bark	Rope making
114.	<i>Hibisis rosa-sinensis</i> L.	Mandar	Tree	Flowers	Ethnoveterinary, cultural
115.	<i>Holarrhena antidysenterica</i> Wall.	Dudhidel	Tree	Fruit	Medicinal (dysentery)
116.	<i>Holarrhena pubescens</i> Buch. Ham.	Kurei	Tree	Leaves	Cup and plate making, cultural
117.	<i>Indigofera cassioides</i> Rottl. Ex. DC	Girli	Shrub	Seeds	Tonic
118.	<i>Ipomea carnea</i> Jace.	Amrika	Shrub	Stem	Land boundary
119.	<i>Ischaemum angustifolium</i> L.	kushkhadar	Grass	Whole Plant	House construction, Rope and Broom making

Sl. No.	Botanical Name	Local	Habit	Part Collected	Uses
120.	<i>Ischaemum rugosum</i> Salisb.	Murdu/ Murdi	Grass	Whole Plant	Fodder, Rope making
121.	<i>Iseilena prostratum</i> (L.) Anderss.	Musakani	Grass	Whole Plant	Medicine (boil)
122.	<i>Jatropha curcas</i> L.	Jada	Shrub	Fruit	Oil extraction (massage on hair)
123.	<i>Launaea acaulis</i> Roxb.	Balarajkanda	Climber	Fruits	Medicine (diabetes)
124.	<i>Lawsonia inermis</i> L.	Hina	Shrub	Stem	Fencing and making of bunds
125.	<i>Leea macrophylla</i> Roxb.	Hathpan	Shrub	Root	Joint pain
126.	<i>Leonotis nepetifolia</i> R.Br.	kharkhatia	Herb	Leaves	Medicine (child birth)
127.	<i>Lagerstroemia parviflora</i> L.	Sihna	Tree	Leaves	Medicine (eyes)
128.	<i>Lowsonia inermis</i> L.	Menjati	Shrub	Leaves	Medicine (asthma)
129.	<i>Luffa operculata</i> L.	Janhi	Climber (cultivated)	Fruits	Edible
130.	<i>Macrotyloma uniflorum</i> Lam.	Kulath	Herb (cultivated)	Fruits	Edible
131.	<i>Madhuca Indica</i> L.	Mahul	Tree	Fruits/flowers, stem	Edible, cultural, oil extraction
132.	<i>Mallotus philippensis</i> Lam.	Sunderi	Tree	Fruit	Medicine (menstruation disorder)
133.	<i>Manilkara hexandra</i> (Roxb) Dub. Syn: <i>Mimusops hexandra</i> Roxb.	Khirmi	Tree	Fruit	Edible
134.	<i>Marsilea minuta</i> L.	Sunsunia	Shrub	Leaves	Edible
135.	<i>Mengifera indica</i> L.	Aam	Tree	Fruit	Edible
				Seed	Edible

Sl. No.	Botanical Name	Local	Habit	Part Collected	Uses
				Leaves	Cultural (making of marriage spot)
138.	<i>Mimosa pudica</i> L.	Lajkuli lata	Under Shrub	Whole Plant	Medicine (tooth pain)
139.	<i>Mitragyna parviflora</i> Roxb.	Munde	Tree	Stem	Firewood
140.	<i>Moringa pterygosperma</i> Gaertn.	Munga	Tree	Leaves and Fruit	Edible
141.	<i>Momordica charantia</i> Descout.	Karla	Climber (cultivated)	Fruits	Edible
142.	<i>Mucuna pruriens</i> DC.	Baikhujen	Shrub	Fruit	Snakebite
143.	<i>Mucuna utilis</i> Wall. Ex Wight	Khursa	Tree	Fruit	Edible
144.	<i>Ocimum gratissimum</i> L.	Bantulsi	Herb	Fruit	Marketing
145.	<i>Ocimum sanctum</i> L.	Tulsi	Herb	Whole Plant	Medicine, cultural
146.	<i>Opuntia dillenii</i> Haw.	Nagfeni	Herb	Pulp	Medicine (eyes redness)
147.	<i>Oryza sativa</i> L.	Dhan	Grass (cultivated)	Seed	Edible
				Straw	Fodder
149.	<i>Panicum colonus</i> L.	Gurji	Grass (cultivated)	Seed	Edible
150.	<i>Panicum sumatrense</i> Roem & Schutt	Suan	Grass (cultivated)	Seeds	Edible
151.	<i>Paspalum sanguinale</i> Lamk.	Sursa	Herb (cultivated)	Seed	Oil
				Leaves	Vegetable
152.	<i>Paspalum scrobiculatum</i> L.	Kodu	Grass (cultivated)	Seed	Edible Given after delivery

Sl. No.	Botanical Name	Local	Habit	Part Collected	Uses
153.	<i>Pennisetum purpureum</i> DC. Baker.	Singh-khar	Grass	Whole Plant	House Construction Broom making, Rope making & Cultural
154.	<i>Peucedanum nagpurensis</i> Prain.	Tejraj	Shrub	Root	Tonic (blood purifier)
155.	<i>Phaseolus mungo</i> L.	Urad	Herb (cultivated)	Grain	Edible
156.	<i>Phoenix sylvestris</i> Roxb.	Ban Khajur	Tree	Fruit	Edible (Ripe)
157.	<i>Phumbago zeylanica</i> L.	Chirawita	Shrub	Root & Leaves	Medicinal (leprosy/ Blood purification)
158.	<i>Phyllanthus officinalis</i> L.	Amla	Tree	Fruit	Edible and medicinal (digestive)
				Leaves	Cultural (Offer to Gods and Goddesses)
160.	<i>Phyllanthus fraternus</i> Webster.	Bhuioela	Shrub	Bark	Medicine (jaundice)
161.	<i>Pongamia pinnata</i> Vent.	Karanj	Tree	Fruit	Oil extraction, medicine
162.	<i>Psidium guava</i> L.	Jam	Tree	Fruit	Both raw and ripe fruits are eaten
				Leaves	Medicinal (Dysentery)
164.	<i>Pterocarpus marsupium</i> Roxb.	Bija	Tree	Stem	House construction, Furniture
165.	<i>Punica granatum</i> L.	Dalim	Tree	Whole Plant	Medicine (Diarrhea), ethnoveterinary
166.	<i>Randia dumetorum</i> Lamk.	Mainhar	Tree	Leaves	Vegetable
167.	<i>Rauvolfia serpentina</i> (L.) Benth ex. Kurz.	Sarpagandha/patalgarud	Under shrub	Fruit	Medicine (Snake bite)
				Root	

Sl. No.	Botanical Name	Local	Habit	Part Collected	Uses
168.	<i>Ricinus communis</i> L.	Jada	Shrub	Fruit	Oil (Headache, massaging body), ethnoveterinary
				Root	Easy delivery
170.	<i>Rivea hypoctateriformis</i> Desr. Ex Lam.	Muti	Shrub	Leave	Edible
171.	<i>Santalum album</i> L.	Chandan	Tree	Stem	Medicine, religious
172.	<i>Schleichera oleosa</i> Willd.	Kusum	Tree	Fruit	Edible, medicine (oil for skin diseases)
173.	<i>Sesamum indicum</i> L.	Til	Herb (cultivated)	Seeds	Edible, Oil extraction
174.	<i>Setaria italic</i> L.	Gurji	Herb (cultivated)	Seeds	Edible
175.	<i>Shorea robusta</i> Gaertn.	Sargi	Tree	Stem	House construction, Furniture, Firewood, Plough Making, Cultural
				Resin	Medicinal (burn wound)
177.	<i>Sida rhombifolia</i> L.	Chitki	Herb	Whole Plant	medicine
178.	<i>Smilax zeylanica</i> L.	Ramdatun/ muturi	Climber	Twig	Medicine
179.	<i>Solanum nigrum</i> L.	Katikuel	shrub	Fruit	Edible
180.	<i>Solanum xanthocarpus</i> Schrad & Wendle	Baigan	Herb (cultivated)	Fruit	Edible
181.	<i>Sorghum vulgare</i> Pers.	Khedjanha	Grass	Seeds	Edible
182.	<i>Sphaeranthus indicus</i> L.	Bhuikadam	Shrub	Root	Medicine (migraine)
183.	<i>Stephegyne parvifolia</i> Roxb.	Kem/ Kadam	Tree	Stem	Cultural (used during marriage)

Sl. No.	Botanical Name	Local	Habit	Part Collected	Uses
184.	<i>Sterculia urens</i> Roxb.	Genduli	Tree	Resin	Medicinal (gynecological)
				Bark	Rope making
186.	<i>Streospermum clelonades</i> L.	Padhel	Tree	Stem	Agriculture/land boundary
187.	<i>Strychnos nux vomica</i> L.	Kochla	Herb	Fruits	Medicine (gynecology), Ethoveterinary
188.	<i>Syzygium cumini</i> (L.) Skeels.	Jamun	Tree	Stem	Cultural (marriage)
				Fruit	Edible
				Leaves	Medicinal (Dysentery), Cultural
				Seed	Medicinal (Diabetic)
				Bark	Medicinal (Dysentery)
193.	<i>Tamarindus indica</i> L.	Tetel	Tree	Fruits	Edible, Medicinal (Ethno-veterinary)
194.	<i>Tectona grandis</i> L.	Sagaun	Tree	Stem	House construction, Furniture, Cultural
195.	<i>Tephrosia purpurea</i> L.	Kolathia	Shrub	Whole Plant	Ethnoveterinary, fish-poisoning, medicine
196.	<i>Terminalia arjuna</i> Bedd.	Arjun/kha	Tree	Stem	Firewood, House construction,
				Root	Stomach disorder
198.	<i>Terminalia bellerica</i> (Gaertn.) Roxb.	Beheda	Tree	Fruit	Medicinal (Digestive)
199.	<i>Terminalia chebula</i> Retz. & Willd.	Harra	Tree	Fruit	Medicinal (Digestive)

Sl. No.	Botanical Name	Local	Habit	Part Collected	Uses
200.	<i>Terminalia tomentosa</i> W & A	Saja	Tree	Stem	House construction, Firewood, cultural
201.	<i>Thespesia lampas</i> D & G.	Bankithoko	Herb	Whole Plant	Medicine
202.	<i>Thalictrum foliolosum</i> DC.	Bansuli	Shrub	Leaves	Medicine (skin)
203.	<i>Tinospora cordifolia</i> Miers.	Gurbel	Climber	Whole Plant	Medicinal (tonic for fever)
204.	<i>Tragia plukenetti</i> R. Sm.	Bichhuati	Climber	Fruit	Medicine
205.	<i>Trichosanthes bracteata</i> Lam.	Mahakal	Herb	Fruits	Medicine (ear pus)
206.	<i>Trichosanthes cucumerina</i> L.	Lahu	Climber	Fruits	Edible
207.	<i>Tridax procumbens</i> L.	Bish khapri	Herb	Leaves	Medicine (skin/wound)
208.	<i>Urginea indica</i> Kunth.	Jangli piaz	Herb	Tuber	Ethno-veterinary
209.	<i>Viccaria pyramidata</i> Medik	Musna	Herb	Flower	Ethno-veterinary
210.	<i>Vigna unguiculata</i> L.	Jhunga	Climber	Fruits	Edible
211.	<i>Viscum nepalense</i> Willd.	Bandala	Shrub	Root	Medicinal
212.	<i>Vitex nigundo</i> L.	Begonia	Tree	Whole Plant	Fencing of agricultural land
213.	<i>Vitex penduncularis</i> W.S.		Tree	Bark	Medicine (avoid child birth)
214.	<i>Vitiveria zizunioides</i> (L). Nash	Kash kash	Grass	Whole Plant	Rope making
215.	<i>Zea mays</i> L.	Makka	Grass (cultivated)	Seed	Edible
216.	<i>Zizyphus jujuba</i> Lam.	Lati Buro	shrub	Fruit	Edible

Sl. No.	Botanical Name	Local	Habit	Part Collected	Uses
217.	<i>Zizyphus mauritiana</i> Lam.	Boro	Tree	Fruit	Edible
218.	<i>Zizyphus xylopyra</i> Willd.	Ghont	Shrub	Bark	Agricultural implements, House construction
219.	<i>Zizypus rugosa</i> Lamk.	Churnachitu	Shrub	Leaves Fruits	Medicine (Malaria) Edible

The following sub-headings categorically describe the collection practice of different plant species and their use patterns.

Edible Plant Species

The Chuktia Bhunjia collect about 73 edible plant species from the Sunabeda wildlife sanctuary. Edible here refers to species that are consumed directly in the form of fruits, leave and rhizomes either raw or ripe. The abundantly collected edible species are *Madhuca indica*, *Mengifera indica*, *Buchnanian lanzan*, *Diospyros melanoxylon*, *Tamarindus indica*, *Embllica officinalis*, *Psidium guava*, *Syzygium cumini*, *Schleichera oleosa*, etc. but the collection of some of the species is governed with sets of customary norms that have been described while elaborating the collection practices. the collection *Madhuca indica* flowers, which generates quick income after agriculture, follow celebration of *Ushavana* festival. The collection of *Mahul* flowers, during February-March, begins with a date fixed by village council in each village following a ritual called *Ushavana*. Each household contributes a fixed amount of money to buy goat to sacrifice and other required materials for the ritual. In the fixed day, *pujhari* (religious priest) worships goddess *Ushavana* before proceeding for collection followed by sacrifice of a male goat. The Goddess is then kept in a new mud vessel. The vessel is covered with a red cloth and shouldered by *pujhari*'s wife to take to the collection site following Bhunjia songs. They collectively proceed to the collection sites. On reaching there, they clear a place to keep Goddess *Ushabhana*. The place is smeared with water and cow dung. Each household occupies some *mahul* trees to collect the flowers. Number of trees captured depends on the number of members gone for collection. So collection of flowers is an individual affair. They stay in the collection sites in temporary hut (*Mahulguda*) till they collectively return to village. They clean in and around captured trees. From next early morning they start collecting the flowers. They collect flowers for two months till the flowers are reduced to non-collectable quantity. In the collection sites, they assemble each night and dance together, male on the one side and female on the other, followed by drum and songs. The collected flowers are dried in the collection sites before selling. They also keep little quantity of flowers to distill liquor or eat by boiling (*mahulchap*). If flowering reduce to non-collectable stage, they together return to the village after which, no one is allowed to collect the flowers. The non-participating women in the collection welcome them by washing the feet of woman carrying back the vessel with *Ushabhana* followed by a sacrifice of fowl or goat. They keep the goddess in *Pujhari*'s house and are later emerged in first monsoon. The flowers are dried and sold either in the local market or in the collection

site for about ₹ 40/kg. People are also seen exchanging the flowers for grocery items in village shops. They also keep few quantities of dried flowers either to consumed as *mahul-chepna* (cooked mahua flower) or to distill liquor. The Chuktia Bhunjia also collect *tol* (*madhuca indica* seeds) during April-May to extract oil that are used for both cooking and body massage. The seeds are halved immediately after collection by hammering that are dried before extracting oil or selling to shop.

Similarly, the collection and consumption of *Mengifera indica* do follow celebration of *aam-jatra* or Chaitra festival in March-April. They collect raw mangos are halved and properly dried before selling. The dried mangos are called *amul* which they sell to traders at ₹45/kg. They also collect pulps from ripe mango (*aamsola*) to consume with rice particularly in the absence of vegetable in summer. *Buchania Lanza* (Chahar), collected during April-May after Chaitra festival has similar economic significance which they sell to traders at ₹50-60/kg. They too keep a leaf-cup of dried *Chahar* because of its cultural significance. Its seeds (*chironji*) are removed by both grinding and grinding that are consumed with jiggery and perceived to have high nutrient value. They seldom sell *chironji* at market for ₹100-120/kg. Collection of *Diospyrus Milanoxylm* fruits is also observed during February-April for consumption often preserving the dried fruits in leave bags (*Patardola*) made of either *Butea monosperma* or *Bauhinia villai*. They also collect its leaves during April/May and sell it to the Forest Department at ₹80/4000 leaves. They also collect *Schleichera oleosa*, *Salanun nigrum*, *Cemacarpus anacardium*, *Diosyros Montana*, *Euphorbia thymifolia*, *Ficus racemosa*, *Phoenix sylvestris*, *Phyllanthus officinalis*, *Scheleichera oleosa*, *Tamarindus indica*, etc. for eating.

The Chuktia Bhunjia also collect a number of rhizomes. The abundantly collected rhizomes are *Eulophia nude*, *Dioscorea foetida*, *Curcuma angistofolia*, etc. They identify the pluckable rhizomes by observing the dryness and colour of the leaves. They perceive that when the fruits are ready to collect, leaves get dries and becomes yellow. Women usually go for collection often accompanied by children. The rhizomes are put in water overnight to remove its bitterness before consumption. The rhizomes are perceived to have high medicinal value. The tools used in rhizome collection include digging hoe (*kued*), axe (*tangia*) and spade (*rafa*). *Tikhur* (*Curcuma angistofolia*) is considered anti-acidic and hot resistant. But its collection is endowed with customary belief. They collect it only after the celebration of *Chaudhua* (first washing of newly harvested rice) in November till Chaitra festival. No one is allowed to collect it after *Chaitra* till celebration of *Chauldhua* which they perceive as period of gestation. They classify *Tikhur* into two categories: those having many offshoots around the main shoot and those having single shoot. They perceive that when the rhizome is ready to collect, its leaves turn into gray and become dry. While digging the site, they take utmost care that immatures are not collected but are left for next collection. The collected *tikhur* are kept near running waterbody overnight to remove its bitterness which is then rubbed against a stone to obtain a semi-liquid pulp locally called *tikhur-ras*. The pulp is transferred to a cloth to filter into an earthen pot. Once the pulp is layered in the pot, they drain the water and properly dry the pulp before storing or selling. Few households are reported to sell it for about 200-250/kg.

Edible wild green leaves (*dal-sag*) also constitute important parts of Chuktia Bhunjia's livelihood largely during rainy season. The frequently collected edible leaves are *Cholorophytum arundinaceum*, *Bauhinia variegata*, *Rivea hypocrateriformis*, *Cassia tora*, *Bauhinia purpurea*, *Marsilea minuta*, *Commelina benghalensis*, etc. that always replace their market consumption of vegetable. The bamboo shoot (*Kardi*) collected during July-August also a part of their food culture but has gender dimension regarding collection. Pubertal girls and menstruating

women are restricted from collecting it simply because they believe that bamboos are abode of village deities. They also keep the dried chopped offshoot (*henua*) to eat as curry. Few of them are found to sell it in the market for ₹200/kg. During same period, Chuktia Bhunjia abundantly collect a number of edible mushroom (*Chhati*) for self-consumption. They simply wash the mushrooms in turmeric water to kill insects or bacteria before preparing curry. They identify four varieties of consumable mushrooms: *Mala Chhati*, *Pial Chhati*, *Bial Chhati* and *Bina Chhati*. (1) *MalaChhati* is small in size. It is reddish in colour and grow in sandy soil. It is only consumed by those who do not have maternal uncle otherwise believed that his/her maternal uncle will die in near future. (2) *Bial Chhati* is exclusively seen on the sandy soil. It is white in colour with varied size. (3) *Pial chhati* is big in size, white in colour and thick. It is cultivated in the kitchen garden simply by putting salt in the decomposed paddy straw. They believe that older the straw, more the *pial chhati*. (4) *Bina Chhati* is small in size and found nearby the tree trunk. They often collect non-edible mushroom like *Agaricus campestris* (*gachh-chhati*) for selling purpose.

Medicines

The Chuktia Bhunjia identify about 95 plant species having medicine value but extensively use 42 species for the purpose. They (including folk doctor) have knowledge of curing about 21 human diseases by using plant medicine dominated being gynecological disorder, malaria, jaundice and skin-related diseases. Barks, roots, leaves of the identified species are usually used for medicines. In majority of ailments, multiple species are admixture to prepare medicine but use of single plant is not completely absent. Sometime single species is used for multiple diseases. For example, *Sphaeranthus indicus* is used for treating both migraine, menstruation disorder and pile. The roots of *Cuscuta reflexa* and *Vitex penduncularis* are used to control pregnancy. Since healthcare is associated with specific beliefs so as the collection of medicinal plants. For example, *Christella semigagitata*, used to control excessive bleeding during menstruation, is collected in full-moon or lunar eclipse day. Some plants are collected in early morning whereas some plants are collected from particular direction. For example, *Caesalpinia salpan* and *Mallotus philippenis* used to cure menstrual disorder are collected from north. The plant species collected non-compliance with their customary beliefs are perceived to become defunct.

The Chuktia Bhunjia possess knowledge to cure livestock diseases using plant-based medicine, although use of mantra therapy cannot be ignored. The frequently used plants for ethnoveterinary practices are *Annona squamosa*, *Calotropis procera* and *Urginea indica*. The turmeric mixed leaves paste of *Annona squamosa* is used for mouth disease whereas *Cemacarpus anacardium* is used to treat foot root. The root paste of *Urginea indica* is grinded with 7 black peppers, garlic and ginger to cure tonsil. The paste is mixed with saw or water and is given to livestock. *Tamarindus indica* fruits are also considered important medicine to cure livestock fever. They chop the fruits with 9 black peepers and a tea spoon of ajwan which is given to livestock by adding in a bucket of water. *Citrullus aromaticus* is used to cure insect infection. Its fruits are grinded with salt, curd, and 5 black peppers and the paste is gently applied on wounded part. However, many times it is cured by mantra therapy accompanied with the use of *Phyllanthus officinalis*. They ask the person having knowledge of curing insect infection usually in Sunday. The livestock are laid down by tying in a rope. A little curd water is poured into the affected part to know the extent of infection. The specialist then chants mantra simultaneously sweeping the wounded part in *Phyllanthus officinalis* leaf. They also use bark paste of *Tephrosia purpurea* and fruit paste of *Pongamia pinnate* to cure the lice infection. Similarly, the use of *Cissus quadrangularis* is

highly observed in treating bone fracture for both human and animal by bone settlers. First, the plant is chopped in a stone and then heated in a mud vessel. The livestock is then laid down. The herbalist then arranges the fractured bone by pulling back and forth on the affected part. The hot paste is orally applied over it. Small pieces of bamboo are tied to avoid removing the medicine.

Agriculture

The Chuktia Bhunjia use about 12 plant species in agricultural practices. *Acacica Arabica* and *Shorea robustas* are used to make plough whereas *Butea monosperma* *Tectona grindis*, *Butea monosperma* and *Cedrela tonna* are used to make leveler. The carrying implement (*bhar*) is made of *Shorea robusta* due to its durability. *Semacarpus anacardium* is believed to work as pesticide and insecticide and thus they fix a branch of it in their agricultural field in lunar eclipse.

Oil Yielding

The Chuktia Bhunjia also extract oil from the seeds of *Madhuca indica*, *Ricinus communis*, *Jetropha curcae*, *Azadirachta indica*, *Pongamia pinnate*, *Cesamum indicum* and *Paspalum sanguinale* by traditional technique as described below:

The collected seeds are frequently exposed to sunlight before extraction of oil. The seeds are then put in a tool locally called Ghana usually made of *Shorea robusta* or *Chloroxylon swietenia*. The tool is made by removing ring portion to make trunk hallow with a small hole at the bottom. A wooden pole connected with another pole is put inside the hallow trunk. The other pole is usually to tie a bullock. After putting seed in the trunk, the bullock is made to move around so that seeds get rub trunk and oil pass filter into the small hole.

They also extract oil from *Jetropha curcae* and *Celastrus paniculate* by following technique.

The collected seeds are completely dried before a day to remove its water contain. The seeds are then chopped in 'kuten' (chopping tool fixed on the ground) striking against the 'musel' (instrument made of *Shorea robustas* to chop cereal). The chopped seeds are then put in hot water and stirred for some times. Once it is completely boiled, the oil portion automatically gets flow over water. It is then extracted from the vessel through a peacock fur which is again boiled to evaporate its water content before keeping in a jar.

Cultural Uses

The Chuktia Bhunjia also use a number of plant species in their socio-religious practices. The important religious plants are *Madhuca indica*, *Shorea robustas*, *Embllica officinalis*, *Ficus religiosa*, *Ficus bengalensis*, *Aegle marmelos*, *Sacred basil*, etc. because of being abode of specific deities. A number of species are also used in festivals. For example, the leafy branches of *Adina cardifolia*, *Terminalia tomentosa*, *Anogeissus latifolia* and *Syzygium cumini* are used for making marriage-spot (*modosal*). *Madhuca indica* has inherent significance in their marriage. In the fixed day, young boys-both in bride and groom side-are asked to collect two branches of *mahul* from the local forest, one considering bride and another, groom. Once they reach to village with the branches, a message is passed on to maternal aunt who comes with a jug of water and turmeric paste, often followed by drum to welcome them. She washes the feet of the person holding the

branches and also branches that indicate welcoming of both bride and groom. The branches are then kept in *modosal* for other formality of marriage.

Similarly, the use of *Aegle marmelos*, *Azadirachta indica*, *Butea monosperma*, *Shorea robusta* and *Bauhinia villai* are observed during mortuary ceremony. They carry the corpus in bamboo. After burying it, each person present in cremation ground puts a piece of *Aegle marmelos* over it. In the day of purification usually performed on 10th day, an affine gives a finger tips of crushed *Azadirachta indica* leaves to every member of deceased clan to eat as a form of purification. The use of leave cups and plates made of *Butea monosperma*, *Shorea robusta* and *Bauhinia villai* is also observed in each ceremony. They also offer mahua liquor and resin of *Shorea robusta* to their deities in leave cup made of *Butea monosperma*.

Other Ecological Knowledge

The Chuktia Bhunjia also collect *Perimela ocimodis*, *Cassia tora*, *Azadirachta indica* seeds, resin, etc. that have a good market value. *Perimela ocimodis*, collected during March-April, is sold for ₹12/kg although are often exchanged for household consumable at village shops. The collected plants are either left in collection site or brought to the home to dry. After drying, they husk it by striking against a stick which is again cleaned by spinning before selling. They also collect *Cassia tora* seeds during same time with similar method. Some households were seen to collect *Azadirachata indica* seed for selling. They sell it for ₹20/kg. Besides, the Chuktia Bhunjia also collect honey during summer (March-May). They sell it in the local market or by visiting villages at ₹150/kg. They classify honey into *Aag*, *Anar*, *Lakad* as per the nature of honey bees, location and taste. *Aag* is found in high tree branches and rock projection. The bee of this type is brown in colour and make a single big size hive. *Anar* is small in size with small hive and produce less honey. *Lakad* is found in hallow tree trunks. The bees of this kind are small in size and build number of cells that are collected by opening the trunk with axe. The Chuktia Bhunjia also apply the bark of *Chloroxylon swietenia* and root of *Aegle marmelos*, *Casearia tomentosa*, *Careya arborea*, *Melia azedarachta*, and *Holoptelea integrifolia* as fish poisoning to catch fishes in pond during summer. Besides, they also make husking tools- *Denki* and *Kuten*- with (*Shorea robusta*) *Khair* (*Acacia catechu*) or *Bamur* (*Acacia arabica*) in *Lalbangla* to de-husk paddies, millet, cereals and pulses and are considered sacred.

The Chuktia Bhunjia do not remain limited to the collection and consumption of resources rather generate their livelihood by selling few marketable produces (Table 2). Thus, knowledge-based ecological resources become buffer for their livelihood but operate through a value chain-system where either the middlemen or a person appointed by the traders purchase the produces from them below market price. Some households often travel to weekly market at *Udyanband* (around 40 kms from sanctuary) to sell their produces.

Table 2: Marketable Species collected by Chuktia Bhunjia

Sl. No	Botanical Name	Part	Season	Rate (Rs./Kg)
1.	<i>Acacia arabica Willd.</i>	Seeds	April-May	15
2.	<i>Aristida setacea Retz.</i>	Grass	October-January	15/bundle
3.	<i>Azadirachta indica A. Juss.</i>	Fruits	May	45
4.	<i>Boswellia serrata Roxb.</i>	Resin	October-December	25
5.	<i>Buchanania lanzan Roxb.</i>	Fruits	May	60
6.	<i>Cassia tora L.</i>	Seeds	March-April	20
7.	<i>Cemacarpus anacardium L.</i>	Fruits	April-May	20
8.	<i>Chlorophotum tumerosum Baker.</i>	Rhizome	Whole year	
9.	<i>Curcuma angistofolia Roxb.</i>	Rhizome	March	200
10.	<i>Dioscorea alata L.</i>	Rhizome	October-November	25
11.	<i>Dioscorea bubifera L.</i>	Rhizome	October-November	30
12.	<i>Dioscorea hispida Willd.</i>	Rhizome	October-November	25
13.	<i>Diospyros Melanoxylon Roxb.</i>	Leaves	April-May	50/bundle
14.	Honey	Juice	Whole year	150
15.	<i>Jatropha curcus L</i>	Fruits	May-June	40
16.	<i>Madhuca indica L.</i>	Flower	Feb-April	40
17.	<i>Mengifera indica L.</i>	Fruit/kernel	April-june	30
18.	<i>Phoemix ocimodis L.</i>	Seeds	March-April	12
19.	<i>Phyllanthus officinalis L.</i>	Fruits	January-Feb.	25
20.	<i>Shorea robusta Gaertn.</i>	Resin	Whole year	100
21.	<i>Starculian urin Roxb.</i>	Resin	Whole year	52
22.	<i>Tamarindus indica L.</i>	Fruits	January-April	40
23.	<i>Terminalia bellarica Gaertn.</i>	Fruits	January-April	20
24.	<i>Terminalia chebulla Retz. & Willd.</i>	Fruits	January-April	30

Discussion

The study found that Chuktia Bhunjia have diversified resource use patterns that continue to support their livelihood but are always governed by set of customary rules regarding collection and utilization of the resources. Their livelihood revolves around the existing knowledge system which they have gained through long interaction with local ecology. The knowledge-based livelihood of Chuktia Bhunjia of Chuktia Bhunjia is observed largely in three different spheres: (a) consumption of wild plant species; (b) generation of household income by selling ethno-ecological species; (c) use of ecological species in agriculture, medicine and rituals. The wild edible plants are always found to act as buffer during food scarcity and seasonally replace their market consumption of vegetable [38–40], although consumption of few species follow celebration of specific rituals unlike other tribal groups [41]. The uses of ethno-ecological species in agriculture, medicine, cultural practices and rituals make their practices cost-effective. The easy availability of the medicinal plants along with the plant-based medicinal knowledge many times enforce them to be secluded from the modern medical facility despite its availability in the sanctuary area. Yet, many times they rely on local herbalists (*baid*). The

Chuktia Bhunjia also frequently earn their livelihood by selling few produces but operates through value-chain system as reported from the involvement of local non-tribals as middlemen to purchase the produces from them. So, it cannot be wrong calling their knowledge as a tool of survival strategy.

Furthermore, the narration of the collection of ethnoecological species by Chuktia Bhunjia portrays that their collection practices are surrounded by number of interconnected factors. The inherent religious beliefs, cosmology, and ecological worldview always influence their collection practices as noted from different rituals and festivals celebrated for collecting particular species. They use very simple methods to collect species. The tools are consisted of those used in agriculture and made of locally available species. Rituals are also found to constitute important component of collection and consumption of edible as noticed from the celebration of *Amjatra*, *Ushavana*, *Chauldhua* etc. The gender nature of species collection is endowed with notion of purity and pollution as they are restricted to collect plants during monthly menstruation and puberty. Certainly, it seems to be patriarchal but ensure their sustainable harvesting of the species for livelihood. The norms associated with their collection practices although indicate their collectiveness but have greater role in influencing their conservation practices and sustainability of resources unlike the cases of other tribal groups in India [42–45].

There has been attempts to develop the tribal communities by massive capital investment but it has not trickled down as expected rather devastating the culture and ecology together. Against this assumption, looking at the interaction of the tribal groups like Chuktia Bhunjia with the ecology in term of collection and consumption of ethno-ecological species reveals that their knowledge bases have enabled them to transcend their destitution and lead their own economic and social enlistment' by taking their own decision towards building their livelihood capacity [3, 46–48]. The way they have instituted their collection practices seems to always provide a frame of reference for strengthening livelihood, life support system and food security at the community level [49–52] because of its nature of sustainability, cost-effectiveness, participatory nature that encompasses practitioner's own-technical insights, wisdom, perceptions, technical know-how and decision making ability [3, 53–54]. However, there have been steady decline of ethno-ecological practices of tribal in India because of the transition of knowledge holders and hindrance of cultural reproduction of those knowledge [55–56].

Yet, coupled with state intervention to the development of Chuktia Bhunjia especially by establishing Chuktia Bhunjia Development Agency (CBDA)- a state-sponsored micro-project that encourages them to adopt the conventionalism as report from its provision of seeds (hybrid) and fertilizer distribution; their restriction to enter core areas of sanctuary (which is assumed to have high population of valuable medicinal plant species) in the post-declaration of Chuktia Bhunjia habitat as wildlife sanctuary and tiger project has resulted into the jeopardization of their medicinal knowledge whereby devastating the sustainable healthcare practices and livelihood. Although traditional cultural practices are still reported, the individualism and their socio-cultural transition has widened their relationship with the nature. For example, the marriage spots that were once made up of locally available plants are gradually being replaced with tent available in market as a result their association with those plant species is reducing at slower rate. Similarly, hunting expedition that was once a part of their marriage ceremony is becoming symbolical due to restriction of forest department. Such behaviour has resulted disassociation of Chuktia Bhunjia with the plant species whereby younger generation are unable to identify the species that was once become a part and parcel of their daily activities. Such

transformation not only disassociated them from the ethno-ecological species but also threaten the sustainability of resources and livelihood together.

Conclusion

To conclude, the ethno-ecological practices among Chuktia Bhunjia is a cultural process in which their inherent culture is found to be an intermediary tool to negotiate with the local landscape for collective survival. The diversified resource use patterns among them are revolved around the local ecosystem but always shaped by morale of culture, beliefs and customary laws that continue to find as striving forces towards sustainably maintaining tradition and harvesting of ethno-ecological species as well. Yet, socio-economic transformation among them because of state intervention has altered their ecological relationships and negatively impacted on knowledge, cultural diversity and identity. Such transformation worries the conservationists to call for a modality to preserve those culture and practices towards strengthening traditional institutions and promoting both biological and cultural diversity. But, as biological diversity is closely intertwined with cultural diversity, preservation of culture is necessary to strengthen the knowledge base. Therefore, conservation of biodiversity essentially necessitates protection of cultural diversity. But without conserving the communities contributing to such cultural diversity the dream for biological diversity is meaningless simply because materialism does not imply sustainability to the tribals rather than knowledge. At policy level, given the implications of ethno-ecological species in food and medicine there is a need to screen those species to measure the medicinal potency and nutritive value for wider acceptability. Here owing to the adaptation of conventionalism by younger generation, the need of the hour is to make them aware about the importance of the species they are using since generations otherwise along with their transition, the subsequent forest policy and proposed tiger project would suppress their knowledge and livelihood together. Therefore, non-destructive way of harvesting of those ethno-ecological species can be encouraged that can possible only with the promotion of cultural diversity, although mere attempts to integrate their knowledge with scientific knowledge can add substantial benefit to the knowledge holders.

Declarations

- **Ethics approval and consent to participate:** No human subjects were involved in this present study.
- **Consent for publication:** The people interviewed were informed about the study's objectives and the eventual publication of the information gathered, although no individual's personal data is involved.
- **Availability of data and materials:** 'Not applicable', "Data sharing not applicable to this article as no datasets were generated or analysed during the current study" because of qualitative nature of the study.
- **Funding:** This study received no financial help from any funding agency.
- **Competing interests:** "The authors declare that they have no competing interests"
- **Authors' contributions:** Bhubaneswar Sabar carried out the fieldwork, collected, tabulated, interpreted the data and drafted the paper. Prof. Dipak K. Midya corrected the drafted paper for finalisation. All authors read and approved the final manuscript.
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References

1. Government of Odisha. 2019. Highlights of Odisha Forestry Sector. Bhubaneswar: Government of Odisha.
2. Berkes, F., J. Colding and F. Folke, 2000. Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Applications*, 10 (5): 1251–1262.
3. Sillitoe, P. 1998. The development of indigenous knowledge: A new applied anthropology. *Current Anthropology*, 39 (2): 223–252.
4. Warren, D. M. 1991. Using indigenous knowledge in agricultural development. World Bank Discussion Paper No. 127, The World Bank, Washington DC.
5. Berkes, F. 1993. Traditional ecological knowledge in perspective. In J.T. Inglis (ed.) *Traditional ecological knowledge: concept and cases*. Canada: International Research Center and International Program on Traditional Ecological Knowledge, pp.1–9.
6. Gopalan A. and P.V.R.M. Reedy. 2006. Empowerment through traditional knowledge system for agricultural sustainability. *Indian Journal of Traditional Knowledge*, 5 (1):158–161.
7. Grim, J. and M.E. Tucker (eds.). 2014. *Ecology and religion*. Washington DC: Island press.
8. Irvine, K.N., D. Hoesly, R. Bell-Williams and S.L. Warber. 2019. Biodiversity and spiritual-well-being. In M. R. Marselle et al. (eds). *Biodiversity and health in the face of climate change* (pp. 213 – 24). Switzerland: Springer.
9. Behera, K. K. 2006. Ethnomedicinal Plants used by the Tribals of Similipal Bioserve, Orissa, India: A Pilot Study, *Ethnobotanical Leaflets*, 10: 149–173.
10. Panda, T. and Padhy, R.N. (2008) Ethnomedicinal plants used by tribes of Kalahandi district, Orissa; *Indian Journal of Traditional Knowledge*. 7(2): 242–249.
11. Rout, S.D., T. Panda and N. Mishra. 2009. Ethnomedicinal plants used to cure different diseases by tribals of Mayurbhanj district of North Orissa. *Ethno Medicine*, 3: 27–32.
12. Sahu. S. C., N. K. Dhal and R.C. Mohanty. 2010. Potential Medicinal Plants Used by the Tribal of Deogarh District, Orissa, India, *Ethno Med*, 4(1): 53–61.
13. Panda, S.K., Rout, S.D., Mishra, N. and Panda, T. (2011). Phytotherapy and traditional knowledge of tribal communities of Mayurbhanj district, Orissa, India. *Journal of Pharmacognosy and Phytotherapy*, 3(7):101–113.
14. Dhal, N.K., S.S. Panda, and S.D. Muduli. 2014. Ethnobotanical studies in Nawarangpur district, Odisha, India. *American journal of phytomedicine and clinical therapeutics*, 2 (2): 257–276.
15. Singh, H., P.A. Dhole, G. Krishna, R. Saravanan and P.K. Baske. 2018. Ethnomedicinal plants used in malaria in tribal area of Odisha, India. *Indian journal of natural products and resources*, 9 (2): 160–167.
16. Mallik, B., T. Panda, R.N. Padhy. 2012. Ethnoveterinary practices of aborigine tribes in Odisha, India. *Asian pacific journal of tropical biomedicine*, 2 (3): S1520-S1525.
17. Routray, A. K., R. Sahoo, K.K. Sardar, R. Patra and A. Sahoo. 2015. Ethnoveterinary practices for small ruminants followed by rural folks in southern Odisha. *Indian journal of traditional knowledge*, 14 2: 319–

324.

18. Sahoo, L.K. and K.C. Satapathy. 2020. Indigenous land classification and management among the Bhunjia community of Odisha. *Journal of the Indian Anthropological Society*, 55 (1&2): 35–49.
19. Behera, H. C. 2021. Traditional agriculture, culture and the indigenous knowledge (IK) among the Kondhs in Odisha, India. *Journal of Huma Ecology*, 73(1–3): 44–55.
20. Sabar, B. 2021. Bringing culture back: traditional agricultural knowledge, food production and sustainable livelihood among Chuktia Bhunjia of Orissa. In V. K. Srivastava (ed.) *India's tribes: unfolding realities* (pp. 94–123). New Delhi: Sage publications.
21. Mishra, S. 2010. Green warriors: conserving local biodiversity through community conservation initiatives in Orissa, India. *Policy Matters* 17: 143–149.
22. Mishra, M. 2018. Traditional knowledge systems, culture and environmental sustainability: concepts from Odisha, India. In K. Prasad (ed.) *Communication, Culture and Ecology* (pp. 51–66). Singapore: Springer.
23. Rath, S. and A. A. Ormsby 2020. **Conservation through traditional knowledge: a review of research on the sacred groves of Odisha, India**, *Human Ecology*, 48 (4): 455–463.
24. Kandari LS and M.D. Omprakash 2009. Enhancing livelihood through non-timber forest products (NTFPs) Collection: A case study of Keonjhar district, Orissa, India. *Ann For*, 17: 251–257. 12.
25. Sachan, S.K.S., J.K. Patra and H.N. Thatoi. 2013. Indigenous knowledge of ethnic tribes for utilization of wild mushrooms as food and medicine in Similipal biosphere reserve, Odisha, India. *International Journal of Agricultural Technology*, 9 (2): 403–416.
26. Kahlon, L. K and R. Singh. 2019. Traditional knowledge and dynamics of edible plants of primitive tribal group 'Paudi Bhuyan' with changing demography migration patterns in Northern Odisha. *Indian Journal of Traditional Knowledge*, 18(1): 7–15.
27. Mallick, S.N., T. Sahoo, S.K. Naik, and P.C. Panda. 2020. Ethnobotanical study of wild edible food plants used by the tribals and rural population of Odisha, India for food and livelihood security. *Plant archives*, 20 (1): 661–669.
28. Majhi, B. 2021. Ethnobotanical knowledge among tribal communities in Kalahandi District of Odisha, India. *Journal of Research in Humanities and Social Science*, 9 (5): 08–11.
29. Kahlon, L.K. and R. Singh. 2018. Current status of biological knowledge of Paudi Bhuyan, a particularly vulnerable tribal group (PVTG) in northern Odisha, India. *International journal of research and analytical reviews*, 5 (3): 217–223.
30. Aminuddin and R.D. Girach, R.D. 1993. Observation on ethnobotany of the Bhunjia-A tribe of Sunabera Plateau. *Ethnobotany*, 5: 83–86.
31. Kandi, B., S.C. Sahu, N.K. Dhal and R.C. Mohanty. 2011. Species diversity of vascular plants of Sunabeda Wildlife Sanctuary, Odisha, India. *New York Science Journal*, 4(3): 1–9.
32. Kandi, B., S.C. Sahu, N.K. Dhal and R.C. Mohanty. 2012. Ethnomedicinal plant wealth of Sunabeda wildlife sanctuary, Nuapada, Odisha. *Ethnobotany*, 24: 108–113.
33. Mahapatra, B., R. Parida, M.K. Jena, A.B. Ota. 2014. Folk knowledge on utilitarian aspects of plants: findings from Chuktia Bhunjia and Gonds in Sonabera Plateau. *Adivasi*, 54 (1/2): 1–8.
34. Vasundhara. 2007. Draft report on eviction from Sunabeda sanctuary. Bhubaneswar: Vasundhara.

35. Saxena H. O. and M. Brahman. 1996. The flora of Orissa, Vol. I-IV. Orissa Forest Development Corporation Ltd, Bhubaneswar.
36. Ota, A.B., B.N. Mohanty and S.C. Mohanty. 2020. Particularly vulnerable tribal groups of Odisha. Bhubaneswar: SC&STRTI.
37. Russel R.V. and R. B. Hiralal. 1916. Tribe and caste of the central provinces of India. London: McMillan.
38. Kala, C.P. 2009. Aboriginal use and management of ethnobotanical species in deciduous forest of Chhattisgarh state of India. *Journal of Ethnobiology and Ethnobotany*, 5: 1–12.
39. Sabar, B. 2015. Food insecurity and coping strategies: a tale of two particularly vulnerable tribal groups in Karnataka. *Journal of Asian and African studies*, 51 (6): 718–741.
40. Mipun, P., N.A. Bhat, D. Borah and Y. Kumar. 2019. Non-timber forest products and their contribution to healthcare and livelihood security among the Karbi tribe in Northeast India. *Ecological Processes*, 8:41.
41. Behera, D.K. and S. Patel. 2000. Resource conservation through religious sanctions and social conventions in a primitive tribal group of Orissa, India. *Journal of Social Science*, 4 (1): 57–64.
42. Mohanty, N., P. K. Das and T. Panda. 2011. Use of plant diversity in household ad rituals by tribal people of Dhenkanal district, Odisha, India. *Journal of applied pharmaceutical science*, 1 (4): 79–82.
43. Rawat, S., B. Nagat, R. Dhanias, S. Singh. 2019. Traditional knowledge of plants used in rituals by inhabitant of rural Himalaya. *International journal of inclusive development*, 5 (1): 17–20.
44. Saxena, L. P. 2020. Community self-organisation from a social-ecological perspective: 'Burlang Yatra' and revival of millets in Odisha (India). *Sustainability*, 12, 1867. doi:10.3390/su1205186.
45. Tynsong, H., M. Dkhar and B.K. Tiwari. 2020. Traditional ecological knowledge of tribal communities of northeast India. *Biodiversitas*, 21: 3209–3224.
46. Mosse, D. 2001. People's knowledge', participation and patronage: operations and representation in rural development. In *Participation: The New Tyranny*, edited by W. Cooke and U. Kothari, 16–35. New York: Palgrave.
47. Reyes-Garcia, V., Vadez, V., Huanca, T., Leonard, W.R. and McDade, T. 2007. Economic development and local ecological knowledge: a deadlock? quantitative research from a Native Amazonian society. *Human Ecology*, 35(3): 371–377.
48. Franco-Moraes, J, C. R. Clement, J. C. de Oliveirac, A. A. de Oliveiraa. 2021. A framework for identifying and integrating sociocultural and environmental elements of indigenous peoples' and local communities' landscape transformations. *Perspectives in Ecology and Conservation*, 19 (2) 143–152.
49. Mtshali, M.N.G., T. Raniga and S. Khan. 2014. Indigenous knowledge systems, poverty alleviation and sustainability of community-based projects in the Inanda region in Durban, South Africa, *Studies of Tribes and Tribals*, 12 (2): 187–199.
50. Whittaker, N. 2015. Traditional ecological knowledge and sustainable food sourcing: Dayutang village, Hani Rice Terraces. *Independent Study Project Collection*, 2069.
51. Boog, Tim van den. 2017. Non-Timber Forest Products – Indigenous ethnobotanical knowledge and livelihood security in West Suriname. MSc Dissertation (Forestry) The University of British Columbia.
52. Lugo-Morin, D. R. 2020. Indigenous communities and their food systems: a contribution to the current debate. *Journal of ethic foods*, 7 (6).

53. Agrawal, A. 1995. Dismantling the divide between indigenous and scientific knowledge. *Development and Change*, 26 (3): 413-439.
54. Pierotti, R. and D. Wildcat 2000. Traditional ecological knowledge: the third alternative (commentary). *Ecological Applications*, 10 (5): 1333-1340.
55. Ghosh, S. K., S.K. Guchhait, and S. Santra. 2014. Decay of traditional ecological knowledge and ethno medicine: a study in Joypur jungle mahal, Bankura District, West Bengal. *IOSR Journal of Humanities and Social Science*, 19 (3): 74-80.
56. Rao, K. K. 2015. External Intervention, local environment, and knowledge erosion: a forest-based community of South India. *Culture, Agriculture, Food and Environment*, 37 (2): 124-129.

Figures

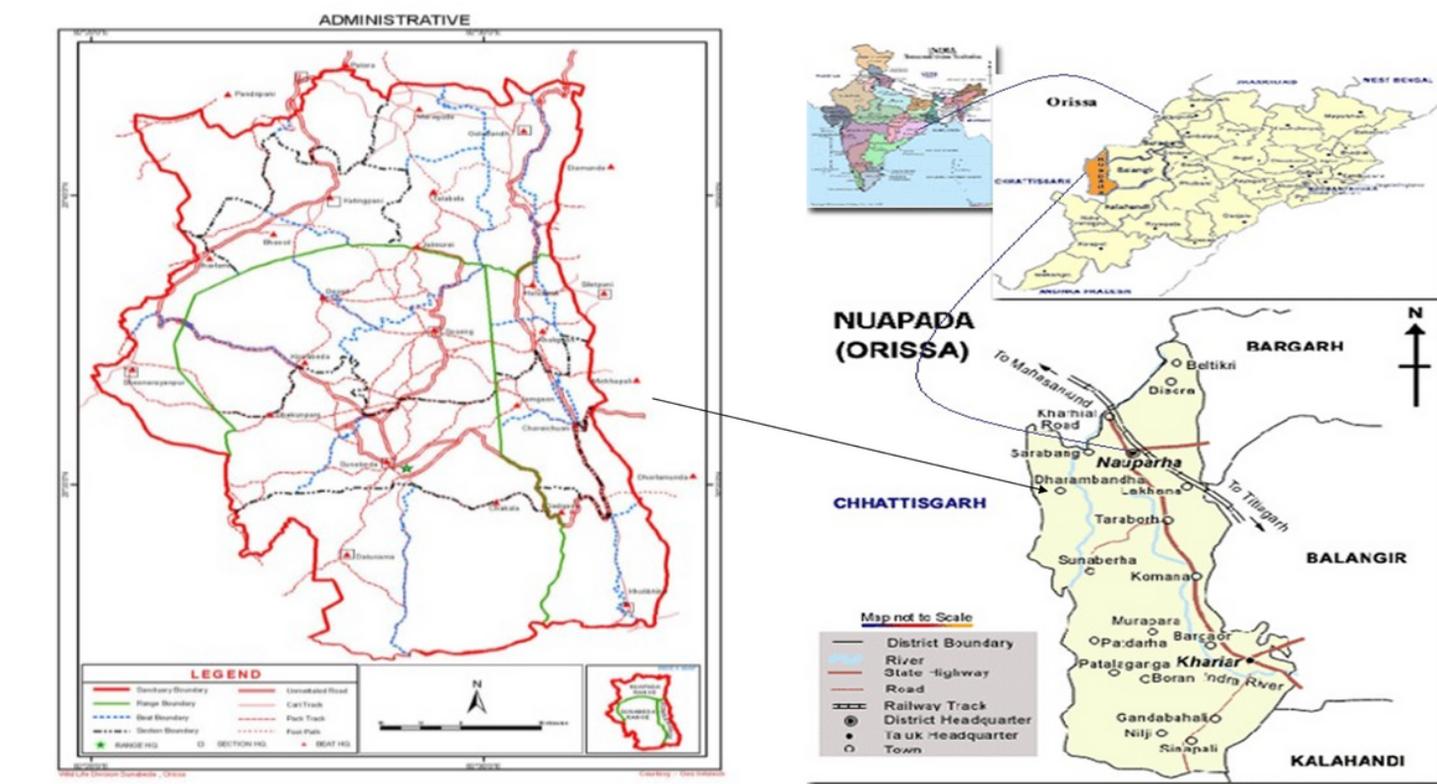


Figure 1

Map 1: Sunabeda Wildlife Sanctuary

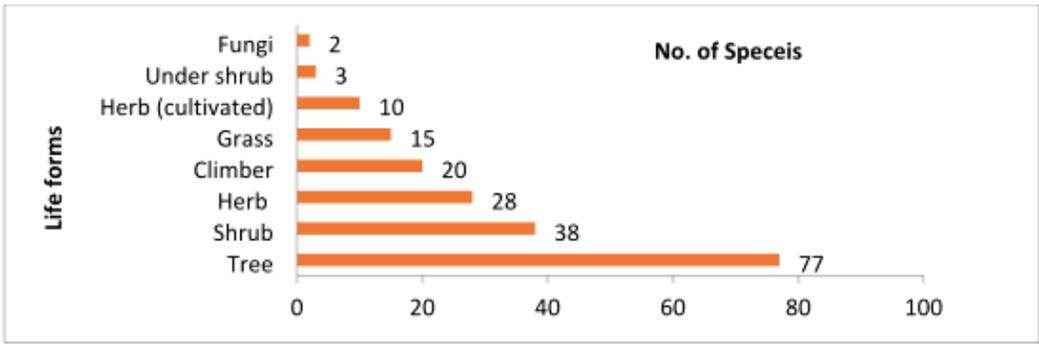


Figure 2

Figure 1: Life form of the species

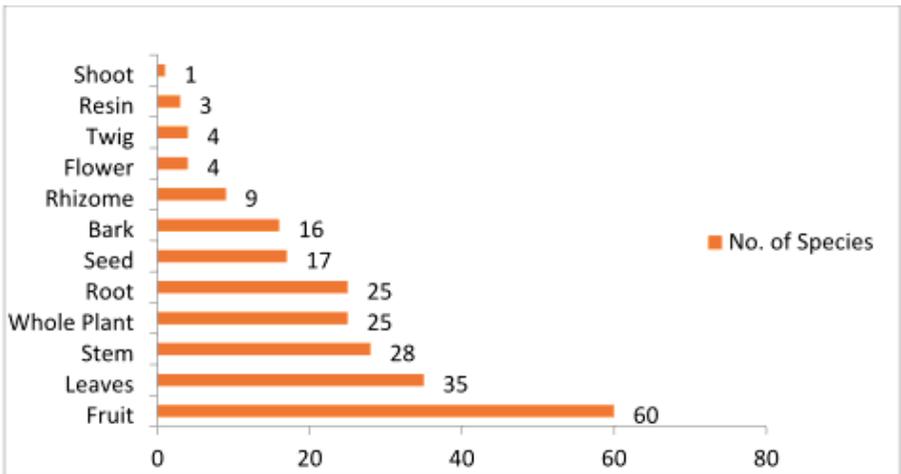


Figure 3

Figure 2: Parts of the plant species collected (in Number)

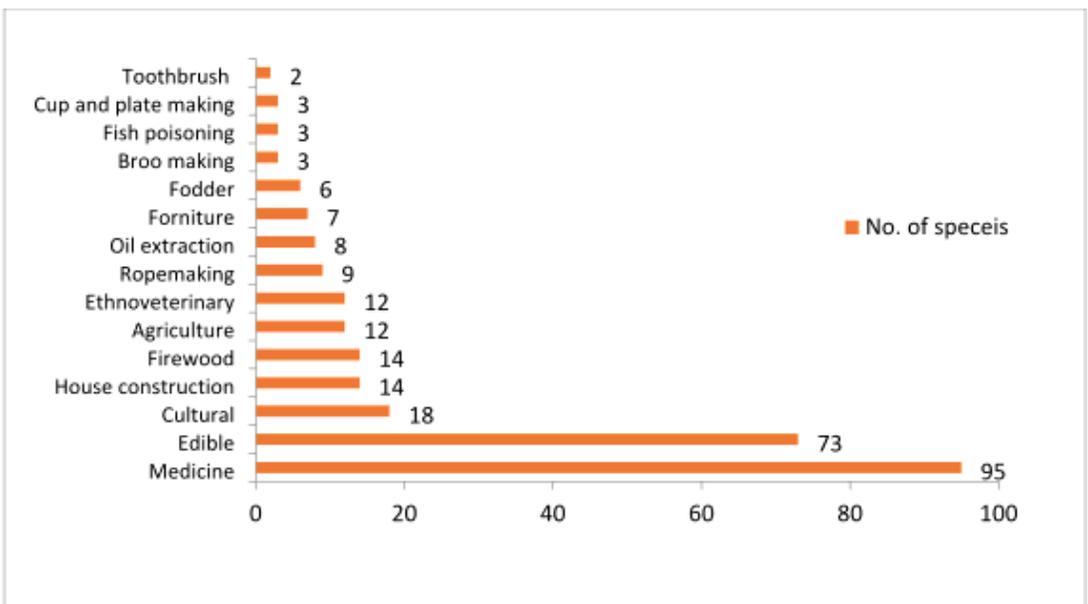


Figure 4

Figure 3: No. of Species Used for Particular Purpose