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Wild Tuber Species Diversity and Its Ethno-Medicinal Use by Tribal People of Koraput District of Odisha, India

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ABSTRACT

The present study was documented the indigenous knowledge on the utilization of tuber species both as food and medicine by the tribal people of Koraput. Field study was carried out in 24 villages of Koraput district of Odisha and the ethnomedicinal information was collected through interview among different tribal group and traditional healers. The use value, informant consensus factors (FIC) and fidelity level (FL) were analyzed to know the important ethnomedicinal tubers used by the tribals. A total of 56 species of tubers distributed in 35 genera belonging to 21 families were identified as commonly used tubers by the tribals and traditional healers for the treatment of 37 types of diseases. These diseases were categorized into 11 ailment categories based on the body systems treated. Most of the medicines were prepared in the form of paste and administered orally. FIC values of the present study indicated that there was a high agreement among the users for the use of plants in the treatment of toothache, cough, nose bleeding and to increase milking of pregnant mother. Six species had highest fidelity level of 100%. The most important species according to their use value were *Dioscorea oppositifolia*, *Colocasia esculenta, Cheilocostus speciosus*, *Dioscorea pentaphylla, Manihot esculenta, Curcuma longa, Curcuma angustifolia*, *Dioscorea alata*, *Dioscorea belophylla* and *Dioscorea tomentosa.* The tuber species with highest fidelity level and use values in the present study may indicate the possible occurrence of valuable phytochemical compounds and it requires a search for potential new drugs to treat various ailments.

1. Introduction

Root and tuber crops occupy a remarkable position in the food security of the developing world due to their high caloric value and carbohydrate content. Some of them are already under cultivation, but other species are growing wild as a neglected group of economic plants. Some of the tuberous species are important due to their medicinal as well as industrial application. Wild edible tuber species are an important source of food in India and have a significant place in the dietary habit of small and marginal farm families and forest-dwelling communities during periods of food scarcity [1, 2]. Edible tubers not only enrich the diet of the people but also possess medicinal properties [3].

Odisha state is known as a genetic paradise for its diversity in plant genetic resources, notably the Koraput is one of the centres of diversity for many food crops and forest species [4] and is also well known for its rich human cultural diversity [5]. Tubers having nutritional properties have been studied time to time in different parts of India by several researchers [6-9]. The traditional knowledge of Koraput region is rapidly degrading due to modernization and the younger generation is not interested to learn from older generation. Thus, some important ethnobotanical information may be lost in absence of proper documentation. Keeping in view of the importance, the present survey enlisted the tuber species used by tribal people of Koraput district of Odisha.

2. Experimental

2.1 Study Area

The study was conducted in Koraput district of Odisha (Fig. 1), during 2014-2015. Information on tuber species were collected from 38 respondents of diversified age groups of six tribal communities, *viz*. Paroja, Bhumia, Gadaba, Bhatra, Durua and Kondha in 24 villages under six community development blocks (Boipariguda, Lakshmipur, Koraput, Lamtaput, Jeypore and Kundra) of Koraput District based on proximity to forests.

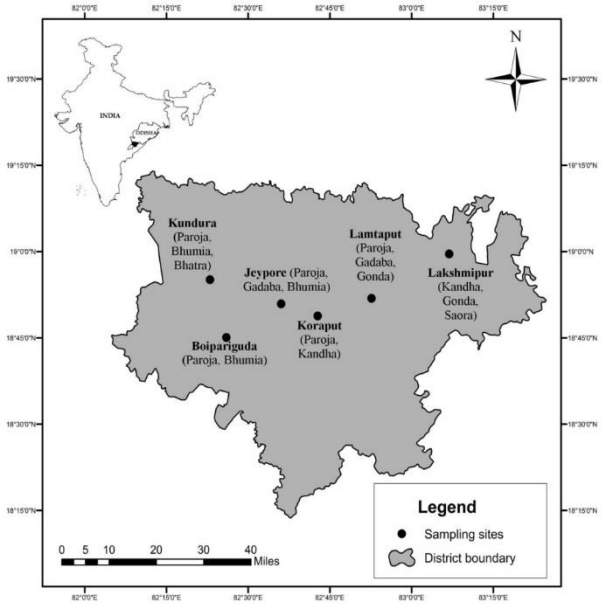

Fig. 1 Map of study site Koraput district of Odisha showing location of blocks surveyed

2.2 Collection, Observation and Documentation

The plants were identified by its vernacular name and later validated by following The Botany of Bihar and Orissa and The Flora of Orissa [10, 11]. Based on the information obtained from the traditional healers and focus group discussion of elder peoples in the study area, all the reported

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ailments were categorized into 11 categories and tabulated. Several diseases were placed in one ailment category based on the body systems treated.

2.3 Informant Consensus Factor (Fic)

The informant consensus factor (Fic) was used to determine agreement between utilization of plants in the ailment categories and the plant users of the study area. The Fic was calculated by using the following formula [12].

Fic = Nur – Nt/Nur – 1

Where Nur refers to the number of use-reports for a particular ailment category and Nt refers to the number of species used for a particular ailment category by all informants.

2.4 Use Value (UV)

The relative importance of each plant species known locally to be used as herbal remedy is reported as use value (UV) and it was calculated using the following formula [13].

UV = ΣU/n

Where UV is the use value of a species, U is the number of use reports cited by each informant for a given plant species and n is the total number of informants interviewed for a given plant.

2.5 Fidelity Level (FL)

To determine the most frequently used plant species for treating a particular ailment category by the informants of the study area, we calculated the fidelity level (FL). The FL was calculated using the following formula [14].

FL (%) =Np/N×100

Where Np is the number of use-reports cited for a given species for a particular ailment category and N is the total number of use reports cited for any given species.

3. Results and Discussion

The present study documented the information of 56 tuberous plants distributed in 35 genera belonging to 21 families, which were commonly used as food and ethnomedicine (Table 1). Among 21 families, the most used family was Dioscoreaceae with 11 species, followed by Zingiberaceae, Araceae and Convulvulaceae. The data was arranged according to the botanical name, common name, family, habit, medicinal importance and use value (Table 1). It was found that the most utilized source of medicines are shrubs (39%) followed by climbers (32%), herbs (25%) and creeper (4%). The most commonly used method of preparation for medicines were paste form followed by juice and powder. Several plant species, e.g. *Tacca leontopetaloides, Alocasia macrorrhizas, Amorphophallus campanulatus, Amorphophallus paeonofolius* and *Dioscorea glabra* are used both for food and medicine. It was observed that the tribal people have much knowledge about the detoxification of the wild tubers before consumption like *Dioscorea bulbifera*, *Dioscorea hispida* and *Urginea indica* used after detoxification.

The most commonly used tuber species was *Ipomoea batatas* with 48 use-reports by 38 informants, giving the highest use value of 1.26. Other important plants with high use value were *Dioscorea oppositifolia* having 1.24 use value with 47 use reports by 38 informants. In general, scarce availability of the plants in the study area leads them to low UV like *Chlorophytum borivilianum* showed low UV of 0.11 by four informants.

In order to analyze the general usage pattern of plants, Informant consensus factor (Fic) was used to highlight the plants use in particular disease and agreement in the use of plants. This helps in the selection of plant for pharmacological and phytochemical studies [15]. The Fic values in the study are ranged from 0.60 to 1.00. The use categories with highest use-reports was gastro intestinal disorder (78 use reports, 32 species) followed by skeleto-muscular system disorders (34 use-reports, 12 species) (Table 2).

Fidelity level is useful for identifying the most preferred species used by the informants for treating certain ailments. Fidelity level is analyzed the disease categories with major agreements of users to emphasize the most important plants used in each category (Fig. 2). Of the reported tuber species, six species had highest fidelity level of 100%, most of which were used in single ailment category with multiple informants. The plants with highest FL were *Amorphophallus paeonifolius, Phoenix acaulis, Cyperus ochraceus, Acorus calamus, Asparagous recemosus* and *Ipomoea paniculata.*

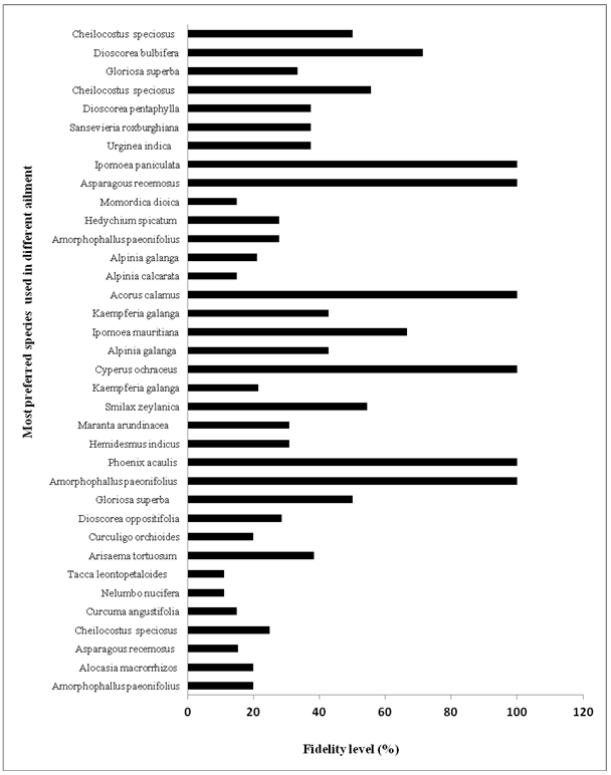

Fig. 2 Fidelity level (%) of most prefered species used in different ailments

Table 1 List of the wild tuber species used by the tribals of Koraput with their medicinal importance

S. no	Scientific Name	Common Name	Family	Habit	Medicinal importance	Use Value
1	*Abelmoschus moschatus* Medik.	Bana bhendi	Malvaceae	Shrub	Root paste is used orally for diarrhoea and applied to the affected area of snake bite.	0.18
2	*Acorus calamus* L.	Bacha	Araceae	Herb	Dry root paste is used orally to treat dysentery, cough and fever.	0.47
3	*Alocasia macrorrhiza* (L.) G. Don.	Manasaru	Araceae	Herb	Tuber paste is applied externally to cure swelling and for treatment of piles	0.37
4	*Alpinia calcarata* (Haw.) Roscoe	Torani	Zingiberaceae	Herb	Tuber paste is massaged with warm mustard oil to treat rheumatism, body pain and weakness.	0.21
5	*Alpinia galanga* (L.) Willd.	Bana ada	Zingiberaceae	Shrub	Roots are used for preparing pickle. Rhizomes are taken orally to cure fever and applied with warm castor oil to treat rheumatism.	0.26
6	*Amorphophallus campanulatus*	Olua	Araceae	Shrub	Tuber paste is applied externally to treat piles.	0.37
7	*Amorphophallus paeonifolius* (Dennst.) Nicolson	Olua kanda	Araceae	Shrub	Tuber paste is applied externally to treat piles, toothache and rheumatism,	0.87

8	*Aponogeton undulatus* Roxb.	Kesru Kanda	Aponogetonaceae	Herb	Tubers are taken after boiling and removing the outer cover.	0.32
9	*Arisaema tortuosum* (Wall.) Schott	Olua kanda	Araceae	Shrub	Tuber Paste is applied on wound caused by snake bite to check poisonous effect.	0.76
10	*Asparagus recemosus* Willd	Satabori	Asparagaceae	Shrub	Root juice is taken orally in dysentery. It is also used for treatment of impotence.	0.76
11	*Bolboschoenus maritisum* (L.) Palla	Ghas kanda	Cyperaceae	Herb	Root juice is used orally against diarrhea and diuretic.	0.16
12	*Cheilocostus speciosus* (J.Konig) C.D. Specht	Keu kanda	Costaceae	Shrub	Tuber paste is applied to the affected area of snake bite and eaten during diarrhea, vomiting, constipation and headache.	1.18
13	*Chlorophytum borivilianum* Santapau & R. R. Fern.	Saphed-musli	Asparagaceae	Herb	Root powder with warm milk is used for strengthening the body.	0.11
14	*Colocasia esculenta* (L.) Schott	Saru	Araceae	Shrub	Tubers are consumed as vegetable after boiling.	1.18
15	*Curculigo orchioides* Gaertn.	Talmuli	Hypoxidaceae	Herb	The paste of tuberous root is applied on the affected part of scorpion bite.	0.24
16	*Curcuma amada*	Ambo ada	Zingiberaceae	Herb	Rhizome are boiled, cooked with pulses and tomato then consumed as curry.	0.42
17	*Curcuma angustifolia* Roxb.	Paluo	Zingiberaceae	Shrub	Tuber powder is drink with water during diarrhoea, indigestion and stomach disorder.	1.05
18	*Curcuma aromatic* Salisb.	Bana haldi	Zingiberaceae	Shrub	Rhizome is used as tonic applied externally to treat sprains.	0.42
19	*Curcuma longa* L.	Haladi	Zingiberaceae	Shrub	Rhizome powder is used orally against worm infection and stomach disorder and applied externally for skin diseases.	1.08
20	*Curcuma zedoaria* (Christm) Roscoe.	Gandha-sunthi	Zingiberaceae	Shrub	Rhizome paste is used orally in indigestion, stomach problems and used as stimulant.	0.18
21	*Cyperus ochraceus* Vahl.	Maisadeti Kanda	Cyperaceae	Herb	Root juice is applied during nose bleeding. Tubers are roasted in charcoal and consumed.	0.18
22	*Cyperus rotundus* L.	Mutha	Cyperaceae	Herb	Warm root paste is applied to treat toothache and root juice is taken orally for stomach pain.	0.16
23	*Dioscorea alata* L	Kamba alu	Dioscoreaceae	Climber	Boiled tuber is eaten to treat indigestion.	1.00
24	*Dioscorea belophylla* (Prain)Voigt ex Haines	Bata kanda	Dioscoreaceae	Climber	Boiled tubers are eaten to treat stomach pain after pregnancy.	1.00
25	*Dioscorea bulbifera* L.	Pita Kanda	Dioscoreaceae	Climber	Tuber paste is used orally to treat worms, piles and dysentery. Powder is used to kill the hair lices.	0.79
26	*Dioscorea glabra* Roxb.	Mitni Kanda	Dioscoreaceae	Climber	Tuber paste is used externally for piles treatment.	0.50
27	*Dioscorea hamiltonii* Hook. f.	Sika Kanda	Dioscoreaceae	Climber	Used as food tonic by tribals, treatment of swelling, stomach ache and piles.	0.74
28	*Dioscorea hispida* Dennst.	Kulia kanda	Dioscoreaceae	Climber	Tubers are roasted, pounded and its paste is applied on wounds and injuries.	0.18
29	*Dioscorea oppositifolia* L.	Pit Kanda	Dioscoreaceae	Climber	Tuber paste is used externally to treat swelling, joint pain, rheumatism and snake and scorpion bite.	1.24
30	*Dioscorea pentaphylla* L.	Soronda kanda	Dioscoreaceae	Climber	Tuber paste is applied on joint swelling, rheumatism	1.13
31	*Dioscorea pubera* Blume	Kasha kanda	Dioscoreaceae	Climber	Tubers are cooked as vegetables.	0.55
32	*Dioscorea tomentosa* J. Koenig. ex Spreng.	Targai Kanda	Dioscoreaceae	Climber	Boiled tubers are use as tonic for strengthening the body.	1.00
33	*Dioscorea wallichii* Hook. f.	Cherenga Kanda	Dioscoreaceae	Climber	Tubers are cooked as curry after successive boiling and also used for stomach pain.	0.26
34	*Gloriosa superba* L.	Pancha angulia	Liliaceae	Herb	It is used as a tonic for treat helminthes and applied externally against snake bites and scorpion stings.	0.58
35	*Hedychium coronarium* J. Koenig.	Ram kedar	Zingiberaceae	Shrub	Roots are used as vegetable during food scarcity and also used to treat rheumatism and loose motion.	0.53
36	*Hedychium spicatum* Sm.	Neelakantha kedar	Zingibera-ceae	Herb	Tuber paste are used externally for rheumatism, loose motion	0.24
37	*Hemidesmus indicus* (L.) R. Br. ex Schult.	Dudhamali kanda	Asclepiada-ceae	Creeper	Root juices are taken orally against worm infection	0.34
38	*Ipomoea paniculata*	Marda mal	Convulvula-ceae	Climber	Tubers are used for increases secretion of milk and poor digestion.	0.32
39	*Ipomoea batatas* (L.) Lam.	Mati Kanda	Convulvula-ceae	Creeper	Tubers are boiled with salt or roasted in charcoal and consumed.	1.26

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40	*Ipomoea cairica* (L.) Sweet	Mitha kanda	Convulvula-ceae	Climber	Tubers are consumed as vegetable.	0.26
41	*Ipomoea mauritiana* Jacq.	Bhuin kumda	Convulvula-ceae	Climber	Tuber paste is applied externally for skin disease and snake bite	0.37
42	*Kaempferia galanga* L.	Adaphul kanda	Zingiberaceae	Shrub	Rhizome juice is taken orally during indigestion, fever and malaria.	0.24
43	*Lasia spinosa* (L.) Thwaites	Kanta kanda	Araceae	Shrub	Rhizomes are washed properly then fried and consumed.	0.16
44	*Leea macrophylla* Roxb. ex Horenem.	Duina	Vitaceae	Shrub	Tuber juice is used orally to treat diarrhoea.	0.16
45	*Manihot esculenta* Crantz	Simli Kanda	Euphorbia-ceae	Shrub	Boiled tuber is used to treat indigestion.	1.11
46	*Maranta arundinacea* L.	Krishna Kanda	Marantaceae	Shrub	Tuber juice is used for indigestion, diarrhea and dysentery.	0.55
47	*Melothria heterophylla* (Lour.) Cogn.	Bana Tundri Kanda	Cucurbitaceae	Climber	Tubers are cooked as curry.	0.11
48	*Momordica dioica* Roxb. ex Willd.	Bana Kankad Kanda	Cucurbitaceae	Climber	Root paste is used externally for rheumatism and taken orally to treat diarrhea and fever.	0.16
49	*Nelumbo nucifera* Gaertn.	Padma kanda	Nymphaea-ceae	Shrub	Rhizome is used as tonic and used to treat diarrhea, dysentery and skin diseases.	0.42
50	*Nymphaea pubescens* Willd.	Kain kanda	Nymphaea-ceae	Shrub	Root juice are taken orally during blood dysentery, stomach pain and diarrhea.	0.29
51	*Phoenix acaulis* Roxb.	Sindi Kanda	Aracaceae	Shrub	Tender roots are eaten for indigestion and mouth disease.	0.47
52	*Pueraria tuberosa* (Willd.) DC.	Bhuin kumda	Fabaceae	Climber	Root paste with honey are taken during fevers and applied externally to reduce swellings of joints.	0.21
53	*Sansevieria roxburghiana* Schult & Schult .f	Muruga	Asparagaceae	Herb	Root powder is used orally for fever, cough, vomiting and worm infection.	0.39
54	*Smilax zeylanica* L.	Mutri mal	Smilacaceae	Climber	Tuber paste with castor oil applied for skin disease	0.47
55	*Tacca leontopetaloides* (L.) Kuntze	Dhui kanda	Taccaceae	Shrub	Tuber powder is used orally in the treatment of piles, diarrhea and dysentery.	0.29
56	*Urginea indica* (Roxb.) Kunth.	Bano piajo	Liliaceae	Herb	Bulbs are used orally to treat abdominal disorder and hypertension.	0.16

Table 2 Number of use reports, number of species used for particular ailment category and informant consensus factor of tuber species of Koraput.

S. No.	Ailment Category	Number of use report	Number of species used	Informant consensus factor (Fic)
1	Gastro intestinal ailment	78	32	0.60
2	Poisonous bite	31	08	0.77
3	Dental care	07	02	0.83
4	Dermatological infection/disease	29	07	0.79
5	Ear, Nose, throat problems(ENT)	05	01	1.00
6	Fever	18	04	0.82
7	Cough	08	02	0.86
8	Skeleto muscular system disorders	34	12	0.67
9	Genito urinary disease	13	03	0.83
10	Common health problem	28	07	0.78
11	Helminthes disease	20	06	0.74

4. Conclusion

This present study revealed that traditional knowledge on the use of tubers is still practiced by the tribal people of Koraput district. The tuber species with highest fidelity level and use values in the present study may indicate the possible occurrence of valuable phytochemical compounds and it requires a search for potential new drugs to treat various ailments.

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