



International Journal of Herbal Medicine

Available online at www.florajournal.com



E-ISSN: 2321-2187
P-ISSN: 2394-0514
IJHM 2015; 3(2): 24-33
Received: 18-04-2015
Accepted: 21-05-2015

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Herbal folk remedies of Dhenkanal district, Odisha, India

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Abstract

An ethnobotanical investigation was carried out to collect, identify and document information on the medicinal plants traditionally used by local inhabitants of Dhenkanal district, Odisha, India. Data were collected from 140 informants of various ages in different villages of the district by using structured questionnaires, complemented by free interviews and informal conversations. Samples of plants that were reported to have medicinal value were collected and identified by botanical classification. One hundred and nine plant species belonging to 53 families were recorded in the interviews and enquiries. The most cited medicinal plant families were Fabaceae, Euphorbiaceae, Caesalpinaceae, Mimosaceae, Asclepiadaceae and Rutaceae. Out of 109 plant species, 34 plant species were used for gastro intestinal ailments (constipation, diarrheas, dysentery, gastric & stomach-ache), 30 for fever, bronchitis, asthma, cough & cold, 20 for anti-inflammatory & skin diseases, 13 for rheumatism, 10 for diabetic, 11 for cardiovascular ailments and 7 plant species for diuretics. The plant parts that were more commonly utilized for the preparation of ethno medicines were the leaves (28.7%), roots (17.4%), bark (13.5%), seeds (10.1%) and fruit (7.3%). The present study contributed to the construction of an inventory of Dhenkanal district ethno medicinal plants, which might be the basis for future scientific validation studies.

Keywords: Dhenkanal district; Folk knowledge, Medicinal plants; Phytotherapy.

1. Introduction

Folk knowledge of the people in a given community has developed over time and is based on experience, often tested over centuries of use, adapted to the local culture and environment and held by individuals or communities^[1]. This knowledge on resource utilization by human beings for a variety of purposes (medicinal, construction, food, fodder etc.) might have been established by trial and error, accumulated over thousands of years, often becomes encoded in everyday cultural practices^[2, 4]. Indigenous knowledge is transmitted orally from generation to generation in the form of folklore and folk sayings^[5, 6] and contributed to the accumulation of a complex wealth of knowledge and skills^[7, 8]. Onset of the industrial revolution and development of advanced allopathic medicine, the practice of botanical healing is discarded. During the last few decades there has been growing interest in therapeutic use of natural products, especially those derived from plants in different countries of the world. This has been amply proved by the multitude of studies reported on this aspect^[9, 16]. This interest in herbal medicines is due firstly to increase awareness of the limited horizon of synthetic pharmaceutical products to control major diseases, and secondly to the current widespread belief that "green medicine" is safe, more accessible and more affordable^[17, 19] because of the pronounced cumulative and irreversible reaction of modern drugs. Moreover, studying local knowledge is useful in documenting, analyzing and disseminating the knowledge on the interaction between biodiversity and human society^[1]. In India the tribal and indigenous communities are found to be using more than 10,000 species of wild plants for various purposes which include about 8,000 species for medicinal uses^[20]. Published literatures in different parts of India have revealed that the people have a unique culture and a rich traditional knowledge^[21, 27]. But any inclusive and elite study on this aspect is yet to be done in Odisha, a state in the eastern region of India^[28, 29]. In this context the ethnobotanical wealth of some geographical areas of the state such as Dhenkanal district is not explored. In this present research article, we report about local ethnobotanical uses of plants collected from traditional practitioners to cure various diseases in Dhenkanal district of Odisha, India. Our aim is to collect the popular knowledge on medicinal plants and their traditional uses to preserve this kind of information that is losing and to provide a base if the collected data can be useful for further phytochemical studies.

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2. Materials and Methods

2.1 Study Area

Dhenkanal district (20° 29' to 21° 11'N and 85°58' to 86°2'E) is located central part of Odisha and covers an area of 4452km², with a population of 11.93 lakhs (2011 Census). Most part of the district is covered with dense forest and a long range of hills (forest cover is 1737.62 km²). Majority of its people lives in villages (91.29%) and agriculture is their main occupation. The climate of the district is hot & dry sub-humid with an average annual rainfall of 1696 mm. The average minimum & maximum temperatures are 19.6 °C and 33.3 °C respectively. The humidity is generally high varying from 31 to 88%. Twenty four tribal communities viz, Sabar, Saor, Juanga, Pendia, Paraja, Araon, Munda, Mirdha, Matia, Mankidi Mahali, Lodha, Koya, Koru, Kolha, Kishan, Kandha, Haria, Ho, Gand, Dharua, Binijhal, Bhomij & Bhuyan are glorifying the district which constitute about 13% of the total population of the district. They depend solely on their surrounding forests ranging from food to medicines.

2.2 Data collection

The field study was carried out in Kamakhyanagar subdivision of Dhenkanal district from January 2011 to February 2013, and information on the use of medicinal plants was obtained through structured questionnaires, complemented by free interviews and informal conversations [30]. The interviews were individually carried out with members of the local population. We interviewed "native specialists", who were considered by their communities as having exceptional knowledge of the use of plants. One hundred and forty (90 men and 50 women) persons were interviewed. Among the interviewees, 10% were of age 21–40 years, 50% were of age of 41–60 years and 40% were 61 years old or more. Surveys were conducted in different villages of the district. Information on vernacular names, life forms, growth, local status, growth ranges, sources, parts used, preparation, administration, and uses of the plant species were collected and recorded from the informants. Personal interviews and group discussions with local inhabitants revealed some valuable and specific information about the plants, which were further compared and authenticated by crosschecking [31]. Interviews with people were also conducted on a systematic basis to know more details about plant species, their management and distribution. The plant families, genera, and species of the collected specimens were identified by using standard floras and available literatures [32, 33]. The identified species were photographed and the voucher specimens were deposited in the herbarium of Botany Department, Kamakhyanagar College, Kamakhyanagar. The list of medicinal plants were depicted in a tabular form along with their botanical names followed by family, their local names in Odia if any and the parts used for medicinal purpose.

3. Results and Discussion

Traditional healers use their five senses to diagnose the diseases, which are remarkable because they live in remote areas and lack of the modern scientific equipments for diagnosis and treatment; however, they treat diseases using medicinal plants [34]. Documentation of such plants from the perspective of ethnobotanical angle is important for the understanding of indigenous knowledge systems. A total of 109 plant species belonging to 53 families were reported to be used as medicine (Table 1; Fig. 1 and 2). The most cited medicinal plant families were Fabaceae, Euphorbiaceae, Caesalpiniaceae, Mimosaceae, Asclepiadaceae & Rutaceae

(Fig.3). The reported plant species were used to treat 79 different ailments/conditions. The most often cited diseases were: asthma, cardiovascular ailments, diabetes, epilepsy, jaundice, malaria, skin ailments and rheumatism. Moreover, out of 109 plant species, 34 plant species were used for gastro intestinal ailments (constipation, diarrheas, dysentery, gastric and stomach-ache), 30 for fever, bronchitis, asthma, cough and cold, 20 for anti-inflammatory and skin diseases, 13 for rheumatism, 10 for diabetic, 11 for cardiovascular ailments and 7 plant species for diuretics. (Table 1). Among the medicinal plants, trees (33.9%) were most frequently used followed by herbs (31.2%), shrubs (24.8%) and climber (10.1%; Fig. 4). The present finding is in agreement with Halim *et al.* (2007) [9] and Yahia (2014) [16]. Most of the respondents mentioned that they preferred wild trees. This finding is similar to Yineger and Yewhalaw (2007) [11] in Ethiopia and Lee *et al.* (2008) [13] in China who reported that their informants collected wild medicinal plants for herbal therapy. Figure 5 shows that leaves were predominantly utilized in herbal medication followed by root, bark, seed, fruit, stem and whole plant. The preferential use of leaves has also been reported by scholars in different countries [9, 35, 40]. Halim *et al.* (2007) [9] opined that plentiful use of leaves ensures sustainable harvesting of medicinal plants; and Schippmann *et al.* (2002) [41] suggest that this also provides an incentive to protect and maintain wild populations and their habitats and the genetic diversity of medicinal plants. The diverse patterns of use of different parts of medicinal plants in the study area show that rural people have a high level of indigenous knowledge. Most of the plant parts are consumed orally after processing, such as squeezing into extracts, or grinding into powder, blending together, soaking in water, boiling in water or milk or mustard oil, rubbing, or burning. Some are taken raw, and some after cooking as vegetables. The addition of non-plant materials such as black salt, salt (sodium chloride), oil and sugar candy to herbal medicines has previously been documented [42, 43].



Fig.1. (a) *Acalypha indica* L. (b) *Ailanthus excelsa* Roxb. (c) *Aristolochia indica* L. (d) *Bauhinia racemosa* Lam. (e) *Boerhavia diffusa* L. (f) *Calotropis gigantea* R.Br.



Fig.2. (a) *Cassia tora* L. (b) *Curculigo orchiooides* Gaertn. (c) *Cyperus rotundus* L. (d) *Dolichos biflorus* L. (e) *Jatropha gossypifolia* L. (f) *Lantana camara* L.

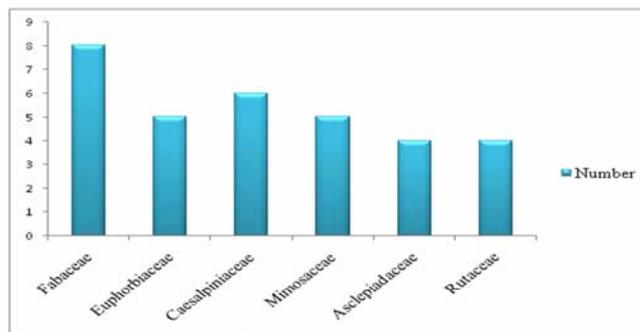


Fig. 3. Dominant plant families used in preparing medicines for various ailments.

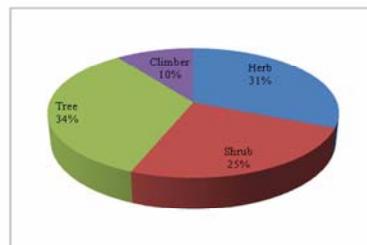


Fig. 4. Growth form analysis of ethnomedicinal plants.

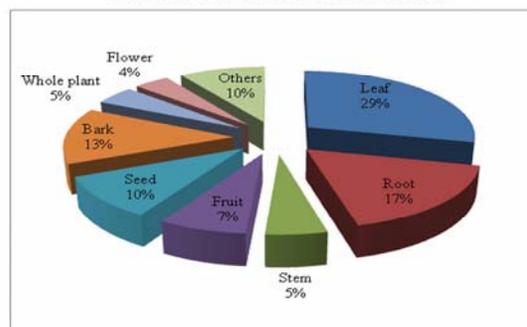


Fig. 5. Percentage of plant parts used in preparing medicines for various ailments.

Table 1: Ethnomedicinal plants of Dhenkanal district, Odisha

Sl. No.	Botanical Name, family, local name(Odia)	Life form	Parts used	Disease/ Condition	Mode of Application
1	<i>Abrus precatorius</i> L. Fabaceae, 'Kaincha'	Herb	Root	Diuresis, fever, bronchitis	The decoction of root is used for diuresis, fever and bronchitis
2	<i>Abutilon indicum</i> G.Don. Malvaceae, 'Pedipedika'	Herb	Leaf	Piles, jaundice, ulcer, leprosy	Fried leaves are used as remedy for jaundice, piles, ulcer and leprosy.
3	<i>Acacia arabica</i> Wild. Mimosaceae, 'Babura'	Tree	Bark, leaf	Asthma, bronchitis	Infusion of bark and leaves is used to cure bronchitis and asthma.
4	<i>Acacia catechu</i> Wild. Mimosaceae, 'Khaira'	Tree	Wood, bark	Cough, anti inflammatory	Decoction of wood and bark is given to cure cough and inflammation of throat.
5	<i>Acacia pinnata</i> Wild. Mimosaceae, 'Dantari'	Shrub	Seed	Body pain	The oil of the seed is applied on the affected part to cure body pain.
6	<i>Acalypha indica</i> L. Euphorbiaceae, 'Muktajari'	Herb	Leaf	Headache	The leaf juice is used as nasal drop in headache.
7	<i>Achyranthus aspera</i> L. Amaranthaceae, 'Aparamanga'	Herb	Leaf, seed	Wound healing, Dog bites, skin disease	Leaf juice is used to heal fresh axe-cut wounds. Decoction of seed is used as an antidote against dog; jackal and cat bite. Leaf juice with a pinch of salt is applied to cure skin infection due to ring worm.
8	<i>Adathoda vasica</i> Nees. Acanthaceae, 'Basanga'	Shrub	Leaf	Piles	5 leaves of this plant, 2-3g root of <i>Abrus precatorius</i> and 3-4g root of <i>Achyranthes aspera</i> is grinded. The paste is taken twice a day after meal for 20 days to cure piles.
9	<i>Ailanthus excelsa</i> Roxb. Simaroubaceae, 'Mahalimba'	Tree	Leaf, root	Asthma, skin disease	Leaf and root of the plant along with Amla fruit are grinded in equal proportion. Honey is added to it and rolled into small pills. Two pills are taken thrice a day with water to cure asthma. The leaf powder mixed with whole plant of <i>Solanum xanthocarpum</i> is used for skin infection.
10	<i>Alangium salvifolium</i> Wang.	Tree	Leaf	Snake bite	The leaf juice is used to cure snake-bite.

	Alangiaceae, 'Ankula'				
11	<i>Albizzia lebeck</i> Benth. Mimosaceae, 'Sirisa'	Tree	Bark	Epilepsy, mental retardation	2 gm bark powder mixed with 5ml of bark decoction of Arjuna (<i>Terminalia arjuna</i>) and 5 drops of honey is given once a day for one month to cure mental retardation and epilepsy.
12	<i>Alternanthera sessilis</i> R.Br. Amaranthaceae, Madaranga	Herb	Whole plant, stem, leaf	Lactation, eye disease,	Decoction (100 ml) of the whole plant with one cup of milk once a day for 15 days is prescribed to feeding mother to increase lactation .Juice of stems and leaves is used to cure eye disease.
13	<i>Andrographis paniculata</i> Nees. Acanthaceae, 'Bhuin limba'	Herb	leaf	Malaria, intestine inflammation, stomach trouble	Cakes (each weighing approx 75g) are prepared by pounding 100g of leaves with 200g of 'Mandia' (<i>Eleusine coracana</i>) grains. Two cakes are prescribed for 2 days as a treatment for inflammation of the intestine due to microbial infection. Infusion of the leaf twigs is given in the morning for prevention of malaria and stomach troubles.
14	<i>Argemone mexicana</i> L. Papaveraceae, 'Kanta agara'	Herb	Latex	Leprosy	The latex of the stem is applied externally to cure wounds of leprosy.
15	<i>Aristolochia indica</i> L. Aristolochiaceae, 'Hansapada'	Climber	Leaf, root	Skin disease, boils, snake bite	The root powder mixed with honey is given to cure syphilis and boils. The juice of fresh root is given in snake-bite.
16	<i>Asparagus racemosus</i> Wild. Liliaceae, 'Satabari'	Herb	Root	Rejuvenator	Tuberous root powder (5g) mixed with 5 drops of honey is given to improve health and restore potency.
17	<i>Bambusa arundinacea</i> Wild. Poaceae, 'Kanta baunsa'	Herb	Root, leaf	Abortion, urinary disorder	Tender leaf paste of the plant mixed with seeds of <i>Sesamum indicum</i> , <i>Trigonella foenum-graecum</i> and honey, The paste is taken for 3 days for easy abortion. Root paste is taken to cure urinary disorder.
18	<i>Barleria prionitis</i> L. Acanthaceae, 'Daskerenta'	Shrub	Leaf, bark.	Cracking heel, ear-ache.	Few drops of leaf juice mixed with corpura are applied in ear to control ear-ache. The paste of dried bark is applied on cracking hills.
19	<i>Bauhinia racemosa</i> Lam. Caesalpiniaceae, 'Ambanasia'	Tree	Root	Joint pain	Root paste is applied externally to cure joint pain.
20	<i>Boerhavia diffusa</i> L. Nyctaginaceae, 'Puruni'	Herb	whole plant	Urinary trouble	The decoction (10ml) of whole plant and 4-5 drops of honey is given to cure urinary troubles.
21	<i>Bombax cieba</i> L. Bombacaceae, 'Simili'	Tree	Bark	Anemia	The juice of bark mixed with honey is given to cure anemia.
22	<i>Borassus flabellifer</i> L. Palmae, 'Tala'	Tree	Bark, flower	Skin infection, syphilis	Half cup of juice of inflorescence is given once daily in empty stomach for 7 days to cure syphilis. The powder of bark is used for skin diseases.
23	<i>Butea monosperma</i> (Lam.)Taub. Fabaceae, 'Palasa'	Tree	Root, bark, seed, latex	Tuberculosis, skin disease, piles, stomach trouble, diarrhoea	Root paste is used for tuberculosis. Seed paste is used to cure skin diseases. Latex mixed with honey is recommended to cure piles and stomach trouble. Decoction of bark is taken to cure diarrhoea.
24	<i>Bryonopsis laciniosa</i> Auct.Non(L.) Cucurbitaceae, 'Sibalingi'	Climber	Root, seed, fruit	Syphilis, stomach disorder, infertility in woman	Tender root paste is taken with water in empty stomach for stomach disorder. Crushed fruit mixed with gram seed and is used to cure syphilis. The seeds are taken to increase the fertility of women.
25	<i>Bryophyllum pinnatum</i> (Lam.) Oken. Crassulaceae, Amarpoi	Herb	Leaf	Inflammation, epilepsy, liver stone, bile stone	2-3 tender leaf is crushed finely and tied over the affected area for 6 hours and repeated for 3 days to cure inflammation. The crushed leaves are inserted into the mouth at the time of senselessness (epilepsy).Infusion of leaves is given in early morning to cure liver stone. Tender leaves are crushed mixed with wheat husk and administered to cure bile stone.
26	<i>Caesalpinia sappan</i> L. Caesalpiniaceae, 'Bada chakunda'	Tree	Heart wood, bark, seed	Tuberculosis, diarrhoea, dysentery, stomach aches, nervous disorders, inflammation	Decoction of wood and bark used to cure tuberculosis, diarrhoea and dysentery. Seeds are used for stomach aches and nervous disorders. Dried heartwood is used against inflammation.
27	<i>Calotropis gigantea</i> R.Br. Asclepiadaceae, 'Arakha'	Herb	Latex, leaf,	Hydrocele, wound healing	2-3 gently warmed leaf with castor oil (<i>Ricinus communis</i>) are bandaged over testicles everyday against hydrocele.The milky latex is applied to treat wounds caused by spines.

28	<i>Cassia fistula</i> L. Caesalpiniaceae, 'Sunari'	Tree	Root,	Purgative	25g of root of <i>Cassia fistula</i> and 10g bark of Arjuna are boiled in 150ml of water and the solution is taken on empty stomach early in the morning for free bowel movement.
29	<i>Cassia occidentalis</i> L. Caesalpiniaceae, 'Kala chakunda'	Herb	Fruit, Leaf	Bone Fracture, snake bite.	Leaf paste mixed with albumin of egg is applied on the fractured area to cure. Powdered fruit mixed with wheat husk is given to treat poisonous snake bite.
30	<i>Cassia tora</i> L. Caesalpiniaceae, 'Bana chakunda'	Shrub	Leaf	Skin disease	Paste of leaf is applied over skin to cure skin diseases.
31	<i>Chloroxylon swietenia</i> DC. Rutaceae, 'Bheru'	Shrub	Leaf	Wound healing	Dried leaf is applied for wound healing.
32	<i>Cissus quadrangularis</i> L. Vitaceae, 'Hadabhanga'	Shrub	Leaf, whole plant.	Bone fracture, stomach-ache,	The paste of Whole plant is applied over bone fractured part once daily till cure. Leaf paste is taken orally to cure stomach-ache.
33	<i>Citrus medica</i> L. Rutaceae, 'Lembu'	Shrub	Fruit,	Diarrhoea	Fruit is crushed, warmed slightly and taken to cure diarrhoea.
34	<i>Coccinia indica</i> Wight & Arn. Cucurbitaceae, 'Bana kunduri'	Climber	Leaf	Diabetes, jaundice, ear-ache	The juice of fresh leaves is used as ear drops for ear-ache. Fresh leaves along with leaves of <i>Kalanchoe pinnata</i> and sugar is mixed with water and taken twice a day for 4-5 days to cure jaundice. Leaf powder mixed with cow's milk is taken orally to treat diabetes.
35	<i>Cocculus hirsutus</i> Diels. Menispermaceae, 'Dadaya'	climber	Leaf	Bilious derangements	The juice of the leaves is given to cure bilious derangements.
36	<i>Curculigo orchoides</i> Gaertn. Hypoxidaceae, 'Talamuli'	Herb	Root	Rheumatism,	Roots (10-15g) are grounded with dried ginger (5g) and long pepper (5 nos.) and the paste is prescribed once in a day for 15 days for rheumatism.
37	<i>Cynodon dactylon</i> Pers. Poaceae, 'Duba'	Herb	Leaf, whole plant	Blood vomiting, wound	The leaf juice is taken to cure blood vomiting. Paste of the whole plant is applied on chronic wounds.
38	<i>Cyperus rotundus</i> L. Cyperaceae 'Mutha'	Herb	Tuber	Indigestion	The powder of tuber is taken regularly to check indigestion.
39	<i>Datura innoxia</i> Mill. Solanaceae, 'Dudura'	Herb	Leaf,	Intoxication, rheumatic pain	Juice of 'Datura' leaves mixed with the tobacco leaves, are chewed to induce more intoxication. The leaf paste along with equal amount of the leaf paste of 'Arakha' (<i>Calotropis gigantea</i>) is applied on the affected joints to cure rheumatic pain.
40	<i>Dodonaea viscosa</i> L. Sapindaceae, 'Mahada'	Shrub	Leaf, stem, root	Rheumatism, skin infections, diarrhoea, pains of hepatic, splenic origin, uterine colic,	The stem and roots are used for the treatment of rheumatism, skin infections and diarrhoea. The decoction of leaf is useful in the case of pains of hepatic or splenic origin and uterine colic.
41	<i>Dolichos biflorus</i> L. Fabaceae	Climber	Leaf, seed	Diabetes, diuretic	The seed is used as diuretic and paste of the leaves is taken orally as anti diabetic.
42	<i>Eclipta alba</i> Hask. Asteraceae, 'Kesadura'	Herb	Leaf	Jaundice, dantruff	The leaf boiled in hot water is mixed with extracts of <i>Leucas aspera</i> and <i>Phyllanthus amarus</i> and taken with butter milk twice a day for period of one week to cure jaundice. Leaf extract is used to relieve dandruff and to naturally blacken gray hairs.
43	<i>Euphorbia hirta</i> L. Euphorbiaceae, 'Hariharika'	Herb	Leaf, Flower, fruit, Latex	Asthma, respiratory tract, wound	The decoction of flowers and fruits are used for asthma and respiratory tract infections. The latex is used for healing of wounds.
44	<i>Euphorbia tirucalli</i> L. Euphorbiaceae, 'Khadisiju'	Shrub	Stem	Healing of Mumps,	The warm juice of stem is applied for healing mumps.
45	<i>Feronia elephantum</i> Corr. Rutaceae, 'Kaitha'	Tree	Fruit	Digestion	Matured fruits are taken for 15 days for digestion.
46	<i>Ficus benghalensis</i> L. Moraceae, 'Bara'	Tree	Bark, latex	Vigour, rheumatism, bleeding in piles	The bark powder with the equal quantity of root powder of <i>Withania somnifera</i> is taken with milk for vigour. The latex is used for rheumatism. A few drops of latex is mixed with milk is taken daily to cure bleeding piles.
47	<i>Ficus religiosa</i> L. Moraceae, 'Aswastha'	Tree	Bark	Rheumatic pains, tetanus	Bark pate is applied to control rheumatic joint pain and tetanus.
48	<i>Gardenia gummifera</i> L. Rubiaceae, 'Gurudu'	Shrub	Resin	Indigestion, constipation, abdominal	The exudates are used in the form of paste to treat indigestion, constipation, abdominal distention, colic pain, fever and skin diseases.

				distentions, colic pain, fever, skin diseases	
49	<i>Gloriosa superba</i> L. Liliaceae, 'Languli'	climber	Root, leaf.	Piles, Skin disease	Root is made into a paste with fresh cow urine and applied on piles twice a day for 7 days. Leaf powder is used for skin diseases.
50	<i>Gmelina arborea</i> Roxb. Verbenaceae, 'Gamhari'	Tree	Root, bark, leaf	Wound, headache, ulcers, snake-bite	Decoction of root bark is used for washing and healing of septic wounds. Leaf paste is applied to relieve headache and juice is used as wash for ulcers. Decoction of the root and bark is given internally for snakebite.
51	<i>Gymnema sylvestre</i> R.Br. Asclepiadaceae, 'Gudumari'	Shrub	Leaf	Diabetes	5-7 leaves with 3-5 <i>Piper longum</i> is taken to control blood sugar.
52	<i>Glycosmis pentaphylla</i> Retz. Rutaceae, 'Chauladhua'	Shrub	Leaf, root, stem	Intestinal worms, eczema, skin diseases, ulcer	Leaf juice is taken for intestinal worms, especially in children. Stems and roots are used for ulcer. Paste of leaves, with a bit of ginger is applied to eczema and other skin diseases.
53	<i>Helicteris isora</i> L. Sterculiaceae, 'Pitabaranda'	Shrub	Fruit, root	Wound healing, odalgescic	The decoction of the root mixed with turmeric powder is applied externally to treat cut and wounds. The fruit is boiled with sesamum oil, cooled and then the filtered oil (2-3 drops) is poured into the ear for odalgescic diseases.
54	<i>Hemidesmus indicus</i> L. Periplocaceae, 'Anantamula'	Herb	Root	Blood purification	2 spoonfuls of root extract mixed with honey is administered thrice a day for 2-3 weeks for blood purification.
55	<i>Holarrhena pubescens</i> (Buch.Han) Apocynaceae, 'Kurei'	Tree	Bark, seed, flower	Fistularia problems, malaria, dysentery.	The flowers are dried and powdered and made into tablets (1g) with cow's milk. One tablet thrice a day is taken for acute fistular problems. Stem bark infusion with honey in the ratio of 3:1 is taken once a day in empty stomach for dysentery. Bark of the plant and black pepper are powdered together and taken orally against malarial fever.
56	<i>Holoptelea integrifolia</i> Roxb. Ulmaceae, 'Dharanj'	Tree	Stem bark	Rheumatism	Stem bark decoction (20ml.) is taken twice a day for 7 days to cure rheumatism.
57	<i>Indigofera tinctoria</i> L. Fabaceae, 'Nil'	Shrub	Leaf, flower	Bronchitis, dry cough, respiratory infection, tuberculosis, burn	Leaf juice is used for bronchitis, dry cough, respiratory infection and tuberculosis. Paste of flowers is applied over the burnt area twice daily for 7 days.
58	<i>Ipomoea mauritiana</i> Jacq. Convolvulaceae, 'Bhuin kakharu'	Climber	Tuber	Gastric, stomach disorder	The tuberous is taken in raw to cure stomach disorders and gastric problems.
59	<i>Ipomoea sepiaria</i> Koeng ex., Roxb. Convolvulaceae, 'Muskani'	Herb	Whole plant, tubers	Laxative, diuretic	The juice of the whole plant is used as diuretic. The tubers are used for laxative.
60	<i>Jatropha gossypifolia</i> L. Euphorbiaceae, 'Lankajada'	Shrub	Latex of leaf, stem, bark, seed	Stomach-ache, digestion, dental problem, arthritis, skin diseases	Latex is taken orally to cure stomach-ache. Stem bark extract is taken before meal for digestion. Latex of the leaf is applied on dental problem. Seed oil is used for arthritis and skin diseases.
61	<i>Justicia gendarussa</i> L. Acanthaceae, 'Kalabasanga'	Herb	Leaf, root, shoot, flower	Asthma, rheumatism	Root extract with a little honey is given to cure asthma. Decoction of leaves, tender shoots and flower are given for rheumatism.
62	<i>Lantana camara</i> L. Verbenaceae, 'Nagaairi'	Shrub	Leaf, bark	Swelling, wound healing, leprous ulcers	Leaf juice is applied externally to treat cut and wounds. Leaves are boiled and applied for swellings. Bark is an astringent and used as a lotion for leprous ulcers.
63	<i>Leucas aspera</i> Spreng. Lamiaceae, 'Gayasa'	Herb	Leaf	Nose bleeding, scorpion sting	2-3 tender leaves and 1-2 black pepper is ground together and the extracted juice (2-3 drops) is put into the nose thrice a day for nose bleeding. The juice of leaf is applied for scorpion sting.
64	<i>Madhuca indica</i> Gmel. Sapotaceae, 'Mahula'	Tree	Flower	Cold, cough, headache	Decoction of flower boiled in water is given twice a day against cold, cough and headache.
65	<i>Mangifera indica</i> L. Anacardiaceae, 'Amba'	Tree	Cotyledon, bark	Blood dysentery, hair falling	Stem bark decoction (15ml) is taken in empty stomach twice a day for 3 days to cure blood dysentery. Pasty mass of cotyledons is applied on heads as a cure for falling of hairs.
66	<i>Melia azederach</i> L.	Tree	Fruit	Anthelmintic,	Fruits are grinded with water and given as an

	Meliaceae, 'Limba'			ectoparasite	anthelmintic. Decoction of fruit is used to remove ectoparasite.
67	<i>Mimosa pudica</i> L. Mimosaceae, 'Lajakuli'	Herb	Leaf, root	Gum bleeding, snake bite, Piles, fistula, aphrodisiac	The root and leaves in 2:1 ratio (by weight) are made into a paste; the paste is used as tooth paste to cure gum bleeding. The leaf extract is used for the treatment of piles and fistula. Root is used against cobra bite. Root powder combine with cow milk is used for aphrodisiac.
68	<i>Momordica charantia</i> L. Cucurbitaceae, 'Kalara'	Climber	Leaf	Diabetes	The paste of seven leaves is given daily on empty stomach for diabetes.
69	<i>Morinda citrifolia</i> L. Rubiaceae, 'Pindra'	Shrub	Leaf	Rheumatism, joint pain	10-20 ml of decoction of leaves is taken thrice a day for 7 days to cure rheumatism and to get relief from joint pain.
70	<i>Moringa oleifera</i> Lam. Moringaceae, 'Sajana'	Tree	Leaf	Hypertension	Leaves are boiled in water and one tumbler is taken early in the morning in empty stomach for hypertension.
71	<i>Mucuna pruriens</i> L. Fabaceae, 'Baidanka'	Climber	Seed, root	Diarrhoea, fever, body pain	Half teaspoonful of seed powder is taken to cure diarrhoea. The root of this plant and <i>Tragia involucrata</i> are powdered in equal proportions and 2g of this powder is given once a day for three days to children suffering from fever and body pain. 5-10g of this powder is given to elderly people for the same disease.
72	<i>Nyctanthes arbortristis</i> L. Nyctaginaceae, 'Gangasiuli'	Tree	Leaf	Malaria	Fresh leaf juice mixed with honey is given to cure malarial fever.
73	<i>Opuntia dillenii</i> Haw. Cactaceae, 'Nagapheni'	Shrub	Pulp	Eye disease	Decoction of the pulp is applied externally for eye disease.
74	<i>Oroxylum indicum</i> Vent. Bignoniaceae, 'Phanphena'	Tree	Root, seed	Stomach trouble, cough, bronchitis	Roots are used to cure stomach trouble. Decoction of seed is used for the treatment of cough and bronchitis.
75	<i>Pergularia extensa</i> (Jacq.) N. E. Br. Asclepiadaceae, 'Uturudi'	Climber	Leaf	Cold, fever	Leaf juice is given for 7 days early in the morning to cure cold and fever.
76	<i>Phaseolus calcaratus</i> Roxb. Fabaceae, 'Bana muga'	Herb	Whole plant	Fever, gout	Decoction of whole plant is given to control fever and gout.
77	<i>Piper longum</i> L. Piperaceae, 'Pipali'	Herb	Fruit	Throat infection	Piece of sugar candy along with a long pepper is kept in mouth and sucked slowly to cure throat infection.
78	<i>Polyalthia cerasoides</i> Roxb. Anonaceae, 'Champati'	Tree	Bark	Diabetes	Two teaspoonful of the bark juice is taken for 5-10 days to cure diabetes.
	<i>Pongmia glabera</i> Vent. Fabaceae, 'Karanja'	Tree	Bark, stem	Post-delivery complications, tooth decay	The bark (15g) boiled in 100ml of water is filtered and the filtrate is given for post-delivery complications. This mixture is taken slightly with warm water to accelerate delivery. Young branch is used as tooth brush to check tooth decay.
79	<i>Psidium guajava</i> L. Myrtaceae, 'Pijuli'	Tree	Fruit	Loose motion	The paste of immature fruit is used to check loose motion.
80	<i>Pterocarpus marsupium</i> Roxb. Combretaceae, 'Piasala'	Tree	Leaf	Diabetes	Leaves are kept overnight in water in a container and taken in the morning in empty stomach for diabetes.
81	<i>Plumbago zeylanica</i> L. Plumbaginaceae, 'Raktachittrak'	Shrub	Root	Indigestion	Two teaspoonful root powder is taken after meal for indigestion.
83	<i>Rauwolfia serpentina</i> L. Apocynaceae, 'Patalagaruda'	Shrub	Root, leaf	Snake bite, malaria	One teaspoonful root powder mixed with black pepper is taken with a cup of water twice a day for two days to cure snake-bite. Leaf Juice mixed with the juice of <i>Andrographis paniculata</i> , <i>Azadirachta indica</i> and honey is given for 7 days to cure malaria.
84	<i>Saraca indica</i> (Auct., non., L.) Sapotaceae, 'Asoka'	Tree	Leaf	Diabetes	One teaspoonful of leaf powder with water is taken for diabetes.
85	<i>Schleichera oleosa</i> Lou. Sapindaceae, 'Kusuma'	Tree	Seed, stem bark,	Rheumatism, itching, gout, scabies	Seed oil is applied gently on affected part to cure rheumatism, gout and scabies. Stem bark paste is applied on skin before bed as curative against itching.
86	<i>Semecarpus anacardium</i> (L.f.) Anacardiaceae,	Tree	Seed	Relieve body pain,	Extracted seed oil is massaged twice a day for one week for body pain.

	'Valia'				
87	<i>Shorea robusta</i> Gaertn. Dipterocarpaceae, 'Sala'	Tree	Seed, stem	Stomach pain, Earache	Powdered seeds are given for stomach pain. Filtered stem juice is used for earache.
88	<i>Sida cordifolia</i> L. Malvaceae, 'Bisiripi'	Herb	Leaf, root	Nervous disorder, facial paralysis, asthmatic bronchitis	Decoction of root is used for nervous disorder and facial paralysis. The leaves are used for the treatment of asthmatic bronchitis.
89	<i>Smilax zeylanica</i> L. Euphorbiaceae, 'Muturi'	Shrub	Root	Dysentery, gastric problem	Decoction of boiled root with honey is given to cure gastric problem. Root paste is used for dysentery.
90	<i>Solanum xanthocarpum</i> Schrat. Solanaceae, 'Ankaranti'	Herb	Leaf, fruit, seed	Tooth-ache, cold & cough, bronchial asthma	The seeds are crushed and smoked. The smoke is held up in mouth for few seconds as a treatment for tooth-ache. By doing so the worms are get expelled. The fruit powder is taken to cure cold and cough. The leaf juice is given for bronchial asthma.
91	<i>Stereospermum suaveolens</i> Roxb. Bignoniaceae, 'Patuli'	Shrub	Root	Nervous disorder	Root paste is given two times a day for 15-30 days for nervous disorders.
92	<i>Strychnos nuxvomica</i> L. Strychnaceae, 'Kochila'	Shrub	Seed	Conjunctivitis, gastritis, dyspepsia	The paste of the seed is applied in conjunctivitis. Seeds are used for gastric trouble and dyspepsia.
93	<i>Swertia angustifolia</i> Buch. Gentianaceae, 'Chireita'	Herb	Leaf	Skin disease, diabetes	The leaves are kept in water overnight. It is filtered early in the morning and taken to cure skin diseases. It is also used to control blood sugar.
94	<i>Syzygium jambolanum</i> (Lam.) DC. Myrtaceae, 'Jamu'	Tree	Seed, bark	Diabetes, kidney stone	About ½ teaspoon seed powder mixed with honey is taken twice daily for 20-30 days to cure diabetes. Teaspoonful of stem bark juice with a pinch of pepper powder and cow milk is used to dissolve stone in kidney.
95	<i>Tamarindus indica</i> L. Caesalpinaceae, 'Tentuli'	Tree	Seed	Wound healing, snake bite	Paste prepared from seeds is used for wound healing and snake bite.
96	<i>Tephrosia purpurea</i> L. Fabaceae, 'Kulathi'	Shrub	Root, whole plant	Stomach-ache, cardiovascular disease	Root paste is given to relieve stomach-ache. The whole plant is used to cure cardiovascular disease.
97	<i>Terminalia alata</i> (Heynt., ex., Roth) Combretaceae, 'Asana'	Tree	Bark	Relieve chest pain	Decoction of boiled bark is taken to relieve chest pain.
98	<i>Terminalia arjuna</i> Wight., Am Combretaceae, 'Arjuna'	Tree	Bark	Urinary problem	Bark powder of <i>Terminalia arjuna</i> mixed with juice of <i>Adhatada vasica</i> and <i>Helicteres isora</i> is given twice a day for seven days to cure urinary problem.
99	<i>Terminalia chebula</i> Obs. Combretaceae, 'Harida'	Tree	Fruit	Digestive problem	One teaspoonful of fruit powder is given with warm water once daily before going to bed.
100	<i>Thespesia populnea</i> Roxb. Malvaceae, 'Habeli'	Tree	Bark, root	Skin infection, liver disease, dysentery, cholera	The decoction of the bark is used for treatment of skin and liver disease. The bark and root decoction is used for dysentery and cholera.
101	<i>Tinospora cordifolia</i> Wild. Minispermaceae, 'Guluchi'	Climber	Stem, leaf	Urinary tract infection, diabetes	Stem powder (10g) with 2-3 g of black pepper (<i>Piper nigrum</i>) powder are prescribed for 7 days to cure urinary tract infection. The leaf juice (10ml) with 3-5 drops of honey is prescribed for reducing blood sugar.
102	<i>Tribulus terrestris</i> L. Zygophyllaceae, 'Gokhura'	Herb	Fruit, whole plant	Dysuria, urinary troubles,	Infusion (15 ml) of matured fruits is taken early in morning in empty stomach for dysuria and urinary troubles. Decoction (15 ml) or powder (5g) of the whole plant is given as health tonic.
103	<i>Tylophora asthmatica</i> (Wight., Am.) Asclepiadaceae, 'Inturudia'	Herb	Leaf, root	Asthma	Leaves and roots in equal ratio made into a paste, 1-2 teaspoonfuls is taken orally with milk twice a day for 30 day for asthma.
104	<i>Urginea indica</i> Roxb. Liliaceae, 'Bana pija'	Herb	Bulb	Heart disease, joint pain	The paste of the bulb is applied externally for joint pains. The juice of the bulb is taken for heart disease.
105	<i>Vernonia anthelmintica</i> L. Asteraceae, 'Somoraja'	Herb	Fruit, seed	Cold fever stomach- ache, skin disease.	The paste of the seed is applied to cure skin disease and stomach-ache. The fruit powder is used for cold fever.
106	<i>Ventilago madraspatana</i> Gaertn. Rhamnaceae, 'Raktapita'	Shrub	Bark	Snakebite	The barks are boiled in water for 2 hours and the infusion is given orally for snake bite.
107	<i>Vitex negundo</i> L. Verbenaceae, Begunia	Shrub	Leaf, flower	Cold, fever, cardiac disorders, diarrhoea	Tender leaves juice is given for cold and fever. Powdered flower are given with milk to treat diarrhoea and cardiac disorders.
108	<i>Withania somnifera</i> Dun.	Shrub	Leaf, root	Adenopathy,	The root powder boiled with cow milk is used for

	Solanaceae, 'Aswagandha'			asthma, hypertension, tuberculosis	adenopathy, asthma and hypertension. The leaves are used to cure tuberculosis.
109	<i>Zingiber officinale</i> Rose. Zingiberaceae, 'Ada'	Herb	Rhizo-me	Cough and cold, indigestion, liver disease, dysuria	Dried ginger boiled with palm sugar candy is taken for chronic cough and cold. The fresh juice of ginger is useful for indigestion and liver diseases. Half a teaspoonful of the rhizome powder with cold water is prescribed at night for 15 days to cure chronic dysuria.

4. Conclusion

The results of our study in Dhenkanal district demonstrate the importance of folk knowledge about medicinal plants in treating various human ailments. However, the area is losing its natural vegetation cover with the medicinally valuable species. Most of the tree species are getting very rare as confirmed by elders and observation during the field work. Tree species are facing threats in their natural habitats from various human activities. The higher population explosion and limited resources in India demand that some alternative means of health care be examined and implemented. In this context, phototherapy resources for health care appear relevant as it requires no special resources, sophistication or expertise in production, preparation and usage. So it has become a necessity to collect record and pharmacologically evaluate the useful alkaloids, tannins, resins or any other beneficial plant product available from the local vegetation for better health care in Odisha. The recording and preserving of folk knowledge is pressing and fundamental.

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