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TRADITIONAL PHYTOTHERAPY IN BHADRAK DISTRICT OF ODISHA, INDIA

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ABSTRACT:

Human health care is a major challenge in India constrained by meager economic resources and lack of trained manpower. Traditional medicine practiced from ancient period in rural India could be an alternative and sustainable solution to this challenge. The main objective of the present investigation was to document the phytotherapeutic knowledge and health care management practices in the interior of Bhadrak district, Odisha, India. The field study was carried in from July 2013 to June 2014 using structured questionnaires, complemented by unstructured interviews and informal conversations with local people engaged in traditional health care practices. Therapeutic use of 53 plant species belonging to 33 families was recorded. Different plant parts like leaf, root, bark, flower, seed and whole plant were found used in raw or cooked form against 46 specific diseases. Prominent among them were cardiovascular ailments, diarrhoea, jaundice, skin ailments and rheumatism. The reported species may be tried clinically for their efficacy

and can be used for the development of new, cheep, effective, and eco-friendly herbal formulations for human health care management.

KEY WORDS: *Folklore, Phytotherapy, Traditional knowledge, Medicinal plants.*

INTRODUCTION:

Scientists have developed a number of herb-based medicines to treat some common and serious diseases such as anti-hypersensitive Reserpine from *Rauvolfia serpentine*; the anticancer Vinblastine and Vincristine from *Catharanthus roseus*; antimalaria Quinine from *Cinchona ladgeriana*; the pain killer Morphine and the anti-cough Codeine from *Papaver somniferum* etc. (Satyavati, 1994; Yarnell, 2000). However, they have often found that the herbs themselves, which possess unique combinations of chemical components, are more effective than the chemical derivatives (Li, 2002). Thus, in one approach, medical science has also focused on the medicinal values of the herbs themselves and how they could best be incorporated into medical practice. Although synthetic medicine continues to progress, the value of medicinal plants are still in practice. Indigenous knowledge based on herbal therapy has always played a pivotal role in the health care systems of many countries. Medicinal plants and plant products in India have been in use, under indigenous systems of medicine like Ayurveda, Sidha and Unani and functions mainly through two systems. Folk system (based on oral traditions, practiced by villagers and the tribal communities) and classical system (based on theoretical knowledge, experimental and philosophical explanations provided by many learned physicians and surgeons of earlier time (Charak Samhita, 1000-800 BC), 'Sushrut (Sushrut Samhita, 800-700 BC) and Vagbhata's 'Astanga Hridaya'. This knowledge so accumulated over the years was improved upon and is being transmitted orally from generation to generation in the form of folklore and folk sayings (Agarwal, 1981; Singh *et. al.*, 2002). According to World Health Organization (WHO), as many as 80% of the world's people depend on traditional medicine for their primary healthcare needs, and a majority of them use plants (Dubey *et. al.*, 2004; Singh et al., 2010).India's varied climate i.e. from alpine in Himalayas to tropical wet in the south and arid in Rajasthan state have given rise to rich biodiversity of medicinal plants (Dubey *et. al.*, 2004). According to the all India coordinated research project sponsored by the Ministry of Environment and Forest, New Delhi, 40% of 18,000 recorded flowering plants have ethnomedicinal value; and scientific validation of these plants can very well prove them as potential source of new drugs (Pushpangadan, 1997). Living close to nature, traditional societies have acquired unique knowledge about the use of wild flora, most of which are unknown to the people who live away from such natural ecosystem as forests. However, the knowledge of herbal medicines is gradually freezing, although some are still practicing the art of herbal healing effectively. After years of observations and analysis, trials, error, experimentation or even by use

of intuitive methods, some innovative people have selected/identified useful members of the flora used for such purposes.

Odisha, one of the states of eastern India, has vast genetic resources amid complex cultural diversity. It has four geographical regions i.e. southern Odisha, western Odisha, central Odisha and northern Odisha. The northern region is constituted with three districts namely Bhadrak, Balasore and Mayurbhanj.There have been many publications on the ethnomedicinal uses of plants from different districts of Odisha (Girach et al., 1998; Uma and Behera, 1998; Nayak *et. al.*, 2004; Panda *et. al.*, 2005; Pandey and Rout, 2006; Rout and Pandey, 2007; Rout *et. al.*, 2009; Sahoo and Satpathy, 2009; Panda, 2010). But, Bhadrak district has hardly been studied(Girach, 1997).So, ethnobotanical exploration have been conducted in different parts of this district, with the purpose of gathering information on traditional use of such plants for the treatment of different ailments. Our aim was to interact with the local folk and traditional healers to collect, record, analyse and report this knowledge on medicinal plants and their uses.

STUDY AREA:

Bhadrak district (20°43'-21°13'N and 86°6'-87° E) is situated in the north eastern part of Odisha and covers an area of 2505 km^2, with a population of 13.34 lakhs (2001 Census). It is bordered by Balasore district in the North, Jajpur in the South, Bay of Bengal and Kendrapara district in the East and Koenjher in the Western part (Figure 1). The district accounts for 1.61% of the state's territory and shares 3.62% of the state's population. Most of its people live in villages (89.42%) and agriculture is their main occupation. The climate of the district is warm and humid with three distinct seasons. The rainy season (mid June to mid October), winter (mid October to February) and summer (March to mid June). The air temperature ranges from 38°C in summer to 13°C in winter and the annual average rainfall is approximately 1,550mm. The district is located in the deltaic region with close proximity to the Bay of Bengal.

METHODOLOGY:

In Bhadrak district, phytotherapy form an integral part of the local culture. The information about plants and their uses are passed from generation to generation through oral folk lore. The elderly people primarily are natural retainers of traditional knowledge in their respective communities. The field study was carried out monthly from July 2013 to June 2014 following established and standard procedures (Jain and Rao, 1977; Jain, 1987; Martin, 1995). Information's on the use of medicinal plants were obtained through structured questionnaires, complemented by free interviews and informal conversations (Huntington, 2000). The "native specialists" were interviewed, who were considered by the community as having exceptional knowledge about the use of plants for different ailments. Eighty nine (65 men and 24 women) persons belonging to three different age groups were interviewed. Among these persons, 10%

were at age of 21-40 years, 50% were at age of 41-60 years and the remaining 40% were 61 years or more. Surveys were conducted in different villages of the district**.** Knowledgeable persons or medicine men (Kaviraj), experienced and aged persons, local healers of the villages were consulted for recording local name, parts of plants used, methods of drug preparation and recommended doses. 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 (Cunningham, 2001). Interviews with people in pastures or forests were also conducted on a systematic basis to know more details about plant species, their management and distribution. The collected specimens were identified by using standard floras and available literatures (Haines, 1925; Saxena and Brahmam, 1996). The list of medicinal plants were depicted in a tabular form along with their botanical names followed by family, their local names in Oriya if any and the parts used for medicinal purpose.

RESULTS AND DISCUSSION:

A total of fifty three plant species belonging to 33 families were recorded as being used to treat different ailments (Table 1; Figure 2-13). Acanthaceae was the most prominent family represented by four species followed by Asteraceae, Fabaceae, Mimosaceae and Rutaceae with three species each. Amaranthaceae, Caesalpiniaceae, Convolvulaceae, Euphorbiaceae Malvaceae, Nyctaginaceae, Poaceae, and Portulaceae family were represented by two species each, whereas, the remaining families were monospecific. Of the reported growth forms, herbs make up the highest proportion of the medicinal species comprising 49% followed by shrubs 23%, trees 19% and climber's 9% respectively (Figure 14).The preferential use of herbs over other growth forms for medicinal purposes is due to better availability of these forms in the study area. Such an observation draws support from the studies of Addo-Fordjour *et. al.,* (2008) and could be attributed to their wide range of bioactive ingredients (Gazzaneo *et. al.,* 2005). Traditional healers claimed that, some medicines prepared by mixture of two or more plants are more potent than those prepared with single plant. The use of multiple plant prescriptions in the treatment of diseases has previously been documented (Cano and Volpato 2004; Ayyanar and Ignacimuthu,2005; Bussmann et al., 2010; Vandebroek *et. al.*, 2010; Wodah and Asase, 2012).Both fresh and dried plant materials were used in the preparation of the single and multiple-plant prescription medicines although fresh materials were generally used. Leaf is predominantly used as a remedy for various ailments (32.9 %), followed by root (17.7 %), whole plant (12.7 %), seeds and bark(8.9 %) and the remainders were fruits, flower, tuber, stem, latex, thorn and pulp (Figure 15). The common use of leaves have also been made in earlier studies (Panda, 2010;Panghal et al., 2010) which may be due to easy finding of this plant part and its availability during all seasons of the year. This practice helps to increase the chances of species survival and enhances the sustainable management of plants than the use of roots and/or the whole plant. The percentage of use of aerial plant parts were higher (79.8 %) than that of underground parts (20.2 %). Forty plants (76 %)

were categorized as wild, while eight plants (15 %) were listed as semi-cultivated and five (9 %) as cultivated plants(Figure 16).Other research has also documented the dominance of wild plants in medicinal use (Yarnell, 2000; Li, 2002; Dubey *et. al.*, 2004; Rout *et. al.*, 2009; Ayyanar and Ignacimuthu, 2005; Panghal *et. al.*, 2010)..The liquid preparations were usually prepared with water and drunk regularly with either glass cup or teaspoon as appropriate measure. The data collected show that majority of medicines are taken orally. The patients were advised not to take improper diet and to avoid any sour substance while undergoing treatment. The herbal medicines prescribed contained other non-plant ingredients such as black salt, salt (sodium chloride) and sugar candy although plants formed the major constituents in these remedies. The addition of non-plant materials to herbal medicines has previously been documented (Asase and Oppong-Mensah, 2009; Chintamunnee and Mahomoodally, 2012) and sometimes it is just to improve the taste of the remedy**.** During the period of investigation, it was found that besides traditional herbal healers, every elderly person both man and woman in the study area have sound knowledge and understanding about medicinal use of some plants, especially those species which are often used for curing common diseases like fever, poisoning, cough and cold, wounds, cuts etc.

The reported plants are used to cure 46 kinds of diseases and/or illness. The study found that the plants recorded are highly valuable for medicinal uses including diarrhoea, dysentery, gonorrhea, leprosy, paralysis, piles, stomach complaints, ulcer, wounds, cholera, diabetes, liver complaints, skin diseases, throat infections, urine complaints, snake bite, malaria, menstrual complaints, rheumatism, tuberculosis and dog bite. Various workers have investigated and reported the medicinal uses of some plants in different countries of the world (Liu, 2009; Joshi *et. al.*, 2011 ; Papovic *et. al.*, 2012; Alan *et. al.*, 2012; Jamal, 2012; Wangyal, 2012; Azam, 2014; Rajamanoharan,2014) . The present report on the use of plants for medicinal purposes draws support from earlier studies in different parts of India(Chandola and Singh,2003; Kingston,2007; Lal and Singh, 2008; Namsa *et. al.*, 2009; Sankaranarayanan *et. al.*, 2010; Sharma and Kumar, 2011). Some of the studied plants are also frequently used in different districts of Odisha (Girach *et. al.*, 1998; Uma and Behera, 1998; Nayak *et. al.*, 2004; Panda *et. al.*, 2005; Pandey and Rout, 2006; Rout and Pandey, 2007; Rout *et. al.*, 2009; Sahoo and Satpathy, 2009; Panda, 2010).The study provides sufficient ground to believe that the traditional practice using native medicinal plants is alive and well functioning in the study area.

CONCLUSION:

The present study indicates that folk ‘domestic medicine’ is still exist among people and play a significant role in the treatment of various human ailments and also testifies ancient traditions in rural areas of Bhadrak district, Odisha. 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 this region. Efforts should be taken to start eco-sustainable cultivation and harvesting programs, and, most importantly, the conservation of local phytotherapeutic knowledge.

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Table 1. Ethnomedicinal inventory of Bhadrak district, Odisha, India

Botanical name, family, local name(Odia)	Habit	Parts used	Disease/Condition	Mode of application
Abrus precatorius L. Fabaceae, 'Kaincha'	Herb	Whole Plant	Fever	Two teaspoonfuls decoction of whole plant is taken orally twice daily for fever.
Abutilon indicum G.Don. Malvaceae, 'Pedipedika'	Herb	Leaf	Blood dysentery, fever and skin allergy	Leaf is crushed and the extracted juice is taken for blood dysentery, fever and skin allergy.
Acacia arabica Wild. Mimosaceae, 'Babura'	Tree	Bark, tender leaf	Tooth infection, diarrhea	Bark of *Acacia arabica* and *Mangifera indica* are boiled and the vapour is allowed over affected part. Tender leaves with black cumin seeds is taken to cure diarrhea.
Adathoda vasica Nees. Acanthaceae, 'Basanga'	Shrub	Leaf, root	Cough, bronchodilator	Fresh leaf and root is crushed with ginger to make a paste. The paste is taken orally.
Achyranthus aspera L. Amaranthaceae, 'Apamaranga'	Herb	Leaf, root, young shoot.	Dog bites, tuberculosis	The young shoots of the plant and the bulb of *Allium sativum* are fried and are used along with mustard oil internally in the case of dog bite. Burned root ashes are applied on the teeth infected with worms for reducing pain and as well as to expel the dead worms out. The juice extracted from the leaf is used to treat primary infection of tuberculosis.
Albizzia lebbeck Benth. Mimosaceae, 'Sirisa'	Tree	Bark, seed, flower	Rheumatism, piles, bronchitis, coughs.	Decoction of bark is given for rheumatism and hemorrhage. Seeds are grinded to make a paste and taken orally for piles. Decoctions of flowers are used in cough and bronchitis.
Alternanthera sessilis R.Br. Amaranthaceae, 'Madaranga'	Herb	Whole plant	Antihelmenthic	Leaves and stems are roasted and taken orally.
Andrographis paniculata Nees. Acanthaceae, 'Bhuin limba'	Herb	whole plant	Fever, warts	Leaf infusion is taken orally to cure fever. 5gm of plant powder mixed with one teaspoonfuls of honey made into pills and given orally to cure warts.
Argemone mexicana L. Papaveraceae, 'Kanta kusum'	Herb	Seed	Viral fever	Extract of seeds is taken.
Aristolochia indica L. Aristolochiaceae, 'Hansapada'	Climber	Root	Snake bite,	10 g root with 7 long peppers is grinded to make a paste. The paste is given as antidote for snake bite.
Asparagus racemosus Wild. Liliaceae, 'Satabari'	Herb	Root	Diarrhea, cough ,bronchitis	The decoction obtained from root is used to cure diarrhea, cough and bronchitis. The root boiled with cow milk is used for increasing milk secretion during lactation. Root tuber is eaten raw to remove kidney stones.
Bambusa arundinacea Wild. Poaceae, 'Kanta baunsa'	Herb	Leaf	Gout	Aqueous extract of leaf is taken orally for gout.
Boerhavia diffusa L. Nyctaginaceae, 'Goudapuruni'	Herb	Leaf, root	Kidney stones, jaundice	Leave paste is taken orally for the removal of kidney stones; the root paste is taken orally to cure jaundice.
Borassus flabellifer L. Palmae, 'Tala'	Tree	Bark, leaf,	Skin infection, dysentery	Juice of tender leaf mixed with water is taken to cure dysentery; barks boiled in water are used for skin infection.
Barleria prionitis L.	Shrub	Leaf, bark,	Fever, toothache,	The juice of the leaf is used to treat cataract fever and

Acanthaceae, 'Daskerenta'		Root	glandular swelling.	the fresh leaves are chewed to relieve toothache. The paste of the root is effective for glandular swellings.
Bombax cieba L. Bombacaceae, 'Simili'	Tree	Thorn, root	Gynecological disorder	Thorn paste with cow milk is applied on pimples. Root paste with unboiled cow milk is taken to regulate the menstruation and with black pepper it is used to control white discharge.
Bryophyllum pinnatum (Lam.)Oken. Crassulaceae, Amarpoi	Herb	Leaf	Dysentery	Fresh leaf paste with black pepper is taken to cure dysentery.
Calotropis gigantea R.Br.Asclepiadaceae, 'Arakha'	Herb	Root	Leucoderma	Root powder is sprayed locally for leprosy and leucoderma.
Cassia fistula L. Caesalpiniaceae,'Sunari'	Tree	Leaf	Jaundice, constipation	Extract of leaves is taken orally against jaundice, constipation and antihelminthes. Decoction of leaves is applied locally on leprosy.
Coccinia indica Wight & Arn.Cucurbitaceae,'Bana kunduri'	Climber	Leaf, root	Antidiabetic	Paste of root and juice of leaf are used for diabetes.
Curculigo orchioides Gaerth.Amarylladaceae, 'Talamuli'	Herb	Root	Skin disease	Paste of root is applied over affected parts.
Cyperus rotundus L. Cyperaceae, 'Mutha'	Herb	Tuber	Jaundice	Crushed tuber powder with water is taken orally.
Cynodon dactylon Pers. Poaceae,'Duba'	Herb	Whole Plant	blood vomiting, chronic wounds	The juice extracted from leaf is taken orally for blood vomiting. The whole plant is crushed, makes a paste and applied over chronic wounds.
Cassia tora L. Caesalpiniaceae, 'Bana chakunda'	Shrub	Leaf	Skin disease	Paste of leaves is applied on skin to cure skin disease.
Citrus medica L. Rutaceae,'Lembu'	Shrub	Fruit, seed,	. Indigestion , inflammation	Fresh fruit juice is taken orally for indigestion and seed paste is used for inflammation.
Corchorus capsularis L. Tiliaceae, 'Nalita'	Herb	Leaf	Dysentery	Leaf juice is taken orally to cure dysentery.
Eclipta alba Hassk. Asteraceae, 'Bhrungaraj'	Herb	Whole plant,	Jaundice, leucoderma, liver complaints	Two teaspoonfuls decoction of whole plant is taken orally twice daily to cure Jaundice, leucoderma and liver complaints.
Euphorbia hirta L. Euphorbiaceae, 'Hariharika'	Herb	Flower, fruit, Latex	Diarrhea and dysentery.	The decoction of flowers and fruits are used for treatment of diarrhea and dysentery. Latex is externally applied for wounds.
Feronia elephantum Corr. Rutaceae, 'Kaitha'	Tree	Fruits, leaf	Digestive, anti dysenteric	Pulp of unripe fruit is used for dysentery. Juice of young leaf mixed with milk and sugar candy is used for intestinal disorder.
Ficus benghalensis L. Moraceae, 'Bara'	Tree	Leaf, latex	Diarrhea	Leaf extract is taken orally in diarrhea. Few drop of the latex is taken orally to overcome sexual impotency.
Ficus religiosa L. Moraceae, 'Aswastha'	Tree	Stem, bark	Gonorrhea	Stem bark in the form of paste is applied to cure gonorrhea.
Glycosmis pentaphylla Retz.Rutaceae, 'Chauladhua'	Shrub	Leaf, root.	Anemia, jaundice	Fresh bark is grinded and half cup of bark decoction is taken orally twice daily for anemia and jaundice.
Ipomoea mauritiana Jacq.Convolvulaceae, 'Bhuin kakharu'	Climber	Tuberous root	Gastric, stomach disorder	Root tubers are sundried and grinded into powder. The powder of 1-2 teaspoonfuls is taken with warm water to cure gastric and stomach disorder.
Ipomoea sepiaria Koeng ex.,Roxb.Convolvulaceae,'Muskani'	Herb	Whole plant	Laxative	Extract of whole plant is used as laxative.
Jatropha curcas L. Euphorbiaceae, 'Lankajada'	Shrub	Latex of leaf, seed, bark.	Oral ulcer, skin disease, rheumatism	Oil is extracted from the seed and applied over the effected part to cure parasitic skin diseases and oral ulcer. Barks are sundried and grinded into rust. The rust of 1-2 teaspoonfuls is prepared as tea and taken

				for one month to cure rheumatism.
Justicia gendarussa Burn.f. Acanthaceae, 'Kalabasanga'	Herb	Leaf	Cold , cough,	Leaf juice of three teaspoonfuls is taken thrice a day before food for 3-7 days for cough and cold.
Lantana camara Roxb. Verbbenaceae,'Nagaairi'	Shrub	Leaf	Tetanus	Decoction of leaf is taken orally for tetanus.
Leucas aspera Spreng. Lamiaceae, 'Gayasa'	Herb	Leaf	Piles	Decoction of leaves with goat milk is taken orally for piles.
Moringa oleifera Lan. Moringaceae,'Sajana'	Tree	Root	Snakebite	Root is crushed to make a paste. The paste is applied in toothache to get relief of poisonous effect of snakebite.
Mucuna pruriens L. Fabaceae,'Baidanka'	Climber	Seed	Fertility improver, nervous disorder	The seed is boiled with cow milk; sunshade dried seed powder with water is effective in treating male sterility and nervous disorder.
Mimosa pudica L. Mimosaceae,'Lajakuli'	Herb	Leaf, root	Insomnia, snake bite	Leaf extract is used in treatment of headache, migraine, insomnia. Root is used against cobra bite. Root powder combine with cow milk is used for aphrodisiac.
Mirabilis jalapa L. Nyctaginaceae	Herb	Leaf	Cold at child birth	1/2 teaspoonful of leaf extract for 3-5 days is very effective for cold at child birth.
Nerium oleander L. Apocynaceae, 'Karabiro'	Shrub	Leaf	asthma, bronchitis	Decoction of leaves is used to cure asthma, bronchitis.
Opuntia dilleni Haw. Cactaceae,'Nagapheni'	Shrub	Pulp	whooping cough, hepatitis, constipation, asthma	Decoction of pulp is taken to cure whooping cough, hepatitis, constipation, asthma.
Passiflora foetida L.Passifloraceae, 'Bisiripi'	Climber	Leaf, Fruit	Blood purifier, burns and scabies	The leaves are burnt and the ash mixed with cow ghee is applied in burns and scabies. Raw ripen fruit is very effective as blood purifier.
Pongmia glabera Vent. Fabaceae,'Karanja'	Tree	Bark, Seed	Skin disease	Methanolic extract of seeds and bark is applied over the effected part.
Portulaca oleracea L. Portulaceae, 'Badabalbalua'	Herb	Whole plant	Blood purifier, burn, head ache and burning sensation	Juice of whole plant is applied in affected areas and taken orally as blood purifier.
Portulaca quadrifida L. Portulaceae, 'Balbalua'	Herb	Whole Plant	Anti-scorbic, skin diseases	The whole plant is used for anti-scorbic, skin diseases.
Sida cordifolia L. Malvaceae,'Bajramuli'	Herb	Leaf, root	Diuretic, skin disease	Juice of leaves is applied as cooling in cuts and wounds, the roots possess diuretic and tonic properties administered for nervous disorders.
Strychnos nuxvomica L. Strychnaceae,'Kochila'	Tree	Fruit , seed	Paralysis	Powdered dried fruits and seeds are taken for paralysis.
Tridax procumbens L. Asteraceae, 'Bisalyakarani'	Herb	Leaf, whole plant	Blisters, boils, cuts & wounds, eczema, sores, stomachache, toothache, ulcers	Leaf paste is used to cure, boils, cuts, sores, wounds and eczema. One teaspoonfuls juice of whole plant is taken orally twice daily to cure stomachache, toothache, ulcers. Leaf paste is very effective for wound place of leprosy.
Vernonia cinerea Less. Asteraceae, 'Poksunga'	Herb	Whole plant	Cholera, constipation, piles, skin diseases, threadworm, spleen complaints and wounds	The whole plant juice of 1-2 teaspoonfuls is taken twice a day before food for 3-7 days for constipation and cholera. Leaf paste is very effective for piles, skin diseases, threadworm, spleen complaints and wounds.
Vitex negundo L. Verbenaceae, 'Begunia'	Shrub	Leaf	Cough, rheumatism	Infusion of leaves is taken for cough. Fresh leaf paste is applied on the affected part to cure rheumatism.

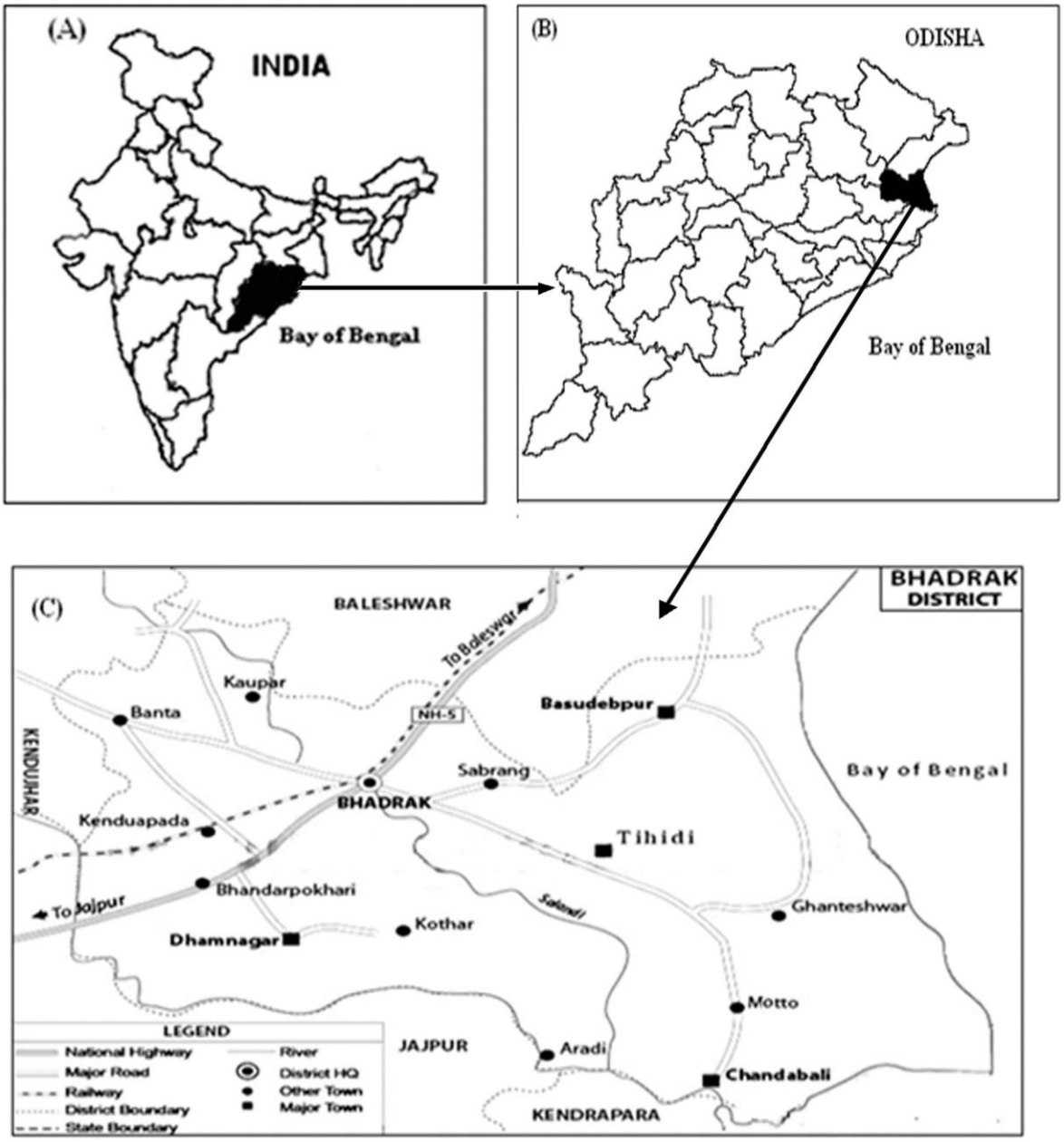

Figure 1. (A) location of the Odisha state in the eastern region of India, (B): location of Bhadrak district and (C) study area showing different blocks of the Bhadrak district.

Figure 2. *Adathoḍa vasica* Nees

Figure 3. *Asparagus racemosus* Wild.

Figure 4. *Boerhavia diffusa* Linn.

Figure 5. *Bryophyllum pinnatum* (Lam.)Oken.

Figure 6. *Cassia fistula* Linn.

Figure 7. *Eclipta alba* Hassk.

Figure 8. *Jatropha curcas* Linn.

Figure 9. *Lantana camara* Roxb.

Figure 10. *Leucas aspera* Spreng.

Figure 11. *Mimosa pudica* Linn.

Figure 12. *Nerium oleander* Linn.

Figure 13. *Strychnos nuxvomica* Linn.

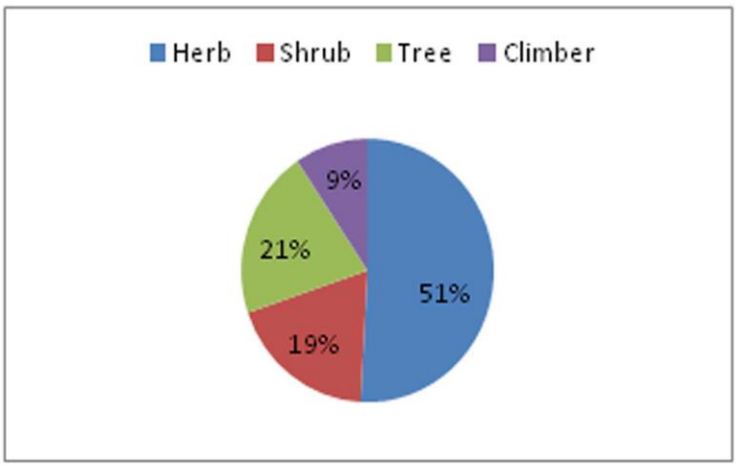

Figure 14. Growth form analysis of ethnomedicinal plants of Bhadrak district.

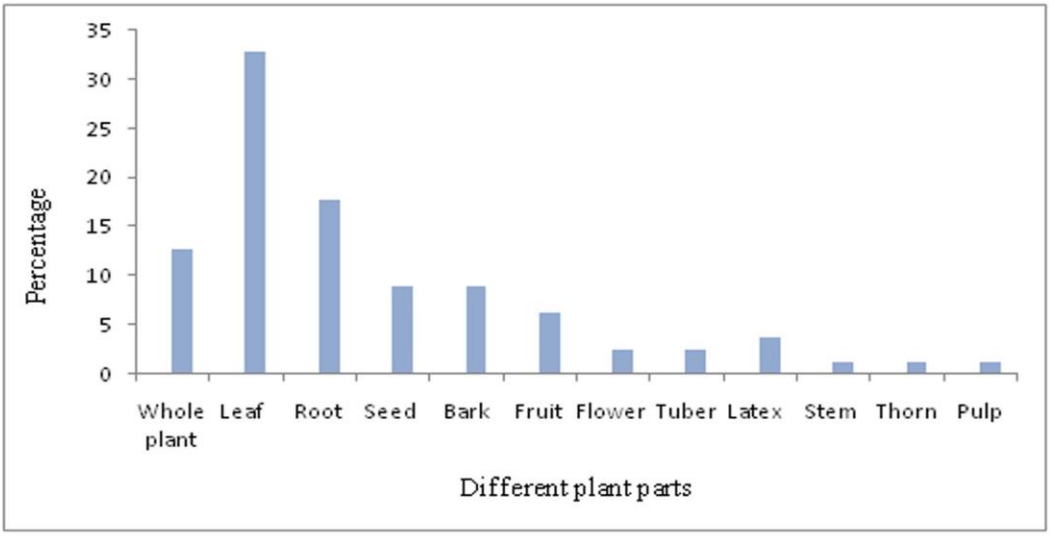

Figure 15. Parts of medicinal plants used.

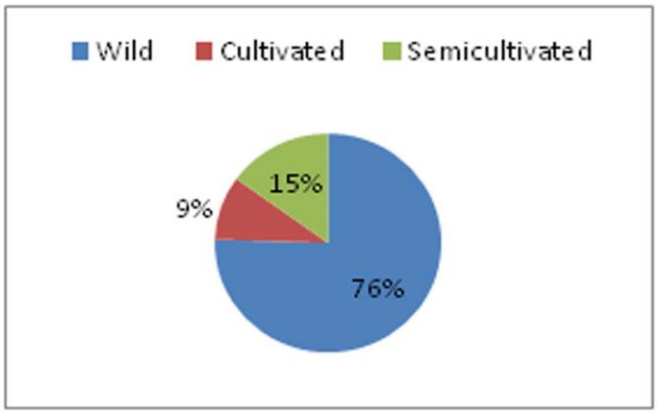

Figure 16. Medicinal plant species in different categories.