



ISSN: 0975-833X

## RESEARCH ARTICLE

### DWINDLING MEDICINAL PLANT RESOURCES OF JAJPUR DISTRICT OF ODISHA (INDIA) AND THEIR UTILIZATION AND CONSERVATION

\*Kunja Bihari Satapathy

Department of Botany, Utkal University, Vani Vihar, Bhubaneswar - 751004, Odisha, India

#### ARTICLE INFO

##### Article History:

Received 21<sup>st</sup> October, 2014  
Received in revised form  
04<sup>th</sup> November, 2014  
Accepted 18<sup>th</sup> December, 2014  
Published online 23<sup>rd</sup> January, 2015

##### Key words:

Dwindling,  
Medicinal plant,  
Odisha,  
Utilization,  
Conservation

#### ABSTRACT

The present paper resulted from field studies carried out by the author in Jajpur district of Odisha for past 20 years (1990-2010). Out of over 1000 species of flowering plants and ferns recorded from the district about 530 species are of medicinal value. Twenty six species of commonly important medicinal plants have a good potential for commercial exploitation. An account of sixty two medicinal plant species, which are fast depleting in the area have been presented, which draws immediate attention for their conservation and protection. These have been enumerated with details of Sanskrit and Odia names, parts used and names of Ayurvedic preparations. Some of the medicinal plants besides many others, facing threat are *Asparagus racemosus*, *Bacopa monnieri*, *Celastrus paniculatus*, *Centella asiatica*, *Cissampelos pareira*, *Crataeva magna*, *Denrophiho falcata*, *Desmodium gangeticum*, *Eclipta prostrata*, *Embelia ribes*, *Gloriosa superba*, *Hedychiium coronarium*, *Hemidesmus indicus*, *Operculina turpethum*, *Oroxylum indicum*, *Sphaeranthus indicus*, *Paederia foetida*, *Piper longum*, *Pterocarpus marsupium*, *Pueraria tuberosa*, *Plumbago indica*, *Rauvolfia serpentina*, *Saraca asoca*, *Strychnos potatorum*, *Vanda tessellata*, *Woodfordia fruticosa* etc., which are widely used in the Ayurvedic system of medicine as well as folklores. This paper also examines possible causes of threat to these species and offer suggestions for their proper utilization and conservation.

Copyright © 2015 Kunja Bihari Satapathy. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

#### INTRODUCTION

Jajpur, an interior district of Odisha, lies between 20°35'-21°10' N latitudes and 85°40'-86°40' E longitudes. It is surrounded on the north by Balasore and Keonjhar districts, on the south by Cuttack and Kendrapara districts, on the west by Dhenkanal district and on the east by Kendrapara district. It consists of two distinct tracts – a hilly region on the west and a fertile plain on the east. With much altitudinal differences and medium precipitation, the district is bestowed with semi-evergreen, moist deciduous, dry deciduous and scrub forests. Till recent past, the district was a rich reservoir of natural resources of medicinal plants in its forests, wastelands, and grazing grounds, hedges and as agricultural weeds in crop fields (Sahu, 2011; Sahu and Satapathy, 2009; Satapathy, 2010; Satapathy, 2000; Satapathy and Brahmam, 1999; Satapathy et al., 2012). A rough estimate based on available record revealed more than five hundred medicinal plants in the district (Nanda and Satapathy, 2001; Sahu, 2011; Sahu and Satapathy, 2009; Satapathy, 2001, 2010; Satapathy and Brahmam, 1999; Satapathy and Chand, 2003, 2000; Satapathy and Nanda, 2000; Satapathy et al., 2012).

Deforestation for various developmental purposes i.e. construction of roads, opening of schools, colleges, hospitals, establishment of several steel industries and mining activities has considerably affected the coverage of the natural forests of Jajpur district. The growing human and cattle population and the ecological factors have imposed a severe pressure on the natural resources and caused immense damage to the forests leaving behind barren hills devoid of flora which included the medicinal plants also. All these pose serious threats to the medicinal plant wealth of the district. Therefore, conservation of these medicinal plant resources is an urgent need of the day. The information regarding conservation efforts involves two levels of data collection. The first step involves a thorough inventory of the medicinal plants of the district, which is an urgent necessity to identify not only the medicinal plant wealth but also suitable and specialised ecological niches for *in situ* conservation. In the second step the threatened or fast-depleting plant species have to be identified along with their medicinal value. In this article, present status of sixty two medicinal plant species has been given and measures for their conservation and protection suggested.

#### MATERIALS AND METHODS

Extensive floristic investigation tours were undertaken by the author in different parts of Jajpur district of Odisha, covering

\*Corresponding author: Kunja Bihari Satapathy

Department of Botany, Utkal University, Vani Vihar, Bhubaneswar - 751004, Odisha, India.

forests of Jatadhari, Kaliapani, Sunajhar, Mahagiri, Kharadi, Bathuria-khola, Ashoka-jhara, Dalimba-pani (Sukinda block); Phulajhara, Badasuli, Gobaraghati (Danagadi block); Chandikhol, Mahavinayaka, Olasuni (Barachana block); and Deuli, Gokarnika, Ratnagiri, Balarampur (Dharmasala block). Floristic assessment tours were also conducted in the plains of Jajpur, Dasarathpur, Bari, Binjharpur and Korei blocks by the author and his team between 1990-2010. Seasonal field-trips were planned for each of the forest areas and collection and preservation of the specimens have been made according to the standard methods followed by the Botanical Survey of India. At the time of collection of specimens, observation on the composition of the forests or vegetation, occurrence and frequency of distribution of medicinal plants in different habitats have been made and recorded. These collected plant specimens have been identified in consultation with available literature (Haines, 1921-1925; Mooney, 1950; Saxena and Brahmam, 1994; Chopra *et al.*, 1956) and deposited in the herbarium of the Botany Department, Vyasagar Autonomous College, Jajpur Road, Odisha. During the course of investigation all the relevant information useful for identification of the threatened or fast-depleting medicinal plant species of the region have been recorded (Ved *et al.*, 2008). The identification of commercially important medicinal plants of the district and their status of exploitation by the local traditional healers or pharmaceutical industries have also been included in this study.

## RESULTS AND DISCUSSION

The plants enlisted in the Tables (1, 2, 3, 4, 5) are some of the potential medicinal plants, which were abundant in various habitats and parts of Jajpur. The rural folks especially the traditional healers have exploited these medicinal plants since long to cure various common ailments. The forests are diminishing day by day, and are getting progressively devoid of medicinal plants during last 20 years (i.e. 1990-2010). It is interesting to note that many of these species are the important ingredients of Ayurvedic drugs and are even used singly. The climatic conditions particularly scanty rainfall couple with high temperature for almost over one decade and the biotic pressure have markedly affected the occurrence and distribution of medicinal plants. As a result of which a large number of medicinal plants have been threatened. However, in the present communication only 62 fast-depleting species of the Jajpur have been dealt to draw the attention of scientists, environmentalists, pharmaceutical industrialists and others for their conservation and protection. These fast-depleting species of medicinal plants can be discussed under the following arbitrary groups based on habitats. The information regarding their medicinal properties, depletion factors along with Ayurvedic, botanical and local names have been furnished in tabular form.

### A. Aquatic and semi-aquatic plants

Owing to scanty precipitation and high temperature prevailed in the area for a period of 10 years (2000-2010), the moist habitats, shallow ponds, roadside ditches dried and as such aquatic plants like species of *Neptunia oleracea*, *Trapa natans* and *Scirpus grossus* and semi-aquatic or marshy plants like

species of *Acorus calamus*, *Bacopa monnieri*, *Centella asiatica*, *Centipeda minima*, *Eclipta prostrata*, *Hygrophila auriculata*, *Ipomoea aquatica*, *Lippia javanica*, *Scirpus articulatus* and *Sphaeranthus indicus* have either vanished or became rare in such habitats or localities all over Jajpur (Table 1). The expansion of roads especially N.H.5 during last five years and conversion of the shallow ponds into cultivable lands also caused the disappearance of some of the aquatic and marshy species. Therefore, it is now difficult to trace these species in specific areas from where their abundance was recorded earlier.

### B. Plants growing in open areas, wastelands and hedges

The increase in pharmaceutical manufacturing units in Jajpur and its neighbouring districts has created a great demand for raw drugs. As such *Rauvolfia serpentina*, *Asparagus racemosus*, *Pueraria tuberosa*, *Hemidesmus indicus*, *Woodfordia fruticosa* and *Desmodium gangeticum* have been rare in nature due to over-exploitation (Table 5). Except *Pueraria tuberosa* all other species are found all over Jajpur. There used to be large patches of this climbing shrub (*Pueraria tuberosa*) on rocky mountainous slopes of Mahagiri (Sukinda) and Phulajhara (Danagadi) but at present it's luxuriant growth is a rare sight in nature. Previously a person going in forest's outskirts was always attracted by the luxuriant growth and abundance of beautiful red flowers of *Woodfordia fruticosa* (Dhataki) and white flowers of *Holarrhena pubescens* (Kutaja). But now these are not so common. All these species are now affected by over-exploitation and other biotic factors (Table 2).

*Tribulus terrestris*, *Evolvulus alsinoides*, *Hybanthus enneaspermus* and *Desmodium gangeticum* are found in grasslands in some parts of the district and is not widespread all over. *Barleria prionitis* and *Andrographis paniculata* were growing in plains or in hilly slopes or sometimes in forests undergrowth throughout the district. But with the shrinking of the forests especially due to mining activities and industrialization, their occurrence has been badly affected. *Tinospora cordifolia*, *Paederia foetida*, *Pergularia daemia*, *Cissampelos pareira*, *Costus speciosus* and *Mucuna pruriens* are usually found growing in wastelands. In nature these plant species are getting scarce. Similarly plant species like *Clerodendrum inerme*, *Jatropha curcas*, *Justicia adhatoda*, *Justicia gendarussa*, *Lawsonia inerme* and *Vitex negundo* earlier grown as hedges in most of the places of Jajpur are now hardly ever found in these areas.

### C. Forest undergrowth

Plants like *Abrus precatorius*, *Gloriosa superba*, *Piper longum*, *Operculina turpethum*, *Plumbago indica*, *Pueraria tuberosa* and *Ichnocarpus frutescens* used to be quite commonly distributed in the forests undergrowth in Mahagiri, Phulajhar and Kaliapani jungles. But now good growth of these species is a rare sight. The distribution is also very thin. *Asparagus racemosus*, *Costus speciosus*, *Hedychium coronarium*, *Urginia indica*, *Elephantopus scaber* and *Curculigo orchoides* used to be quite abundantly growing in the forest undergrowth of Ashokajhara, Balarampur area and also sparsely distributed in Chandikhole and Gobaraghati hills of the district. But due to degradation of the forest areas, mining activities and over-exploitation, these species are becoming sparse (Table 3).

Table 1. Aquatic and semi-aquatic plants

Botanical name	Ayurvedic name	Local name	Uses	Depletion factor(s)
<i>Acorus calamus</i> L.	Vacha	Ghoda-bacha	Pharyngitis	Natural & Biotic
<i>Bacopa monnieri</i> (L.) Pennel.	Brahmi	Panikundi	Epilepsy, Polyuria	Natural (scanty rains)
<i>Canscora decussata</i> (Roxb.) Sch.	Sankhini	Shankha-pushpi	Forgetfulness, Insanity	Biotic & Natural
<i>Centella asiatica</i> (L.) Urb.	Mandukaparni	Thalakudi	Epilepsy, Psychosis	Natural & Biotic
<i>Centipeda minima</i> (L.) A.Br.	Kshabaka	Bilachinka	Dysentery	Natural (scanty rains)
<i>Eclipta prostrata</i> (L.) L.	Bhringaraja	Kesuta	Hair falling	Biotic & Natural
<i>Hygrophila auriculata</i> (K.Schum.) Heine	Kokilaksha	Koilikhia	Urinary- calculi	Natural
<i>Ipomoea aquatica</i> (L.)Poir.	Kalambi	Kalama-saga	Diabetes	Natural (scanty rains)
<i>Limnophila aromatica</i> (L.) Merr.	Amragandha	Ambakasia-dala	Antiseptic, Galactagogue	Natural
<i>Lippia javanica</i> (Burm.f.) Spreng.	Nagadaman	Naguari	Burning sensation	Natural (scanty rains)
<i>Marsilea minuta</i> L.	Sunisannah	Sunusunia-saga	Fever, Insomnia	Natural
<i>Neptunia oleracea</i> Lour.	Alambusa	Pani-lajakuli	Earache, Syphilis	Natural and Biotic
<i>Scirpus articulatus</i> L.	Chichora	Gai-chira	Vomiting	Natural
<i>Scirpus grossus</i> L.	Kaseruka	Kesara-mula	Diarrhoea, Boils	Natural
<i>Sphaeranthus indicus</i> L.	Mundi	Bhuin-kadamba	Jaundice, Piles	Natural
<i>Trapa natan</i> (Roxb.) Makino	Sringataka	Pani singada	Tonic, Menorrhagia	Biotic and Natural
<i>Vallisneria natan</i> (Lour.)Hara	Shaivala	Pani-siuli	Stomachic, Leucorrhoea	Natural

Table 2. Plants growing in open areas, waste-lands, hedges etc

Botanical name	Ayurvedic name	Local name	Uses	Depletion factor(s)
<i>Aandrogaphis paniculata</i> Nees	Bhunimbah	Bhuinimba	Liver disorder	Biotic & Natural
<i>Asparagus racemosus</i> Willd.	Satavari	Chhatuari	Hyperacidity	Biotic (overexploitation)
<i>Barleria prionitis</i> L.	Sahachara	Dasakeranta	Rheumatoid-arthritis	Biotic (overexploitation)
<i>Caesalpinia crista</i> L.	Putikaranja	Latakaranja	Spleenic- disorder	Biotic
<i>Clerodendrum viscosum</i> Vent.	Bhantaka (Bhandera)	Kharakhari	Diabetes, Tumour	Biotic & Natural
<i>Costus speciosus</i> (Koen.) Sm.	Kushtha	Kudha	Polyuria	Natural & Biotic
<i>Desmodium gangeticum</i> (L.)DC.	Salaparni	Vidarigandha	Rejuvenator, Cardiac-diseases	Biotic (overexploitation)
<i>Evolvulus alsinoides</i> (L.)L.	Sankhapuspi	Bichhamalia	Rejuvenator	Biotic (overexploitation)
<i>Gloriosa superba</i> L.	Langali	Agnisikha, Dasaraphula	Rheumatism, Arthritis	Biotic (overexploitation)
<i>Hybanthus enneaspermus</i> (L.) F.v. Muell.	Charati	Madanamastak	Diabetes, Impotency	Biotic
<i>Operculina turpethum</i> L.	Trivrit	Tihudi	Diabetes	Natural
<i>Paederia foetida</i> L.	Prasarini	Pasaruni	Gastric-trouble	Biotic & Natural
<i>Piper longum</i> L.	Pippali	Pipali	Cough, fever	Natural & Biotic
<i>Rauwolfia serpentina</i> (L.) Benth. ex Kurz.	Sarpagandha	Patalagaruda	Hypertension, Insomnia	Biotic (overexploitation)
<i>Tribulus terrestris</i> L.	Gokshura	Gokhara	Tonic	Natural & Biotic
<i>Vitex trifolia</i> L.	Sindhuvarah	Bana-begunia	Rheumatism, Amenorrhoea	Natural & Biotic

Table 3. Forest undergrowth

Botanical name	Ayurvedic name	Local name	Uses	Depletion factor(s)
<i>Gymnema sylvestre</i> (Retz.) R.Br. ex Sch	Meshasringi	Gudamari	Diabetes, Hydrocele	Natural & Biotic
<i>Hedychium coronarium</i> Koenig.	Sathee	Dulal champa	Bronchitis	Biotic & Natural
<i>Helicteres isora</i> L.	Avartani	Modimodika	Dysentery, Flatulence	Biotic & Natural
<i>Plumbago indica</i> L.	Chitraka	Chitaparu	Dyspepsia, Piles	Biotic (overexploitation)
<i>Pueraria tuberosa</i> DC.	Vidari	Bhuinkakharu	Tonic, Lactagogue	Biotic (overexploitation)
<i>Urginia indica</i> (Roxb.)Kunth.	Vanapalandu	Banapiyajja	Rheumatism, Scabies	Biotic
<i>Woodfordia fruticosa</i> (L.) Kurz.	Dhataki	Dhatuliphula	Leucorrhoea, Bilous fever	Natural & Biotic

Table 4. Other species of the forests

Botanical name	Ayurvedic name	Local name	Uses	Depletion factor(s)
<i>Celastrus paniculatus</i> Willd.	Jyotismati	Karasana, Pengu	Rheumatism	Biotic & Natural
<i>Dalbergia sissoo</i> Roxb.	Shimshapa	Sisu	Sciatica, Leucoderma	Biotic & Natural (super-cyclone)
<i>Dendrophthoe falcata</i> (L.f.)Etting	Vanda	Malanga, (Bridhanga)	Sterility in female	Biotic (overexploitation)
<i>Embelia ribes</i> Burm.f.	Vidanga	Baibidanga	Threadworm	Biotic & Natural
<i>Holarrhena pubescens</i> Wall. ex G.Don.	Kutaja	Koruan	Dysentery, Diarrhoea	Biotic & Natural
<i>Madhuka indica</i> J.F.Gmel.	Madhuka	Mahula	Rheumatism, Constipation	Biotic & Natural (super-cyclone)
<i>Mallotus philippensis</i> (Lam.) Muell-Arg.	Kampillaka	Sinduri/Kunkuma	Worm infestation	Biotic & Natural
<i>Oroxylum indicum</i> (L.) Vent.	Syonaka	Phanaphana	Cough, asthma	Biotic & Natural
<i>Pterocarpus marsupium</i> Roxb.	Beejakah	Piyasala	Leucorrhoea, Diabetes	Biotic & Natural (uper-cyclone)
<i>Saraca asoca</i> (Roxb.) de Wilde	Ashoka	Asoka	Menstrual disorder	Biotic (overexploitation)
<i>Strychnos potatorum</i> L.f.	Kataka	Nirmali	Gastritis	Biotic
<i>Symplocos racemosa</i> Roxb.	Lodhrah	Lodha	Throat infection	Niotic & Natural
<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Am.	Arjunah	Arjuna	Heart problem	Biotic (overexploitation)
<i>Terminalia bellirica</i> (Gaertn.)Roxb.	Bibhitakah	Bahada	Constipation, Hypertension	Biotic & Natural (super-cyclone)
<i>Vanda tessellata</i> (Roxb.) Don	Rasna	Rasna	Bronchitis, Fistula	Biotic (overexplotation)
<i>Viscum articulatum</i> Burm.f.	Kamini	Malanga	Fresh cut	Biotic (overexplotation)
<i>V. monoicum</i> Roxb.ex DC.	----	Manjodama	Cough, Dyspnoea	Biotic (overexplotation)
<i>V. orientale</i> Willd.	----	Malanga	Neuralgia, Itch	Biotic (overexplotation)

## D. Other species of the forests

There has been a considerable reduction of *Dalbergia sissoo* (Simsapa), *Helecteres isora*, *Madhuca indica* (Madhuka), *Mallotus philippensis*, *Oroxylum indicum*, *Saraca asoca*, *Symplocos racemosa* and *Terminalia bellirica* (Bibhitaki) population in the forests of Jajpur district, particularly in the blocks of Sukinda and Danagadi. Simsapa (*Dalbergia sissoo*) is one of the most valuable timbers yielding plant of the district, the heartwood of which is also used in traditional medicines. It is an important component of the forests of Ambasara (Sukinda), growing just at the base of the hills. It used to be profusely growing on the hills of Sukinda and Danagadi blocks.

*Terminalia bellirica*, *Madhuca indica*, *Saraca asoca*, *Holarrhena pubescens* and *Pterocarpus marsupium* have been exploited noticeably and depleted to a large extent in Kaliapani and Kharadi forest areas (Table 4). There used to be very good population of these trees in Sukinda forest areas. All these species are economically important besides being of immense therapeutic worth. The population of epiphytic and parasitic plant species such as *Dendrophthoe falcata*, *Cuscuta reflexa*, *Vanda tessellata*, *Cymbidium linnei*, *Rhynchostylis retusa*, *Viscum articulatum* and *Viscum monoicum* have become scanty in the forest areas of the district mainly due to over-exploitation. Prior to the year 1995, someone visiting to 'Ashokajhar' - a forest-side tourist spot, was attracted by a stream and the luxuriant growth and abundance of 'Ashoka' (*Saraca asoca*) tree bearing beautiful yellow flowers. But now this plant is threatened in its natural habitat and becoming critically endangered because of overexploitation and other biotic factors.

## E. Commercially exploited medicinal plant species

This district harbours a number of tribal groups who depend upon the ethnobotanical resources for their livelihood and primary healthcare. Till date, over 600 plant species have been inventoried for ethnomedicinal uses in the district (Satapathy and Brahmam, 1999; Satapathy, 2001; Satapathy, 2010; Sahu and Satapathy, 2009; Satapathy and Chand, 2000; Satapathy *et al.*, 2012; Sahu, 2011). In the forests of Sukinda and Danagadi blocks of Jajpur district, there is heavy exploitation of medicinal plants both in organized and unorganized sectors. About 26 potential medicinal plant species are found to be commercially exploited (Table 5). The pressure of commercial exploitation is severely endangering many species. It is evident from the present investigation that 15 out of 26 species are used by collecting their underground parts (roots, rhizomes and tuber).

It is needless to emphasize that such over-exploitation exerts a tremendous biotic pressure on these species. The available indications on medicinal plants in the district suggest that unless suitable strategies and action plans are drawn, one may witness a serious erosion and endangerment of valuable medicinal plants.

### Conservation

Conservation of plants today is not a style but a requirement. If human race is to survive we must learn to live in harmony with the environment and to take measures to preserve the living resources. With this view, various conservation measures have been suggested in this paper to protect the above mentioned threatened medicinal plants.

Table 5. Some important commercially exploited medicinal plants of the district

Botanical name	Parts used	Habit	Ayurvedic preparations	Exploitation level	Threat level
<i>Asparagus racemosus</i> Willd.	Tuber	Scandent shrub	Satawari-ghrita	**	-
<i>Barleria prionitis</i> L.	Root	Shrub	Sahachar-taila	**	-
<i>Boerhaavia diffusa</i> L.	Root	Diffuse herb	Punarnavasava	*	-
<i>Centella asiatica</i> (L.) Urb.	Whole-plant	Trailing herb	Geriforte tab., Nardyl tab.	**	-
<i>Cissampelos pareira</i> L.	Root	Twining herb	Pathadi ghrita	*	-
<i>Crateva magna</i> (Lour.) DC.	Leaf & Bark	Tree	Varunadiquath, Calcuosin	**	VU
<i>Dendrophthoe falcata</i> (L.f.) Etting	Whole-plant	Parasitic herb	Rasnadi quath	*	-
<i>Desmodium gangeticum</i> (L.) DC.	Root	Herb	Dasamularista, Salaparnyadi-taila	***	-
<i>Eclipta prostrata</i> (L.) L.	Leaf	Decumb-ent herb	Bhringaraja-rasayana	**	-
<i>Embelia ribes</i> Burm.f.	Seed	Shrub	Bidangarista Bidang tail	**	VU
<i>Gloriosa superba</i> L.	Root	Climber	Ramalaya cream / tab.	**	E
<i>Gmelina arborea</i> Roxb.	Stem & Root	Tree	Dasamularista, Aravindasava	**	-
<i>Hemidesmus indicus</i> R.Br.	Root	Twining herb	Saribasava, Madana modak	**	-
<i>Operculina turpethum</i> L.	Root, Seed	Twining herb	Trivritadi modak, Brahmi ghrita	***	VU
<i>Oroxylum indicum</i> (L.) Vent.	Bark, Fruit	Tree	Dashmularista, Chyavanprash	***	E
<i>Plumbago zeylanica</i> L.	Root	Shrub	Chitrakadi-churna	**	-
<i>Pueraria tuberosa</i> DC.	Tuber	Climbing shrub	Vidarikanda-yog	***	VU
<i>Rauvolfia serpentina</i> Benth.	Root	Under-shrub	Sarpagandha-vati	***	EN
<i>Rotula aquatica</i> Lour.	Root	Woody shrub	Aravindasava	**	-
<i>Saraca asoca</i> (Roxb.) de Wilde	Bark	Tree	Ashokaristha	***	CR
<i>Sida cordifolia</i> L.	Root & Leaf	Herb	Balarista, Blood vista	**	-
<i>Strychnos potatorum</i> L.f	Seed & Bark	Tree	Nirmali churna	**	VU
<i>Symplocos racemosa</i> Roxb.	Bark	Tree	Mritsanjivani sura	***	CR
<i>Vanda tessellata</i> (Roxb.) Don	Root	Epiphytic herb	Rasnadi kasaya	***	-
<i>Vitex peduncularis</i> Wall.	Leaf & Bark	Small tree	Filcocid	**	-
<i>Woodfordia fruticosa</i> Kurz.	Flower	Shrub	Dhatakyarista, Ashokarista	*	-

Exploitation level: low (\*); medium (\*\*); high (\*\*\*)

Threat level: VU-Vulnerable, EN-Endangered, CR-Critically Endangered (Abbreviations according to IUCN)

The different species of medicinal plants require both *in situ* and *ex situ* conservation.

### (i) *In situ* conservation

In-situ conservation is always preferred. It can be done in two ways i.e.

(a) Conservation involving several species of endangered medicinal plants which happen to grow in a few sq. km. covering larger areas - such areas can be conserved as biosphere reserve i.e. Mahagiri hill range of this district. Plant species including *Dalbergia sissoo*, *Pterocarpus marsupium*, *Saraca asoca*, *Oroxylon indicum*, *Symplocos racemosa*, *Crataeva magna*, *Litsea glutinosa*, *Strychnos potatorum*, *Terminalia bellirica* and other associated species and their undergrowth comprising of medicinal plants (*Gloriosa superba*, *Rauvolfia serpentina*, *Piper longum*, *Hedychium coronarium*, *Celastrus paniculatus*, *Embelia ribes*, *Operculina turpethum*, *Pueraria tuberosa*, *Scindapsus officinalis*, *Cycas circinalis*) can be conserved in the forests in their natural habitats.

(b) Conservation involving solitary species or group of threatened species growing in almost pure population together with other medicinal plants - such areas can be conserved as 'Gene sanctuaries'. A large number of threatened medicinal plant species in the Sukinda forests can best be protected in their natural habitats. Out of 62 medicinal plants, species like *Dalbergia sissoo*, *Pterocarpus marsupium*, *Strychnos potatorum*, *Saraca asoca*, *Terminalia bellirica*, *Madhuca indica*, *Shorea robusta* and almost all other species can be conserved, by selecting specific areas with dense populations of desired species in the forest areas.

### (ii) *Ex situ* conservation

The strategy for *ex situ* conservation is usually taken up when it is not possible to conserve the species by *in situ* methods as described above. This involves conservation in (a) Herbal farms or botanical gardens (b) Seed banks and (c) *in vitro* cultures or tissue cultures. The methodology of *ex situ* conservation has already been adopted for threatened plants at Regional Plant Resource Centre, Bhubaneswar. Reproducible protocols for *in vitro* plant regeneration have been developed for *Dalbergia sissoo* at the Plant Tissue and Cell culture Facility in P.G. Department of Botany, Utkal University, Bhubaneswar. Further plants like *Centella asiatica*, *Bacopa monnieri*, *Celastrus paniculatus* and many other species could be considered for *ex situ* conservation through plant cell, tissue, organ culture.

### (iii) Other measures of Conservation

(a) Deforestation and over-exploitation of plant resources should be checked and afforestation of natural trees and shrubs should be promoted to maintain the health of the ecosystem.

(b) A thorough scientific study of traditional medicinal plants should be conducted and their usefulness are to be evaluated.

(c) Germplasm collection of the medicinal herbs should be exhaustive.

(d) Cultivation of some selected medicinal plants should be done extensively in order to cater to the demand of the local pharmaceutical industries and traditional healers.

(e) Certain important valleys and meadows with rich germplasm diversity should be declared as economic plant reserves/sanctuaries. The rare and threatened species should be introduced here for their *ex situ* conservation.

(f) The sacred groves provide an effective means of conservation, as observed in the jungles encompassing Chandikhole, Olasuni, Jatadhari and Mahavinayaka temple of the Jajpur district. These forest pockets exhibited optimum growth of vegetation. Therefore, efforts should be made to protect these unique habitat locations by declaring them as national monuments. However, recently Mahavinayak forest range has been declared as Mini-biosphere reserve by the Government of Odisha.

(g) As a conservation measures spread of weeds like *Lantana camara*, *Parthenium hysterophorus*, *Xanthium strumarium*, *Mikania micrantha*, *Chromolaena odorata*, *Acanthospermum hispidum* etc. in the forests should be effectively checked. The weeds not only destroy the ground flora but also affect the floristic composition. Such damage of undergrowth is observed in the forests areas located at Danagadi and Sukinda. Similarly spread of weeds like *Eichhornia crassipes* and *Salvinia molesta* in the water bodies should be checked, as its growth adversely affect the floristic composition of the aquatic ecosystem.

(h) A general awareness among rural folks must be created on medicinal plants around them so that they will be interested to conserve and protect them. Without the co-operation of general public, any attempts to conserve medicinal plants *in situ* or through germplasm collection will be a failure. For this purpose regional and local medicinal plant gardens should be developed which should take care of the locally available medicinal plants.

### Conclusion

In this communication effort has been made to provide a picture of some selected fast-depleting medicinal plants of Jajpur district of Odisha and conservation measures suggested with a view to save these plants from becoming rare or extinct. Conservation of these precious medicinal herbs will not only provide genuine raw drugs for the pharmaceutical industries to manufacture quality drugs, but it may also help in improving the ecosystems.

### Acknowledgement

The author is thankful to the Principal, Vyasagar Autonomous College, Jajpur-Road, Odisha for providing facilities. Thanks are also due to the authorities of University Grants Commissions, New Delhi, for providing financial assistance.

## REFERENCES

- Chopra, R.N., Nayar, S.L. and Chopra, I.C. 1956. Glossary of Indian Medicinal Plants. CSIR, New Delhi.
- Haines, H. H. (1921-1925). The Botany of Bihar and Orissa, 6 parts, London.
- Mooney, H.F. 1950. Supplement to the Botany of Bihar and Orissa, Ranchi.
- Nanda, G.C. and Satapathy, K.B. 2001. Plants for diabetes ( A comprehensive compilation based on folklore and trials) Central Research Institute for Ayurveda (CCRAS, New Delhi), Bhubaneswar, Orissa. pp.34.
- Sahu, B.B. 2011. Studies on the Medicinal plant resources in healthcare system of Jajpur district of Orissa. Ph.D. Thesis, Utkal University, Odisha, pp.517.
- Sahu, B.B. and Satapathy, K.B. 2009. Plants used by the Tribes and Rural folks for common ailments in Jajpur district of Orissa. *Ethnobotany*, 21 (1&2): 103-107.
- Satapathy K.B. 2010. Ethnoveterinary practices in Jajpur district of Orissa. *Indian Journal of Traditional Knowledge*, 9 (2): 338-343.
- Satapathy K.B. and Brahmam M. 1999. Some interesting phyto-therapeutic claims of tribals of Jajpur district, Orissa, India. *J. Econ. Tax. Bot.*, 23 (2) 467-472.
- Satapathy K.B. and Chand P.K. 2003. Plants used in healthcare of tribal women and children of Sundergarh district of Orissa. *Plant Sci. Res.*, 25 (1&2) 52-57.
- Satapathy K.B., Sahu B.B. and Jena G.S. 2012. Crop weeds diversity and their ethnomedicinal uses in the treatment of common ailments in Jajpur district of Odisha (India). *IJMA*, 2 (1): 80-89.
- Satapathy, K.B. 2000. Medicinal plants in and around Jajpur district of Orissa. In Proc. Natl. Sem. Medicinal plants in our Environment: Their exploration, application and conservation (Ed. K.B. Satapathy and P.K.Chand) V.N. College, Jajpur-road, Orissa pp.45-53.
- Satapathy, K.B. 2001. Ethnobotanical studies of Jajpur district of Orissa. UGC-sponsored Project report pp.56.
- Satapathy, K.B. and Brahmam M. 1999. Some interesting phyto-therapeutic claims of tribals of Jajpur district, Orissa, India. *J. Econ. Tax. Bot.*, 23 (2) 467-472.
- Satapathy, K.B. and P.K. Chand 2000. Medicinal plants in our environment and their use in primary healthcare. In Proc. Natl. Sem. Medicinal plants in our Environment: Their exploration, application and conservation (Ed. K.B. Satapathy and P.K.Chand) V.N. College, Jajpur-road, Orissa pp.37-44.
- Satapathy, K.B. and Nanda, G.C. 2000. Matshyahara ke rup me paejane waley kuchh jal poudhe ka aushadhiya guna-vatta. Proc. Natl. Sem. on Jal Kheti, CIFA (ICAR, New Delhi), Kaushalyaganga, Bhubaneswar, Orissa. (in press)
- Saxena, H.O. and Brahmam, M. 1994. Flora of Orissa. Orissa Forest Development Corporation, Bhubaneswar.
- Ved, D.K., Kinhal, G.A., Ravikumar, K., Vijaya Sankar, R., Sumathi, R., Mahapatra, A.K. and Panda, P.C. 2008. Conservation Assessment Prioritisation for Medicinal plant of Orissa. *Regional Plant Resource Centre*, Bhubaneswar. P-8.

\*\*\*\*\*