

## MEDICINAL ORCHIDS OF ARUNACHAL PRADESH: A REVIEW

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### Abstract

Orchids are one of the largest groups of Angiosperms belonging to the family Orchidaceae. Orchids are extremely popular as ornamental plant and lesser is the known about their ethnomedicinal uses. Since from the primitive periods, medicinal plants including orchids have occupied a distinct place in human's life for treatment of variety of ailments. The present review paper deals with the enumeration of such medicinal orchids found in Arunachal Pradesh. 112 orchid species belonging to 53 genera are presented here with their references. This paper also discusses uses of orchids in traditional medicine, their threat status and in-situ conservation in Arunachal Pradesh.

**Keywords:** Medicinal orchids, Arunachal Pradesh

### INTRODUCTION

The literal meaning of the term orchid (*orkhis*) in Greek is testicles and it was Theophrastus who first coined the term as the anatomy of plant resembles testicles (Steward and Griffith, 1995). Orchids are one of the largest and most diverse groups of angiosperms consisting of nearly 25,000 – 30,000 species belonging to 750 – 800 genera (Dressler, 1993). They are found in virtually all regions around the world except Antarctica, but their greatest diversity occurs in tropical and sub-tropical regions. Orchids are the flowers of most fascinating and gorgeous of all nature's flower's and exhibit a wide range of diversity in form, size, colour and texture that make them unique among the ornamentals. They are generally cultivated for beautiful flowers and are widely known for their economic importance and very less for their medicinal use (Singh et al., 2012).

In Himalaya region, studies on orchids are mainly focused on their documentation but

there is a lack of phytochemical and pharmacological studies on medicinal orchids. Limited information on medicinal values of orchids regarding their therapeutic properties in different parts of the world is available and specifically corresponded to particular regions and community. Compilation of such information is very important to provide the reference for the drug development of many problematic diseases at present.

In Himalaya region, large number of orchids are reported to be used in ethnomedicine. Some common Ayurvedic drugs like *Jivanti* and *Rasna* are of orchid's origin (Uniyal, 1975). However, Chinese were the first to present documentary evidence for medicinal uses of orchids. Some common orchids used in Chinese Ancient System of medicine includes *Dendrobium nobile*, *Gastrodia elata*, *Bletilla striata*, etc., (Bulpitt et al., 2007). India is the richest habitat of orchids. India comprise of about 2500 species in 167 genera, out of which 550 species are reported

from Arunachal Pradesh which is highest in number reported from any single state. In India, some orchids like *Eulophia campestris*, *Orchis latifolia* and *Vanda roxburghii* have drawn the attention of scientific community because of their medicinal properties (Stuart, 1984; Singh and Duggal, 2009). Arunachal Pradesh is the richest both in terms of diversity and abundance of orchids, however, limited number of medicinal orchids were reported till date. This review article deals with the ethnomedicinal uses of orchids native to Arunachal Pradesh. A list of 112 orchids are presented with their traditional uses in medicines.

### USE OF ORCHIDS IN TRADITIONAL MEDICINE

In many countries, orchids have been used as traditional drugs for a very long time (Bulpit et al., 2007). There is no doubt that the Chinese were the first to cultivate and describe orchids, and they were almost certainly the first to describe orchids for medicinal use. The Chinese were also the first to write books devoted to orchids (Jalal et al., 2008). Orchids particularly *Dendrobium* species have been used as medicinal herbs in different countries for centuries. About 40 *Dendrobium* species are still used in traditional Chinese medicine. Other genera of medicinal orchids which are heavily exploited includes *Acampe*, *Aerides*, *Coelogyne*, *Crepidium*, *Dactylorhiza*, *Gastrodia*, *Eulophia*, *Flickingeria*, *Otochilus*, *Pholidota*, *Satyrium* and *Vanda* (Subedi, et al., 2013).

Indian system of traditional medicine has also long history of orchid use. *Ashtavarga* known as the 'herb of immortality' is an important ingredient of various classical Ayurvedic formulations like *Chavyanprasa*, which consists drugs of orchid's origin such as *Crepidium acuminatum*, *Malaxis muscifera*, *Habenaria intermedia* and *Platanthera*

*edgeworthii* (Singh and Duggal, 2009). Also, *Dendrobium macraei* is used as a source of an important Ayurveda drug called 'Jivanti' (Kasera and Shukla, 2001). *Dendrobium fimbriatum*, *Papilionanthe teres*, *Eria muscivola*, *Eulophia campestris*, *Satyrium nepalense*, *Laparis odorata*, *Orchis latifolia*, *Vanda cristata*, *V. tessalata*, *V. coerulea*, *V. spathulata*, *Cymbidium giganteum*, *C. aloifolium*, *C. williomsoni*, *Dendrobium nobile*, *D. moschatum*, *Phaius tancaurvilleae* are some of the important medicinal orchids used by traditional healer in Indian subcontinent (Suresh et al., 2000; Kong et al., 2003; Hossain et al., 2009; Medhi and Chakrabarti, 2009).

Orchids like *Brachycorythis obcordata*, *Coelogyne cristata*, *Dactylorhiza hatagirea*, *Otochilus porrectus*, *Rhynchostylis retusa*, *Satyrium nepalense* and *Vanda cristata* are still largely used in Trans-Himalayan region, while orchids like *Cypripedium himalaicum*, *Dendrobium densiflorum*, *Gymnadenia conopsea* and *G. orchidis* are commonly used in Sowa-Rigpa system of traditional medicine (Joshi and Joshi, 2006; Dakpa, 2007). *Vanda* has a long history of use by the native population for anti-inflammatory properties (Kumar et al., 2005). Indian *Vanda* does indeed express anti-proliferative effects against various types of cancers, including carcinoma, lung and stomach (Ho and Chen, 2003). Some orchid species have been in use as an anti-dote against scorpion, snake and insect bites such as *Habenaria fusifera*, *Habenaria pantlingiana* and *Habenaria roxburghii* (Jalal et al, 2008; Behera et al., 2013).

Other Asian countries such as Indonesia, Malaysia, Taiwan, Singapore, Vietnam, Sri Lanka, Thailand, Myanmar, etc. have been using orchids in traditional medicine since the ancient time till date (Basu et al., 1971; Kumar et al., 2000; Hernández-Romero et al., 2005; Luo et al., 2007). Similarly, use of orchids in

Africa, America and Europe has a long history and is being used even today in various preparations. In Africa, the Zulus used several orchids for therapeutic purposes such as *Bulbophyllum maximum*, *Cyrtorchis arcuata*, *Eulophia flaccida*, *E. cucullata* and *Galeola foliate*. In America, *Vanilla planifolia* was used as useful herb for the treatment of hysteria, fevers, impotence, rheumatism and to increase

the energy of muscular systems since 15th century. In Europe significant medicinal orchids includes *Ophrys apifera*, *O. muscifera*, *O. fuciflora*, *O. sphegodes*, *Orchis simia*, *O. mascula*, *Himantoglossum hircinum*, *Serapias vomeracea*, *S. lingua*, *Dactylorhiza majalis*, *D. majalis* and *foliosa*. These species are mainly used as aphrodisiac and for healing properties (Pant, 1568).



Figure 1: Medicinal Dendrobiums- (a) *D. chrysanthum*; (b) *D. moschatum*; (c) *D. fimbriatum*; (d) *D. densiflorum*; (e) *D. crepidatum*; (f) *D. devonianum*; (g) *D. nobile*; (h) *D. jenkinsii*

### ARUNACHAL PRADESH AND ITS MEDICINAL ORCHID DIVERSITY

Arunachal Pradesh lies between the 26°28' N to 29°30' N latitude and 91°30' E to 97°30' E longitude. It is situated in the transition zone between the Himalaya and Indo-Burmese regions surrounded by Bhutan in the West, Tibet in the North, Myanmar in the East and the North East states of Assam and Nagaland in the South (Mani, 1974; Rodgers and Panwar, 1988; Singh et al., 2007). The state is located within the Eastern Himalaya global biodiversity hotspot which is recognized as one of the 34

global mega biodiversity hotspot (Myers et al., 2000) and is among the 200 globally important Eco-regions (Olson and Dinerstein, 1998). The altitudinal range is wide starting from 130 m at foothills regions up to 6000 m and above in higher mountains. The state harbors the world's northernmost tropical rainforest and is estimated to have nearly 50 % of the total flowering plant species of India (Rao and Hajra, 1986; Chowdhury, 1998; Procter et al., 1998; Whitmore, 1998). More than 600 species of orchids were reported from the state so far. Most of the orchids are found in between sub-tropical to lower temperate regions.

At present the state have 550 confirmed species, of which 112 species belonging to 53 genera were found to be used in different traditional medicine system. These includes 71 epiphytes, 40 terrestrials and 01 mycotroph. *Dendrobium* (18 spp.), *Coelogyne* (10 spp.), *Cymbidium* (07 spp.) and *Calanthe* (05 spp.) were the four most common medicinal orchid genera found in Arunachal Pradesh. Some medicinal *Dendrobiums* are shown in figure 1. The western part of Arunachal Pradesh harbors highest medicinal orchids (101 species i.e. 90 %) followed by eastern part of the state (69 species i.e. 62 %) and least by central part (59

species i.e. 53 %). Thirty-five medicinal orchids were recorded only from west part, eight only from eastern part and two only from central part of the state. Though Arunachal Pradesh has huge number of medicinal orchids, they were rarely used by the ethnic people of the state. *Dactylorhiza hatagirea*, a traditionally important medicinal orchid was also reported to be existing in the state, but further research is required for its confirmation. The traditional medicinal uses of each species compiled from various published literatures are given in table 1.

Table 1: Ethnomedicinal uses of orchids

SN	Botanical name	Part used	Traditional Uses	References
1.	<i>Acampe carinata</i> (Griff.) Panigrahi	Rt, Lf	Root used in acute rheumatism, sciatica, neuralgia, secondary syphilis and uterine diseases. Paste applied externally to treat scorpion and snakebites. Leaf decoction administered orally to get relief chest pain, stomach disorders and acidity	1, 2, 3
2.	<i>Acampe praemorsa</i> (Roxb.) Blatt. & McCann	Rt	Crushed root used as tonic. Paste applied externally to treat rheumatism and pains. Paste taken orally to cure arthritis	4, 5
3.	<i>Acampe rigida</i> (Buch.-Ham. ex Sm.) P.F.Hunt	Rt, Lf	Relieves muscle pain, joint pain and promote blood circulation	6
4.	<i>Aerides multiflora</i> Roxb.	Lf	Paste applied to treat cuts, wounds and earache. Also used in tonic preparation	7, 8, 9, 10
5.	<i>Aerides odorata</i> Lour.	Wh	Leaf is antibacterial. Leaf paste used to treat cuts, wounds, to heal boils in ears and noses. Whole plant used in tuberculosis, joint pain and swellings. Seed used as wound healing	3, 4, 5, 7, 8, 9
6.	<i>Argostophyllum brevipes</i> King & Pantl.	Tb	Powder used in preparation of jaundice medicine	11
7.	<i>Argostophyllum callosum</i> Rchb.f.	Tb	Powder used in inflammation, diabetes, wound and skin disorders	11
8.	<i>Anoectochilus roxburghii</i> (Wall.) Lindl.	Wh	Infusion consumed to control fever, lung disease, hypertension and to treat tuberculosis	8, 12
9.	<i>Anthogonium gracile</i> Wall. ex Lindl.	Tb	Grounded tuber applied to the cracking heels for quick relief from pain. Paste used to treat bone fracture, dislocation and boils	13, 14

SN	Botanical name	Part used	Traditional Uses	References
10.	<i>Arundina graminifolia</i> (D. Don) Hochr.	Rt, St	Root used to relieve body ache. Scrapped bulbous stem applied on foot-heels to treat the cracks	3, 15
11.	<i>Brachycorythis obcordata</i> (Lindl.) Summerh.	Tb	Tuber is expectorant, astringent and nutritious. Powder taken with milk as tonic and to overcome dysentery	7, 8, 9, 16, 17
12.	<i>Bulbophyllum careyanum</i> (Hook.) Spreng.	Lf, Pb	Decoction of leaf powder consumed to get fast recovery after childbirth and to cause abortion. Fresh pulp of pseudobulb used in burns	9
13.	<i>Bulbophyllum leopardinum</i> (Wall.) Lindl. ex Wall.	Lf, Pb	Fresh pulp or juice used in burns	10
14.	<i>Bulbophyllum odoratissimum</i> (Sm.) Lindl. ex Wall.	Wh	Infusion or decoction used to treat tuberculosis, chronic inflammation and fracture	10, 18
15.	<i>Bulbophyllum sterile</i> (Lam.) Suresh	Pb	Pseudobulb used in rheumatism and swellings	19
16.	<i>Calanthe plantaginea</i> Lindl.	Rz	Dry powder with milk taken as tonic and aphrodisiac	9
17.	<i>Calanthe puberula</i> Lindl.	Rz	Dry powder with milk taken as tonic	9
18.	<i>Calanthe sylvatica</i> (Thouars) Lindl.	Fl, Lf	Flower juice used to stop nose or gum bleedings. Leaves used to treat cold and cough	3, 7, 9, 11
19.	<i>Calanthe tricarinata</i> Lindl.	Lf, Pb	Leaf paste applied on sores and eczema. Leaf and pseudobulb are aphrodisiac	7, 15
20.	<i>Calanthe triplicata</i> (Willemet) Ames	Rt, Fl, Pb	Root and flower used as analgesic during diarrhea and teeth cavities problems. Pseudobulb used in treatment of gastrointestinal disorders	3, 20
21.	<i>Cephalanthera longifolia</i> (L.) Fritsch	Rz	Used as appetizer, tonic and wound healer. Powder used to increase vigour, vitality and to alleviate impotency	3, 7, 11, 17
22.	<i>Cleisostoma williamsonii</i> (Rchb.f.) Garay	Lf, St	Used to heal fractured bones and also consumed during diarrhoea	3, 21
23.	<i>Coelogyne corymbosa</i> Lindl.	Pb	Juice applied in wounds and burns as analgesic. Paste applied on forehead to relieve headache	20, 22
24.	<i>Coelogyne cristata</i> Lindl.	Pb	Used as aphrodisiac and to overcome constipation. Juice applied in wounds and boils. Gums exuded from pseudobulbs used to treat sores	16, 22
25.	<i>Coelogyne fimbriata</i> Lindl.	Pb	Paste or juice consumed to relieve headache, fever and indigestion. Pulp applied over burnt skin. Powder form used as ingredients in tonic preparation	10, 15
26.	<i>Coelogyne flaccida</i> Lindl.	Pb	Paste applied externally to relieve frontal headache and fever. Juice taken during indigestion	8, 9, 15
27.	<i>Coelogyne fuscescens</i> Lindl.	Pb	Juice or paste used to reduce abdominal pain and to heal burns	7, 8, 9

SN	Botanical name	Part used	Traditional Uses	References
28.	<i>Coelogyne nitida</i> (Wall. ex D.Don) Lindl.	Pb	Juice or juice used to overcome headache, fever and burns	9
29.	<i>Coelogyne ovalis</i> Lindl.	Wh	Pseudobulb is aphrodisiac. Whole plant effective against cough, urinary infections and eye disorders	3, 8, 15, 20
30.	<i>Coelogyne prolifera</i> Lindl.	Pb	Paste used to relieve fever, headache, backache, burn and boil	8, 9, 15
31.	<i>Coelogyne punctulata</i> Lindl.	Pb	Used in burn injuries and wound	3, 20
32.	<i>Coelogyne stricta</i> (D.Don) Schltr.	Pb	Paste applied externally to relieve headache and fever	7, 8, 9, 17
33.	<i>Conchidium muscicola</i> (Lindl.) Rauschert	Wh	Used in cardiac, respiratory and nervous disorders	8, 17
34.	<i>Corymborkis veratrifolia</i> (Reinw.) Blume	Lf	Leaf juice used as emetic. Also used during constipation and fever in children	11
35.	<i>Cremastra appendiculata</i> (D.Don) Makino	Rt, St	Root powder used in snakebite. Stem used in dental caries	3, 11
36.	<i>Crepidium acuminatum</i> (D.Don) Szlach.	Rt, Pb	Root powder used in burns. Pseudobulb used to treat bronchitis, cold, cough, fever, tuberculosis and weakness. Pseudobulb also used as tonic and male aphrodisiac	3, 7, 8, 9, 11, 17
37.	<i>Cymbidium aloifolium</i> (L.) Sw.	Wh	Rhizome is purgative, also used in bone fracture. Powdered rhizome consumed as tonic. Root paste used to cure rheumatism and nervous disorders. Pseudobulb used as demulcent agent. Seed powder used for healing wounds. Leaf used in boils and fever. Whole plant used in weakness of eye, burns and sores	1, 3, 7, 8, 9, 15, 17, 20, 21, 22, 23, 24
38.	<i>Cymbidium devonianum</i> Paxton	Wh	Concentrated decoction used in cough and cold. Root paste used in boils	8, 15
39.	<i>Cymbidium elegans</i> Lindl. [Syn. <i>Cymbidium longifolium</i> D.Don]	Wh	Fresh juice is coagulating and used to treat deep wounds. Also used in nervous disorders	6, 8, 9
40.	<i>Cymbidium ensifolium</i> var. <i>munronianum</i> (King & Pantl.) T. Tang & F.T. Wang	Rt, Fl	Root decoction used to treat gonorrhoea. Flower decoction used in eye sore disorders	3, 12, 20
41.	<i>Cymbidium hookerianum</i> Rchb.f.	Sd	Seeds are applied to cuts and injuries as haemostatic	3
42.	<i>Cymbidium iridioides</i> D.Don	Lf, Pb, Rt	Fresh juice of leaf used as blood clotting in fresh wounds. Pseudobulb and root powder used as tonic and eaten during diarrhoea	7, 8, 9, 20, 21
43.	<i>Cymbidium macrorhizon</i> Lindl.	Rz	Decoction used as diaphoretic and in treatment of boils	25
44.	<i>Dendrobium amoenum</i> Wall. ex Lindl.	Pb	Fresh paste applied to cure burnt skin and dislocated bones	9

SN	Botanical name	Part used	Traditional Uses	References
45.	<i>Dendrobium chrysanthum</i> Wall. ex Lindl.	St, Lf	Stem used as tonic to nourish stomach, enhance immune system, promote the production of body fluid and reduce fever. Leaf used as antipyretic and mild skin diseases	12, 26, 27
46.	<i>Dendrobium chrysotoxum</i> Lindl.	St, Fl, Lf	Extract of stem and flower used as tonic. Leaf extract used as antipyretic	12, 28
47.	<i>Dendrobium crepidatum</i> Lindl. & Paxton	Pb, St	Pseudobulbs paste used in fractured and dislocated bones. Stem used as tonic, in arthritis and rheumatism	28, 29
48.	<i>Dendrobium densiflorum</i> Lindl.	Pb, Lf	Pseudobulb cures vomiting and quenches thirst. Lowers fever of phlegm. Rejuvenates degenerated power of the digestive system caused due to lack of digestive fluids and loss of appetite. Pulp of the pseudobulbs used in boils, pimples and other skin eruptions. Leaf paste used in fractures bones, sprains and inflammations	3, 8, 9, 11, 15, 30
49.	<i>Dendrobium denudans</i> D.Don	St	Used to treat cough, cold, nasal block and tonsillitis. Also used as tonic for age-old and children	11
50.	<i>Dendrobium devonianum</i> Paxton	St	Dried stems used as an immune system enhancer	31
51.	<i>Dendrobium eriiflorum</i> Griff.	Pb	Paste used to treat fractured and dislocated bones. Dried powder used as tonic	9
52.	<i>Dendrobium falconeri</i> Hook.	St	Consumed as tonic and used in lung cancer	28
53.	<i>Dendrobium fimbriatum</i> Hook.	Wh, Pb	Whole plant used in liver upset and nervous debility. Pseudobulb considered as aphrodisiac, stimulant and demulcents. Pseudobulb used in liver upsets, nervous debility, fever and as tonic. Leaf used in fractured bones	2, 3, 7, 8, 12, 21, 28
54.	<i>Dendrobium fugax</i> Rchb.f.	Wh	Powder used as a tonic and general debility stimulant	9
55.	<i>Dendrobium jenkinsii</i> Wall. ex Lindl.	St	Used in gastritis, dehydration during fever, thrush and dried eyes like ailments	11
56.	<i>Dendrobium longicornu</i> Lindl.	Wh, Rt	Plant juice used to relieve fever. Boiled roots used to feed livestock suffering from cough	9, 15
57.	<i>Dendrobium moniliforme</i> (L.) Sw.	Pb	Used as anti-inflammatory	32
58.	<i>Dendrobium monticola</i> P.F.Hunt & Summerh.	Pb	Pulps of the pseudobulbs used in boils, pimples and other skin eruptions	7, 8, 17
59.	<i>Dendrobium moschatum</i> (Buch.-Ham.) Sw.	Pb, Lf	Pseudobulb decoction consumed during general body weakness. Pseudobulb paste used to treat fractured and dislocated bones. Leaf juice used during earache	3, 11, 28, 30, 33

SN	Botanical name	Part used	Traditional Uses	References
60.	<i>Dendrobium nobile</i> Lindl.	Wh	Stem is considered as tonic, vigour, aphrodisiac, stomachic, analgesic and anti-ageing. Decoction of stem used to reduce salivation, thirst, tongue dryness, night sweating, menstrual pain and nightfall. Powdered stem used in dyspepsia, parched and thirsty mouth, fever, anorexia, pulmonary tuberculosis and lumbago. Whole plant used in nervous disorders. Seeds applied to the freshly cut wounds for quick healing	3, 11, 20, 21, 28, 34
61.	<i>Dendrobium transparens</i> Wall. ex Lindl.	Pb	Paste used to treat fractured and dislocated bones	9
62.	<i>Dienia cylindrostachya</i> Lindl.	Pb	Powder used as tonic	9
63.	<i>Epipactis helleborine</i> (L.) Crantz	Wh	Tuber used to treat insanity, gout, headache and stomachache. Whole plant used in nervous disorders	7, 8, 9, 17, 20
64.	<i>Eulophia dabia</i> (D.Don) Hochr.	Rh	Used as appetizer, tonic and aphrodisiac. Used in treatment of purulent cough and heart trouble. Infusion given to infants to reduce cough, cold and as blood purifier	7, 8, 9, 20
65.	<i>Eulophia spectabilis</i> (Dennst.) Suresh	Tb, Lf	Tuber is appetizer, aphrodisiac and used as tonic and blood-purifier. Also useful in tuberculosis glands on neck, tumors and bronchitis. Decoction of tuber used to treat pinworm and roundworm infections. Leaf paste used in skin diseases	3, 8, 10, 11, 33
66.	<i>Galeola falconeri</i> Hook.f.	Tb	Paste used externally in treatment of STDs like syphilis	This study
67.	<i>Geodorum densiflorum</i> (Lam.) Schltr.	Tb	Used as poultice in wounds, skin diseases, carbuncles and insect bites. Also used to cure dysentery, diabetes, improving fertility in men and to regularize menstrual cycle in women	20, 35, 36
68.	<i>Goodyera repens</i> (L.) R.Br.	Wh	Tuber paste externally applied to treat syphilis. Extract taken as blood purifier during irregular menstruation. Whole plant used against eye disorders and snake bites	11, 20, 37, 38
69.	<i>Goodyera schlechtendaliana</i> Rchb.f.	Wh	Leaf and stem used as blood purifier, in acne, pruritus, psoriasis and fungal infections on skin. Extract of whole plant used as tonic for curing internal injuries and to improve blood circulation	3, 11, 39
70.	<i>Gymnadenia orchidis</i> Lindl.	Tb	Powered form used to treat cuts, wounds, gastritis, diarrhea, liver and urinary disorders. Milk decoction taken as aphrodisiac and tonic. Rejuvenates bodily strength, increases sperm count and restores diminished kidney heat	3, 7, 8, 9, 11, 15, 20, 30
71.	<i>Habenaria dentata</i> (Sw.) Schltr.	Wh	Whole plant considered as analgesic, aphrodisiac, disinfectant and anti-rheumatic. Used to treat urinary and orthopedic problems	40, 41



SN	Botanical name	Part used	Traditional Uses	References
72.	<i>Habenaria furcifera</i> Lindl.	Tb	Paste applied on cuts, wounds and insect bites. Also used as tonic to improve body fluid	42
73.	<i>Habenaria pantlingiana</i> Kraenzl.	Tb	Extract is used in snake and snake bites	22
74.	<i>Habenaria pectinata</i> D.Don	Tb, Lf	Tuber used in arthritis. Leaf juice applied in snakebite	9, 43, 44
75.	<i>Herminium lanceum</i> (Thunb. ex Sw.) Vuijk	Wh	Extract of plant given in suppressed urination	37
76.	<i>Liparis nervosa</i> (Thunb.) Lindl.	Tb	Used to treat stomachache, malignant ulcers	8, 17
77.	<i>Liparis odorata</i> (Willd.) Lindl.	Lf, St	Leaf juice used to treat cancerous ulcer, gangrene and burns. Stem used to cure throat cancer	3, 11, 21
78.	<i>Luisia trichorrhiza</i> (Hook.) Blume	Wh	Paste applied externally to cure muscular pain and orally consumed to treat jaundice	4, 8, 9, 17, 20
79.	<i>Luisia tristis</i> (G.Forst.) Hook.f.	Lf	Juice is used to treat chronic wounds, boils and burns	7, 9, 15, 17
80.	<i>Malaxis muscifera</i> (Lindl.) Kuntze	Pb	Useful in sterility, seminal weakness, dysentery, fever and general debility as a tonic. Powdered form used to treat male infertility and decoction in fever and burning limbs	3, 8, 9, 11
81.	<i>Monomeria barbata</i> Lindl.	Tb	Used in treating coughs, pulmonary tuberculosis and trauma	45
82.	<i>Mycaranthes pannea</i> (Lindl.) S.C.Chen & J.J.Wood	Rt, Lf	Decoction of root is used in washing chicken pox and also used in malaria. Leaf poultice applied to fractured bones and muscle swellings	6
83.	<i>Nervilia macroglossa</i> (Hook.f.) Schltr.	Tb	Used to increase male impotency	46
84.	<i>Oberonia caulescens</i> Lindl.	Tb	Used in liver ailments	7, 8, 20
85.	<i>Oberonia falconeri</i> Hook.f.	Wh	Used in bone fractures	47
86.	<i>Otochilus albus</i> Lindl.	Wh	Powder is used as tonic	9
87.	<i>Otochilus porrectus</i> Lindl.	Wh	Used as tonic and also in the treatment of sinusitis and rheumatism	8, 19, 48
88.	<i>Papilionanthe teres</i> (Roxb.) Schltr.	Wh	Paste applied externally to treat high fevers and dislocated bones. Juice used in burning sensation and to reduce fever, cough and cold	3, 8, 9, 11, 15, 21
89.	<i>Peristylus constrictus</i> (Lindl.) Lindl.	Rt	Fresh extract are applied on boils	36
90.	<i>Phaius tankervilleae</i> (Banks) Blume	Tb, Lf, FL	Tuber is tonic. Tuber paste used to reduce swelling of gout, to reduce pain of fractured bones, redness and swelling. Also eaten during dysentery. Poultice made of tubers and leaves used to heal infected wounds and boils	3, 6, 11, 20, 21, 29, 36

SN	Botanical name	Part used	Traditional Uses	References
91.	<i>Pholidota articulata</i> Lindl.	Wh	Whole plant used as tonic. Root powder used to treat cancer. Fruit juice used to treat skin ulcers and skin eruptions. Pseudobulb applied to treat dislocated bones	7, 8, 9, 15, 22, 49
92.	<i>Pholidota chinensis</i> Lindl.	Pb	Extract used in toothache, stomachache and inflammation	3, 50
93.	<i>Pholidota imbricata</i> Lindl.	Pb	Juice applied to relieve pain of nasal, abdominal and rheumatic. Paste used to reduce fever, pain and swelling during arthritis. Powder used as tonic	3, 7, 8, 10, 11, 17
94.	<i>Pholidota pallida</i> Lindl.	Rt, Pb	Juice applied to relieve nasal, abdominal and rheumatic pains. Powder used to treat insomnia	3, 7, 8, 9, 17
95.	<i>Pinalia spicata</i> (D.Don) S.C.Chen & J.J.Wood	St	Paste consumed to reduce stomachache and applied externally to reduce headache	7, 8, 9
96.	<i>Platanthera latilabris</i> Lindl.	Pb	Used as blood purifier	20
97.	<i>Pleione humilis</i> (Sm.) D.Don	Pb	Dried powder is tonic. Paste used in cut and wounds	8, 9, 15
98.	<i>Pleione maculata</i> (Lindl.) Lindl. & Paxton	Rz	Used in liver complaints and stomach ailments	3, 7, 8, 17, 20
99.	<i>Pleione praecox</i> (Sm.) D.Don	Pb	Dried powder is tonic. Paste used in cut and wounds	8, 9, 15
100.	<i>Polystachya concreta</i> (Jacq.) Garay & H.R.Sweet	Pb	Used in treatment of arthritis	20
101.	<i>Ponerorchis chusua</i> (D.Don) Soo	Tb	Used in treatment of diarrhea, dysentery and chronic fever	3
102.	<i>Renanthera imschootiana</i> Rolfe	Lf	Paste used in skin diseases	5
103.	<i>Rhynchostylis retusa</i> (L.) Blume	Lf, Rt, Fl	Paste of leaves and roots used in rheumatism. Leaf juice used in constipation, gastritis, acidity and as emollient. Root juice used in cuts and wounds. Decoction of root used in menstrual pain, arthritis, cuts and wounds. Dry flower used as emetic	8, 10, 11, 15, 16, 17, 48
104.	<i>Satyrium nepalense</i> D.Don	Tb	Used in diarrhea, dysentery and malaria. Tubers eaten as aphrodisiac and growth supplement of children. Juice used externally in cut and wounds. Powder is tonic and used to reduce cold, cough and fever.	3, 7, 8, 9, 11, 15, 16, 17, 21
105.	<i>Smitinandia micrantha</i> (Lindl.) Holttum	Rt, St	Root powder used as tonic. Stem has antibacterial property	7, 8
106.	<i>Spiranthes sinensis</i> (Pers.) Ames	Wh	Decoction used during intermittent fever. Soup made of tubers used to cure fatigue, hemoptysis, kidney diseases and as tonic. Root and stem paste used in sores	7, 8, 9, 51

SN	Botanical name	Part used	Traditional Uses	References
107.	<i>Thunia alba</i> (Lindl.) Rchb.f.	Wh	Paste applied to treat dislocated bones	8, 9, 15
108.	<i>Tropidia curculigoides</i> Lindl.	Tb, St	Decoction given in diarrhoea and malaria	3, 11, 20
109.	<i>Vanda coerulea</i> Griff. ex Lindl.	Lf	Leaf juice is expectorant and used in eye diseases, diarrhoea, loose motion, dysentery and external skin diseases	3, 5, 11, 21
110.	<i>Vanda cristata</i> Wall. ex Lindl.	Lf, Rt	Leaf juice is expectorant and used in tonsillitis, bronchitis, dry cough and general weakness as tonic. Leaf paste applied to cuts and wounds. Root paste used in cuts, wounds, boils and dislocated bones	3, 8, 10, 11, 15, 16, 21, 22, 48
111.	<i>Zeuxine longilabris</i> (Lindl.) Trimén	Wh	Used to treat whooping cough	52
112.	<i>Zeuxine strateumatica</i> (L.) Schltr.	Rt, Tb	Dry powder used as tonic	9, 22, 33

[Rt: Root; St: Stem; Wh: Whole plant; Tb: Tuber; Lf: Leaf; Rz: Rhizome; Pb: Pseudobulb; 1: Ramesh et al., 2012; 2: Dey, 1984; 3: Yonzon, et al., 2012; 4: Dash et al., 2008; 5: Deorani and Sharma, 2007; 6: Toeh, 2016; 7: Vaidya et al., 2000; 8: Baral and Kurmi, 2006; 9: Subedi 2011; 10: Subedi et al., 2013; 11: Panda and Mandal, 2013; 12: Nongdam, 2014; 13: Bantawa and Rai, 2009; 14: Lokho, 2012; 15: Manandhar, 2002; 16: Joshi and Joshi, 2006; 17: Shrestha, 2000; 18: Gutierrez, 2010; 19: Shanavaskhan et al., 2012; 20: Jalal et al., 2010; 21: Medhi and Chakrabarti, 2009; 22: Behera et al., 2013; 23: Chowdhery, 2001; 24: Nongdam and Chongtham, 2011; 25: Dudgal, 1972; 26: Anonymous, 1986; 27: Li et al., 2001; 28: San and Myint, 2009; 29: Pant, 2013; 30: Dakpa, 2007; 31: Zi, 2016; 32: Lin et al., 2001; 33: Kirtikar and Basu, 1935; 34: Anonymous, 1997; 35: Keerthiga and Anand, 2014; 36: Hossain, 2009; 37: Joshi et al., 2009; 38: Paul and Hegde, 1998; 39: Du et al, 2002; 40: Sood, 2006; 41: Yonzon et al., 2011; 42: Jalal et al, 2008; 43: Chauhan, 1999; 44: Singh and Duggal, 2009; 45: Yang et al., 2010; 46: Pankaj, 2013; 47: Kumar, 2008; 48: Joshi and Joshi, 2000; 49: Bhattacharjee, 1998; 50: Wang et al., 2006; 51: Wiart, 2012; 52: Rajendran et al., 1997]

### THREAT STATUS

Globally, orchids are the most threatened species among the flowering plants. Orchids are depleting at an alarming rate due to over-exploitation, onslaught habitat destruction by urbanization and shifting cultivation, loss of pollinators, destructive diseases, climate changes and unauthorized trade (Gopinath 1994; Suseela and Thomas, 2000). Orchids which are used for medicine and as ornament are under considerable threat due to over collection (Pant et al., 2002). Most of the orchid species has been categorized as rare and endangered, and are listed under appendix II of CITES (Anonymous, 2017). Few species were

even included in appendix I of CITES to control illegal trade of such species which includes *Aerangis ellisii*, *Dendrobium cruentum*, *Laelia jongheana*, *Laelia lobata*, *Paphiopedilum* spp., *Peristeria elata*, *Phragmipedium* spp. and *Renanthera imschootiana*.

IUCN have evaluated threat status of 880 orchid species, of which 162 (18.41 %) are categorized as Critically Endangered (CE), 242 (27.61 %) as Endangered (EN), 113 (12.84 %) as Vulnerable (VU), 49 (5.57 %) as Near Threatened (NT), 01 species (*Oeceoclades seychellarum*) as Extinct and rest under Least Concern (Anonymous, 2016). Out of 880 orchid species evaluated by IUCN, 19 are found

in Arunachal Pradesh which includes *Gastrochilus calceolaris* (CE), *Paphiopedilum fairrianum* (CE), *Bulleyia yunnanensis* (EN), *Paphiopedilum venustum* (EN), *Paphiopedilum wardii* (EN), *Malaxis muscifera* (VU), *Pholidota chinensis* (NT), *Bulbophyllum cauliflorum* (LC), *Bulbophyllum delitescens* (LC), *Bulbophyllum leopardinum* (LC), *Coelogyne rigida* (LC), *Conchidium pusillum* (LC), *Cypripedium tibeticum* (LC), *Dendrobium aphyllum* (LC), *Erythrodes blumei* (LC), *Erythrorchis altissima* (LC), *Podochilus khasianus* (LC), *Spiranthes sinensis* (LC) and *Zeuxine strateumatica* (LC). These 19 species also includes 5 medicinal orchids.

There are many more orchids which are native to Indo-Burma hotspot region and are facing high degree of habitat threat due to over harvesting accompanied by their slow growth rate such as *Calanthe plantaginea*, *Cephalanthera longifolia*, *Crepidium acuminatum*, *Dactylorhiza hatagirea*, *Gymnadenia orchidis*, etc. Such orchids also needs to be evaluated and categorized under 'The Red List of Threatened Species' both at regional and global level.

#### IN-SITU CONSERVATION OF ORCHIDS IN ARUNACHAL PRADESH

The Department of Environment and Forests, Government of Arunachal Pradesh has established a sanctuary (Sessa Orchid Sanctuary) particularly for orchid conservation in West Kameng district. The sanctuary having geographical area of 100 km<sup>2</sup> is the richest area in terms of orchid diversity with around 183 species in 55 genera (Anonymous, 2016). Besides this, sacred groves play an important role in conservation of orchids. Sacred groves are rich in biodiversity and the local communities conserve each and every species in a sustainable manner with their socio-cultural and religious practice. Some orchids like

*Dendrobium hookerianum*, *D. nobile* and *D. gibsonii* are considered sacred by the tribal people (Hegde, 1984) but multiple use-values exacerbate the threat of overexploitation for these species.

#### CONCLUSION

Arunachal Pradesh is blessed with 112 species of medicinal orchids. These orchids are still widely used in traditional system of medicines, but it is sad that necessary scientific studies on the medicinal properties of these orchids are still on the bottom of the agenda. Thus extensive research is necessary to be able to fully recommend the orchid species for their medicinal uses.

Also, the rich natural gene pool of orchid is depleting at an alarming rate particularly due to over-exploitation for medicinal and ornamental purposes. Species like *Liparis olivacea* have already become extinct from the wild and many more are on the verge of extinction (Subedi, 2011). Recent advances in conservation biology with biotechnological approaches have paved the safeguard for plant biodiversity, however, very little effort has been made to cultivate the medicinal orchids for commercial scale, which have put further stress. Thus, besides promoting artificial propagation, collection of any orchids from wild should be totally banned at every level and awareness should be created for effective conservation.

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