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Review Article

A comprehensive review on ethnobotanical applications and pharmacological activities of *Acampe praemorsa* (Roxb.) Blatt. & McCann (Orchidaceae)

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ABSTRACT

Orchidaceae is one of the two largest families in angiosperms. Orchids are popular owing to the most beautiful flowers they produce and due to their wide spread ethnobotanical importance. In this review, ethnobotanical uses and pharmacological activities of *A. praemorsa* is discussed by referring flora, journals, and search engines such as Google scholar, ScienceDirect and Pubmed. Ethnobotanical investigations have revealed the potential therapeutic roles of different parts of *A. praemorsa*. The orchid is used traditionally by for treating ailments such as stomachache, earache, backache, wounds, neuralgia, rheumatism, eye diseases, sciatica, cough and fracture. *A. praemorsa* is investigated for various pharmacological activities. Studies have revealed the potential of *A. praemorsa* to exhibit a range of bioactivities such as anticancer, antibacterial, antifungal, antioxidant and anti-inflammatory activities. In conclusion, *A. praemorsa* is an extensively used epiphytic orchid for medicinal purposes in several parts of the India and other countries. Major emphasis has to be given in order to conserve this medicinally important orchid species. *A. praemorsa* can be a promising candidate in terms of its pharmacological potential.

Keywords: Orchids, Orchidaceae, *Acampe praemorsa*, Ethnobotanical, Pharmacological

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INTRODUCTION

The family Orchidaceae represents one of the highly evolved and most diverse group of angiosperms with about 29000 species (coming under roughly 880 genera) found distributed in different parts of the world. This is the second largest family next to Asteraceae and comprises approximately 8% of all vascular plants. The abundance as well as distribution of orchids vary from region to region and depends on climatic conditions. Orchids may be epiphytes, lithophytes, terrestrials or saprophytes depending upon the habit in which they are growing. Majority of orchids are epiphytic in nature. Many orchids are common in occurrence while some are rare and critically endangered. A high degree of endemism is also reported in certain species of orchids. Orchids exhibits significant diversity with respect to size, color and shape of the flowers. Orchids produce minute seeds whose germination is aided by fungal symbiosis. The existence and diversity of orchids is threatened by various factors such as over-exploitation, climate change and habitat loss (mainly due to anthropogenic activities, for e.g. deforestation). Orchids have found ethnobotanical significance. Orchids are well known for producing

extremely beautiful flowers (with distinct pollination mechanisms) and hence, orchids are grown for ornamental purposes and also for generating income out of that. Besides, many orchid species are widely used traditionally all over the world as food and for treating various human and veterinary ailments. Different parts of the orchids such as roots, leaves and pseudobulbs have found medicinal values. Studies have shown the potential of orchid extracts and purified compounds from orchids to exhibit a myriad of pharmacological activities including antimicrobial, anti-inflammatory, antioxidant, and anticancer activities¹⁻²⁶.

Orchids are widespread in distribution and are known to occur in tropical and temperate regions. India represents one of the biodiversity hotspots for orchids. Western Ghats, Eastern Ghats, Himalayas and North-east states of India harbor a variety of plant species including several orchid species, many of which are endemic to particular area. More than 1300 species of orchids belonging to about 180 genera are found in India. Many orchid species are used as food as well as medicinally in India for various treatment purposes. Indigenous medicinal systems such as Ayurveda, Unani and Siddha make use of several orchid species for remedy

against certain kinds of ailments or disorders²⁷⁻³⁹. The monopodial genus *Acampe* Lindl. consists of around 8 species, majority of which are found in Asia. *Acampe praemorsa* (Roxb.) Blatt. & McCann (Synonym *A. papillosa* Lindl., *A. wightiana* Lindl. ex Wight) is an epiphytic orchid, usually found growing on trunks of several tree species. The orchid is widespread in distribution and is known to occur in countries viz. India, Vietnam, Thailand, Bangladesh, Myanmar, Bhutan, Sri Lanka, Nepal, Burma and China. The orchid *A. praemorsa* is distributed in various states viz. Karnataka, Andhra Pradesh, Gujarat, Chhattisgarh, Odisha, Kerala, Maharashtra, Tamil Nadu, Rajasthan, Madhya Pradesh and many North-east states. *A. praemorsa* is one of the medicinally important orchids and is reported to be ethnomedicinally useful for treating various illnesses including rheumatism^{1,24,29,40-44}. In Western Ghats, *A. praemorsa* is used as one of the larval host plants by the butterflies⁴⁵. In this review, an extensive literature survey

was conducted to compile data available on ethnomedicinal uses and pharmacological activities of *A. praemorsa* by referring standard flora, journals and search engines viz. PubMed, Google Scholar and Science Direct.

PLANT DESCRIPTION

Acampe praemorsa (Figure 1) is a common, large, robust epiphyte having stout stem up to 30-40cm in length and 1-1.5cm diameter. Leaves are distichous, thick, up to 10-30x2-3.5cm, coriaceous, lorate and the apex is unequally 2-lobed. Inflorescence corymbose (several, 3-4cm), much shorter when compared to leaves. Flowers are clustered (8-12), fragrant, long-lasting, are densely arranged and approximately 1.2cm across. Petals and sepals subequal, yellow, barred with red. The lip is white, caruncled, and sparsely speckled with magenta to dark brown. Capsule sessile, fusiform^{14,46}.

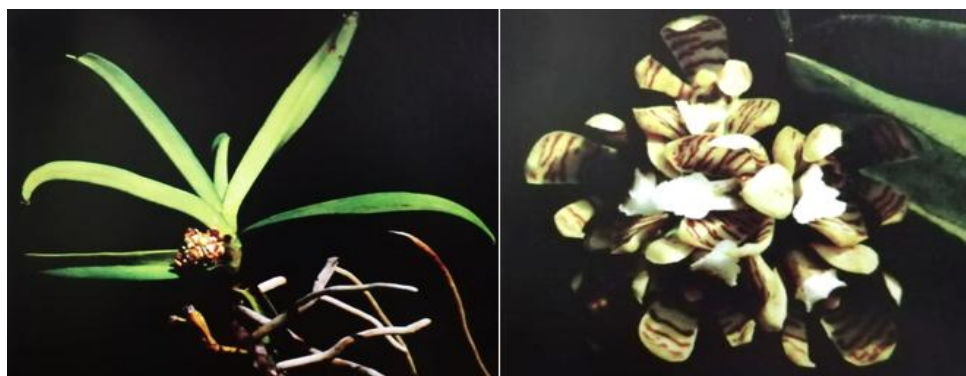


Figure 1: *Acampe praemorsa*⁴⁷

ETHNOBOTANICAL USES OF *A. PRAEMORSA*

Higher plants have been a significant part of traditional medicine. All over the world, orchids have been used for medicinal purposes. Tribal communities extensively utilize several orchid species for treating various ailments in certain formulations. *A. praemorsa* is one among the several orchid species that find ethnomedicinal significance. Various parts, in particular roots, are used medicinally for treating rheumatism, neuralgia, snake and scorpion bite, stomach disorders, earache, cough, fever, stomach disorders,

secondary syphilis, uterine diseases etc. The roots of *A. praemorsa* are used in the preparation of herbal shampoo^{18,48-58}. The ethnic people of Visakhapatnam district, Andhra Pradesh, India make use of *A. praemorsa* for managing diabetes⁵⁹. The leaf paste of *A. praemorsa* is used by Arakuvalley tribes of Visakhapatnam district, Andhra Pradesh, India to get relief from chest pain and hyperacidity⁶⁰.

In Nagaland, the root paste is consumed orally in order to get relief from rheumatism⁶¹.

Table 1: Ethnobotanical uses of *A. praemorsa*

Region	Part	Form	Use	Reference
Kerala, India	Seed, leaf	Juice	Stomachache, ear-ache, reduction of body temperature, antibiotic for wound	Shanavaskhan et al. ⁵³
Tamil Nadu, India	Root	Paste	Arthritis	Devi et al. ⁶⁷
Sikkim, India	Root	Paste, decoction	Neuralgia, traumatic pain, arthritis, rheumatism, backache, menstruation pain, sciatica	Panda and Mandal ⁶⁸
Nagaland, India	Root	Paste	Burning sensation, asthma, bronchitis, secondary syphilis, mild uterine diseases, eye diseases	Nongdam ⁶⁹
Malappuram, Kerala, India	Whole plant	Extract	Rheumatism	Chithra and Geetha ⁷⁰
Feni district, Bangladesh	Leaf	Juice	Rheumatism, cough, ear complaint	Uddin et al. ⁷¹
Orissa, India	Root	Paste	Arthritis	Dash et al. ⁷²
Meghalaya, India	Root	Juice	As tonic and for treatment of rheumatic disorders	Singh and Borthakur ⁷³
Nepal	Root	Powder	Rheumatism	Subedi et al. ⁵⁶
Madhya Pradesh, India	Root	Decoction	Cough	Tiwari et al. ⁷⁴
Salem district, Tamil Nadu, India	Leaf	Paste	Fracture	Mishra et al. ⁷⁵
Kerala, India	Leaf	-	Shampoo	Kumar et al. ⁷⁶
Andhra Pradesh, India	Whole plant	-	Fracture	Reddy et al. ⁷⁷

Tribal communities (bagali, chakma and marma communities) in south east Bangladesh uses leaves and whole plants of *A. praemorsa* for treating fever, ear ache, injury and male and female problems⁶². The Kokani tribe of Nasik district of Maharashtra, India, uses the plant to treat wound. The pastes made from the roots are applied on the fractured organ of the cattle⁶³. In Kanhepimpali village, Maharashtra, the leaves of *A. praemorsa* were used in ethnoveterinary practices. The leaves made hot (steam or direct flame), mashed and applied directly on the limb of cattle⁶⁴. The roots of *A. praemorsa* are used as a tonic and for treatment of rheumatism in Bangladesh⁶⁵. The Khasia community of Moulvibazar district, Bangladesh uses root of *A. praemorsa* for the treatment of rheumatism and sciatica⁶⁶. More information on ethnomedicinal uses of *A. praemorsa* is shown in **Table 1**.

PHYTOCHEMICALS IDENTIFIED IN *A. PRAEMORSA*

Orchids are known to produce a myriad of phytochemicals including alkaloids, triterpenoids and phenolic compounds. Incredible advancement in spectral and chromatographic techniques resulted in the recovery and elucidation of structures of many phytochemicals from natural products including orchids^{6,12,78-82}. Studies have been carried out to detect phytochemicals/phytochemical groups in *A. praemorsa*. A new phenanthropyran named as Praemorsin, was isolated from the whole plant of *A. praemorsa*⁸³. Anuradha and Rao⁸⁴ have also isolated and elucidated the structures of two compounds viz. flavidin and flavidinin from *A. praemorsa*. Maridass et al.⁸⁵ have identified flavonoids and cardiac glycosides in *A. praemorsa*. Suja and Williams⁸⁶ identified alkaloids, flavonoids, tannins, saponins, phenol, terpenoids and steroids in the plant. The study by Marjoka et al.⁸² revealed the presence of alkaloids, flavonoids, glycosides, saponins, tannins and steroids in the leaves of *A. praemorsa*. Akter et al.⁸⁷ identified the phytochemical groups viz. glycosides, flavonoids, saponins, tannins, terpenoids, steroids, coumarins, anthraquinones in the leaves of *A. praemorsa*.

PHARMACOLOGICAL ACTIVITIES OF *A. PRAEMORSA*

Several studies have been carried out to investigate biological activities of *A. praemorsa*. The plant is reported to exhibit bioactivities viz. antibacterial, antifungal, anti-inflammatory, anticancer and antioxidant activity. A brief description on pharmacological potential of *A. praemorsa* is discussed.

Anti-inflammatory activity

Ethanol and aqueous extracts obtained from whole plant of *A. praemorsa* were evaluated for anti-inflammatory activity by carrageenan-induced paw oedema model in rats. Aqueous extract was shown to exhibit significant anti-inflammatory activity when compared to ethanolic extract⁸⁸.

Anticancer activity

Soumiya et al.⁸⁹ evaluated anticancer activity of ethanol extract of *A. praemorsa* leaves by MTT assay. The extract was shown to exhibit cytotoxic effect against A549 cell line dose dependently with IC₅₀ value of 14.63 µg/ml. Jhansi and Khasim⁹⁰ determined cytotoxic potential of methanolic and ethyl acetate extracts of *A. praemorsa* by MTT assay against two cell lines viz. HeLa and MCF-7 cells. Extracts were toxic to both cell lines with marked activity being shown by ethyl acetate extract as indicated by IC₅₀ values. Extracts exhibited potent cytotoxicity against MCF-7 cells when compared to HeLa cells.

Antioxidant activity

Suja and Williams⁸⁶ screened antiradical activity of aqueous and ethanol extracts of *A. praemorsa* by hydroxyl and DPPH radical scavenging activity. A dose dependent scavenging of radicals was observed.

Antibacterial activity

Studies have shown the potential of *A. praemorsa* to inhibit many bacteria including drug resistant strains of bacteria. Hoque et al.⁹¹ evaluated antibacterial activity of *A. praemorsa* extracts by disk diffusion assay. Among extracts, ethanol extract revealed marked activity as it inhibited three out of five test bacteria while petroleum ether extract did not cause inhibition of any bacteria. All extracts were failed to inhibit *Staphylococcus aureus*. Paul et al.⁹² showed the potential of leaf extract of *A. praemorsa* to inhibit kanamycin and ampicillin resistant strains of *E. coli*. Jhansi and Khasim⁹⁰ evaluated methanol and ethyl acetate extracts of leaves of *A. praemorsa* to inhibit gram positive and gram negative bacteria. Overall, ethyl acetate extract was effective in displaying marked antibacterial activity than methanol extract. **Table 2** shows more information on antibacterial activity of *A. praemorsa*.

Antifungal activity

Aqueous extract prepared from *A. praemorsa* was effective in causing inhibition of phytopathogenic fungi viz. *Alternaria alternata*, *Curvularia lunata*, *Colletotrichum corchori*, *Fusarium equiseti*, *Macrophomina phaseolina* and *Botryodiplodia theobromae* with highest and least inhibitory activity against *C. lunata* and *M. phaseolina*, respectively⁹¹. Swami et al.⁹³ evaluated antifungal potential of leaf and root of *A. praemorsa*. Petroleum ether extract of leaf and root and methanol extract of leaf revealed dose dependent inhibition of *Aspergillus niger* and *Candida albicans*, however, methanol extract of root was ineffective in causing inhibition of both fungi. Akarsh et al.⁹⁴ revealed the antifungal effect of cow urine extract of *A. praemorsa* against *Colletotrichum capsici* and *Fusarium oxysporum*. Cow urine extract was more effective against *C. capsici* (50% inhibition) than *F. oxysporum* (11.90% inhibition). **Table 2** shows more information on antifungal activity of *A. praemorsa*.

Table 2: Antibacterial and antifungal activity of *A. praemorsa*

Part	Extract	Method	Activity against	Reference
Whole plant	Methanol extract	Agar well diffusion	<i>S. aureus</i> , <i>Escherichia coli</i> and <i>Pseudomonas aeruginosa</i>	Ranjitha et al. ⁹⁵
Whole plant	Methanol extract	Poisoned food technique	<i>C. capsici</i> and <i>F. oxysporum</i>	Akarsh et al. ⁹⁶
Leaf and root	Butanol, chloroform, diethyl ether and methanol extracts	Disk diffusion assay	Gram positive and gram negative bacteria	Behera et al. ⁵⁴
Leaf and root	Methanol and petroleum ether extracts	Agar well diffusion assay	Gram positive and gram negative bacteria	Swami et al. ⁹³
Whole plant	Methanol extract	Poisoned food technique	<i>Bipolaris sorokiana</i>	Kekuda et al. ²⁰

CONCLUSIONS

Orchids differ from other groups of plants with respect to distinct floral morphology, association with mycorrhizae, pollination pattern and production of tiny seeds⁹⁷. Since time immemorial, orchids have aesthetic and medicinal values as well as economic importance. Habitat loss and over-exploitation seems to be the important threat for existence and dwelling of orchids in natural habitats. An extensive literature survey carried out in this study revealed the potential medicinal uses of whole plant as well as various parts of *A. praemorsa*. The plant is widely used for treating several ailments including rheumatism, stomachache, fracture, wounds, bronchitis and cough. The plant is reported to exhibit some bioactivities viz. antimicrobial, anticancer, anti-inflammatory and antioxidant activity. *A. praemorsa* seems to be a suitable candidate for development of novel therapeutic agents. More emphasis has to be given for conservation of this medicinal orchid species through *in-situ* and *ex-situ* protocols.

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CONFLICTS OF INTEREST

None declared

REFERENCES

- Hedge SN. Orchid wealth of India. Proc Indian Natn Sci Acad 1997; 63(3):229-224.
- Rajendran A, Rao RN, Kumar RK, Henry AN. Some medicinal orchids of Southern India. Ancient Science of Life 1997; 17(1):10-14.
- Kong J, Goh N, Chia L, Chia T. Recent advances in traditional plant drugs and orchids. Acta Pharmacol Sin 2003; 24(1):7-24.
- Bulpitt CJ, Li Y, Bulpitt PF, Wang J. The use of orchids in Chinese medicine. J Royal Soc Med 2007; 100:558-563.
- Kasulo V, Mwabumba L, Cry M. A review of edible orchids in Malawi. Journal of Horticulture and Forestry 2009; 1(7):133-139.
- Gutierrez RMP. Orchids: A review of uses in traditional medicine, its phytochemistry and pharmacology. J Med Plants Res 2010; 4(8):592-638.
- Hsiao Y, Pan Z, Hsu C, Yang Y, Hsu Y, Chuang Y, Shih H, Chen W, Tsai W, Chen H. Research on orchid biology and biotechnology. Plant Cell Physiol 2011; 52(9):1467-1486.
- Hossain MM. Therapeutic orchids: traditional uses and recent advances - An overview. Fitoterapia 2011; 82(2):102-140.
- Chinsamy M, Finnie JF, Van Staden J. The ethnobotany of South African medicinal orchids. S Afr J Bot 2011; 77:2-9.
- Barman D, Devadas R. Climate change on orchid population and conservation strategies: A review. Journal of Crop and Weed 2013; 9(2): 1-12.
- Chinsamy M, Finnie JF, Van Staden J. Anti-inflammatory, antioxidant, anti-cholinesterase activity and mutagenicity of South African medicinal orchids. S Afr J Bot 2014; 91:88-98.
- Arora M, Mahaian A, Sembi JK. A review on phytochemical and pharmacological potential of family Orchidaceae. Int Res J Pharm 2017; 8(10):9-24.
- De LC, Pathak P, Rao AN, Rajeevan PK. Commercial Orchids. De Gruyter Open Ltd, Warsaw/Berlin, 2014, Pp 244-247.
- Bhat GK. Flora of South Kanara, Akriti Prints, Mangalore, India, 2014, Pp 93.
- Chase MW, Cameron KM, Freudenstein JV, Pridgeon AM, Salazar G, Berg CVD, Schuiteman A. An updated classification of Orchidaceae. Bot J Linn Soc 2015; 177:151-174.
- Milet-Pinheiro P, Navarro DMAF, Dotterl S, Carvalho AT, Pinto CE, Ayesse M, Schlindwein C. Pollination biology in the dioecious orchid *Catasetum uncatum*: how does floral scent influence the behavior of pollinators? Phytochemistry 2015; 116:149-161.
- Ma X, Kang J, Nontachaiyapoom S, Wen T, Hyde KD. Non-mycorrhizal endophytic fungi from orchids. Curr Sci 2015; 108:1-16.
- De LC, Medhi RP. Orchid- A diversified component of farming systems for profitability and livelihood security of small and marginal farmers. Journal of Global Biosciences 2015; 4(2):1393-1406.
- Attri LK. Therapeutic potential of orchids. World J Pharm Pharm Sci 2016; 5(2):438-446.
- Kekuda PTR, Akarsh S, Nawaz NAS, Ranjitha MC, Darshini SM, Vidya P. In vitro antifungal activity of some plants against *Bipolaris sorokiniana* (Sacc.) Shoem. Int J Curr Microbiol Appl Sci 2016; 5(6):331-337.
- Bhattacharyya P, Van Staden J. *Ansellia africana* (Leopard orchid): A medicinal orchid species with untapped reserves of important biomolecules-A mini review. S Afr J Bot 2016; 106:181-185.
- Nugroho LH, Pratiwi R, Susandarini R, Wardoyo ERP, Megawati O, Handayani S. Isolation of bioactive compounds from two orchid species and preliminary test of their cytotoxicity against T47D breast cancer cells. International Journal of Pharmacognosy and Phytochemical Research 2016; 8(1):150-155.
- Givnish TJ, Spalink D, Ames M, Lyon SP, Hunter SJ, Zuluga A, Doucette A, Caro GG, McDaniel J, Clements MA, Arroyo MTK, Endara L, Kriebel R, Williams NH, Cameron KM. Orchid historical biogeography, diversification, Antarctica and the paradox of orchid dispersal. J Biogeogr 2016; 43:1905-1916.
- Muthukumar T, Kowsalya A. Comparative anatomy of aerial and substrate roots of *Acampe praemorsa* (Rox.) Blatt. & McCann. Flora 2017; 226:17-28.
- Khajuria AK, Kumar G, Bisht NS. Diversity with ethnomedicinal notes on Orchids: A case study of Nagdev forest range, Pauri Garhwal, Uttarakhand, India. Journal of Medicinal Plants Studies 2017; 5(1):171-174.
- Hinsley A, De Boer HJ, Fay MF, Gale SW, Gardiner LM, Gunasekara RS, Kumar P, Masters S, Metusala D, Roberts DL, Veldman S, Wong S, Phelps J. A review of the trade in orchids and its implications for conservation. Bot J Linn Soc 2018; 186:435-455.
- Jonathan HK, Raju SAJ. Terrestrial and epiphytic orchids of Eastern Ghats. EPTRI - ENVIS Newsletter 2005; 11(3): 2-4.
- Kala CP, Sajwan BS. Revitalizing Indian systems of herbal medicine by the national medicinal plants board through institutional networking and capacity building. Curr Sci 2007; 93(6):797-806.
- Medhi RP, Chakrabarti S. Traditional knowledge of NE people on conservation of wild orchids. Indian J Tradit Know 2009; 8(1):11-16.
- Sinu PA, Kuriakose G, Chandrashekar K. Epiphytic orchid diversity in farmer-managed Soppinabetta forests of Western Ghats: implications for conservation. Curr Sci 2011; 101(10):1337-1346.
- Pushpa S, Nipun M, Pankaj G, Gurkirpal S, Sumit D, Sakshi S. *Malaxis acuminata*: A review. Int J Res Ayurveda Pharm 2011; 2(2):422-425.
- Ram RB, Lata R, Meena ML. Conservation of floral biodiversity of Himalayan mountain regions with special reference to orchids. Asian Agri-History 2011; 15(3):231-241.
- Jalal JS, Jayanthi J. Endemic orchids of peninsular India: a review. Journal of Threatened Taxa 2012; 4(15):3415-3425.
- Pant B. Medicinal orchids and their uses: Tissue culture a potential alternative for conservation. Afr J Plant Sci 2013; 7(10):448-467.
- Kumari H, Nishteswar K. A pilot study on rasa (taste quality) determination of an extra Ayurvedic pharmacopoeial drug *Bulbophyllum neilgherrense* Wight. Annals of Ayurvedic Medicine 2013; 2(3):72-79.
- De LC, Medhi RP. Diversity and conservation of rare and endemic orchids of North East India - A review. Indian Journal of Hill Farming 2014; 27(1):138-153.
- Warghat AR, Bajpai PK, Srivastava RB, Chaurasia OP, Chauhan RS, Sood H. In vitro protocorm development and mass multiplication of an endangered orchid, *Dactylorhiza hatagirea*. Turk J Bot 2014; 38:737-746.

38. Mohanty JP, Pal P, Barma AD. An overview on orchids. *Universal Journal of Pharmaceutical Sciences and Research* 2015; 1(1):45-50.
39. Mishra AP, Saklani S. *Satyrium nepalense*: A rare medicinal orchid of western Himalaya (India); phytochemical screening, antimicrobial evaluation and conservation studies. *Indonesian J Pharm* 2012; 23(3):162-170.
40. Kumar SC, Kumar SPC. An orchid digest of Manipur, Northeastern India. *Rheedea* 2005; 15(1):1-70.
41. Gogoi K, Borah RL, Das R, Yonzon R. Present status of orchid species diversity resources of Joypur reserve forest of Dibrugarh district (Assam) of North East India. *International Journal of Modern Botany* 2012; 2(3):47-67.
42. Sharma S, Singh SK, Kumar R, Mao AA. A compendium of monopodial orchids of Meghalaya. *Keanean Journal of Science* 2013; 2:93-106.
43. Tanaka N, Yukawa T, Htwe KM, Murata J. An orchid checklist of Mt. Popa, Central Myanmar. *Bull Natl Mus Nat Sci Ser B* 2015; 41(2):69-89.
44. Jalal JS, Jayanthi J. An updated checklist of the orchids of Maharashtra, India. *Lankesteriana* 2018; 18(1):23-62.
45. Nitin R, Balakrishnan VC, Churi PV, Kalesh S, Prakash S, Kunte K. Larval host plants of the butterflies of the Western Ghats, India. *Journal of Threatened Taxa* 2018; 10(4):11495-11550.
46. Teoh ES. *Medicinal orchids of Asia*. Springer International Publishing, Switzerland, 2016, Pp 85-87.
47. Gurudeva MR. *Karnatakada orchid (seethale) sasyagala sachithra kaipidi*. Divyachandra Prakashana, Bangalore, India, 2015, Pp 195.
48. Watt G. *A dictionary of the economic products of India*. Superintendent of Government Printing, India, 1885; Pp 64-65.
49. Singh U, Wadhvani AM, Johri BM. *Dictionary of economic plants in India*. Indian Council of Agricultural Research, New Delhi, 1990, Pp 5.
50. Karuppusamy S, Muthuraja G, Rajasekaran KM. Status of orchids on Kolli hills of Eastern Ghats, Tamil Nadu. *EPTRI-ENVIS Newsletter* 2009; 15(3):3-5.
51. Lakadong NJ. Assessment of endemism, rarity and conservation status of a few medicinal plant species of Meghalaya. Ph.D thesis, North-Eastern Hill University, Shillong, India, 2009.
52. Yonzon R, Lama D, Bhujel RB. Medicinal Orchids of the Himalayan region. *Pleione* 2011; 5(2):265-273.
53. Shanavaskhan AE, Sivadasan M, Alfarhan AH, Thomas J. Ethnomedicinal aspects of angiospermic epiphytes and parasites of Kerala, India. *Indian J Tradit Know* 2012; 11(2):250-258.
54. Behera D, Rath CC, Tayung K, Mohapatra UB. Ethnomedicinal uses and antibacterial activity of two orchid species collected from Similipal Biosphere Reserve Odisha, India. *Int J Agric Technol* 2013; 9(5):1269-1283.
55. Linthoingambi L, Das AK, Singh PK, Ghosh SK. Medicinal uses of orchid by tribes in India: a review. *Int J Curr Res* 2013; 5(10):2796-2798.
56. Subedi A, Kunwar B, Choi Y, Dai Y, van Andel T, Chaudhary RP, de Boer HJ, Gravendeel B. Collection and trade of wild-harvested orchids in Nepal. *J Ethnobiol Ethnomed* 2013; 9:64.
57. Vibha P, Singh N. Plants used in herbal shampoo. *International Journal of Institutional Pharmacy and Life Sciences* 2016; 6(3):287-293.
58. Tsering J, Tam N, Tag H, Gogoi BJ, Apang O. Medicinal orchids of Arunachal Pradesh: A review. *Bulletin of Arunachal Forest Research* 2017; 32(1&2):1-16.
59. Padal SB, Murty PP, Rao SD, Venkaiah M. Ethnomedicinal plants from Paderu division of Visakhapatnam district, A.P, India. *J Phytol* 2010; 2(8):70-91.
60. Padal SB, Sandhyasri B, Chandrasekhar P. Traditional use of monocotyledon plants of Arakuvalley Mandalam, Visakhapatnam district, Andhra Pradesh, India. *IOSR J Pharm Biol Sci* 2013; 6(2):12-16.
61. Deb CR, Deb MS, Jamir NS, Imchen T. Orchids in indigenous system of medicine in Nagaland, India. *Pleione* 2009; 3(2):209-211.
62. Akhter M, Hoque MM, Rahman M, Huda MK. Ethnobotanical investigation of some orchids used by five communities of Cox's Bazar and Chittagong hill tracts districts of Bangladesh. *Journal of Medicinal Plants Studies* 2017; 5(3):265-268.
63. Kuvar SD, Bapat UC. Medicinal plants used by Kokani tribals of Nasik district Maharashtra to cure cuts and wounds. *Indian J Tradit Know* 2010; 9(1):114-115.
64. Nirban AA. A study on indigenous technical knowledge about rice cultivation and bovine health management practices in Konkan region of Maharashtra. Ph.D thesis, University of Agricultural Sciences, Dharwad, India, 2006.
65. Hossain MM. Traditional therapeutic uses of some indigenous orchids of Bangladesh. *Medicinal and Aromatic Plant Science and Biotechnology* 2009; 3(S1):100-106.
66. Alam MS, Haider RM. Ethnomedicinal plants used by the Khasia community people in Moulvibazar district of Bangladesh. *International Journal of Ethnobiology & Ethnomedicine* 2018; 5(1):1-6.
67. Devi PN, Aravindhan V, Bai NV, Rajendran A. An ethnobotanical survey of orchids in Anamalai hill range, Southern Western Ghats, India. *Int J Phytomed* 2015; 7(3):265-269.
68. Panda AK, Mandal D. The folklore medicinal orchids of Sikkim. *Ancient Science of Life* 2013; 32(2):92-96.
69. Nongdam P. Ethno-medicinal uses of some orchids of Nagaland, North-east India. *Res J Med Plant* 2014; 8(3):126-139.
70. Chithra M, Geetha SP. Plant based remedies for the treatment of rheumatism among six tribal communities in Malappuram district, Kerala. *International Journal of Botany Studies* 2016; 1(4):47-54.
71. Uddin MZ, Kibria MG, Hassan MA. Study of ethnomedicinal plants used by the local people of Feni district, Bangladesh. *J Asiat Soc Bangladesh Sci* 2015; 41(2):203-223.
72. Dash PK, Sahoo S, Bal S. Ethnobotanical studies on orchids of Niyamgiri hill ranges, Orissa, India. *Ethnobotanical Leaflets* 2008; 12:70-78.
73. Singh B, Borthakur SK. Wild medicinal plants used by tribal communities of Meghalaya. *J Econ Taxon Bot* 2011; 35(2):331-339.
74. Tiwari AP, Joshi B, Ansari AA. Less known ethnomedicinal uses of some orchids by the tribal inhabitants of Amarkantak plateau, Madhya Pradesh, India. *Nature and Science* 2012; 10(12):33-37.
75. Mishra SB, Dwivedi S, Shashi A, Prajapati K. Ethnomedicinal uses of some plant species by ethnic and rural peoples of the Salem district of Tamilnadu with special reference to the conservation of vanishing species. *Ethnobotanical Leaflets* 2008; 12:873-887.
76. Kumar GE, Kumar PG, Sasikala K, Sivadasan KK. Plants used in traditional herbal shampoos (Thaali) of Kerala, India: A documentation. *Asia Pacific Journal of Research* 2014; 1:56-63.
77. Reddy KN, Subba rajuv GV, Reddy CS, Raju VS. Ethnobotany of certain orchids of Eastern Ghats of Andhra Pradesh. *EPTRI - ENVIS Newsletter* 2005; 11(3):5-9.
78. da Silva JAT. Orchids: Advances in tissue culture, genetics, phytochemistry and transgenic biotechnology. *Floriculture and Ornamental Biotechnology* 2013; 7(1):1-52.
79. Johnson M, Janakiraman N. Phytochemical and TLC studies on stem and leaves of the orchid *Dendrobium panduratum* subsp. *villosum* Gopalan & A.N.Henry. *Indian J Nat Prod Resour* 2013; 4(3):250-254.
80. Porte LF, Santin SMO, Chiavelli LUR, Silva CC, Faria TJ, Faria RT, Ruiz ALTG, Carvalho JE, Pomini AM. Bioguided identification of antifungal and antiproliferative compounds from the Brazilian orchid *Miltonia flavescens* Lindl. *Z Naturforsch* 2014; 69c:46-52.
81. Minh TN, Khang DT, Tuyen PT, Minh LT, Anh LH, Quan NV, Ha PTT, Quan NT, Toan NP, Elzaawely AA, Xuan TD. Phenolic compounds and antioxidant activity of *Phalaenopsis* orchid hybrids. *Antioxidants* 2016; 5:31.
82. Marjoka A, Alam O, Huda MK. Phytochemical screening of three medicinally important epiphytic orchids of Bangladesh. *Jahangirnagar University J Biol Sci* 2016; 5(1):95-99.
83. Anuradha V, Rao PNS. Praemorsin, a new phenanthropyran from *Acampe praemorsa*. *Phytochemistry* 1994; 37(3):909-910.
84. Anuradha V, Rao PNS. Revised structure of flavinidin from *Acampe praemorsa*. *Phytochemistry* 1994; 35(1):273-274.
85. Maridass M, Hussain ZMI, Raju G. Phytochemical survey of orchids in the Tirunelveli hills of South India. *Ethnobotanical Leaflets* 2008; 12:705-712.
86. Suja MR, Williams CB. Micropropagation, phytochemical screening and antioxidant potential of a wild epiphytic orchid *Acampe praemorsa* (Roxb) of Kanyakumari district, India. *European Journal of Pharmaceutical and Medical Research* 2016; 3(5):572-576.
87. Akter M, Huda MK, Hoque MM. Investigation of secondary metabolites of nine medicinally important orchids of Bangladesh. *J Pharmacogn Phytochem* 2018; 7(5):602-606.
88. Bhattacharya S, Bankar GR, Nayak PG, Shirwaikar A. Evaluation of anti-inflammatory activity of aqueous and ethanolic extracts

- of *Acampe praemorsa* on carrageenan-induced paw oedema in rats. Pharmacologyonline 2009; 2: 315-319.
89. Soumiya G, Williams CB, Suja MR. In vitro anticancer activity of ethanolic leaf extract of *Acampe praemorsa* (Roxb.). World J Pharm Res 2018; 7(7):1020-1025.
90. Jhansi K, Khasim SM. Antimicrobial and in vitro cytotoxic studies of *Acampe praemorsa* and *Aeridis odorata* of Orchidaceae. Ann Plant Sci 2018; 7(2):2088-2095.
91. Hoque MM, Khaleda L, Al-Forkan M. Evaluation of pharmaceutical properties on microbial activities of some important medicinal orchids of Bangladesh. J Pharmacogn Phytochem 2015; 4(4):265-269.
92. Paul P, Chowdhury A, Nath D, Bhattacharjee MK. Antimicrobial efficacy of orchid extracts as potential inhibitors of antibiotic resistant strains of *Escherichia coli*. Asian J Pharm Clin Res 2013; 6(3):108-111.
93. Swami G, Salvi J, Katewa SS. Investigating antimicrobial aspects of *Acampe praemorsa* (Roxb.) Blatt. & mc. Asian J Tradit Med 2014; 9(4):105-109.
94. Akarsh S, Pavithra GR, Roopa KN, Ranjitha MC, Kekuda PTR. Antifungal activity of cow urine extracts of selected plants against phytopathogenic fungi. Sch J Agric Vet Sci 2016; 3(4):305-308.
95. Ranjitha MC, Akarsh S, Kekuda PTR, Darshini SM, Vidya P. Antibacterial activity of some plants of Karnataka, India. J Pharmacogn Phytochem 2016; 5(4):95-99.
96. Akarsh S, Kekuda PTR, Ranitha MC, Vidya P, Monica, Firdos G. Inhibitory activity of some plants against *Colletotrichum capsici* and *Fusarium oxysporum* f. sp. *zingiberi*. Journal of Medicinal Plants Studies 2016; 4(4):165-168.
97. Kumar P, Jalal JS, Rawat GS. Orchidaceae, Chotanagpur, state of Jharkhand, India. Check List 2007; 3(4):297-304.

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