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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 activities[1-26].

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 disorders[27-39]. 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 butterflies[45]. 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 subsessile, 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 diabetes [59]. The leaf paste of *A. praemorsa* is used by Arakuvalley tribes of Visakhapatnam district, Andhra Pradesh, India to get relief from chest pain and hyperacidity[60].

In Nagaland, the root paste is consumed orally in order to get relief from rheumatism[61].

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 problems[62]. 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 cattle[63]. 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 cattle[64]. The roots of *A. praemorsa* are used as a tonic and for treatment of rheumatism in Bangladesh[65]. The Khasia community of Moulvibazar district, Bangladesh uses root of *A. praemorsa* for the treatment of rheumatism and sciatica[66]. 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 Rao[84] 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 Williams[86] 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 it 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

Ethanolic 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 extract[88].

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 IC_{50} value of 14.63µg/ml. Jhansi and Khasim[90] 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 IC_{50} values. Extracts exhibited potent cytotoxicity against MCF-7 cells when compared to HeLa cells.

Antioxidant activity

Suja and Williams[86] 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 Khasim[90] 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*, *Colletotrihum corchori*, *Fusarium equiseti*, *Macrophomina phaseolina* and *Botryodiplodia theobromae* with highest and least inhibitory activity against *C. lunata* and *M. phaseolina*, respectively[91]. 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	*S. aureus*, *Escherichia coli* and *Pseudomonas aeruginosa*	Ranjitha et al.[95]
Whole plant	Methanol extract	Poisoned food technique	*C. capsici* and *F. oxysporum*	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	*Bipolaris sorokiana*	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 seeds[97]. 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

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