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Aerides multiflora Roxb.: An Important Ornamental and Medicinal Orchid

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ABSTRACT

Aerides multiflora Roxb. belonging to the family Orchidaceae is known for its multi-utility. It is being used in the preparation and for cuts and wounds traditionally and traded for its fragrance and as a cut flower. Among the isolates studied, emerged as the most potent inhibitor, suggesting that it be a candidate structure for inhibitor drug development in the management of type 2 DM. As a result, an attempt has been undertaken to analyze the species therapeutic potential in both traditional and modern medicine systems. The high demand, this species has attracted a lot of attention for conservation and domestication. It is subjected to indiscriminate and unsustainable harvesting, habitat degradation, road construction, and other anthropogenic activity in the wild, resulting in decreased natural populations. This review throws light on the relevant information about the properties of the high-value medicinal orchid and immediate corrective efforts required for the conservation of this medicinal orchid in its natural habitat and promotion of cultivation and GACP to assure a long-term mode of utilization.

Keywords: Tonic, Biphenathreneaerimultin –C, α-glucosidase, Medicinal orchid.

INTRODUCTION

Orchids are one of the most beautiful flowering plants and also the most highly evolved, having a varied usage. India has a broad range of climatic conditions, resulting in a diverse orchid flora. They also inhabit a diverse range of habitats, from tropical to alpine, with about 35000 species and 800 genera worldwide, including 1141 species and 166 genera in India [1]. Orchids are prized not only for their beautiful blossoms, but many have also been utilized for medicinal purposes. Although there has been progress in comprehending the orchid family, risks to orchid survival continue to grow every day. The IUCN Red List of Threatened Species has designated 948 (3.3 percent) of the world's orchid species as threatened [2, 3].

The Genus *Aerides* Lour

Aerides, often known as fox tail orchids, is monopodial epiphytes with a rapid growth rate. About 20 species of Aerides distributed from Sri Lanka, India, Nepal, Bhutan, Burma, China, Thailand, Indochina, and Malaysia to the Philippines and Indonesia. The freely produced pendent spikes of closely set, fragrant blooms make these orchids popular. *Aerides* develop quickly and can support a large number of spikes from the primary plant. A few species are particularly interesting because of their complex lips, which sometimes hide the column. *Aerides* is increasingly being employed in hybridization with related species and hybrids.

Description, Habitat and Distribution of the Species

Aerides multiflora Roxb. belongs to the family Orchidaceae pertaining from a beautiful genus of *Aerides* Lour. of the "foxtail orchids" especially known for its attractive flowers and foliage[4]. It consists of approximately 21 species that are native to South and South-East Asia [5]. The plant is indigenous to Bangladesh, India, Nepal, Myanmar, Thailand, Malaysia, Philippines, Laos, Cambodia, and Vietnam. In India, it is geographically distributed over North-Western Himalayas, Sikkim, West Bengal, and Arunachal Pradesh. It can grow at a wide range of altitudinal elevations from 150m up to 1200m from lowland tropical to subtropical forests [6].

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A. multiflora though having an epiphytic habitat can also grow as terrestrial when subjected to use as an ornamental orchid usually flowering from March to August. Generally, this orchid bears long-lasting and beautiful pink fragrant flowers in a pendant raceme. (Figure 1,2)[7]. This species has the potential to produce floricultural elite hybrids when served as a parent in a hybridization programme[8][9].

Ethno botany and Indigenous Medicinal Uses

Plants have been utilized in traditional medicine for many thousands of years and are still considered amongst the most ancient forms of health care known to mankind. Traditional systems of medicine that have evolved over the centuries among many societies are still retained as a great knowledge base in herbal remedies prior to the establishment of modern medicine. It is critical to document indigenous knowledge through ethno botanical studies in order to conserve and utilize biological resources. One of the most reliable ways to drug discovery has been discovered to be ethno botanical survey. Based on ethno botanical data, several active chemicals have been discovered in plants and employed as patented medications.

Susruta and Vagbhata in ancient Sanskrit literature recognized the medicinal value of orchids as early as 250–300 BC. The Sanskrit word for orchid is "Vanda," which refers to a type of lovely monopodial orchid [10]. Orchids were employed in Chinese medicine as far back as 2800 BC. Traditionally the use of orchids for their medicinal value and their cultivation was first described by the Chinese as early as 200 BC [11, 12].

Many orchids have apparent medicinal and glycosidal relevance, despite their floricultural usefulness and high decorative appeal. Nevertheless, the fact that orchids play an important role in herbal medicines is often overlooked [13]. Orchids are also one of the important ingredients in ancient Indian systems of medicine called “Ayurveda”. Asthavarga an important ingredient in many classical formulations viz., Chavyanprasah is reported to contain 4 species of orchids namely, *Malaxis muscifera, Malaxis acuminata, Habenaria intermedia, Habenaria edgeworthi* [14]. *A. multiflora.* with a local name in Nepal as Parajivi where the leaf Powder is used in tonic preparation and traded for both medicinal and floriculture aspects [15]. It has been reported that the paste of leaves, bulbs, and roots is applied to treat cuts and wounds [16,17, 18, 19]. It is also locally called Draupadi Puspa in Bangladesh where the whole plant is used as a bitter tonic and also for joint pains [13].

Phytochemical and Pharmacological Activity

The first phytochemical and biological investigation of A. multiflora was done by Thant *et al.*[9]. Their studies on the whole plants of *A.multiflora* revealed the presence of three new biphenanthrene derivatives named aerimultins A, B, C, and a new natural phenylpropanoid ester dihydrosinapyldihydroferulate, together with six known compounds 6-Methoxy coelonin, Gigantol, Imbricatin, Agrostonin, Dihydroconiferyldihydro-p-coumarate, 5-Methoxy-9,10-dihydrophenanthrene-2,3,7-triol.

The whole plant of *A.multiflora* showed antibacterial activity against *Klebsiella pneumonia* and *Salmonella aureus* [20]. During its phytochemical studies, the dimericphenanthrenes obtained from this plant family were investigated for α-glucosidase inhibitory activity. Inhibition of this enzyme can significantly reduce postprandial hyperglycemia [9, 21]. Among the isolates, biphenathreneaerimultin-C emerged as the most potent inhibitor, showing much higher potency than the drug acarbose, suggesting that it be a candidate structure for α-glucosidase inhibitor drug development in the management of type 2 DM [22, 23,24].

Conservation Status and Constraints

A. multiflora has been listed under Appendix II of CITES as they have been illegally harvested and traded in for use in local traditional medicine, horticulture, and international trade [15]. However, the size and frequency of its natural populations are on a gradual decline because of habitat destruction, and unscrupulous collections for commercial and scientific purposes. In the near future extracting it unsustainably from its natural habitat and in huge quantities. In addition, habitat destruction from various natural calamities and human activities, such as development, will likely make the species threatened [25]. In Sikkim, Uttarakhand, and other states, wild harvesting is prohibited, but there should be a well-defined protocol for wild collection. This orchid has not been reported to be grown commercially on a large scale for medicinal purpose. The pharmaceutical companies' primary source of availability in the market is still wild collection. The knowledge of the traditional use of local medicinal herbs and orchids is thought to be declining all over the Himalayas region, due to the loss of interest among younger generations and the easy accessibility to modern health care facilities. The major constraints hindering the commercialization of cultivation are the non-availability of quality planting material, poor development and extension support in the cultivation and processing, unorganized markets, etc [26].

Conservation Approaches

Good agricultural collection and cultivation practices

Explicit and uncontrollable collection of numerous orchid species from wild have lead to significant loss of habitat resulting in decline of many high valued plants over the years [27]. Cultivation of medicinal plants and orchids will reduce pressure on the natural and wild gathering, as well as the use of unauthentic replacements and adulterants, which have resulted in a drop in the standard of pharmaceuticals used by Indian medical systems [28]. It has become a necessity to provide training and conservation programs which are absolute necessary for all stakeholders. Developing and providing guidelines on Good Agricultural Collection Practices (GACP) to the inhabitants dwelling near the forest and those who depend on their livelihood for sustainable harvest so to add value to harvest over a long time and aim towards conservation. [29].

***In-vitro* approaches for Conservation**

Traditional conservation methods alone will not save this herb from being exploited and extinction in its natural habitat. Tissue culture and micropropagation techniques are promising in-vitro approaches that have the potential to help manage and conserve this medicinal orchid in the long run. The species' traditional propagation is too slow and ineffective to overcome the threat of extinction. As a result, the only

viable option for fast propagation is in vitro propagation. Tissue culture studies in *A. multiflora* are very limited. Table 1 a summarization of *In-vitro* study with major observations recorded for conservation of *A. multiflora* based on use of various explants for initiating cultures. Under the NMPB sponsored project for conservation at field gene bank and standardization of protocols for tissue culture for Medicinal orchids at. Regional Research Station, Hill Zone, Uttar Banga Krishi Visvavidyalaya, we have been developing rapid In-vitro regeneration protocol and conservation (Data not published). (Figure 3,4)

Table 1: Tissue culture studies on different explants from species *Aerides multiflora*

Tissue culture study	Explants type	Optimum concentration	Major Observations	Reference
Regeneration	Leaf explants	BA @ 2 mgl^{-1} + NAA @ 0.5 mgl^{-1}	Rapid mass multiplication, High regeneration frequency, early response and high proliferation.	[30]
Regeneration	Encapsulated Protocorm like bodies (PLB's)	PLB's (0.1-0.2cm) in 3.5% Sodium alginate and Calcium Chloride (100mM) in liquid M medium	Germination 93.8%, 80% Survivability, Viability at 4^0C could be maintained till 75 days (7.4% seeds)	[31]
Regeneration	Root segments	Mitra medium + BA @ 2 mgl^{-1} + NAA@0.5 mgl^{-1}	50% explants within 6 weeks, 80% survival	[32]
In-vitro symbiotic seed germination	Seeds	Seed germinated with culture isolate of AM301	Protocorm develop after 8 weeks. Roots and leaves emerged after 12 & 15 weeks, Survival rate 98%.	[33]
Cost-effective Regeneration	Seeds	2% table sugar solution instead of Sucrose. 2% Isabgol as gelling agent. Autoclaved tap water instead of Double distilled water.	Media formulated with table sugar and Isabgol as Carbon source and gelling media with autoclaved tap water reduced cost of Media preparation without compromising plantlet quality and survival rate i.e. 80%	[34]

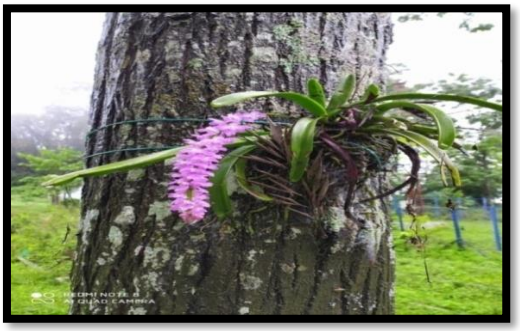

Figure 1: Aerides multiflora in its natural habitat

Figure 2: Flowering and Seed setting

Figure 3: Callus formation used for conservation and later can be used as an explants source

Figure 4: Plantlets formation ready for hardening

Reintroduction in Nature and *Ex-situ* Conservation

Local Research Institutes and Forest Departments can assist in its management by adopting conservation measures and maintaining such endangered plant species in their field gene banks as a step for *Ex-situ* conservation. Producing high-quality planting material through micropropagation and reintroduction into the species' natural habitat would bolster attempts to resurrect the species in areas where it is threatened with extinction. Training for various stakeholders can also be provided to popularise the Field Gene Bank (FGB) in strengthening and promoting the long-term utilization of this plant and its genetic resources.

CONCLUSION

This review article focused on exploring the untapped medicinal potential and properties of such orchids having both medicinal and floricultural significance. Simultaneously, we should also try to identify and isolate focusing more on the phytochemical and biological aspects of the active compound responsible for every property, and identify if they act singly or in combination with other compounds present in the medicinal orchid. In addition, keeping in view the demand and status of this species, further emphasis must be given in the area of research to overcome these problems and promote cultivation, propagation, awareness, and conservation of this species through various *in-situ* and *ex-situ* conservation methods.

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Conflict of interest

The author reports no conflicts of interest in this work.

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