



Ex-situ conservation of *Andrographis* species in Botanic Garden, Yogi Vemana University, Kadapa, Andhra Pradesh, India

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Abstract

The Botanic Garden of Yogi Vemana University has been involved in the conservation of endemic, threatened, and medicinal plants in the Eastern Ghats of Andhra Pradesh. A total of 8 *Andrographis* species belonging to the Acanthaceae family were collected from the Eastern Ghats of Andhra Pradesh and are being maintained in a botanic garden.

Keywords: *Andrographis* species, medicinal plants, ex-situ conservation, conservatory garden, Andhra Pradesh

Introduction

In developing countries, the usage of medicinal plants in health care practices is relatively high. In China, traditional Chinese medicine (TCM) is largely plant-based. The World Health Organization (WHO) has estimated that over 80 % of the population in developing countries relies on plant-based medicines (Akerle, 1992) [2]. India exhibits a remarkable outlook in modern medicines that are based on natural products besides the traditional system of Indian medicines. Traditional systems of medicine like Ayurveda, Homeopathy, Sidda, and Unani have been followed since ancient times in the Indian sub-continent. It is estimated that more than 6,000 plant species are being used in traditional folk and herbal medicine (Huxley, 1984) [6]. In modern times, plants play a significant role, and the belief is that they have vast potential for treatment of diseases and they are supposed to be safe in use, effective, and simple with no or lesser side effects.

The state of Andhra Pradesh, with a geographical area of 276,754 sq. km, accounts for 8.4 % of India's territory. The vegetation of the state largely represents dry deciduous types (Pattanaik *et al.*, 2009) [10]. The Eastern Ghats in Andhra Pradesh contribute to the vast biological diversity and form one of the centres of endemic plants. Acanthaceae is one of the top nine families with a large number of medicinal plants (Abhyankar & Reddy, 2007) [1]. According to the International Plant Name Index (IPNI), the genus *Andrographis* comprises 40 species (<http://www.ipni.org>). These are of potential medicinal value, and 26 species of the genus are found in India (Karthikeyan, 2009) [8], and 11 species are distributed in the state of Andhra Pradesh (Pullaiah *et al.*, 2018) [11]. Deforestation, forest degradation and fragmentation, biological invasion, and unsustainable extraction of medicinal parts seem to have adversely affected the populations of native species and brought changes in the distribution pattern of various plant species, including *Andrographis*. Important factors such as its endemism, narrow and localized population, and extreme anthropogenic stress on the forest land have also led to their decline in their natural habitats in Andhra Pradesh.

The Yogi Vemana University Botanic Garden was established in the year 2008 and is maintained by the

Department of Botany. This botanic garden extends over 25 acres within the university campus and is located 15 km away from Kadapa City. The garden is situated at 14°28' 09" N, 78°42'43" E at an altitude of 149 m. This area receives moderate annual rainfall falls about 377 mm, and experiences a mean daily maximum temperature of 25.9° C (in the summer season, it is 41° C). In the year 2017, this garden obtained support under the Assistance to Botanical Gardens by the Ministry of Environment and Forest & Climate Change (MoEF & CC and BSI) and was given status as Lead Botanic Garden for conserving RET species from the Eastern Ghats of Andhra Pradesh.

The garden is currently harbouring about 900 indigenous and exotic taxa belonging to 118 families, including 120 RET species. As a part of this research project specially focused on *Andrographis* species for their conservation and maintenance in the garden. In the present study, a total of 8 species were collected from the different localities of Andhra Pradesh and are being maintained in the Botanic Garden. This will promote the avoidance of species extinction in the wild and as well as help for species maintenance. The collected plants were prepared as herbarium specimens by following standard herbarium methodology for identification, and these herbarium specimens were deposited in YVU Herbarium for future reference.

Result and discussion

A total of 8 species are conserved in the Botanic Garden. Among these, 2 species are endemic to Andhra Pradesh: *Andrographis nallamalayana* and *Andrographis glandulosa*, and 3 species are endemic to South India: *Andrographis beddomei*, *Andrographis lineata*, and *Andrographis serpyllifolia*. *Andrographis paniculata* is occasionally distributed; the remaining two species are naturally distributed in gardens, viz., *Andrographis echioides* and *Andrographis longipedunculata*. Due to their vast medicinal value, the *Andrographis* species are facing severe threats in their natural habitats. In contrast, the saplings were collected from different localities in Andhra Pradesh and maintained in the Botanic Garden for ex-situ conservation. (Fig :1)

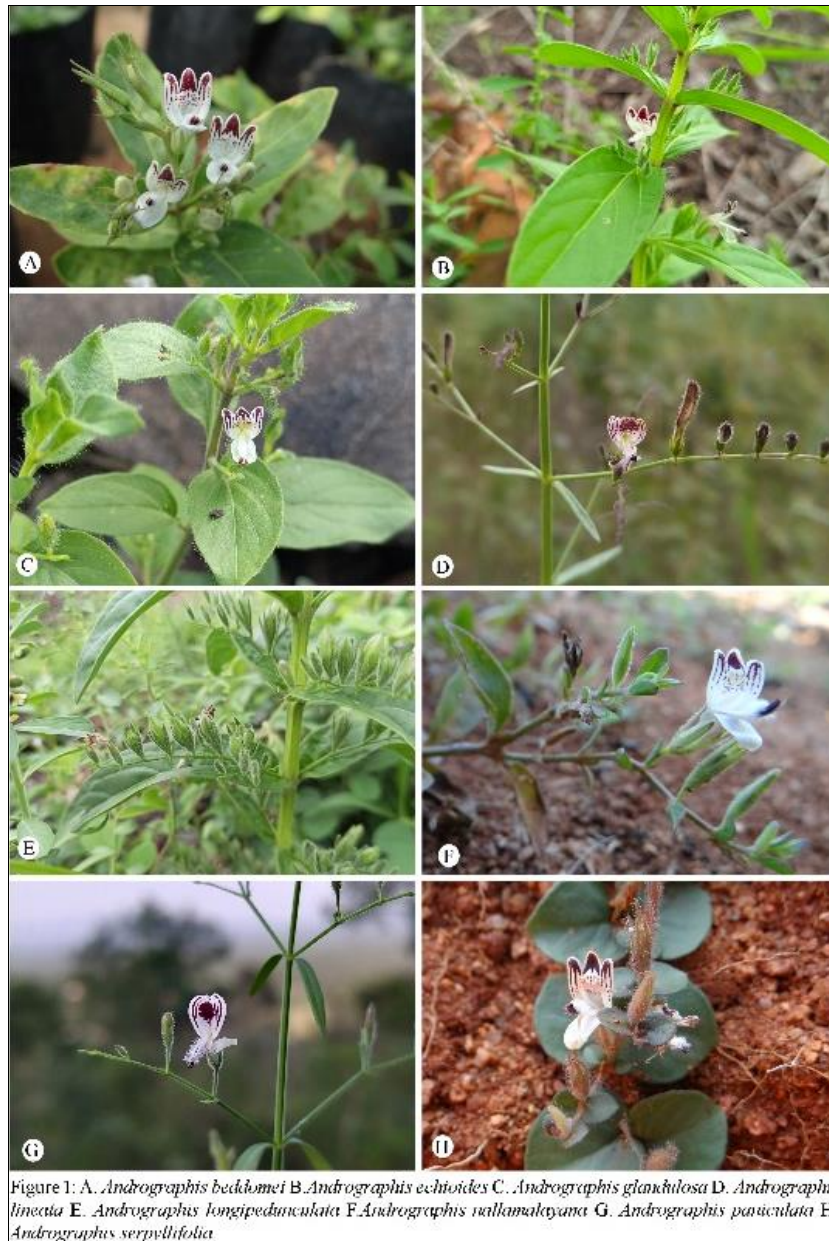


Figure 1: A. *Andrographis beddomei* B. *Andrographis echioides* C. *Andrographis glandulosa* D. *Andrographis lineata* E. *Andrographis longipedunculata* F. *Andrographis nullamakayana* G. *Andrographis paniculata* H. *Andrographis serpyllifolia*

***Andrographis beddomei* C. B. Clarke**

It is one of the significant endemic species sporadically distributed in the dry deciduous forests at an elevation between 250 and 700 m, and it is endemic to Southern India (Singh *et al.*, 2015) [14]. The plant roots are used to treat Alzheimer's disease (Goel *et al.*, 2024) [4]. The saplings were collected from Palakonda Hills and the Guvvalachervu Reserve Forest in the Kadapa district of Andhra Pradesh.

***Andrographis glandulosa* (Roth) Nees**

It is a strictly endemic species reported from the state of Andhra Pradesh (Pullaiah *et al.*, 2018) [11]. It was collected from the Seshachalam Biosphere Reserve, Lankamala Wild Life Sanctuary of Kadapa, and Sri Penusila Lakshmi Narasimha Swami Wild Life Sanctuary of Nellore districts.

***Andrographis echioides* (L.) Nees**

It is one of the most commonly distributed species due to its wide niche in wastelands, forests, scrub jungles, cultivated fields, and grasslands. It is found in almost all the districts, and the majority of the population is distributed in scrub-type vegetation along the roadside under dry conditions. It is

used as a remedy for fevers. Flavone glucoside echioidin and Dihydroechioidinin, a flavanone (Jayaprakasam *et al.*, 1999) [7] and, a chalcone glucoside, androechin were isolated from it. This species was commonly distributed in the Botanic Garden.

***Andrographis lineata* Nees**

It is another important endemic species endemic to Southern India (Singh *et al.*, 2015) [14]; locally, it is called Tella nelavemu. Leaf extract was shown to have a hepatoprotective effect against liver damage in rats (Sangameswaran *et al.*, 2008) [13]. It was also shown to be very effective as an anti-hyperglycemic and anti-hyperlipidaemic. The saplings were collected from the Talakona and Tirumala hills of the Seshachalam Biosphere Reserve of Andhra Pradesh.

***Andrographis longipedunculata* (Sreem.) L.H. Cramer ex Karthik. & Moorthy**

Commonly distributed species in forests, scrubs, and grasslands. It was frequently distributed in the Botanic Garden. *Andrographis echioides* and *A. longipedunculata*

were represented by the separate genus *Indoneesiella* (Pullaiah & Ali-Moulali, 1997) [12]. Karthikeyan *et al.*, (2009) listed these species under the *Andrographis* genus.

***Andrographis nallamalayana* J.L. Ellis**

It is one of the most important endemic species; its distribution is restricted only in Andhra Pradesh (Pullaiah *et al.*, 2018) [11]. It is commonly called kachugadda. It was collected from the Nallamalais of Kurnool, Veligonda Hills of Nellore, Jyoti reserve forest, and the Lankamala Wild Life Sanctuary of Kadapa districts. Plant leaf extract is used for *in vitro* cytotoxic and phytochemical activity for anticancer (Goel *et al.*, 2012). The root extract of this plant has ethnomedicinal value and is used to treat leucoderma (Venkatasubbaiah & Savithamma, 2012) [15]. The phytochemical screening revealed the presence of alkaloids, flavonoids, phenols, steroids, and triterpenoids, and their anti-microbial activity (Padma and Venakataraju, 2013) [9] has been established.

***Andrographis paniculata* (Burm.f.) Wall. ex Nees**

It is the most abundant and widely distributed species in moist, shady places. Locally, it was called Nelavemu. Plant leaf extract is used for *in vitro* cytotoxic and phytochemical activity for anticancer (Goel *et al.*, 2021) [3]. The plant roots are used to treat Alzheimer's disease (Goel *et al.*, 2024). This species is collected from different localities of Andhra Pradesh.

***Andrographis serpyllifolia* (Rottler ex Vahl) Wight**

It is a prostrate herb with stout root stocks. It is endemic to South India (Singh *et al.*, 2015) [14]. It was distributed in the Anantapur, Kadapa, and Chittoor districts of Andhra Pradesh and is locally called Akuchandrika. The root extract of the plant is used to cure fever. Two acylated flavone glucosides were isolated from it. The plant extract is used in treating wounds and is also found effective in the treatment of jaundice. Aqueous and methanolic extracts of this plant showed anti-proliferative and antioxidant properties. This plant is used as a traditional Indian herbal medicine for malaria and dysentery. Serpyllin, a flavone, was isolated from this plant (Govindachari & Parthasarathy, 1968) [5].

Conclusion

Botanic Gardens conserve plant diversity through ex-situ methods and can prevent extinction through integrated conservation actions. The Botanic Garden, Yogi Vemana University plays an important role in the conservation of rare, endemic, threatened, and medicinally important species of the Eastern Ghats of Andhra Pradesh. This will help with species maintenance and survival and also be useful for educational purposes, public awareness of plants, and scientific purposes

Acknowledgments

The authors gratefully acknowledge the Ministry of Environment Forest and Climate Change (MoEF & CC and BSI) (no. 10/16/2016-CS/BG. Dated: 31-03-2017) for financial support under the ABG scheme and Andhra Pradesh State Biodiversity Board for financial support. The authors are also thankful to the Andhra Pradesh State Forest dept. for given permissions.

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