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INTRODUCTION AND EX-SITU CONSERVATION OF RED-LIST MEDICINAL PLANTS IN ANDHRA UNIVERSITY CAMPUS

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Abstract

Medicinal plants are now under great pressure due to their excessive collection so there is a need to immediate attention for conservation of some important medicinal and red list plants. During the period of 2009-2015 germplasm was collected and introduced in to the Andhra University Botanical Garden. A total of 72 introduced species belonging to 66 genera and 35 families were successfully acclimatized in the botanical garden, included 18 red list plants. After acclimatization all plants are transferred to the garden and special block was maintaining as red list medicinal garden.

Key words: Andhra University, Botanical garden, Ex-situ Conservation, Medicinal plants, Red list plants

Introduction

Indian forests have rich in biodiversity among the 12 mega diversity countries (Bapat *et al.*, 2008) and with 4 major hotspots (Himalaya, Indo-Burma, Sundalanda and Western Ghats & Sri Lanka and the Western Ghats) among the 35 World hotspots (www.bsienvi.nic.in). As reported by Bapat *et al.*, (2008) 47000 species occurred in the India. India has 15-20% medicinal plants among the 20,000 medicinal plants listed by World Health Organization (WHO) in various countries end estimates 80% of the people are depending upon medicinal plants for medicine in developing countries (Gupta, 1995; Cotton, 1997). The cosmetic industries are extremely using several medicinal plants for natural products (Belt *et al.*, 2003). Indians are using 7,500 plants for medicine among the 17,000 higher plants (Shiva, 1998). Approximately 25% of drugs are derived from plants (Prajapati *et al.*, 2003).

At this critical movement the medicinal plants are facing severe threat due to the cause of their extreme collection and utilization. In India more than 90% of medicinal plants are facing threat due to over exploitation by herbal industries. Pharmaceutical and drug industries are have been demanding for valuable medicinal plants due their exceptional medicinal properties, thus it leads to increasing illegal collection of many medicinal plants from forests. Extinction of many valuable medicinal plants is caused by overexploitation or un-skilled harvesting of medicinal plants (Kumari *et al.*, 2011). This worst-case scenario, India has to take immediate attention on conservation of medicinal plants (Kumari *et al.*, 2011).

In India, about 2,000 drugs have been obtaining from medicinal plants. 560 plants are identified as red list threatened species by International Union for Conservation of Nature and Natural Resources (IUCN) in India. IUCN estimated that about 34,000 (12.5%) world vascular plants are under different threatened conduction (Phartyal *et al.*, 2002). Many of these medicinal plants have narrow distribution (Nautiyal *et al.*, 2002), so they are more going to extinction (Jablonski, 2004).

Introduction of threatened plants into common gardens would maintains protection of germplasm, seed banks, increasing their number using tissue culture techniques, cryopreservation using through genetic transformation with disease, pest and stress tolerance genes is *Ex situ* conservation (Vera *et al.*, 2010). *Ex situ* conservation has received international recognition with its inclusion in Article 9 of the Convention on Biological Diversity (Glowka *et al.*, 1994).

Materials and Methods

Andhra University is the one of the oldest Universities in India. It was established in 1926 with 200 hectares. It is located between 17⁰35'-17⁰40' N and 83⁰20'-83⁰25' E with an

average elevation of 60 m from the sea level. It is encompassed by the Bay of Bengal in the East and South and with a fringe of Eastern Ghats ridges, and located in the Southern part of Greater Visakhapatnam City. It is influenced by tropical climate with an average annual temperature recorded between 18⁰C and 45⁰C and an average rain fall of 1000-1200 mm, received from both Southwest and Northwest monsoons during the months of July – November. The University contains two sections, the South (Science and Arts Colleges) and North campus (Engineering College), separated by an 80 feet wide road with their administrative buildings (Fig. 1). More than 60% of the University Campus is occupied by greenery.



Fig 1. Map of the Study area

Collection and introduction of medicinal and red-list plants

During the period of 2009-2015 medicinal and red listed, economically useful plants were collected from various localities of the Eastern Ghats of Andhra Pradesh. Germplasm was collected as seedlings, saplings sometimes vegetative part like tubers, stem cuttings, suckers etc. Seeds and fruits were collected for propagation of plants which is not multiply by vegetative reproduction. All plants are planted in the pots and special attention was taken for the sensitive plants in the experimental botanical garden of the Andhra University. After acclimatization of the plants to University climatic conditions all plants are transferred to the garden and special block was maintained as red list medicinal garden with special care (Shanagr and Rawat, 2013).

Results

A total of 72 species belonging to 66 genus and 35 families were successfully introduced and acclimatized in to the experimental botanical garden in Andhra University (Table 1). Among the 72 species one is Pteridophyte (*Dryneria quercifolia*), one is

Gymnosperm, (*Cycas sphaerica*) and remaining 70 are angiosperms (Dicots 46 and Monocots 24). Look in to life-form wise trees 15, shrubs 9, climbers 22, and herbs 17, grasses 3 epiphytes 5 and 1 fern. A total of 70 plants identified as medicinal plants for various diseases remaining 2 plants *Cycas sphaerica* and *Vanilla wightiana* are ethno botanical and commercial crop related wild species respectively (Fig. 2, 3 & 4).

Table 1: List of introduced Medicinal and Red list plants in the Botanical Garden

S.No	Name of the Taxa	Habit	Family	Red list status in Andhra Pradesh
1	<i>Abrus precatorius</i> L.	Climber	Fabaceae	
2	<i>Acampe praemorsa</i> (Roxb.) Blatter & Mc Cann	Epiphyte	Orchidaceae	
3	<i>Aegle marmelos</i> (L.) Correa	Tree	Rutaceae	Vulnerable
4	<i>Aganosma dichotoma</i> (Roth) K. Schlum.	Climber	Apocynaceae	
5	<i>Alocasia decipiens</i> Schott	Herb	Araceae	
6	<i>Alpinia calcarata</i> Roscoe	Herb	Zingiberaceae	
7	<i>Alstonia venenata</i> R.Br.	Shrub	Apocynaceae	
8	<i>Anamitra cocculus</i> (L.) Wight & Arn.	Climber	Menispermaceae	
9	<i>Anodendron paniculatum</i> (Roxb.) A.DC.	Climber	Apocynaceae	Endangered
10	<i>Ardisia solanaceae</i> Roxb.	Shrub	Myrsinaceae	
11	<i>Argyreia nervosa</i> (Burm. f.) Boj.	Climber	Convolvulaceae	
12	<i>Boehmeria platyphylla</i> D. Don	Shrub	Urticaceae	
13	<i>Chlorophytum tuberosum</i> (Roxb.) Baker	Herb	Liliaceae	
14	<i>Coliis ambonicus</i> (Lour.) Spreng.	Herb	Lamiaceae	
15	<i>Colocasia esculenta</i> (L.) Schott & Endl.	Herb	Araceae	
16	<i>Costus speciosus</i> (Koen.) Smith	Herb	Costaceae	Near Threatened
17	<i>Curcuma pseudomontana</i> Garaham	Herb	Zingiberaceae	Vulnerable
18	<i>Curculigo orchiolides</i> Gaertn.	Herb	Hypoxidaceae	
19	<i>Cycas sphaerica</i> Raxb.	Tree	Cycadaceae	DD
20	<i>Cymbidium alofolium</i> (L.) Sw.	Epiphyte	Orchidaceae	
21	<i>Cymbopogon coloratus</i> (Nees) Stapf	Herb	Poaceae	
22	<i>Dalbergia latifolia</i> Roxb.	Tree	Fabaceae	

23	<i>Decalepis hamiltonii</i> Wight & Arn.	Climber	Asclepiadaceae	Endangered (Globally)
24	<i>Dillenia indica</i> L.	Tree	Dilleniaceae	
25	<i>Dioscorea hispida</i> Dennst.	Climber	Dioscoreaceae	
26	<i>Dioscorea bulbifera</i> L.	Climber	Dioscoreaceae	
27	<i>Diospyros peregrina</i> (Gaertn.) Guerke	Tree	Ebanaceae	
28	<i>Dryneria quercifolia</i> (L.) J.Sm.	Fern	Polypodiaceae	
29	<i>Embelia ribes</i> Burm.f.	Climber	Myrsinaceae	Critically Endangered
30	<i>Erycibe paniculata</i> Roxb.	Climber	Convolvulaceae	
31	<i>Gardenia latifolia</i> Ait.	Tree	Rubiaceae	
32	<i>Globba bulbifera</i> Roxb.	Herb	Zingiberaceae	
33	<i>Gloriosa superba</i> L.	Climber	Liliaceae	Vulnerable
34	<i>Gymnema sylvestre</i> (Retz.) R.Br. ex Schult.	Climber	Asclepiadaceae	Vulnerable
35	<i>Haldinia cordifolia</i> (Roxb.) Ridsd	Tree	Rubiaceae	
36	<i>Hoya pendula</i> Wight & Arn.	Climber	Asclepiadaceae	
37	<i>Hymenodictyon orixense</i> (Roxb.) Mabb.	Tree	Rubiaceae	
38	<i>Justicia adhatoda</i> L.	Shrub	Acanthaceae	
39	<i>Litsea deccanensis</i> Gamble	Tree	Lauraceae	
40	<i>Maytenus emarginata</i> (Willd.) Ding Hou	Shrub	Celastraceae	
41	<i>Mucuna pruriens</i> (L.) DC.	Climber	Fabaceae	
42	<i>Ocimum basilicum</i> L.	Herb	Lamiaceae	
43	<i>Ocimum gratissimum</i> L.	Herb	Lamiaceae	
44	<i>Peperomia dindigulensis</i> Miq.	Herb	Piperaceae	
45	<i>Pholidota imbricata</i> (Roxb.) Lindl.	Epiphyte	Orchidaceae	
46	<i>Piper attenuatum</i> Buch.	Climber	Piperaceae	
47	<i>Piper longum</i> L.	Climber	Piperaceae	
48	<i>Piper nigrum</i> L.	Climber	Piperaceae	Endangered
49	<i>Plumbago zeylanica</i> L.	Herb	Plumbaginaceae	
50	<i>Plectranthus barbatus</i> Andrews	Herb	Lamiaceae	
51	<i>Premna latifolia</i> Roxb.	Tree	Verbenaceae	
52	<i>Rauvolfia serpentina</i> (L.) Benth. ex kurz	Herb	Apocynaceae	Critically Endangered
53	<i>Saraca asoca</i> L.	Tree	Caesalpiniaceae	Endangered

54	<i>Sarcostemma acidum</i> (Roxb.) Voight	Climber	Asclepiadaceae	
55	<i>Schefflera stellata</i> (Gaertn.) Harms	Shrub	Araliaceae	
56	<i>Semecarpus anacardium</i> L.f.	Tree	Anacardiaceae	
57	<i>Smilax zeylanica</i> L.	Climber	Smilaxaceae	Vulnerable
58	<i>Spermadictyon suaveolens</i> Roxb.	Shrub	Rubiaceae	
59	<i>Stemona tuberosa</i> Lour.	Climber	Stomonaceae	Vulnerable
60	<i>Sterculia urens</i> Roxb.	Tree	Sterculiaceae	Vulnerable
61	<i>Thysanolaena maxima</i> (Roxb.) O. Ktze.	Grass	Poaceae	
62	<i>Tinospora sinensis</i> (Lour.) Merr.	Climber	Menispermaceae	Vulnerable
63	<i>Vanda tessellata</i> (Roxb.) Hook. ex G. Don	Epiphyte	Orchidaceae	
64	<i>Vanilla wightiana</i> Lindl.	Climber	Orchidaceae	Rare
65	<i>Vetiveria zizanioides</i> (L.) Nash	Grass	Poaceae	
66	<i>Vitex negundo</i> L.	Shrub	Verbenaceae	
67	<i>Wattakaka volubilis</i> (L.f.) Stapf	Climber	Asclepiadaceae	
68	<i>Wendlandia heynei</i> (Roem. &Schult.) Santapau & Merchant	Tree	Rubiaceae	
69	<i>Woodfordia fruticosa</i> (L.) Kurz.	Shrub	Lythraceae	
70	<i>Zingiber montanum</i> (Koenig) Sietrich	Herb	Zingiberaceae	
71	<i>Zingiber roseum</i> (Roxb.) Roscoe	Herb	Zingiberaceae	Endangered
72	<i>Zingiber zerumbet</i> (L.) Roscoe ex Sm.	Herb	Zingiberaceae	

A total of 18 species belonging to 18 genera and 15 families are red list plants in Andhra Pradesh, which 2 species are Critically Endangered *Rauvolfia serpentina*, *Embelia ribes*, 5 Endangered *Anodendron paniculatum*, *Decalepis hamiltonii*, *Saraca asoca*, *Piper nigrum*, *Zingiber roseum*, 8 vulnerable *Aegle marmelos*, *Curcuma pseudomontana*, *Gloriosa superba*, *Gymnema sylvestre*, *Smilax zeylanica*, *Sterculia urens*, *Stemona tuberosa*, *Tinospora sinensis*, 1 Near Threatened *Costus speciosus*, 1 Data Deficiency *Cycas sphaerica* and 1 Rare species *Vanilla wightiana* (Reddy *et al.*, 2003; Reddy and Reddy, 2008; Padalet *et al.*, 2009; Pattanaiket *et al.*, 2009; Rao *et al.*, 2010; Rao *et al.*, 2014; Rao and Rao, 2014; Syamalaet *et al.*, 2014; Arunaet *et al.*, 2015) were successfully acclimatized and well growing in the garden (Table 1).

Some of the plants like *Ocimum gratissimum*, *Abrus*, *Mucuna* are now multiplying by their seeds and some plants like *Curcuma*, *Costus*, *Zingiber*, *Curculigo*, *Woodfordia*, *Spermadictyon suaveolens* etc. are now in flowering condition. Some of the high altitude and moist deciduous forest species like *Anodendron paniculatum*, *Schfflera stellata*, *Wendlandia*

heynei, *Stemona tubarosa*, *Embelia ribes*, Zingiberaceae members are also acclimatized to the university climatic condition.



Fig. 2 a) *Anamitra cocculus* (L.)Wight &Arn., b) *Anodendron paniculatum* (Roxb.)A.DC., c) *Boehmeria platyphylla* D. Don, d) *Costus speciosus* (Koen.) Smith, e) *Curcuma pseudomontana* Garaham, f) *Curculigo orchiolides* Gaertn., g) *Cymbopogon coloratus* (Nees) Stapf, h) *Decalepis hamiltonii* Wight &Arn.



Fig. 3 a) *Gloriosa superba* L., b) *Haldinia cordifolia* (Roxb.) Ridsd, c) *Justicia adhatoda* L., d) *Litsea deccanensis* Gamble, e) *Peperomia dindigulensis* Miq., f) *Piper longum* L., g) *Semecarpus anacardium* L.f., h) *Smilax zeylanica* L.



Fig. 4 a) *Stemona tuberosa* Lour., b) *Sterculia urens* Roxb., c) *Vanilla wightiana* Lindl., d) *Wendlandia heynei* (Roem. & Schult.) Santapau & Merchant, e) *Woodfordia fruticosa* (L.) Kurz., f) *Zingiber montanum* (Koenig) Sietrich, g) *Zingiber roseum* (Roxb.) Roscoe, g) *Zingiber zerumbet* (L.) Roscoe ex Sm.

Discussion

University Botanical Garden was well established and maintaining by the department of botany, with good number of species and introduced valuable species like *Pterocarpus santalinus*, *Santalum album*, *Terminalia bellerica*, *Dalbergia latifolia* and *Artocarpus heterophyllus*. Due to the introduction of medicinal and red-list plants to the University campus various types of plant visitors, pollinators like bees and butterflies are visiting very frequently. Introduction of the global endemic and endangered plants *Cycas sphaerica* and *Decalepis hamiltonii* (Reddy and Reddy, 2008; Rao *et al.*, 2014) is most important achievement for long term conservation. It is very interesting point is that higher altitude and moist deciduous forest plants are notably acclimatized in the University medicinal garden. Moreover, the Madras Presidency conservator Lushington introduced some important species like *Pterocarpus santalinus*, *Santalum album*, *Terminalia bellerica*, *Dalbergia latifolia*, *Artocarpus heterophyllus*, *Saraca asoca*, *Semicarpus anacardium*, *Haematoxylon campechianum*, *Terminalia chebula*, *Gyrocarpus americana*, *Gemlina arborea* etc. (Venkateswarlu, 1972), global endemic and endangered species *Pterocarpus santalinus* is well established in the University Campus. *Santalum album* has scatted distribution but few species like *Haematoxylon campechianum*, *Terminalia chebula*, *Gyrocarpus americana*, *Gemlina arborea* are now disappeared in University campus.

Conclusion

Acclimatization of some higher altitude, moist deciduous forest plants and endemic plants is indicating University campus climatic conditions are much suitable for the introduction and ex-situ conservation of vulnerable forest species. So there is a need to expand the garden and introduction of some more medicinal, red list and other valuable plants for ex-situ conservation. This kind of activities would help in ex-situ conservation of vulnerable plants and established every University and colleges should establish and maintain the red list medicinal gardens for the *ex-situ* conservation. Simultaneously these gardens would help the students to gain knowledge on medicinal and red list plants and it would create awareness on conservation of Biodiversity too.

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