

**Research article**

# Inventory of trees in the urban landscape: A case study in Andhra University, Visakhapatnam, Andhra Pradesh

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**Abstract:** Documentation of existing flora of the urban environment is important to determine existing resources and to set target for future improvement. An understanding of the flora in regional level must play an important role in elucidating the larger patterns of distribution of biodiversity. Floristic inventory of trees of Andhra University campus in Visakhapatnam city was carried out during 2010 to 2016. This study resulted in record of 175 tree species pertains to 132 genera under 53 families. The data presented will be a valuable source of information for management of tree resources in the Andhra University campus.

**Keywords:** Medicinal plants - Trees - Urban landscape - Visakhapatnam.

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## INTRODUCTION

Trees are the largest and perennial growth forms. A tree is defined as a woody plant that attains diameter of 10 cm or more at the breast height (130 cm above ground) (Reddy *et al.* 2007). Trees provide basic needs of human beings in the form of air, food, timber, paper, fuel wood, medicine etc. (Sandhyarani *et al.* 2007, Bajpai *et al.* 2015, Truyen *et al.* 2015, Borah *et al.* 2016, Dutta *et al.* 2016, Sarkar & Devi 2017). They are also providing other basic products and drugs (Reddy *et al.* 2009, Mehra *et al.* 2014). Trees act as noise filters, air purifiers; sequester carbon and pollutant traps (Pherson *et al.* 1997, Beckett *et al.* 2000, Chave *et al.* 2005, Vivek P & Parthasarathy 2015). Trees of the concretized urban environment provide food and residence to many of birds and animals (Fernandez-Zuricic 2000). Urban greening and urban forests are particularly important to healthy cities in developing countries (Thaiutsa *et al.* 2008). Urban greenery that includes streets with trees, parks, educational institutions play vital role in conservation of tree cover, environment as well. It can decrease the urban island heat effect (Chow & Roth 2006). Results of tree inventory and assessment of urban environment can be a useful for excellent urban planning and conservation of important tree species (Cy 2006).

Understanding of the distribution of tree species plays an important role in illuminate the larger patterns of distribution of biodiversity. Trees are useful for analysis of species-area and species-individual relationships because they are easy to locate precisely and to count. Tropical trees are especially interesting subjects because of there is rich in species diversity (Condit *et al.* 1996). Documentation of existing green cover of the urban environment is important to determine existing resources and to set target for future improvements (Miller 1996). Due to escalating urbanization, green space and urban trees become increasingly important in developing countries (Cy 2006). Number of threatened species also existed in urban areas. Urbanization is one of the major threats to the natural vegetation (Sodhi *et al.* 2010). Present study focused on exploration on tree diversity and their distributional status in the Andhra University Campus urban landscape.

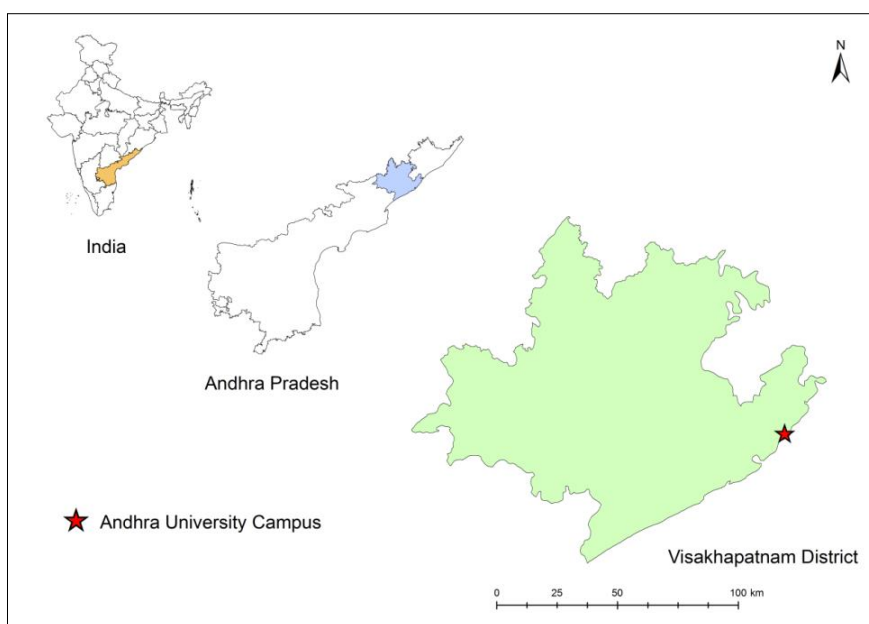
## MATERIALS AND METHODS

### Study area

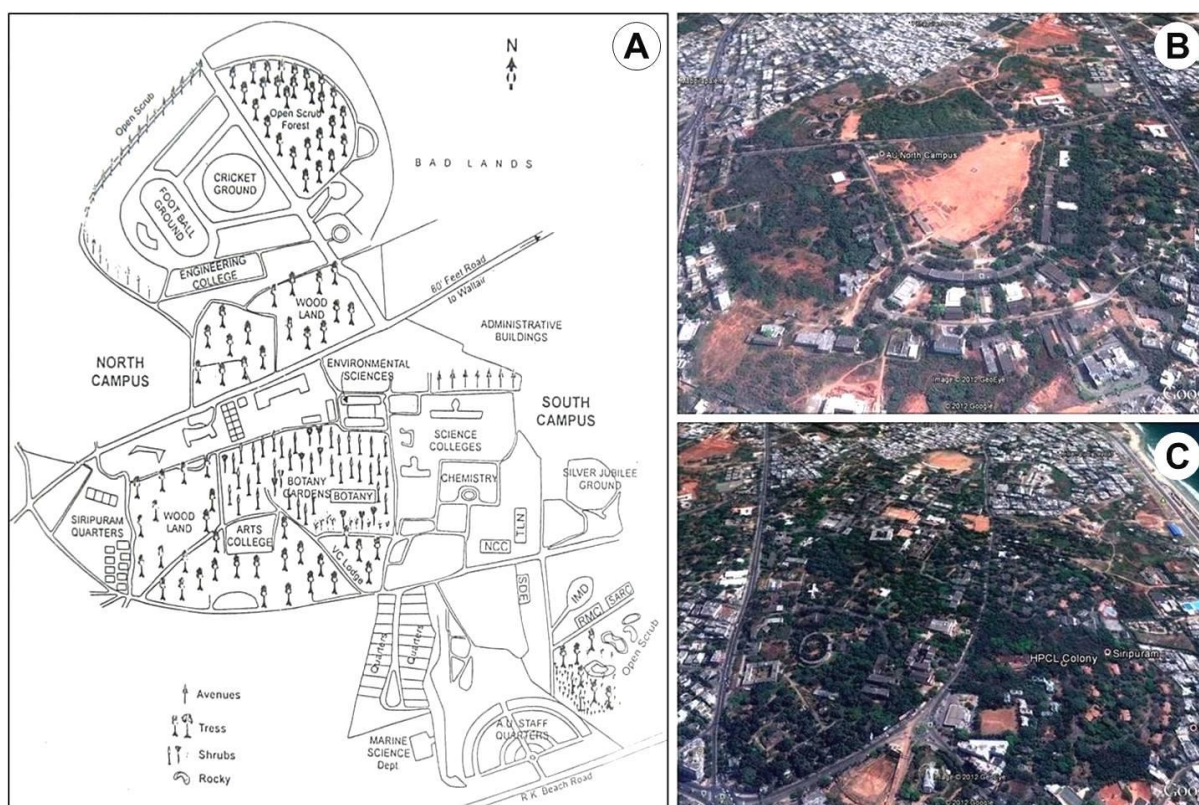
Andhra University was established in 1926 located between 17° 35' to 17° 40' N, 83° 20' to 83° 25' E, with an elevation of 60 m in Visakhapatnam City with an area of 200 hectares (Fig. 1, 2). Campus has tropical humid climate with an average annual temperature between 18°C and 45°C and an average rain fall of 1000–1200 mm.

### Data collection

During the period of 2010–2016 author was observed tree diversity and their distribution in Andhra University Campus. All taxa were identified up to species level with the help of floras and literature (Gamble & Fischer 1915–1935, Venkateswaralu *et al.* 1972, Pullaiah, 1997, Pullaiah & Chennaiah 1997, Pullaiah & Moulali 1997, Bose *et al.* 1998, Pullaiah & Sandhyarani 1999, Rao *et al.* 1999, Reddy & Reddy 2008, Subbarao & Kumari 2008, Rao *et al.* 2010, Rao 2011, Rao *et al.* 2015, Rao 2016). Data such as botanical name, family, distributional status and occurrence were provided, local (Telugu) names and common names also provided as far as possible. All the plant species were arranged according to alphabetical order of their scientific names. Nomenclature as far as possible has been made up-to date ([www.plantlist.org](http://www.plantlist.org)) (Table 1). Some of the plant photographs were provided for easy identification (Figs. 6–8).



**Figure 1.** Map of the Study area.



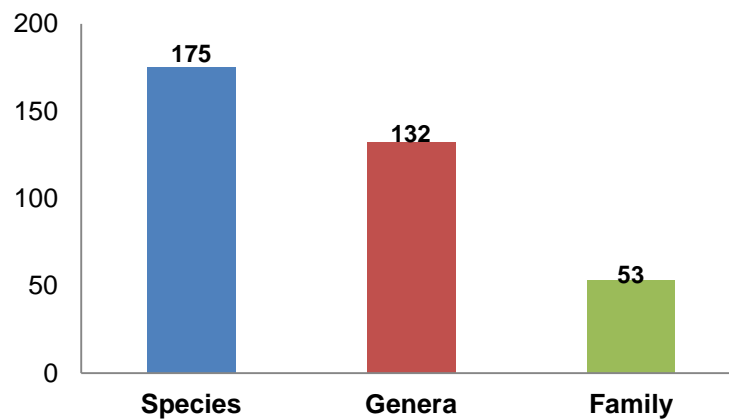
**Figure 2.** A, Route map of Andhra University Campus; B, Satellite (Google Earth) map of University North Campus; C, Satellite (Google Earth) map of University South Campus.

## RESULTS

A total of 175 tree species pertaining to 132 genera under 53 families were recorded from the Andhra University Campus (Table 1, Fig. 3). Among the 175 trees, 5 (2.85%) species *i.e.* *Araucaria columnaris* (Forst.) Hk., *Thuja orientalis* L., *Cycas circinalis* L., *Cycas revoluta* Thunb. and *Cycas sphaerica* Roxb. are gymnosperms and remaining 170 (97.14%) species are belonging to angiosperms. Among the angiosperms 160 (91.42%) species are dicots and 10 (5.71%) species are monocots.

*Ficus* is the dominant genus with 6 (3.42%) species followed by 3 genera *Euphorbia*, *Hibiscus* and *Citrus* each with 4 (2.28%) species, 6 genera *Tabebuia*, *Terminalia*, *Cycas*, *Diospyros*, *Albizia* and *Ixora* are with 3 (1.71%) species 16 genera *Annona*, *Alstonia*, *Plumeria*, *Bauhinia*, *Caesalpinia*, *Senna*, *Anogeissus*, *Cordia*, *Phyllanthus*, *Dalbergia*, *Lagerstroemia*, *Ochna*, *Mussaenda*, *Murraya*, *Manilkara* and *Sterculia* are with 2 (1.14%) species and remaining 106 genera are with single (0.57%) species were reported.

Among the 53 families Rubiaceae is the dominant family with 14 (8%) species followed by Caesalpiniaceae 12 (6.85%) species, 2 (3.77%) families Euphorbiaceae and Mimosaceae are with 11 (6.28%) species, Arecaceae with 10 (5.71%) species, Moraceae with 9 (5.14%) species, 2 (3.77%) families Bignoniaceae and Fabaceae are with 8 (4.57%) species, 2 (3.77%) families Apocynaceae and Rutaceae are with 7 (4%) species, 3 (5.66%) families Combretaceae, Malvaceae and Myrtaceae are with 5 (2.85%) species, 3 (5.66%) families Anacardiaceae, Lythraceae and Sapotaceae are with 4 (2.28%) species, 4 (7.54%) families Annonaceae, Cycadaceae, Ebenaceae and Sterculiaceae are with 3 (1.71%) species, 6 (3.42%) families Bombacaceae, Cordiaceae, Meliaceae, Ochnaceae, Sapindaceae and Verbenaceae are with 2 (1.14%) species and remaining 27 (50.94%) families are with single (0.57%) species were reported.



**Figure 3.** Details of species richness, genus and families of the study area.

**Table 1.** Trees inventory and their details in Andhra University campus. [D.St.- Distributional Status, Occ.- Occurrence; C- Common, O- Occasional, R- Rare, NAT- Natural, CULT- Cultivated, AVN- Avenue, ORN- Ornamental, INT- Introduced in to the Botanical Garden]

S.No.	Name of the plant	Family	Local (Telugu) Name	Common Name	D.St.	Occ.
1	<i>Acacia auriculiformis</i> Benth.	Mimosaceae	Australia tumma	Australian Oke	C	INT
2	<i>Adenanthera pavonina</i> L.	Mimosaceae	Bandi gurivinda	Peacock flower fence	R	NAT
3	<i>Aegle marmelos</i> (L.) Correa	Rutaceae	Maaredu	Bengal Quince	R	INT
4	<i>Ailanthus excelsa</i> Roxb.	Simaroubaceae	Peddamanu	Indian Tree of Heaven	R	AVN
5	<i>Alangium salvifolium</i> (L. f.) Wangerin	Alangiaceae	Uduga	Sage-leaved alangium	R	NAT
6	<i>Albizia chinensis</i> (Osbeck) Merr.	Mimosaceae	Chinduga	Chinese albizia	R	NAT
7	<i>Albizia lebbek</i> (L.) Willd.	Mimosaceae	Dirisena, Siresha puspam	East Indian Walnut	O	NAT
8	<i>Albizia saman</i> (Jacq.) Merr.	Mimosaceae	Nidraganneru	Rain Tree	O	NAT
9	<i>Alstonia scholaris</i> (L.) R.Br.	Apocynaceae	Edakula pala	Devil tree, white cheesewood	O	AVN
10	<i>Alstonia venenata</i> R.Br.	Apocynaceae	Chinna edakula pala	Poison Devil Tree	R	INT
11	<i>Anacardium occidentale</i> L.	Anacardiaceae	Zeedimamidi	Cashe Nut	C	CULT
12	<i>Annona reticulata</i> L.	Annonaceae	Rama phalam	Bull's heart	O	CULT
13	<i>Annona squamosa</i> L.	Annonaceae	Seeta phalam	Custard apple	O	CULT
14	<i>Anogeissus acuminata</i> (Roxb. ex DC.) Guill. & Seneg.	Combretaceae	Pasi chettu	Button tree	R	INT
15	<i>Anogeissus latifolia</i> (Roxb. ex DC.) Wall.	Combretaceae	Sirimanu	Axlewood	R	NAT
16	<i>Araucaria columnaris</i> (Forst.) Hk.	Araucariaceae	Christmas tree	Monkey puzzle tree	O	ORN
17	<i>Areca catechu</i> L.	Arecaceae	Pokachekka	Areca palm	R	ORN



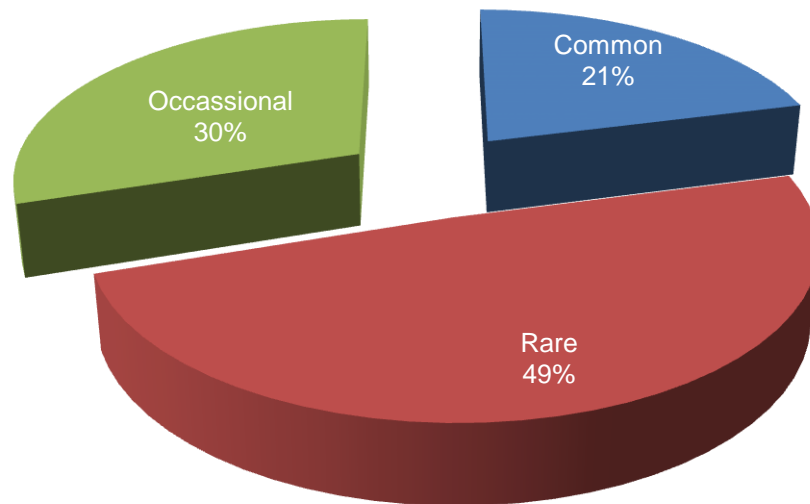
18	<i>Artocarpus heterophyllus</i> Lam.	Moraceae	Panasa	Honey Jack tree	O	CULT
19	<i>Azadirachta indica</i> A. Juss.	Meliaceae	Vepa	Neem	R	NAT
20	<i>Bauhinia purpurea</i> L.	Caesalpiniaceae	Devakanchanam	Pink bauhinia	C	ORN
21	<i>Bauhinia tomentosa</i> L.	Caesalpiniaceae		yellow bauhinia	R	ORN
22	<i>Bixa orellana</i> L.	Bixaceae	Mitayirangu	Lipstick tree	R	CULT
23	<i>Bombax ceiba</i> L.	Bombacaceae	Erra buruga	Red silk cotton	R	NAT
24	<i>Borassus flabellifer</i> L.	Arecaceae	Tati chettu	Palmyra Palm	O	NAT
25	<i>Brownea coccinia</i> Jacq.	Caesalpiniaceae		Rose of Venezuela	R	ORN
26	<i>Butea monosperma</i> (Lam.) Taub.	Fabaceae	Moduga	Flame of the forest	R	ORN
27	<i>Caesalpinia coriaria</i> (Jacq.) Willd.	Caesalpiniaceae	Divi Divi	American Sumach	O	NAT
28	<i>Caesalpinia pulcherrima</i> (L.)	Caesalpiniaceae	Chinna turayi	Peacock Flower	C	ORN
29	<i>Callistemon lanceolatus</i> (Sm.) Sweet	Myrtaceae	Bottle brush	Bottle brush	R	CULT
30	<i>Calophyllum inophyllum</i> L.	Clusiaceae	Ponna chettu	Alexandrian laurel	R	ORN
31	<i>Carica papaya</i> L.	Caricaceae	Boppayi	Papaya	O	CULT
32	<i>Caryota urens</i> L.	Arecaceae	Jeeluga	Fish tail palm	O	ORN
33	<i>Cascabela thevitia</i> (L.) Lippold	Apocynaceae	Pachha ganneru	Yellow oleander	O	ORN
34	<i>Cassia fistula</i> L.	Caesalpiniaceae	Reela	Golden shower	C	ORN
35	<i>Cassine glauca</i> (Rottb.) O. Kuntze	Celastraceae	Nirija	Ceylon Tea	R	NAT
36	<i>Casuarina equisetifolia</i> Forst. & Forst f.	Casuarinaceae	Sarugudu	Sae oke	R	ORN
37	<i>Ceiba pentandra</i> (L.) Gaertn.	Bombacaceae	Pachha buruga	White silk cotton	R	NAT
38	<i>Citrus aurantifolia</i> (Christm.) Swingle	Rutaceae	Nimma	Limon	R	CULT
39	<i>Citrus aurantium</i> L.	Rutaceae	Narinja	Orange	R	CULT
40	<i>Citrus limon</i> (L.) Burm.	Rutaceae	Dabba	Lemon	R	CULT
41	<i>Citrus sinensis</i> (L.) Osbeck	Rutaceae	Bathai	Sweet orang	R	CULT
42	<i>Cocos nucifera</i> L.	Arecaceae	Kobbari, tenkaya	Coconut plam	O	CULT
43	<i>Cordia dichotoma</i> Forest.	Cordiaceae	Nakkeri	Earth cake tree	O	NAT
44	<i>Cordia sebestena</i> L.	Cordiaceae		Aloe Wood tree	O	ORN
45	<i>Couroupita guianensis</i> Aubl.	Lecythidaceae	Naga lingam	Cannon ball tree	R	ORN
46	<i>Crateva magna</i> (Lour.) DC.	Capparaceae		Sacred garlic pear	R	NAT
47	<i>Cycas circinalis</i> L.	Cycadaceae		Fern palm	R	ORN
48	<i>Cycas revoluta</i> Thunb.	Cycadaceae	Madana kamashi	Japanese sago palm	R	ORN
49	<i>Cycas sphaerica</i> Roxb.	Cycadaceae	Kodhada chettu		R	ORN
50	<i>Dalbergia latifolia</i> Roxb.	Fabaceae	Rose wood	Rose wood	R	INT
51	<i>Dalbergia sissoo</i> Roxb.	Fabaceae	Sosso	Sisso	R	INT
52	<i>Delonix regia</i> (Boj. ex Hook.) Rafin.	Caesalpiniaceae	Tureyi	Gulmohar	O	AVN
53	<i>Dichrostachys cinerea</i> (L.) Wighth & Arn.	Mimosaceae	Veluturu	Sickle Bush	R	NAT
54	<i>Diospyros chloroxylon</i> Roxb.	Ebenaceae	Illenda		O	NAT
55	<i>Diospyros ferrea</i> (Willd.) Bakh.	Ebenaceae	Pisinika	Black ebony	O	NAT
56	<i>Diospyros malabarica</i> (Desr.) Kostel.	Ebenaceae	Neeti tumiki	Malabar ebony	R	INT
57	<i>Dypsis lutescens</i> (H.Wendl.) Beentje & J.Dransf.	Arecaceae		Bamboo palm	R	ORN
58	<i>Elaeis guineensis</i> Jacq.	Arecaceae	Palm oil chettu	Oil palm	R	INT
59	<i>Enterolobium timbouva</i> Mart.	Mimosaceae		Earpod tree	R	AVN
60	<i>Erioglossum rubiginosum</i> Bl.	Sapindaceae		Rusty sapindus	R	INT
61	<i>Erythrina variegata</i> L.	Fabaceae	Badita	Indian Coral tree	R	NAT
62	<i>Erythroxyllum monogynum</i> Roxb.	Erythroxylaceae	Devadari	Bastard Sandal, Red cedar	R	NAT
63	<i>Eucalyptus globulus</i> Labill.	Myrtaceae	Jamail	Southern blue-gum	C	CULT
64	<i>Euphorbia antiqiorum</i> L.	Euphorbiaceae	Jemudu	Antique Spurge	R	ORN
65	<i>Euphorbia caducifolia</i> Haines.	Euphorbiaceae	Katte jemudu	Leafless Milk Hedge	R	ORN
66	<i>Euphorbia pulcherrima</i> Willd. ex Klotzsch	Euphorbiaceae		Christmas Star	O	ORN
67	<i>Euphorbia tirucalli</i> L.	Euphorbiaceae	Katimandu	Pencil cactus	R	ORN
68	<i>Ficus amplissima</i> Sm.	Moraceae	Jeechettu	Bat tree	O	NAT
69	<i>Ficus benghalensis</i> L.	Moraceae	Marri	Indian Fig tree	O	NAT
70	<i>Ficus benjamina</i> L.	Moraceae		Weeping fig	C	ORN
71	<i>Ficus elastica</i> Roxb.	Moraceae	Rabbaru chettu	Indian Rubber	R	ORN
72	<i>Ficus hispida</i> L. f.	Moraceae	Bodda marri	Wild Fig	O	NAT
73	<i>Ficus racemosa</i> L.	Moraceae		Cluster fig tree	C	NAT
74	<i>Ficus religiosa</i> L.	Moraceae	Raavi	Wisdom tree	C	NAT

75	<i>Flacourtia indica</i> (Burm.f.) Merr.	Flacourtiaceae	Kanavegu chettu	Indian plum	R	NAT
76	<i>Flueggea virosa</i> (Roxb. ex Willd.) Royle	Euphorbiaceae		Bushweed	C	NAT
77	<i>Gardenia latifolia</i> Ait.	Rubiaceae	Bikki	Papra	R	ORN
78	<i>Gliricidia sepium</i> (Jacq.) Kunth ex Walp.	Fabaceae	Madri	Quickstick	C	ORN
79	<i>Grevillea robusta</i> A. Cunn. ex R.Br.	Proteaceae	Silver oke	Silver Oke	R	INT
80	<i>Guaiacum officinale</i> L.	Zygophyllaceae		Guaiacwood	R	ORN
81	<i>Guazuma ulmifolia</i> Lam.	Sterculiaceae		Bastard Ceder	R	INT
82	<i>Haldinia cordifolia</i> (Roxb.) Ridsd.	Rubiaceae	Kamba	Haldu	R	INT
83	<i>Hamelia patens</i> Jacq.	Rubiaceae		Hamelia	C	ORN
84	<i>Hibiscus mutabilis</i> L.	Malvaceae	Muddamandara	Cotton rosemallow	R	ORN
85	<i>Hibiscus rosa-sinensis</i> L.	Malvaceae	Mandara	China rose	C	ORN
86	<i>Hibiscus schizopetalus</i> (Dyer) Hook. f.	Malvaceae		Coral hibiscus	O	ORN
87	<i>Hibiscus tiliaceus</i> L.	Malvaceae	Etagogu	Coast cotton tree	R	ORN
88	<i>Hymenodictyon orixense</i> (Roxb.) Mabb.	Rubiaceae	Dudippa	Bridal Couch, bandaaru-chettu	R	INT
89	<i>Ixora coccinia</i> L.	Rubiaceae	Rama banum	flame of the woods	C	ORN
90	<i>Ixora finlaysoniana</i> Wall. ex G.Don	Rubiaceae	Tellaguttupulu	Fragrant Ixora, White Siamese Ixora	O	ORN
91	<i>Ixora pavetta</i> Andrews	Rubiaceae	Korivi	Torch tree	O	NAT
92	<i>Jacaranda mimosifolia</i> D.	Bignoniaceae		Jacaranda	O	AVN
93	<i>Jacquinia ruscifolia</i> Jacq.	Theophrastaceae		Jaqinia	R	ORN
94	<i>Jatropha curcas</i> L.	Euphorbiaceae	Adavi amudam, Pedda nepalam	Barbados nut	R	INT
95	<i>Kigelia africana</i> (Lam.) Benth.	Bignoniaceae	Enugu kaaya	Susage tree	O	AVN
96	<i>Lagerstroemia indica</i> L.	Lythraceae	Chinna gogu	Bonnet flower	R	ORN
97	<i>Lagerstroemia speciosa</i> (L.) Pers.	Lythraceae	Varagogu	Queen's pride	R	ORN
98	<i>Lannea coromandelica</i> (Houtt.) Merr.	Anacardiaceae	Gumpina	Indian ash tree	O	NAT
99	<i>Lawsonia inermis</i> L.	Lythraceae	Gorinta	Henna plant	R	ORN
100	<i>Leucaena leucocephala</i> (Lam.) de Wit	Mimosaceae	Chandra chettu	Subabul	C	NAT
101	<i>Licuala grandis</i> Wndl.	Arecaceae		Ruffled Fan Palm	O	ORN
102	<i>Litsea deccanensis</i> Gamble	Lauraceae	Naaramamidi	Deccan Tallow Laurel	R	INT
103	<i>Madhuca indica</i> J. Gmelin	Sapotaceae	Ippa	Indian Butter tree	R	NAT
104	<i>Magnolia champaca</i> (L.) Baill. ex Pierre	Magnoliaceae	Chettu champanga	Champak	O	ORN
105	<i>Mangifera indica</i> L.	Anacardiaceae	Mamidi	Mango	C	NAT
106	<i>Manihot glaziovii</i> Müll. Arg.	Euphorbiaceae	Rabbaru chettu	Ceara rubber tree	R	INT
107	<i>Manilkara hexandra</i> (Roxb.) Dubard	Sapotaceae	Pala	Ceylon Iron wood	R	NAT
108	<i>Manilkara zapota</i> (L.) P. Royen	Sapotaceae	Sapota	Sapodilla	R	CULT
109	<i>Melaleuca bracteata</i> F. Muell.	Myrtaceae		Black tea-tree, River tea-tree	O	ORN
110	<i>Memecylon edule</i> Roxb.	Melastomaceae	Alli	Kaayam, Delek bangas	R	ORN
111	<i>Millingtonia hortensis</i> L. f.	Bignoniaceae	Kada malle	Cork tree	R	AVN
112	<i>Mimusops elengi</i> L.	Sapotaceae	Pogadu	Spanish cherry	C	AVN
113	<i>Mitragyna parviflora</i> (Roxb.) Korth.	Rubiaceae	Neer kadamba	Water cadamba	R	NAT
114	<i>Morinda coreia</i> Buch.-Ham.	Rubiaceae	Togaru	Tohari wood	O	NAT
115	<i>Moringa oleifera</i> Lam.	Moringaceae	Munaga	Drum Stick	R	CULT
116	<i>Muntingia calabura</i> L.	Elaeocarpaceae	BP paluu	Chinese Cherry	O	AVN
117	<i>Murraya koenigii</i> (L.) Spreng.	Rutaceae	Karivepaku	Curry leaf	R	NAT
118	<i>Murraya paniculata</i> (L.) Jack	Rutaceae	Puvelaga	Orange Jasmine	R	ORN
119	<i>Mussaenda erythrophylla</i> Schum. & Thonn.	Rubiaceae		Red Flag Bush	O	ORN
120	<i>Mussaenda frondosa</i> L.	Rubiaceae		Dhobi tree	O	ORN
121	<i>Neolamarckia cadamba</i> (Roxb.) Bossier	Rubiaceae	Kadamba	Kadam	R	AVN
122	<i>Nerium oleander</i> L.	Apocynaceae	Erra ganneru	Oleander	C	ORN
123	<i>Nyctanthes arbor-tristis</i> L.	Oleaceae	Parijatam	Night-flowering Jasmine	R	ORN
124	<i>Ochna obtusata</i> DC.	Ochnaceae		Ramdhan Champa, Mickey-mouse	R	NAT
125	<i>Ochna squarrosa</i> L.	Ochnaceae		Bird's-eye bush	O	ORN
126	<i>Parkia biglandulosa</i> Wight & Arn.	Mimosaceae	Tennis ball	Badminton Ball Tree	R	AVN

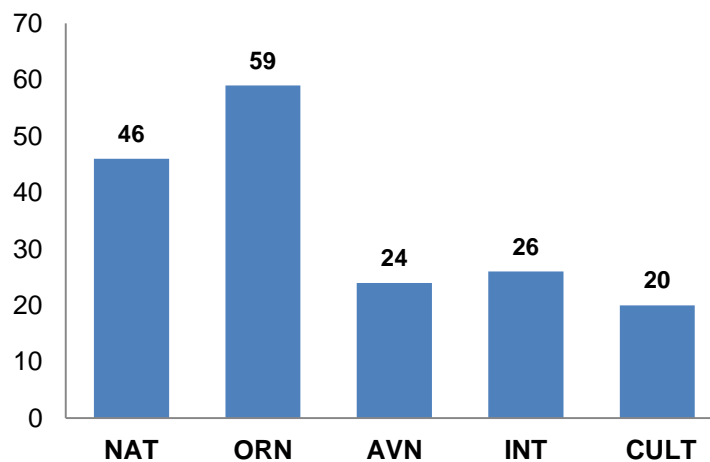
127	<i>Peltophorum pterocarpum</i> (DC.) Barker ex Heyne	Caesalpiniaceae	Coffee pod	Rusty Shield Bearer	C	AVN
128	<i>Phoenix sylvestris</i> (L.) Roxb.	Arecaceae	Eeta	Wield date palm	C	NAT
129	<i>Phyllanthus acidus</i> (L.) Skeels	Euphorbiaceae	Racha Usiri	Star gooseberry	O	CULT
130	<i>Phyllanthus emblica</i> L.	Euphorbiaceae	Usiri	Indian Goose Berry	O	CULT
131	<i>Pisonia grandis</i> R.Br.	Nyctaginaceae	Aravappu kura	Lettuce tree	C	ORN
132	<i>Pithecellobium dulce</i> (Roxb.) Benth.	Mimosaceae	Chema chinta	Manilla tamarind	O	NAT
133	<i>Plumeria alba</i> L.	Apocynaceae	Nuru vahalu	Temple tree	O	ORN
134	<i>Plumeria rubra</i> L.	Apocynaceae	Deva ganneru	Temple tree	O	ORN
135	<i>Polyalthia longifolia</i> (Sonner) Thw.	Annonaceae	Naramamidi, Asoka	Ashoka	C	ORN
136	<i>Pongamia pinnata</i> (L.) Pierre	Fabaceae	Ganuga/Kamu	Indian Beech tree	C	AVN
137	<i>Posoqueria latifolia</i> Aubl.	Rubiaceae		Monkey apple	R	ORN
138	<i>Premna mollissima</i> Roth	Verbenaceae	Nelli	Dusky leaved fire brand	R	NAT
139	<i>Prichardia pacifica</i> Seem. & Wendl.	Arecaceae		Fiji Fan Palm	O	ORN
140	<i>Prosopis chilensis</i> (Molina) Stuntz	Mimosaceae	Tella tumma, Kanche tumma	Chilean mesquite	C	NAT
141	<i>Psidium guajava</i> L.	Myrtaceae	Jama	Guava	R	CULT
142	<i>Pterocarpus santalinus</i> L. f.	Fabaceae	Erra chandanam	Red sandal	C	INT
143	<i>Punica granatum</i> L.	Lythraceae	Danimma	Pomegranate	R	CULT
144	<i>Putranjiva roxburghii</i> Wall.	Euphorbiaceae	Puttaranjivi	Lucky Bean Tree	O	INT
145	<i>Ravenala madagascariensis</i> Sonn.	Streliziaceae	Travellar palm	Travellar palm	R	ORN
146	<i>Ricinus communis</i> L.	Euphorbiaceae	Amudam	Caster	C	NAT
147	<i>Roystonea regia</i> (H.B. & K.) O.F. Cook	Arecaceae	Bojja chettu	Royal palm	O	ORN
148	<i>Santalum album</i> L.	Santalaceae	Chandanam, Gandam	Sandal wood	C	INT
149	<i>Sapindus emarginatus</i> Vahl.	Sapindaceae	Konkudu, Ritta kaya	Soap nut	C	NAT
150	<i>Saraca asoca</i> (Roxb.) de Wilde	Caesalpiniaceae	Ashoka chettu	Ashoka Tree	R	INT
151	<i>Semecarpus anacardium</i> L.	Anacardiaceae	Nallazeedi	Marking nut	R	INT
152	<i>Senna siamea</i> (Lam.) H.S. Irwin & Barneby	Caesalpiniaceae	Chetuu tangedu	Kassod tree	C	AVN
153	<i>Senna spectabilis</i> (DC.) H.S. Irwin & Barneby	Caesalpiniaceae		Yellow cassia	O	ORN
154	<i>Sesbania sesban</i> (L.)	Fabaceae	Avisa	Egyptian riverhemp	R	INT
155	<i>Shorea robusta</i> Gaertn. f.	Dipterocarpaceae	Guggilam	Sal	R	INT
156	<i>Spathodea campanulata</i> P. Beauv.	Bignoniaceae	Tulip	African tulip	O	AVN
157	<i>Sterculia foetida</i> L.	Sterculiaceae	Seema badam	Jangle Badam	O	INT
158	<i>Sterculia urens</i> Roxb.	Sterculiaceae	Kovela, Tapasi	Gum karaya	R	INT
159	<i>Streblus asper</i> Lour.	Moraceae	Barnika	Sand Paper Tree, Toothbrush tree	R	NAT
160	<i>Switenia mahagoni</i> (L.) Jacq.	Meliaceae	Mahagani	mahogany	R	AVN
161	<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	Neredu	Indian Cherry	C	AVN
162	<i>Tabebuia argentea</i> (But. & K. Schum) Britt.	Bignoniaceae		Silver Trumpet Tree	O	AVN
163	<i>Tabebuia aurea</i> (Silva Manso) Benth. & Hook.f. ex S.Moore	Bignoniaceae		Caribbean trumpet tree	O	AVN
164	<i>Tabebuia rosea</i> (Bertol.) DC.	Bignoniaceae		Rosy trumpet tree	O	AVN
165	<i>Tamarindus indica</i> L.	Caesalpiniaceae	Chinta	Tamarind	C	NAT
166	<i>Tecoma stans</i> (L.) Kunth	Bignoniaceae	Swarna ganneru	Yellow trumpet flower	C	ORN
167	<i>Tectona grandis</i> L. f.	Verbenaceae	Teku	Teak	C	CULT
168	<i>Terminalia arjuna</i> (Roxb. DC.) Wight. & Arn.	Combretaceae	Tella maddi	Arjun tree	O	AVN
169	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Combretaceae	Tanikaya	Beleric	R	AVN
170	<i>Terminalia catappa</i> L.	Combretaceae	Badam	Indian Almond	C	AVN
171	<i>Thespesia populnea</i> (L.) Soland. ex Correa	Malvaceae	Ganga raavi	India tulip tree	O	AVN
172	<i>Thuja orientalis</i> L.	Cupressaceae		Tree of life	C	ORN
173	<i>Wendlandia heynei</i> (Roem. & Schult.) Santapau & Merchant	Rubiaceae	Tellapucu	Tilki	R	INT
174	<i>Wrightia tinctoria</i> R.Br.	Apocynaceae	Ankudu	Ivory wood	C	NAT
175	<i>Ziziphus mauritiana</i> Lam.	Rhmnaceae	Regu	Chinese date	O	NAT

As per number of individuals and distributional status, all trees are classified into 3 categories namely common, occasional and rare. Among the 175 tree species in the University Campus, 36 (20.57%) species are in common, 53 (30.28%) species are in occasional and 86 (49.14%) species are in rare (Fig. 4).

As per occurrence of the trees in the University Campus all trees are classified as natural (NAT), cultivated (CULT), avenue (AVN), ornamental (ORN) and introduced in to the Botanical Garden (INT). The highest numbers of trees 59 (33.71%) species are growing as ornamental trees, followed by natural 46 (26.28%) species, introduced 26 (14.85%) species, avenue 24 (13.71%) species and 20 (11.42%) species are cultivated species (Fig. 5).



**Figure 4.** Distributional status of Trees in the University Campus.

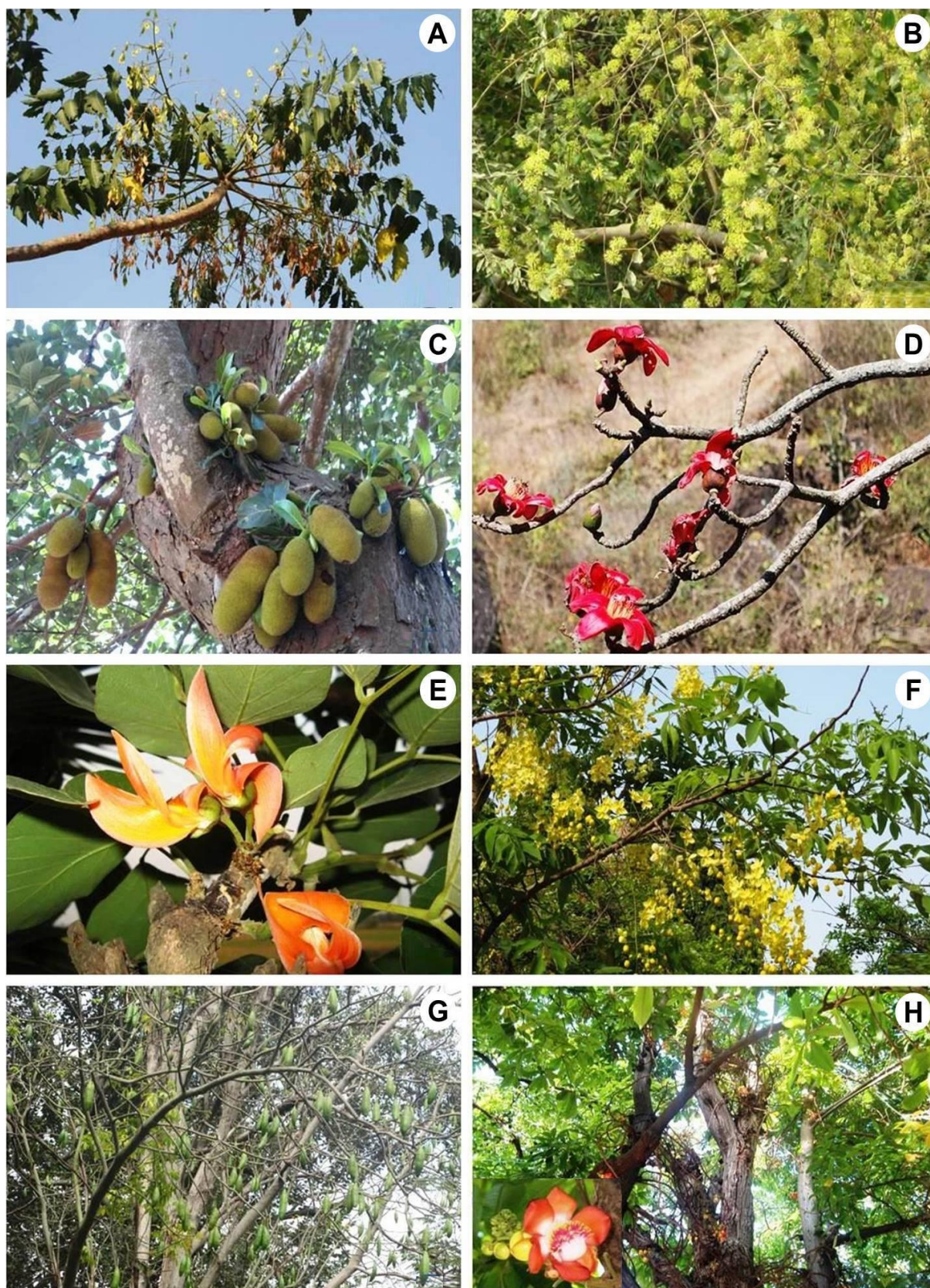


**Figure 5.** Details of occurrence of the trees in the University Campus. [NAT- Natural, CULT- Cultivated, AVN- Avenue, ORN- Ornamental, INT- Introduced in to the Botanical Garden]

*Cycas circinalis* L., *Dalbergia latifolia* Roxb., *Pterocarpus santalinus* L.f., *Saraca asoca* (Roxb.) de Wilde, *Aegle marmelos* (L.) Correa, *Sterculia urens* Roxb. and *Ochna obtusata* DC. trees are red listed medicinal plants in Andhra Pradesh (Reddy & Reddy 2008, Rao & Rao 2014). While, *Cycas sphaerica* and *Pterocarpus santalinus* are endemic trees endemic to Eastern Ghats and endemic to Andhra Pradesh respectively (Rao *et al.* 2014).

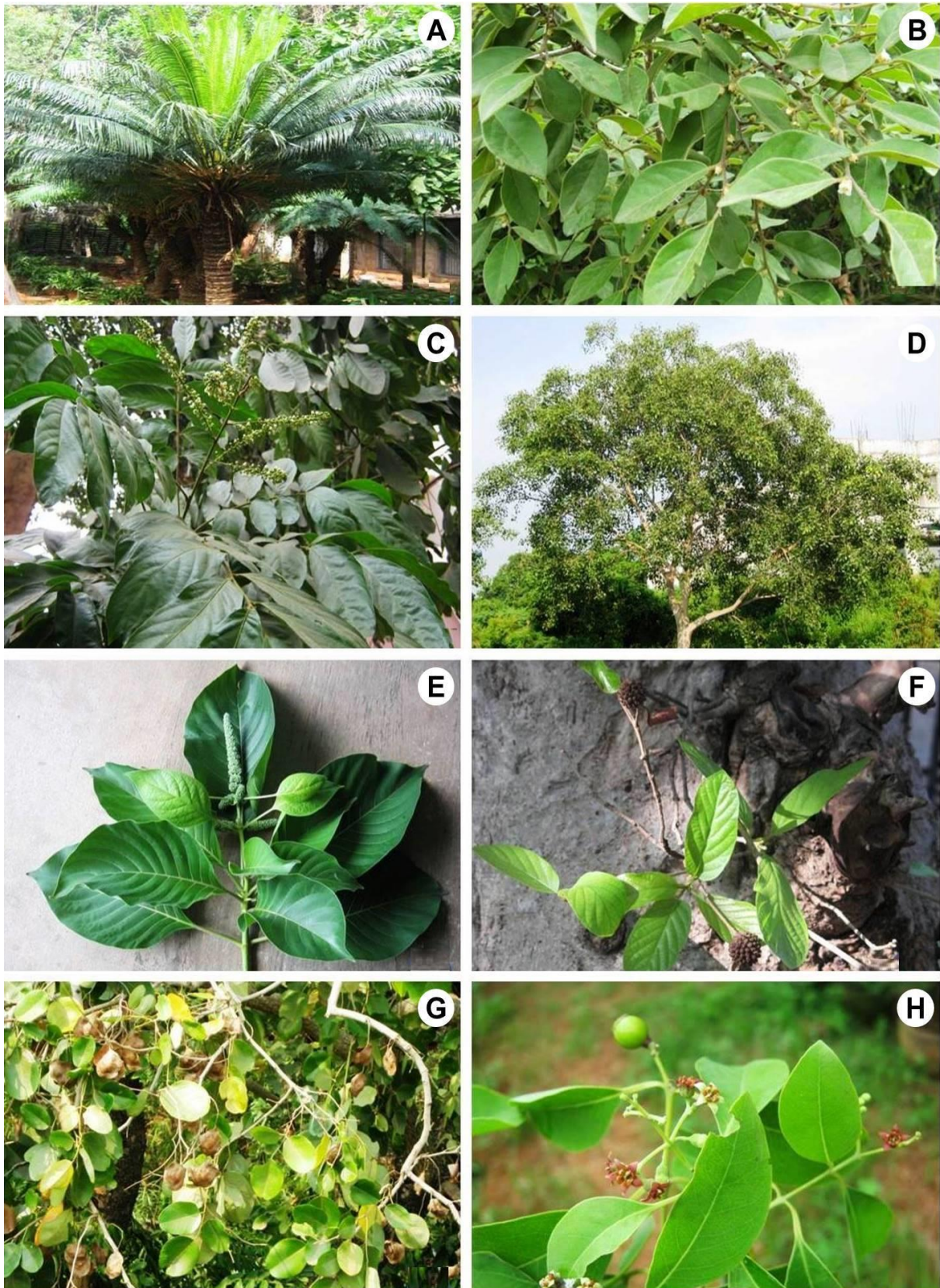
Due to the effect of massive cyclone Hudhud with wind speeds 175 km/h on 12<sup>th</sup> October 2014 ([https://en.wikipedia.org/wiki/Cyclone\\_Hudhud](https://en.wikipedia.org/wiki/Cyclone_Hudhud)) several trees were uprooted in the University Campus. *Colvillea racemosa* Bojer, *Commiphora caudata* (Wight & Arn.) Engl., *Strychnos nux-vomica* L., *Limonia acidissima* Groff, and *Capparis grandis* L. f. trees were disappeared from the Campus and *Borassus flabellifer* L., *Peltophorum pterocarpum* (DC.) Barker ex Heyne trees were decreased in their number of individuals. *Syzygium cumini* (L.) Skeels, *Mangifera indica* L., *Tamarindus indica* L., *Pterocarpus santalinus* L. f. have lost their canopy but now recovered. After cyclone, University authorities planted several trees in the Campus, among them *Spondias pinnata* (L. f.) Kurz and *Acrocarpus fraxinifolius* Arn., are newly introduced species and now they are growing well.





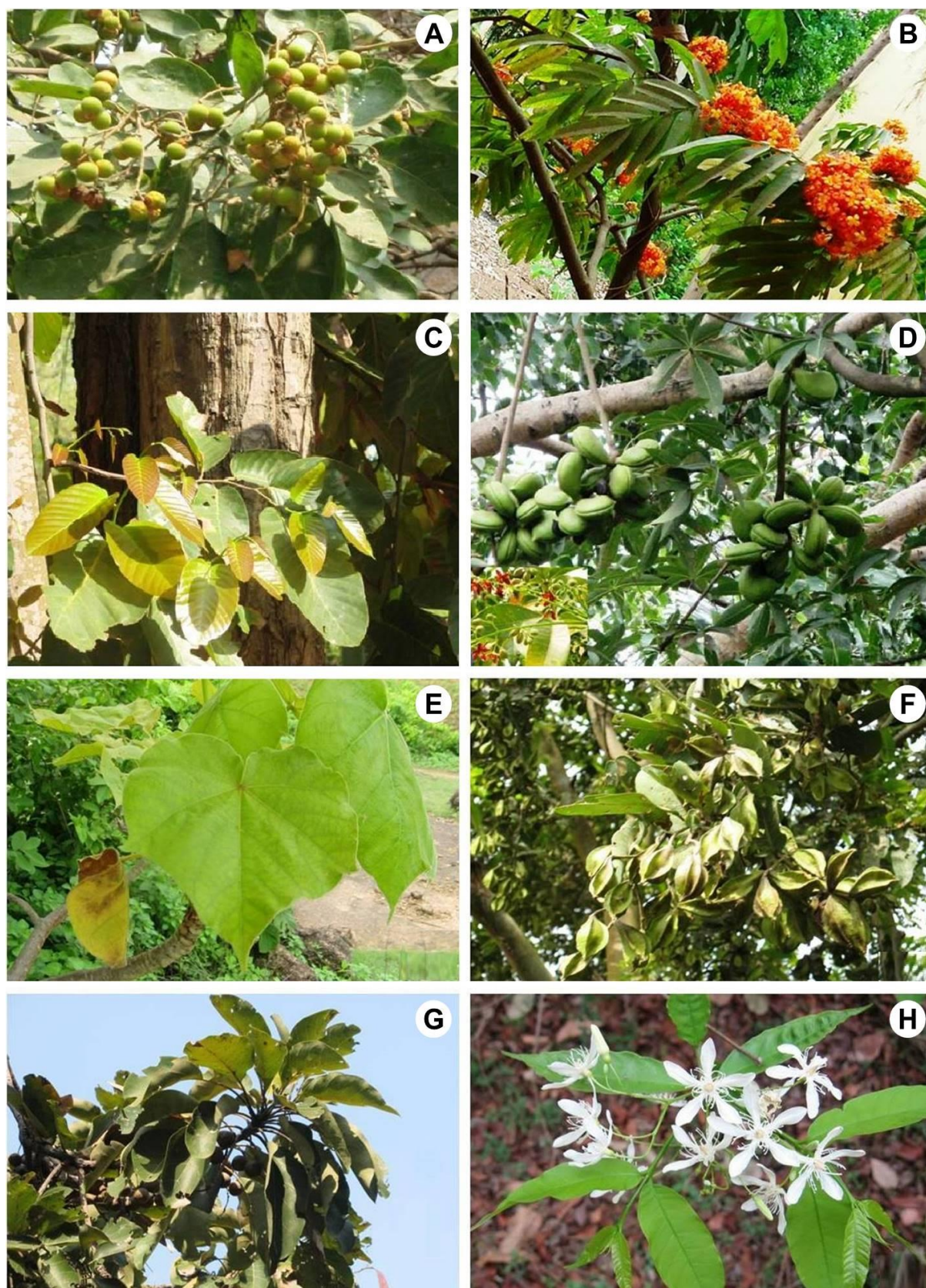
**Figure 6.** A, *Ailanthus excelsa* Roxb.; B, *Anogeissus acuminata* (Roxb. ex DC.) Guill. & Seneg.; C, *Artocarpus heterophyllus* Lam.; D, *Bombax ceiba* L.; E, *Butea monosperma* (Lam.) Taub.; F, *Cassia fistula* L.; G, *Ceiba pentandra* (L.) Gaertn.; H, *Couroupita guinensis* Aubl.





**Figure 7.** A, *Cycas circinalis* L.; B, *Diospyros chloroxyylon* Roxb.; C, *Erioglossum rubiginosum* Bl.; D, *Ficus religiosa* L.; E, *Hymenodictyon orixense* (Roxb.) Mabb.; F, *Mitragyna parviflora* (Roxb.) Korth.; G, *Pterocarpus santalinus* L. f.; H, *Santalum album* L.





**Figure 8.** A, *Sapindus emarginatus* Vahl.; B, *Saraca asoca* (Roxb.) de Wilde; C, *Shorea robusta* Gaertn. f.; D, *Sterculia foetida* L.; E, *Sterculia urens* Roxb.; F, *Terminalia arjuna* (Roxb. DC.) Wight. & Arn.; G, *Terminalia bellirica* (Gaertn.) Roxb.; H, *Wrightia tinctoria* R.Br.

## DISCUSSION

A total of 73 trees species reported from Pondicherry University Campus (Parthasarathy 2010); 109 tree species reported from Banaras Hindu University campus (Singh 2015); 39 trees reported from Adikavi Nannaya University Campus (Rao 2016); 448 species reported from Ramachandrapuram mandala included 97 tree



species (Kumar *et al.* 2015a). The present research reports 175 tree species from Andhra University campus revealed that the campus has rich plant diversity. University flora resembles to the nearest forest Kambalakonda Wildlife Sanctuary in the Visakhapatnam city in their wild species and comparatively University has rich tree diversity than the sanctuary with 175 tree species and 73 tree species respectively (Naidu *et al.* 2012) because the campus has a good number of cultivated, avenue, ornamental and introduced tree species.

Present study also supports that *Ficus* is the predominant genus in India with other floristic studies (Gadgil *et al.* 1996, Sandhyarani *et al.* 2007, Rasingam & Parathasarathy 2009, Kumar *et al.* 2015b). Presence of the Rubiaceae, Caesalpiniaceae, Euphorbiaceae, Mimosaceae, Arecaceae, Moraceae, Bignoniaceae, Fabaceae, Apocynaceae and Rutaceae have made the University Campus seems to be a forest ecosystem (Gadgil *et al.* 1996, Kudavul & Parthasarathy 1999, Chittibabu & Parthasarathy 2000, Sandhyarani *et al.* 2007, Pitchairamu *et al.* 2008, Selvamony *et al.* 2008, Reddy *et al.* 2009, Sahu *et al.* 2010).

## CONCLUSIONS

It is healthy sign occurrence of 175 tree species in University Campus but it is necessary to enhance the flora of with more number of native species, emphasizing more on endemic, red list and medicinal plants. This activity will amplify *ex-situ* conservation of these species and also spark awareness among students on biodiversity conservation. I also suggest *in-vitro* propagation of red list species like *Pterocarpus santalinus* L.f. and *Saraca asoca* (Roxb.) de Wilde), *Aegle marmelos* (L.) Correa and *Sterculia urens* Roxb. which are already existing in the University Campus. The present strongly supports that, the introduction of native trees into the urban landscape.

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