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Campus survey on floristic biodiversity at Nehru Arts and Science College, Thirumalayampalayam, Coimbatore, Tamil Nadu, India

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Abstract
Western Ghats and adjacent locations (foothills) are an important biodiversity hotspots in the country and are facing rapid diminishing trend in the floristic diversity in terms of their numbers and variety in response to various biotic and abiotic factors. As the result of urbanization, floristic diversity of the foothills of Western Ghats has been modified rapidly. Though not documents pertaining to past plant diversity not available with study area, Nehru Arts and Science College, Thirumalaiyampalayam, Coimbatore, it has necessitated the quantitative assessment of vegetation within the campus. The present study, forms reference document for the future studies and insists the necessity of conservation of phyto-diversity and to impede the ongoing and upholding loss due to extension activities. In the present investigation a sum of 97 genera belonging to 49 families were identified and documented among them nine were monocotyledons. Observations indicated that the campus possess >75-80% of wild as well as native plant species and remaining accounted for cultivated ornamentals. More than 40 invasive species including 6 weed species were documented during the study. Vegetation is the green mirror of the ecosystem where they absorbs toxic gases and makes the atmosphere afresh. As they are considered as breathing organelles of the ecosystem, vegetation conserved and protected from devastation due to anthropogenic activities.

Keywords: *Floristic, Survey, Documentation, Campus, Conservation*

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I. Introduction

Floristic studies are primarily essential to assess the sustainable utilization of biodiversity and its management of an identified phyto-geographical area which will provide information on existing status and changing floristic pattern, species invasion, if any, and rare, endemic and threatened taxa. It may be noted that preparation of flora of smaller areas is a prerequisite for the revision of the flora of a vast area. Western Ghats and Eastern Himalayan region of India are reported as biodiversity treasure of the country which occupies prominent positions in the map of mega diversity hotspots of the world. Considering the record of endemic species of both the places, Western Ghats found to be older than that of Himalayas (Nirubama Kumar *el al*., 2021).

In mid-nineteenth century, Gardener described the flora of southern Western Ghats of Coimbatore and Nilgiri mountains followed by Lushington, Fischer and Bladder, individually in the early twentieth century recorded the comprehensive floristic details (Jayanthi Palanisamy and Rajendran Arumugam, 2014). Though, time to time and region-specific floristic documentation done, a couple of decades ago, Chandrabose individually in 1967 and he along with Nair 1988 documented the flora of Coimbatore city while Vajravelu and Joseph in 1974 reported the flora of Anamallai hills of Coimbatore district which lies an integral part of the Western Ghats. Recently, Jayanthi Palanisamy and Rajendran Arumugam (2013) documented a comprehensive account of the floristic diversity of Coimbatore, particularly on the plant diversity of the Madukkarai hills of Coimbatore district of Tamil Nadu.

Urbanization is a crucial component of the modern world with economic expansion which developed at the cost of devastation of biodiversity; considering the negative impacts of environmental issues, it is critical to understand how metropolitan cities are evolving and managed to sustain remnant of native vegetation. At this juncture, it is very much required to have experienced people who understand the delicacies to establish ecofriendly environment and its sustenance. As the Thirumalayampalayam is located adjacent to Madukkarai hills of Western Ghats and the area is being developed, it is necessitated to examine the flora of the specific specimen

site. After establishment of the establishment of educational institution, no comprehensive floristic account of Nehru Arts and Science College, Thirumalayampalayam was documented. Apart from documentation of floristic account of the college campus, assessment of native natural flora is warranted to their sustenance and rehabilitation of rare plant species.

II. Materials and methods

Study area

Geologically the Western Ghats arising abruptly from the narrow Konkan and Malabar coasts, these hills run 1600 km north-south between the river Tapti in Gujarat and Kanyakumari in Tamil Nadu covering an area approximately equal to 160,000 sq km. In the east, they slope gently towards the Deccan Plateau and in the Nilgiris, Palanis and parts of Karnataka, the Western Ghats extend considerably eastwards, locally merging with the Eastern Ghats (Anbarasu *et al*., 2014). Towards the south, the hill chain is divided into two by the Palghat Gap (a mere 13 km gap at its narrowest) rendering a physically homogeneous high altitude plateau into two rather distinct biogeographic units, namely, the Nilgiris complex in the north and the Anaimalai-Palani complex in the south.

College campus

The Nehru College of Arts and Science, Thirumalayampalayam, Coimbatore is located at the foothills of Western Ghats, home to one of the world;s Richest centers of biodiversity. The campus is geographically located at 76°92' 96°2' and 10°88'00°1' N Latitude. The College is considered as one of the greenery Educational institution in Coimbatore with a spread of 35 acres. The campus is known for its excellence in learning and teaching environment, in addition the entire campus has a fairly diverse ecological setting (Technical Report of Green Campus Audit, 2021).

Climatic conditions

Oppressive and overcast weather prevails during wet season at Madukkarai Hill region while is humid and partly cloudy during dry spell and hot round the year. Temperature of the region varies from 20.0 to 35.6ºC rarely below 20.0ºC or above 38.0ºC. Hot season exist for two months between March and May while hottest month of the year (April/May) recorded a mean minimum temperature 25.0ºC and mean maximum temperature above 36.0ºC. Madukkarai hill region enjoys cool weather conditions between October and January with daily mean maximum temperature swing around 30.0ºC. During the coolest moth December the mean minimum and maximum temperature registered around 20.0 to 29.0ºC. The chance of wet days differs significantly throughout the year. Madukkarai hill region experienced both south-west and north-east monsoons between mid-May to November during that period recorded with a greater than 28% of wet days where it receives not less than 0.04 inches of precipitation (http://www.worldweatheronline.com).

Floristic survey and data collection

Documentation of plant diversity of Nehru Arts and Science College Campus was undertaken systematically and documented during 2022, to cover most species at varying growth stages. Natural vegetation with in the campus was the primary focus of a periodic survey for identification and collection of plant species followed by botanical name, common name, family, habit, and monocot/dicots. In order to find various plant species that are native to the area, field trips were made to every single corner of the college campus during the duration of the study. Field observations were made and plants were digitalized. Plant species were identified using regional floras (Gamble and Fisher, 1957; Nair and Henry, 1983; Henry *et al*., 1987; 1989).

III. Results and discussion

The present study conducted to document the flora of the Nehru Arts and Science College campus, Thirumalayampalayam, Coimbatore. Since, the campus located the foothills of Western Ghats and that too in the vicinity of Madukkari Hills, it is imperative to study the changing pattern of vegetation in this area. As the beginning of the exploration, the present study will serve as a document for the future explorations. Further, in order to identify the invaded species and endangered plants due to economic expansion, the generated data should be compared with the available secondary data on flora of Maddukkari Hills and documented.

Ensuring the varied biodiversity recorded within the campus indicated existence of the real-time ecosystem where the vegetation indicators for assessing the varying levels of environmental geological and quality. In general, growing plants improve the outdoor air quality and provide shelter to various bird species.

It present study 97 genera belonging to 49 families, including the Fabaceae, Rhamnaceae, Lamiaceae, Caricaceae, Musaceae, Anacardiaceae, Lauraceae, Euphorbiaceae, Lamiaceae, Meliceae, Portceae, Commelincee, Lythraceae, Sapindaceae, Talinaceae, Nyctaginaceae, Aracaceae, Bignonia ceae, Asparagaceae, Sapotaceae, Malvaceae, Verbenceae, Rubiaceae, Amaranthaceae, Myrtaceae, Cuppressaceae, Heliconiacee,

Cycadaceae, Poaceae, Boraginaceae, Moraceae, Asparagaceae, Moringaceae, Rutaceae, Oleaceae, Phyllanthaceae, Annonaceae, Asteraceae, Apocynaceae, Passifloraceae, Araliaceae, Marantaceae, Acanthaceae, Amaryllidaceae, Moraceae, Sterlitizaceae, Crassulaceae and Basillaceae were identified and documented. Among the documented families Fabaceae (11 Genera), Euphorbiaceae (7 Genera), Aracaceae (7 Genera), Verbenaceae (3 Genera), Apocynaceae (3 Genera) and Asteraceae (3 Genera) were seemed to be dominated among them.

Plants from a family with just one genus were also predominant and they are Amaranthaceae, Cuppressaceae, Heliconiaceae, Cycadaceae, Caricaceae, Musaceae, Anacardiaceae, Lauraceae, Portaceae, Commelinaceae, Sapindaceae, Talinaceae, Sapotaceae, Portulacaceae, Poaceae, Boraginaceae, Moringaceae, Oleaceae, Phyllanthaceae, As the plants belonging from the families Moraceae, Sterlitizaceae, Crassulaceae and Basillaceae were found to be vanishing in the campus ecosystem, it has been suggested to preserve them and necessary steps to be taken for their conservation.

There were nine monocotyledons recorded in the campus of Nehru Arts and Science Collegewhich belonged to Amaranthaceae, Poaceae, Arcaceae, Asparagaceae, Commelinaceae, Amaryllidaceae, Strelitiziaceae and Marantaceae families. A huge number of trees, shrubs, herbs climbers and creepers were identified and recorded (Table 1 and Plates). It may be noted that the vegetation within the campus represents native, manually created and invaded species.

The observations indicated that the NASC campus has more than 75-80 % of wild as well as native plant species and remaining proportion consisted of cultivated ornamental plant species. Ground flora is comparatively sparse, but fairly rich in undistributed areas while certain common climbers found among the shrubs. Although the campus is rich in grass species some of them are rare species. Number of above species decreased in number and a few face the danger of going to extinct due to anthropogenic activities like regular clearing and construction activities. The campus has 42 invasive species of which 6 species were weeds. Presence of invasiveweeds is an indication of disturbances to the natural setting in the vegetated areas which is substantiated the earlier report (Technical Report of Green Campus Audit, 2021).

Plants, which perform a significant function for people and the environment, are an important component of any community. The livelihood and economy of many societies are depending up on well-being of forests. Plants are a long-term answer to many problems that people confront, and they are a significant resource for any community, particularly those in urban or suburban environments (Lindenmayer and Laurance, 2016). Plants must be a part of the global debate in order to create a healthy and flourishing society. Due to changing climate and increasing population, it has been estimated that 75% of the world's population will be reside in urban areas by 2050 which results in smaller habitats and greater spatial isolation (Ramakrishnan *et al*., 2017; Danya and Yaazhini, 2022).

In metropolitan cities, green spaces are typically remnants of native vegetation or yards or gardens and urban forest or urban tree cover continued to decline year after year across the country (Anders and Henrik, 2012). It has been reported that habitat destruction is main cause of species extinction and biodiversity losses in natural ecosystems (Koh *et al*., 2004; Pimm and Raven, 2000). The intrinsic ability of self-sustenance of forest vegetation are losing gradually by the awful activities of over grazing, increased logging, encroachments, illegal mining, construction of dam, reservoirs, industrial and institutional buildings, etc. Such activities lead to their conversion into species-poor forest ecosystems (Harischandra Darro *et al*., 2020).

Conservation and preservation of plant diversity is an important social economic and moral issue and has interrelations with all bioresources. The Nilgiris, a portion of Western Ghats, is one of the richest biogeographic provinces in peninsular India. it has been reported that the region consisted of about 1175 species belonging to the 416 genera (Sharma *et al*., 1997). Rapid exploitation and expansion of the Nilgiris for raising horticultural and agricultural crops, creation of hydroelectric projects have affected virgin forest cover. As a result, many of the valuable and rare, endemic plant species which were once abundant are facing about to extinction stage.

Several initiatives were taken to protect the biodiversity of fragile ecosystem. It may be noted that conversion of forests for want of economic expansion might result in loss of biodiversity and release of huge amount of C into the atmosphere. In this connection it is imperative to understand the changes in pattern of vegetation structure, composition and diversity to bring resilience and arrest the process of degradation (Harichandra Darro *et al*., 2020).

Biodiversity varied with geographical conditions and prevailing environmental conditions as well. Green campus audit conducted at SVKM'S UPGCASC Campus (Mumbai) revealed that the campus comprises a total of 75 species belonging to 32 genera under 20 families excluding lichens, pteridophytes and bryophytes (SVKM'S UPGCASC Report of Green Campus Audit, 2021). At the same time, the biodiversity census of VNR VJIET Campus (Hyderabad) comprises of a total of 51 species belonging to 26 genera under 15 families besides lichens, pteridophytes and bryophytes (VNR VJIET Report of Green Campus Audit, 2021). Though, green campus audit conducted at Mumbai and Hyderabad located away from Western Ghats, since Western Ghats traversed from Maharastra to Tamil Nadu it has been highlighted in this section. However, a comparative study should be carried out with these institutions for occurrence of identical native flora and invaded species.

Recently floristic survey has been conducted at Karunya Institute of Technology and Sciences (Deemed University) where native plants belonging from 27 families and 53 genera were documented besides ornamentals representing 32 families and 58 genera were identified (Report of Green Campus Audit, 2021). Similarly, as an integral part of environmental audit conducted at Bharathiar University, Coimbatore revealed that the campus recorded as high as 345 vascular plant species representing 261 genera from 73 families (Bharathiar University Technical Report of Green Campus Audit, 2021).

Though the Karunya Institute of Technology and Sciences (Deemed University), Bharathiar University and Nehru Arts and Science College are located in the foot hills of Western Ghats, there are certain variation observed in biodiversity pattern. Never the less when compared to that of Nehru Arts and Science College, both campuses of Karunya and Bharathiar Universities spread over > 300 acres and availability of virgin landscape is greater than that of Nehru College.

Establishing the vegetation or investing in plants is an asset in addressing the requirements of people where they live (Jessica and Nicole, 2019). Establishing gardens is an important criteria to achieving the goal of healthy, flourishing urban forests in cosmopolitan cities. In this context, educational institutions must provide useful knowledge and create awareness on protecting the vegetation in and around the area where they located.

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Table 1. List of plant species identified and documented at NASC

No.	Botanical Name	Common Name	Family Name	Monocot/ Dicot	Habit
1	*Delonix regia (*Hook.) Raf.	Flamboyant	Fabaceae	Dicot	Tree
2	*Callindra haemotocephala* Hassk.	Powder Puff	Fabaceae	Dicot	Tree
3	*Ziziphus oenopila* (L.) Miller	Jackal Jujube	Rhamnaceae	Dicot	Shrub
4	*Carica papaya* L.	Papaya	Caricaceae	Dicot	Tree
5	*Leucaena leucophylla (*Lam.)	Coffee bush	Fabaceae	Dicot	Tree
6	*Senna siamea (*Lam.)	Casod tree	Fabaceae	Dicot	Tree
7	*Musa paradisica* L.	Banana	Musaceae	Dicot	Tree
8	*Mangifera indica* L.	Mango	Anacardiaceae	Dicot	Tree
9	*Cassia sieberena* DC.	Drum Stick	Fabaceae	Dicot	Tree
10	*Gemelina arboria* Roxb.	Beech wood	Lamiaceae	Dicot	Tree
11	*Peltophorum pterocarpum* (DC.) K . Heyne	Yellow Flame	Fabaceae	Dicot	Tree
12	*Laurus nobilis* L.	Sweet Bay	Lauraceae	Dicot	Tree
13	*Euphorbia heterophylla* L.	Fire Plant	Euphorbiaceae	Dicot	Shrub
14	*Swietenia mahagoni (*L.) Jc.q	American Mahogany	Meliaceae	Dicot	Tree
15	*Dalbergia siscoo* Roxb.	North Indian Rose wood	Fabaceae	Dicot	Tree
16	*Melia azedarach* L.	Chinberry	Meliacee	Dicot	Tree
17	*Grevillea robusta*R.Br.	Southern Silky Oak	Porteaceae	Dicot	Tree
18	*Sesbania punicea* Cav.(Benth.)	Spanish Gold	Fabceae	Dicot	Shrub
19	*Thespesia populnea* (L.) Sol.	Portia tree	Malvaceae	Dicot	Tree
20	*Psidium gujava* L.	Gujava	Myrtaceae	Dicot	Tree
21	*Lantana camera* L.	Lantana	Verbenaceae	Dicot	Shrub
22	*Pongamia pinnata* (L.) Pierre	Oil tree	Fabaceae	Dicot	Tree
23	*Dypsis butesans* (H.wendl.) Beentje	Golden Cane Palm	Arecaceae	Monocot	Tree
24	*Juniperus horiontalis* Moench	Creeping Cedar	Cupressacee	Monocot	Tree
25	*Heliconia psittacorum* L.f.	Parakeet Flower	Heliconiaceae	Dicot	Tree
26	*Portulaca grandiflora* Hook.	Moss Rose	Portulacaceae	Dicot	Herb
27	*Musenda philippica* A. Rich.	White Musenda-orueen Sirikit	Rubiaceae	Dicot	Shrub
28	*Azardirachta indica* A. Juss.	Neem	Meliaceae	Dicot	Tree
29	*Cycas revolute* Thunb.	Sago Palm	Cycadaceae	Dicot	Tree
30	*Althernanthera bettizickiana* (Regel) Voss	Calico Plant	Amaranthaceae	Monocot	Shrub
31	*Ixora fintaysoxicana* L.	White Jungle Flame	Rubiaceae	Dicot	Shrub
32	*Syzygium cumini* (L.) Skeels	Java Plum	Myrtaceae	Dicot	Tree
33	*Ficus benghalensis* L.	Banyan Tree	Moraceae	Dicot	Tree
34	*Asparagus officinalis* L.	Asparagus	Asparagaceae	Monocot	Herb
35	*Lagerstroemia speciosa* (L.) Pers.	Giant Crepe-myrtle	Lythraceae	Dicot	Tree
36	*Agavea mericana* L.	American Aloe	Asparagaceae	Monocot	Herb
37	*Codiaeum variegatum* (L.) A. Juss	Garden Croton	Euphorbiaceae	Dicot	Shrub
38	*Ixora chinensis* Lam	Chinese Ixora	Rubiaceae	Dicot	Shrub
39	*Duranta erecta* L.	Golden Dewdrop	Verbenaceae	Dicot	Shrub
40	*Bauhinia blakeana* L.	Hong Kong Orchid Tree	Fabaceae	Dicot	Tree
41	*Bambusa vulgaris* Schrad	Bamboo	Poaceae	Monocot	Tree
42	*Acacia mangium* Willd.	Black Wattle	Fabaceae	Dicot	Tree
43	*Roystonea regia (*Kunth). O.F. Cook	Cuban Royal Palm	Arecaceae	Monocot	Tree
44	*Cordia sebestena* L.	ScarletCordia	Boraginaceae	Dicot	Tree
45	*Hamelia patens* Jacq.	Firebush	Rubiaceae	Dicot	Tree
46	*Tabebuia rosea* (Bertol.)D.C.	Rose Trumpet Tree	Bignoniaceae	Dicot	Tree
47	*Amorpha fruticosa* L.	Desert False Indigo	Fabaceae	Dicot	Shrub
48	*Manilkar azapota* (L.) P.Royen	Chikoo	Sapotaceae	Dicot	Tree
49	*Moringa oleifera* Lam.	Drumstick Tree	Moringaceae	Dicot	Tree
50	*Citrus limon* (L.) Burm.f.	Lemon	Rutaceae	Dicot	Tree
51	*Forsythia viridissima* Lindl.	Chinese Golden	Oleaceae	Dicot	Tree

		Bell Tree			
52	*Phyllanthus acidus* (L.) Skeels.	Gooseberry	Phyllanthaceae	Dicot	Tree
53	*Annona montana* Macfad.	Mountain soursop	Annonaceae	Dicot	Tree
54	*Ambrosia psilostachya* D.C.	Cuman Ragweed	Asteraceae	Dicot	Herb
55	*Rauwolfia tetraphylla* L.	Devil-pepper	Apocynaceae	Dicot	Tree
56	*Croton tiglium* L.	PurgingCroton	Euphorbiaceae	Dicot	Herb
57	*Hibiscus rosasinensis* L.	Chinese Hibiscus	Malvaceae	Dicot	Tree
58	*Tabernaemontana divaricata* (L.) R. Br.	Pinwheel Flower	Apocynaceae	Dicot	Shrub
59	*Turnera ulmifolia* L.	Yellow Alder	Passifloraceae	Dicot	Herb
60	*Rhapis excelsa* (Thunb). A. Henry	Broadleaf Lady Palm	Arecaceae	Monocot	Tree
61	*Polyscias scutellaria* (Burm.f) Fosberg	Shield Aralia	Araliaceae	Dicot	Shrub
62	*Aegle marmelos* (L.) Correa	Indian Bael Tree	Rutaceae	Dicot	Tree
63	*Maranta arundinacea* L.	Arrowroot	Marantaceae	Monocot	Herb
64	*Allamanda cathartica* (L.)	Golden trumpet vine	Apocynaceae	Dicot	Climber
65	*Ecbolium viride* (Forssk.) Alston	Neelambaram, Neelambari	Acanthaceae	Dicot	Shrub
66	*Boungainvillea Spectabilis* (Willd.)	Great bougainvillea	Nyctaginaceae	Dicot	Climber
67	*Ficus benjamina* (L.)	Weeping fig	Moraceae	Dicot	Tree
68	*Ravenala madagascriesis* (Sonn.)	Traveller'spalm	Strelitiziaceae	Monocot	Tree
69	*Bryophyllum* (Lam.) Oken	Cathedralbells	Crassulaceae	Dicot	Long-ived, Perennial fleshy, succulent
70	*Crinum asiatum* (L.)	Asianpoison bulb	Amaryllidaceae	Monocot	Herb
71	*Diffencebachia seguine* (Jacq.) Schott	Dumbcane	Aracaceae	Monocot	Shrub
72	*Chrysanthemum* (L.)	Indian Chrysanthemum	Asteraceae	Dicot	Shrub
73	*Basella alba* (L.)	Malabarspinach	Basellaceae	Dicot	Perennial climber
74	*Agapanthus praecox* (Willd.)	Africanlilly	Amarylliadaceae	Monocot	Perennial plant
75	*Hemigraphis alternate* (Burm.f.) T. Anderson	Red lvy	Acantheaceae	Dicot	Herb
76	*Hydrocotyle verticillata* (Thunb.)	Whorled marshpennywort	Araliaceae	Dicot	Creeping
77	*Charysathemum grandifolrum* (Ramat.) Hemsl	Cut mum, Gardenmum, Potmum, Florist	Asteraceae	Dicot	Perennialplant
78	*Tradescantia zebrine* (Schinz) D.R. hunt	Inch Plant	Commelinaceae	Monocot	Long-lived Pernnial herbaceous Plant
79	*Plectranthus sautellarioides* (L.) Benth	Coleus	Lamiaceae	Dicot	EvergreenPerennial
80	*Cuphea hyssopifolia* (Kunth)	Mexicanheather	Lythraceae	Dicot	Shrub
81	*Cardiosperum helicabum* (L.)	Balloonvine, Heartseed	Sapindaceae	Dicot	Climber
82	*Ricinus communis* (L.)	Castoroil plant	Euphorbiaceae	Dicot	Shrub
83	*Talinum fruticosum* (L.) Juss	Verdolaga-Francesa	Talinaceae	Dicot	Shrub
84	*Mirabilis jalapa* (L.)	Four O'Clock plant	Nyctaginaceae	Dicot	Bushy herbaceous Plant
85	*Epipremnum aureum* (Linden and Andre) G.S.Bunting	Goldenpothos	Aracaceae	Monocot	Climber
86	*Mercurialis perennis* (L.)	Dog's mercury	Euphorbiaceae	Dicot	Herb
87	*Tecoma capensis* (Thunb.) Spach	Cape Honey suckle	Bignoniaceae	Dicot	Shurb
88	*Agave vivipara* (L.)	Mescal Casero	Asparagaceae	Monocot	Shrub
89	*Dypsis lutescens* (H.Wendl.) Beentje & J. Dransf.	Yellow Cane Palm	Arecaceae	Monocot	EvergreenTree
90	*Agalaonema commutatum* (Schott)	Chinese Evergreen	Araceceae	Monocot	Clumber
91	*Ruscus hypophyllum* (L.)	Spineless Butcher's Brom	Asteraceae	Dicot	Shrub
92	*Ficus macrophylla* (Desf. ex. Pers)	Moreton Bay	Moraceae	Dicot	Tree

		Fig			
93	*Euphorbia lacteal* (L.)	Comdelabra Spurge	Euphorbiaceae	Dicot	Shrub
94	*Codiaeum variegatum* (L.) A. Juss.	Gardencroton	Euphorbiaceae	Dicot	Shrub
95	*Schefflera actionophylla* (Endl.) Harms	Umbrella Tree	Araliaceae	Dicot	Tree