



Documentation of Invasive Alien Plant Species in Anaikatty Hills, Coimbatore, Western Ghats

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Abstract: In this paper presented a comprehensive inventory of the non-native vascular flora of Anaikatty hills. The survey was undertaken to document the invasive alien plant species in different ecosystems during September 2017 to October 2019 in Anaikatty hills, Coimbatore forest division, Western Ghats. A total of 98 invasive alien species under 81 genera and 40 families were recorded. Asteraceae is the most dominant family with 16 species followed by Amaranthaceae and Solanaceae (6 species each). *Cassia* and *Ipomoea* are the dominant genera (4 species each) followed by *Indigofera* and *Solanum* (3 species each). The life form analysis of the invasive alien flora showed that herbaceous species constitute the major life form (73.47%) followed by shrubs (9.18 %), climbers (8.16 %), trees (5.10 %) and grasses (4.08 %). Phytogeographical regions analysis revealed that tropical American elements (57.14 %) are the most dominant. It is an immense need to control the infestations of such alien and naturalised weeds in the natural ecosystem. This can be eliminated by better planning, periodic monitoring and adopt suitable controlling measures.

Keywords: Non-native, Asteraceae, Plant invasions, Western Ghats, Tropical America

Invasive alien plants are introduced deliberately or unintentionally outside their natural habitats into new areas where they express the capability to establish, invade and outcompete native species (Sujay et al 2010, Pant and Sharma 2010, McGeoch et al 2010). Most of the introduced herbaceous and shrubby taxa multiply in a limited period of time and destroy the endemic and native vegetation (Nagi and Hajra 2007). Humans are main vector for both intentional and accidental introduction of alien plant and animal species and they reach high densities and biomass (Hurka et al 2003, Parthasarathy et al 2012). Invasion by exotic species is one the major causes for loss of biodiversity (Richardson et al 2000). Thus, invasive plants are a serious impediment for conservation and sustainable use of biodiversity.

International Union for Conservation of Nature and Natural Resources (IUCN) defines alien invasive species as a non-indigenous species which get established in natural or semi-natural ecosystem or habitat, changes the quality of the habitat, alters the functioning of natural ecosystem and ultimately threatens to the biological diversity. Investigation of alien invasive species has become an imperative issue as invasion is considered a serious ecological and socio-economic problem in India and also at global level. Invasive plant species in a forest landscape displaces the native species by out competing the seeds of native species to

germinate and by suppressing the growth of native saplings. Considering the negative impacts of invasive alien species invasion in the Indian forest ecosystems, the present study was carried out to enumerate the invasive alien species in Anaikatty hills, Coimbatore forest division, Western Ghats.

MATERIAL AND METHODS

Study area: The study was carried out in Anaikatty hills, Coimbatore forest Division, Southern Western Ghats during September 2017 to October 2019. Anaikatty hills is situated in the part of Nilgiri Biosphere Reserve and falls between the latitudes 11° 01'N to 11° 09'N and longitudes is 76° 44'E to 76° 55'E, covering 180 sq km. The reserve forest is represented by several forest types such as west coast semi evergreen, southern moist mixed deciduous, southern dry mixed deciduous, southern dry deciduous forest and grassland. The study area is very rich in wildlife harbouring a good population of Asian elephants, Indian Gaur and numerous other wild fauna and flora. The climate of the area is semi-arid as it is located in the rain shadow part of the Western Ghats. Maximum temperature varied between 28°C and 36° C during 1998-2001 (Nirmala 2002). The average rainfall of Anaikatty is about 670 mm, and majority of it is from the south-west monsoon.

Field survey: Intensive field studies were carried out to

Table 1. List of invasive alien plant species in Anaikatty hills, Coimbatore, Western Ghats

Species name	Family	Life-form	Forest type in which occur	Origin country	Uses
<i>Acacia auriculiformis</i> L.	Mimosaceae	Tree	D MDF, MDF	Australia	Fuel wood, Timber
<i>A. farnesiana</i> (L.) Willd	Mimosaceae	Tree	DDF, D MDF	South America	Fuel wood
<i>Acanthospermum hispidum</i> DC.	Asteraceae	Herb	DDF, D MDF, MDF	Brazil	Medicinal
<i>Aerva javanica</i> (Burm. f.) Juss. ex Schult.	Amaranthaceae	Herb	DDF, D MDF	Tropical America	Medicinal
<i>Agave americana</i> L.	Agavaceae	Shrub	DDF, D MDF, MDF	America	Fibre, Ornamental
<i>Ageratina adenophora</i> (Spreng.) King & Robinson	Asteraceae	Herb	MDF, SEF	Mexico	Fodder
<i>Ageratum conyzoides</i> L.	Asteraceae	Herb	DDF, D MDF, MDF	Tropical America	Medicinal
<i>Alternanthera philoxeroides</i> (Mart.) Griseb.	Amaranthaceae	Herb	DDF, D MDF	Tropical America	None
<i>Alternanthera pungens</i> Humb.	Amaranthaceae	Herb	DDF, D MDF	Tropical America	Fodder
<i>Amaranthus spinosus</i> L.	Amaranthaceae	Herb	D MDF, MDF	Tropical America	Vegetable, Medicinal
<i>Antigonon leptopus</i> Hook. & Arn.	Polygonaceae	Climber	DDF, D MDF, MDF	Tropical America	Ornamental
<i>Argemone mexicana</i> L.	Papaveraceae	Herb	DDF, D MDF, MDF	South America	Medicinal
<i>Asclepias curassavica</i> L.	Asclepiadaceae	Herb	D MDF, MDF	Tropical America	Medicinal
<i>Bidens pilosa</i> L.	Asteraceae	Herb	MDF, SEF	Tropical America	Fodder
<i>Blainvillea acmella</i> (L.) Philipson	Asteraceae	Herb	D MDF, MDF	Tropical America	None
<i>Boerhavia erecta</i> L.	Nyctaginaceae	Herb	DDF, D MDF	Tropical America	Medicinal
<i>Calotropis gigantea</i> (L.) R. Br.	Asclepiadaceae	Shrub	DDF, D MDF	Tropical Africa	Medicinal, Ornamental
<i>Cassia hirsuta</i> L.	Caesalpinaceae	Herb	DDF, D MDF, MDF	Tropical America	Medicinal
<i>Cassia occidentalis</i> L.	Caesalpinaceae	Herb	DDF, D MDF, MDF	South America	Medicinal
<i>Cassia tora</i> L.	Caesalpinaceae	Herb	DDF, D MDF	South America	Medicinal
<i>Cassia uniflora</i> Miller	Caesalpinaceae	Herb	D MDF, MDF	Tropical America	Medicinal
<i>Catharanthus roseus</i> L.	Apocynaceae	Herb	DDF, D MDF, MDF	Tropical America	Medicinal, Ornamental
<i>Chloris barbata</i> (L.) Sw.	Poaceae	Grass	DDF, D MDF, MDF	Tropical America	Fodder, Medicinal
<i>Chromolaena odorata</i> L.	Asteraceae	Shrub	DDF, D MDF, MDF,	Tropical America	Fuel wood
<i>Cleome gynandra</i> L.	Cleomaceae	Herb	DDF	Tropical America	Medicinal
<i>Cleome monophylla</i> L.	Cleomaceae	Herb	D MDF	Tropical Africa	Vegetable
<i>Cleome viscosa</i> L.	Cleomaceae	Herb	DDF, D MDF	Tropical America	Medicinal
<i>Crotalaria pallida</i> Dryand	Fabaceae	Herb	DDF, D MDF, MDF	Tropical America	Fodder
<i>Croton bonplandianum</i> Baill.	Euphorbiaceae	Herb	DDF, D MDF, MDF	South America	Fodder, Medicinal
<i>Cuscuta reflexa</i> Roxb.	Cuscutaceae	Twiner	DDF, D MDF, MDF	Mediterranean	None
<i>Cyperus iria</i> L.	Cyperaceae	Herb	DDF, D MDF, MDF	Tropical America	Fibre
<i>Datura innoxia</i> Mill.	Solanaceae	Herb	D MDF, MDF	Tropical America	Medicinal
<i>Datura metel</i> L.	Solanaceae	Shrub	D MDF, MDF	Tropical America	Medicinal
<i>Delonix regia</i> (Bojer) Raf.	Caesalpinaceae	Tree	DDF, D MDF, MDF	Madagascar	Ornamental
<i>Digera muricata</i> (L.) Mart.	Amaranthaceae	Herb	D MDF, MDF	South West Asia	Medicinal, Vegetable
<i>Echinochloa colona</i> (L.) Link.	Poaceae	Grass	D MDF, MDF	South America	Fodder
<i>Eclipta prostrata</i> (L.) Mant.	Asteraceae	Herb	D MDF, MDF	Tropical America	Medicinal
<i>Emilia sonchifolia</i> (L.) DC.	Asteraceae	Herb	D MDF	Tropical America	Medicinal
<i>Euphorbia heterophylla</i> L.	Euphorbiaceae	Herb	D MDF	Tropical America	Ornamental
<i>Euphorbia hirta</i> L.	Euphorbiaceae	Herb	DDF, D MDF, MDF	Tropical America	Medicinal

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Species name	Family	Life-form	Forest type in which occur	Origin country	Uses
<i>Galinsoga parviflora</i> Cav.	Asteraceae	Herb	DMDF, MDF	Tropical America	None
<i>Gnaphalium polycaulon</i> Pers.	Asteraceae	Herb	DDF, DMDF	Tropical America	Fodder
<i>Gomphrena serrata</i> L.	Amaranthaceae	Herb	DDF, DMDF	Tropical America	Fodder
<i>Hyptis suaveolens</i> (L.) Poit.	Lamiaceae	Herb	DDF, DMDF, MDF	Tropical America	Medicinal
<i>Imperata cylindrica</i> (L.) Raensch	Poaceae	Grass	DDF, DMDF, MDF	Southeast Asia	Fodder
<i>Indigofera astragalina</i> DC.	Fabaceae	Herb	MDF	Tropical America	None
<i>Indigofera linifolia</i> (L.f.) Retz.	Fabaceae	Herb	DDF	Tropical South America	Fodder
<i>Indigofera linnaei</i> Ali.	Fabaceae	Herb	DMDF	Tropical Africa	Fodder
<i>Ipomoea carnea</i> Jacq.	Convolvulaceae	Shrub	DDF, DMDF, MDF	South America	Manure
<i>Ipomoea hederifolia</i> L.	Convolvulaceae	Twiner	MDF	Tropical America	Medicinal
<i>Ipomoea pes-tigridis</i> L.	Convolvulaceae	Twiner	DMDF, MDF	Tropical east Africa	Medicinal
<i>Ipomoea staphylinia</i> Roem. and Schult.	Convolvulaceae	Climber	DDF, DMDF, MDF	Tropical Africa	Fodder
<i>Jatropha gossypifolia</i> L.	Euphorbiaceae	Shrub	DDF, DMDF	Tropical America	None
<i>Lagascea mollis</i> Cav.	Asteraceae	Herb	DMDF	Tropical central America	Medicinal
<i>Lantana camara</i> L.	Verbenaceae	Shrub	DDF, DMDF, MDF, SEF	Tropical America	Ornamental
<i>Leonotis nepetiifolia</i> (L.) R.Br.	Lamiaceae	Herb	DMDF, MDF	Tropical Africa	Medicinal
<i>Leucaena leucocephala</i> (L.) de Wit	Mimosaceae	Tree	DDF, DMDF	Mexico	Fodder, Fuel wood
<i>Ludwigia adscendens</i> (L.) Hara.	Onagraceae	Herb	DDF, DMDF, MDF	Tropical Africa	Medicinal
<i>Malvastrum coromandelianum</i> (L.) Garcke	Malvaceae	Herb	DDF, DMDF, MDF	Tropical America	Fibre
<i>Martynia annua</i> L.	Pedaliaceae	Herb	DDF, DMDF	Tropical America	Medicinal
<i>Merremia aegyptia</i> (L.) Urb.	Convolvulaceae	Climber	DDF	Tropical America	None
<i>Mimosa pudica</i> L.	Mimosaceae	Herb	DDF, DMDF, MDF	Brazil	Medicinal
<i>Ocimum americanum</i> L.	Lamiaceae	Herb	DDF, DMDF	Tropical America	Medicinal
<i>Opuntia stricta</i> Haw.	Cactaceae	Shrub	DDF, DMDF, MDF	Tropical America	Fruit edible
<i>Oxalis corniculata</i> L.	Oxalidaceae	Herb	DDF, DMDF, MDF	Europe	Vegetable
<i>Parthenium hysterophorus</i> L.	Asteraceae	Herb	DDF, DMDF, MDF	South America	Fodder
<i>Passiflora foetida</i> L.	Passifloraceae	Climber	DDF, DMDF	South America	Medicinal
<i>Pedaliium murex</i> L.	Pedaliaceae	Herb	DDF, DMDF	Tropical America	Medicinal
<i>Peperomia pellucida</i> (L.) Kunth	Piperaceae	Herb	MDF, SEF	Tropical South America	None
<i>Peristrophe paniculata</i> (Forssk.) Brummit	Acanthaceae	Herb	DDF, DMDF	Tropical America	Fodder
<i>Physalis minima</i> L.	Solanaceae	Herb	MDF	Tropical America	Medicinal
<i>Pilea microphylla</i> (L.) Liebm.	Urticaceae	Herb	MDF, SEF	South America	Medicinal
<i>Pistia stratiotes</i> L.	Araceae	Herb	DDF, DMDF	Tropical America	Medicinal
<i>Polygonum chinense</i> L.	Polygalaceae	Herb	DDF, DMDF	South Asia	None
<i>Portulaca oleracea</i> L.	Portulacaceae	Herb	DMDF, MDF	South America	Vegetable
<i>Portulaca quadrifida</i> L.	Pourtulacaceae	Herb	DMDF, MDF	Tropical America	Medicinal
<i>Prosopis juliflora</i> (Sw.) DC.	Mimosaceae	Tree	DDF, DMDF	Mexico	Fuel wood
<i>Richardia scabra</i> L.	Rubiaceae	Herb	DDF, DMDF, MDF	South America	None
<i>Rorippa dubia</i> (Pers.) H. Hara	Brassicaceae	Herb	DMDF, MDF	Tropical America	None
<i>Ruellia tuberosa</i> L.	Acanthaceae	Herb	DDF, DMDF	Tropical America	Ornamental
<i>Saccharum spontaneum</i> L.	Poaceae	Grass	DDF, DMDF	West Asia	Fodder
<i>Scoparia dulcis</i> L.	Scrophulariaceae	Herb	DDF, DMDF	Tropical America	Medicinal

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Species name	Family	Life-form	Forest type in which occur	Origin country	Uses
<i>Sida acuta</i> Burm. f.	Malvaceae	Herb	DDF, DMDF, MDF	Tropical America	Medicinal
<i>Solanum diphylum</i> L.	Solanaceae	Herb	MDF	West Indies and South America	None
<i>Solanum nigrum</i> L.	Solanaceae	Herb	DMDF, MDF	Tropical America	Vegetable
<i>Solanum seaforthianum</i> Andrews	Solanaceae	Climber	DDF, DMDF	Brazil	Medicinal, Ornamental
<i>Sonchus oleraceus</i> L.	Asteraceae	Herb	DDF, DMDF	Mediterranean region	None
<i>Spermacoce hispida</i> L.	Rubiaceae	Herb	DMDF, MDF	Tropical America	Medicinal
<i>Stachytarpheta jamaicensis</i> (L.) Vahl	Verbenaceae	Herb	MDF	Tropical America	Ornamental
<i>Synadenium grantii</i> Hook. f.	Euphorbiaceae	Shrub	DMDF, MDF	Tropical America	Ornamental
<i>Synedrella nodiflora</i> (L.) Gaertn.	Asteraceae	Herb	DMDF, MDF	West Indies	None
<i>Tribulus terrestris</i> L.	Zygophyllaceae	Herb	DDF, DMDF	Tropical America	Medicinal
<i>Tridax procumbens</i> L.	Asteraceae	Herb	DDF, DMDF	Central America	Medicinal
<i>Triumfetta rhomboidea</i> Jacq.	Tiliaceae	Herb	DMDF, MDF	Tropical America	Medicinal
<i>Typha angustata</i> Bory and Chauv.	Typhaceae	Aquatic Herb	DDF, DMDF, MDF	Tropical America	None
<i>Urena lobata</i> L.	Malvaceae	Herb	DDF, DMDF	Africa	Medicinal
<i>Waltheria indica</i> L.	Sterculiaceae	Herb	DDF, DMDF, MDF	Tropical America	Medicinal
<i>Xanthium strumarium</i> L.	Asteraceae	Herb	DDF, DMDF, MDF	North America	Medicinal

DMDF-Dry Mixed deciduous Forest, DDF-Dry Deciduous Forest; MDF-Moist Deciduous Forest; SEF-Semi-Evergreen Forest

record the invasive alien plant species from September 2017 to October 2019. Plant specimens were collected and preserved as voucher specimens following standard procedures. The identification of plants was done with the help of Flora publications (Hooker 1872-1897, Gamble 1915-1936, Henry et al 1987, Matthew 1983, Nair and Henry 1983, Chandrabose and Nair 1988). The nativity of the invasive species was determined based on the information available in the published literatures (Maheswari 1960, Sekar 2012, Singh et al 2013, Divakara et al 2013, Sekar et al 2015, Reshi et al 2017). The invasive alien species are listed alphabetically followed by family, life-form, forest types, origin country and use values in which it occurs.

RESULTS AND DISCUSSION

A total of 98 species of invasive alien plant species belonging to 81 genera and 40 families were recorded in the Anaikatty hills, Coimbatore (Table 1). Herbs (73.47%) formed the predominant life-form followed by shrubs (9.18%), climbers (8.16%), trees (5.10%) and grasses (4.08%). The predominance of herbaceous life form in the invasive alien flora of the study area is in conformity with findings of Naidu et al (2015) reported for the tropical forests of Northern Andhra Pradesh and Sekar et al (2015) for Himachal Pradesh. A total of 40 families of invasive alien flora recorded, among this Asteraceae constituted the predominant family with 16

species, followed by Solanaceae and Amaranthaceae (8 species each). The comprehensive list of invasive alien flora for India (Rao and Murugan 2006) and China (Huang et al 2009) reported Asteraceae as the most dominant family. The dominance sequence of invasive alien genera of the study area comprised *Ipomea* and *Cassia* (4 species each) and *Cleome* (3 species). The invasive alien species in this study are categorized based on their Geographic origin. A total of 18 geographical origins/regions are considered for the analysis. Tropical American elements contributed 57.14% of invasive alien species followed by South America (12.24%) and Tropical Africa (8.16%). The invasive alien flora of India was also found to be dominated (58%) by Tropical American elements (Reddy 2008, Singh et al 2010). Five invasive alien tree species are reported in the present study. Among this *Acacia auriculiformis*, *Leucaena leucocephala*, *Delonix regia* and *Prosopis juliflora* are planted in social forest or commercial forestry and agroforestry. These species are cause major problems as invaders of natural and seminatural ecosystems (Richardson 1998). *Leucaena leucocephala* and *Prosopis juliflora* are small fast-growing trees native to Mexico. *Prosopis juliflora* was introduced to India around 1870 (Raizada and Chatterji 1954) and *Leucaena leucocephala* around 1950 (ILDIS 2007). Of the 98 invasive alien species found in Anaikatty hills, highest number in the dry mixed deciduous forest (85 species) followed by moist

deciduous and dry deciduous (62 species each) and semi evergreen forest (6 species). The obnoxious invasive species, *Lantana camara* and *Chromolaena odorata* (*Eupatorium odoratum*) was in all the four forest types surveyed. *Prosopis juliflora* has extensively invaded the dry deciduous forest. *Pistia stratiotes*, *Typha angustata* and *Ludwigia adscendens* were abundantly found in rivers and other water bodies. *Hyptis suaveolens* has dominant in along the waysides of the most of the areas. Majority of the invasive alien species recorded in the Anaikatty hills, have use values for humans. Plant parts use values reported included medicinal, fodder, ornamental, vegetable, fuel wood, fibre, edible, timber and manure. (Table 1). Prakash and Balasubramanian (2018) also reported that most of the invasive alien species are used in various purposes in the nearest area. About 50% of the invasive alien species of the present study area have medicinal uses.

CONCLUSION

Anaikatty hills, Southern Western Ghats is invaded by a set of invasive alien species including such as *Lantana camara*, *Hyptis suaveolens* and *Chromolaena odorata*. Particularly the dry deciduous forests are infested by diverse number of invasive weeds which require management intervention for the weed control.

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