DOI:10.26524/krj.2024.4

Kongunadu Research Journal 11 (1): 25-33, 2024
Publisher: Kongunadu Arts and Science College, Coimbatore.

https://krjournal.com/index.php/krj/article/view/643

RESEARCH ARTICLE

An inventory of invasive alien species in Anuvavi Hills, Coimbatore District, Tamil Nadu, India

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ABSTRACT

Invasive alien species pose a significant threat to global biodiversity and ecological balance. This study aimed to document and assess invasive alien species' diversity, distribution, and potential impacts in Anuvavi Hills, Coimbatore district, India. Extensive field surveys were conducted within Anuvavi Hills from August 2023 to February 2024 to record invasive alien species. The collected specimens were identified, classified, and grouped based on their life forms and families. A total of 68 invasive alien species belonging to 29 families and 57 genera were documented. Dicotyledons were dominant, with 64 species, while monocotyledons comprised 4 species. The Asteraceae family had the highest species richness, followed by Amaranthaceae, Tiliaceae, Caesalpiniaceae, Cleomaceae, Euphorbiaceae, Malvaceae, and Mimosaceae. Herbs constituted the majority of life forms, followed by shrubs, climbers, and trees. This study contributes to the growing body of knowledge on invasive alien species in India. The findings suggest that Anuvavi Hills harbors a diverse array of invasive alien species, highlighting the need for effective management strategies to mitigate their potential impacts on native ecosystems. The documented species have various uses in traditional medicine, ornamental gardening, and fodder, but some may also pose threats to human health and biodiversity.

Keywords: Anuvavi hills, biodiversity, ecological impacts, invasive alien species

1. INTRODUCTION

Invasive species have spread extensively across all categories of living organisms and ecosystems worldwide [1]. These species may be introduced either inadvertently or deliberately [2] and they exhibit distinctive traits, including fast reproduction and growth, strong dispersal abilities, remarkable adaptability to various ecological settings, resilience to diverse soil and climate conditions, abundant seed production facilitating easy dispersal, rapid dissemination rates, prolonged flowering and fruiting periods, aggressive root system growth, short generational spans, and wide native distribution ranges [3]. The encroachment of alien plant species into new environments has emerged as the second most significant peril to plant diversity after habitat loss [4]. The International Union for Conservation of Nature and Natural Resources (IUCN) describes "alien invasive species" as non-indigenous organisms that take root in natural or semi-natural habitats, acting as agents of disruption and endangering native biodiversity. Exotics are termed biological pollutants for their detrimental impacts on both natural and human-controlled ecosystems. The profound ecological ramifications of swiftly spreading introduced vegetation and non-native plant species pose a significant menace to biodiversity [5]. Roughly 10% of the globe's vascular plants possess the capability to infiltrate different ecosystems and influence indigenous organisms either directly or indirectly. In India, approximately 18% of the flora consists of non-native species, with American species comprising 55%, Asian and Malaysian species 30%, and European and Central Asian species 15%. The necessity for a comprehensive regional and national database on invasive non-native species is evident, as it would facilitate monitoring their distribution and impact across different regions, enabling the development of effective management strategies [6]. Considering these impacts, the present study was conducted to document the invasive alien species in Anuvavi Hills, Coimbatore district.

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2. MATERIALS AND METHODS

2.1. Study Area

The study was carried out in Anuvavi Hills [Figure 1], situated at coordinates 11º03.5'N and 76º50.9'E, with an elevation of 690 meters above sea level, are found along the Anaikatty Highway, approximately 22 kilometers southwest of Coimbatore city. This region serves as a convergence point between a branch of the Western Ghats and the plains of Coimbatore. The plains themselves are a patchwork of cultivated lands interspersed with both small and large-scale brick factories. The predominant vegetation in the area is classified as dry deciduous and grassland.

2.2. Data Collection

The field survey was carried out from August 2023 to February 2024 in Anuvavi Hills, Coimbatore district. During the field visit, a total of 5 field trips were conducted, documenting various invasive alien species and observing their morphological characteristics in their natural state. Comprehensive data were recorded in the field notes. The collection of invasive alien species spanned across diverse localities within the study area, including rural regions, agricultural lands, wastelands, roadsides, ponds, moist areas, and stream banks. Additionally, photographs were captured during the field visits, depicting the study regions and different alien plant species. Subsequently, the plants were identified utilizing resources such as the Flora of the Presidency of Madras [7], Flora of Tamil Nadu Carnatic [8], and Flora of Tamil Nadu [9].

Figure 1. Overview of the Study Area

3. RESULTS AND DISCUSSION

In this present survey, a total of 68 invasive alien species belonging to 29 families and 57 genera were documented in Anuvavi Hills, Coimbatore district. Among them, dicotyledons were 64 species with polypetalae 23, gamopetalae 26 and monochlamydeae 15 species, and monocotyledons with 4 species respectively [Table 1 and Figure 2]. The Asteraceae family was the dominant contribution to 12 species followed by Amaranthaceae with 9 species, Tiliaceae with 4 species, Caesalpiniaceae, Cleomaceae, Euphorbiaceae, Malvaceae, and Mimosaceae families with 3 species, and the remaining families were one or two species in each were depicted in Figure 2. The extensive inventory of invasive alien flora in India [10] and China [11] reported Asteraceae as the predominant family. The documented species are grouped into different lifeforms and herbs were dominantly present in 78% (53 species) followed by shrubs at 12% (8 species), Climbers at 6% (4 species), and Trees at 3% (3 species) were represented in Figure 3. [12] also reported that the lifeform analysis of the documented invasive alien flora showed that herbaceous species constitute the major life form with 73.47% respectively. Among 57 genera the *Alternanthera* and *Corchorus* have a maximum contribution of 4 species dominantly in the study area followed by *Cassia* and *Cleome* with 3 species and *Ipomoea* and *Euphorbia* with 2 species in each, while the remaining genera are monogeneric with a single genus.

Most of the species are commonly used in several aspects such as green vegetables, medicine, ornamental, fodder, and fuel wood by local peoples. Among 9 species are green vegetables namely

Alternanthera tenella, A. sessilis, Amaranthus spinosus, Boerhavia erecta, Cassia obtusifolia, Celosia argentea, Digera muricata, Eclipta prostrata and *Portulaca oleraceae* most of the species are collected in their surroundings some species are commonly cultivated and weekly once or twice consumed by rural peoples. Nowadays the local people commonly use *Alternanthera philoxeroides,* a highly toxic weed generally grown in polluted sewage areas and the plant accumulates heavy metals in its roots and leaves. According to [13], when it is consumed as a vegetable by humans and cattle as feed, it can cause serious health hazards and even sometimes lead to death. Hence, the awareness of correctly identified *Alternanthera sessilis* is very essential for society and it controls the health risks of livestock and humans. It treats stomach disorders, diarrhea, dysentery, wounds, fever, vomiting blood, headaches, and vertigo [14].

However, some alien species are highly used in our traditional medicinal systems in Siddha and Ayurveda. In this investigation, we observed 9 alien species namely *Achyranthes aspera, Calotropis gigantea, Cleome gynandra, Eclipta prostrata, Mimosa pudica, Spermacoce hispida, Tridax procumbens, Tribulus terrestris* and *Vernonia cinerea* are medicinally important and commonly used by local peoples for healthcare. Otherwise, some species such as *Lantana camera, Mirabilis jalapa,* and *Antigonon leptopus* are grown in home gardens for ornamental purposes; while the *Leucaena leucocephala* is commonly grown in hedges for fodder. These are some beneficial effects of alien species in this region. Previously some authors have documented the invasive alien species threats and uses in various regions of Tamil Nadu. [15] studied 93 weed species belonging to 85 genera and 42 families in the Kanyakumari district and their medicinal value in rural healthcare.

Most of the alien species are highly hazardous to the native flora and fauna diversity worldwide. These plant seeds with good germination quality and survival in all climates are the main reason for easily spreading out worldwide and these weeds are directly or indirectly changing their native biodiversity. In the present field observation, the *Parthenium hysterophorus, Lantana camera, Prosopis juliflora, Eichhornia crassipes, Xanthium indicum, Argemone mexicana, Ageratum conyzoides,* and *Hyptis suaveolens* are highly affected the natural biodiversity and agricultural fields in the study area. Hence, the *Parthenium hysterophorus* is allergens that affect humans and livestock. The plant produces allelopathic chemicals that suppress crop and pasture plants [16]. These species are easily spread out in vigorous growths and occupy the largest area in a short period which has severe effects on native plant diversity [17]. It is well known that invasive species compete with indigenous species for nutrition, light, water, and space. Hence continuous monitoring and control of the spread of those species is important to protect native species from extinction.

***Bidens pilosa* L.**

***Aerva javanica* (Burm.f.)**

***Prosopis juliflora* (Sw.) DC.**

Figure 2. Images of some invasive alien species documented in the study area

Table 1. List of invasive alien species in the study area

S.No.	Binomial Name	Family Name	Habit	Origin	Location	Uses
1.	*Acanthospermum hispidum* L.	Asteraceae	Herb	Tropical America	Wasteland	Medicinal
2.	*Achyranthes aspera* Ros.	Amaranthaceae	Herb	South-East Asia	Roadsides	Medicinal
3.	*Aerva javanica* (Burm.f.)	Amaranthaceae	Herb	Tropical Africa	Wasteland	Medicinal
4.	*Ageratum conyzoides* L.	Asteraceae	Herb	Tropical America	Agriculture field	Medicinal
5.	*Alternanthera pungens* Kunth.	Amaranthaceae	Herb	Tropical America	Wasteland	Fodder
6.	*Alternanthera sessilis* (L.) Kr. Br	Amaranthaceae	Herb	Tropical America	Agriculture field	Fodder
7.	*Alternanthera philoxeroides* (Mart) Griseb.	Amaranthaceae	Herb	Southern America	Aquatic region	None
8.	*Alternanthera tenella* Colla.	Amaranthaceae	Herb	Tropical America	Aquatic region	Medicinal
9.	*Amaranthus spinosus* L.	Amaranthaceae	Herb	Tropical America	Wasteland	Vegetable
10.	*Antigonon leptopus* Hook & Arn.	Polygonaceae	Climber	Northern America	Roadsides	Ornamental

11.	*Aregemone mexicana* L.	Papaveraceae	Herb	Southern America	Wasteland	Medicinal
12.	*Ascelpias curassavica* L.	Asclepiadaceae	Herb	Tropical America	Aquatic region	Medicinal
13.	*Bidens pilosa* L.	Asteraceae	Herb	Southern America	Wasteland	Fodder
14.	*Blainvillea acmella* L.	Asteraceae	Herb	Tropical Asia	Roadsides	Medicinal
15.	*Boerhavia erecta* L.	Nyctaginaceae	Herb	Tropical America	Roadsides	Medicinal
16.	*Borassus flabellifer* L.	Arecaceae	Tree	Southern Asia	Roadsides	Medicinal
17.	*Cathranthus pusilus* (Murr.) G. Don	Apocyanaceae	Herb	Tropical Asia	Agriculture field	Ornamental
18.	*Calotropis gigantea* (L.) W. T. Aiton	Asclepiadaceae	Shrub	Tropical Asia	Wasteland	Medicinal
19.	*Cassia absus* L.	Caesalpiniaceae	Herb	Tropical Asia	Roadsides	Medicinal
20.	*Cassia obtusifolia* L.	Caesalpiniaceae	Herb	Central & South America	Roadsides	Medicinal
21.	*Cassia hirusta* L.	Caesalpiniaceae	Shrub	Tropical America	Wasteland	Medicinal
22.	*Celosia argentea* L.	Amaranthaceae	Herb	Tropical Africa	Agriculture field	Medicinal
23.	*Chloris barbata* (L.) Swartz	Poaceae	Herb	Tropical America	Wasteland	Fodder
24.	*Chormolaena odarata* (L.) R. King	Asteraceae	Herb	Tropical America	Wasteland	Medicinal
25.	*Cleome monophylla* L.	Cleomaceae	Herb	Tropical Africa	Agriculture field	Fodder
26.	*Cleome gynandra* L.	Cleomaceae	Herb	Tropical Africa	Wasteland	Medicinal
27.	*Cleome viscosa* L.	Cleomaceae	Herb	Tropical America	Wasteland	Medicinal
28.	*Corchorus aestuans* L.	Tiliaceae	Herb	Tropical Africa	Agriculture field	Medicinal
29.	*Corchorus fascicularis* Lam.	Tiliaceae	Herb	Tropical Africa	Agriculture field	Medicinal
30.	*Corchorus tridens* L.	Tiliaceae	Herb	Tropical Africa & Asia	Roadsides	Fibre
31.	*Corchorus trilocularis* L.	Tiliaceae	Herb	Tropical Africa	Roadsides	Fibre

32.	*Crotalaria pallida* Aiton	Fabaceae	Herb	Tropical Africa & Asia	Roadsides	Fodder
33.	*Croton bonplandianum* Baill.	Euphorbiaceae	Herb	Southern America	Wasteland	Fodder
34.	*Cuscutta reflexa* Roxb.	Cuscutaceae	Climber	Indian subcontinent	Roadsides	Medicinal
35.	*Cyperus iria* L.	Cyperaceae	Herb	Tropical America	Aquatic region	Fodder, Fibre
36.	*Digera muricata* (Roxb.) R. Br.	Amaranthaceae	Herb	Tropical Asia & Africa	Agriculture field	Medicinal
37.	*Datura innoxia* P. Miller.	Solanaceae	Shrub	Tropical America	Wasteland	Medicinal
38.	*Eclipta prostrata* L.	Asteraceae	Herb	Northern America	Aquatic region	Medicinal
39.	*Eichhornia crassipes* (Mart.) Solms	Pontederiaceae	Herb	Southern America	Aquatic region	Medicinal
40.	*Emilia sonchifolia* (L.) DC.	Asteraceae	Herb	Tropical Asia	Agriculture field	Medicinal
41.	*Euphorbia heterophylla* L.	Euphorbiaceae	Herb	Tropical America	Roadsides	Ornamental
42.	*Euphorbia hypercifolia* L.	Euphorbiaceae	Shrub	Tropical America	Aquatic region	Ornamental
43.	*Hyptis suaveolens* (L.) Poit.	Lamiaceae	Shrub	Tropical America	Wasteland	Medicinal
44.	*Indigofera linnaei* Ali.	Fabaceae	Herb	Northern Australia	Wasteland	Fodder
45.	*Ipomoea carnea* Jacq.	Convolvulaceae	Shrub	Southern America	Aquatic region	Medicinal
46.	*Ipomoea obscura* (L.) Ker Gawler	Convolvulaceae	Climber	Tropical Africa	Aquatic region	Medicinal
47.	*Leucaena leucocephala* (Lam.) Dewit.	Mimosaceae	Tree	Southern Mexico	Roadsides	Fodder
48.	*Lantana camara* L.	Verbinaceae	Shrub	Tropical America	Roadsides	Medicinal, Ornamental
49.	*Mimosa pudica* L.	Mimosaceae	Herb	Tropical America	Aquatic region	Medicinal

50.	*Mirabilis jalapa* L.	Nyctaginaceae	Shrub	Tropical America	Roadsides	Medicinal
51.	*Malvastrum coromandelianum* L.	Malvaceae	Herb	Northern & Southern America	Roadsides	Medicinal
52.	*Ocimum americanaum* L.	Lamiaceae	Herb	Tropical America	Wasteland	Medicinal
53.	*Parthenium hysterosporus* L.	Asteraceae	Herb	Tropical America	Wasteland	Fodder
54.	*Peristrope paniculata* (Forssk.) R. K. Brummitt	Acanthaceae	Herb	Tropical Africa	Wasteland	Medicinal, Fodder
55.	*Prosopis juliflora* (Sw.) DC.	Mimosaceae	Tree	Mexico & South America	Wasteland	Fuelwood
56.	*Portulaca oleracea* L.	Portulacaceae	Herb	Europe	Agriculture field	Vegetable, Medicinal
57.	*Passiflora foetida* L.	Passifloraceae	Climber	Tropical America	Wasteland	Medicinal
58.	*Ruellia tuberosa* L.	Acanthaceae	Herb	Central America	Aquatic region	Ornamental
59.	*Sida acuta* Burm. f.	Malvaceae	Herb	Central America	Roadsides	Medicinal
60.	*Spermacoce hispida* L.	Rubiaceae	Herb	Tropical Asia	Wasteland	Medicinal
61.	*Stachytarpheta jamaicensis* (L.) Gaertin.	Verbinaceae	Herb	Tropical America	Roadsides	Medicinal, Ornamental
62.	*Synedrella nodiflora* (L.) Vahl.	Asteraceae	Herb	Tropical America	Wasteland	Ornamental
63.	*Tridax procumbens* L.	Asteraceae	Herb	Tropical America	Roadsides	Medicinal
64.	*Tribulus terrestris* L.	Zygophyllaceae	Herb	Southern Eurasia & Africa	Roadsides	Medicinal
65.	*Urena lobata* L.	Malvaceae	Herb	Tropical Asia & America	Wasteland	Medicinal
66.	*Vernonia cinerea* (L.) Less.	Asteraceae	Herb	Tropical Asia	Roadsides	Medicinal
67.	*Waltheria indica* L.	Sterculiaceae	Herb	Tropical America	Wasteland	Medicinal
68.	*Xanthium indicum* L.	Asteraceae	Herb	Northern America	Wasteland	Medicinal

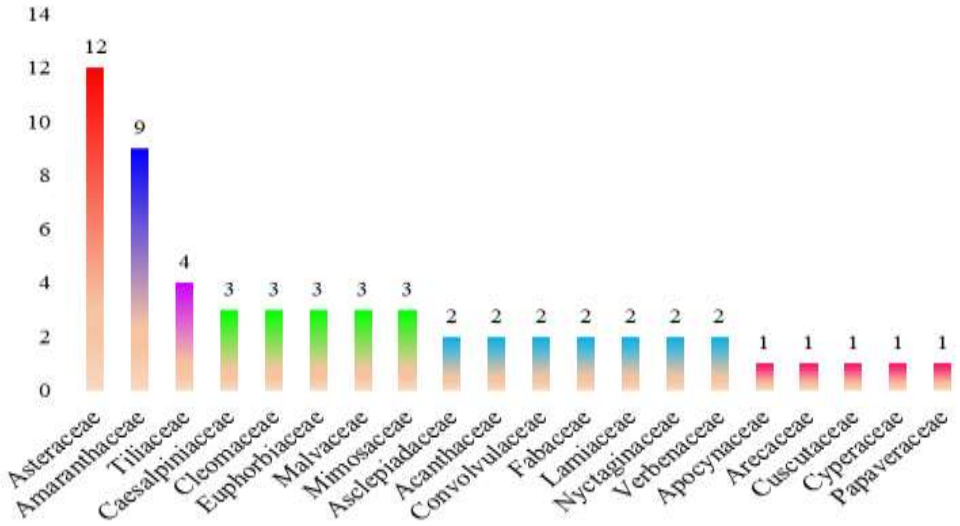

Figure 3. Family-wise analysis of Alien species in Anuvavi Hills, Coimbatore District

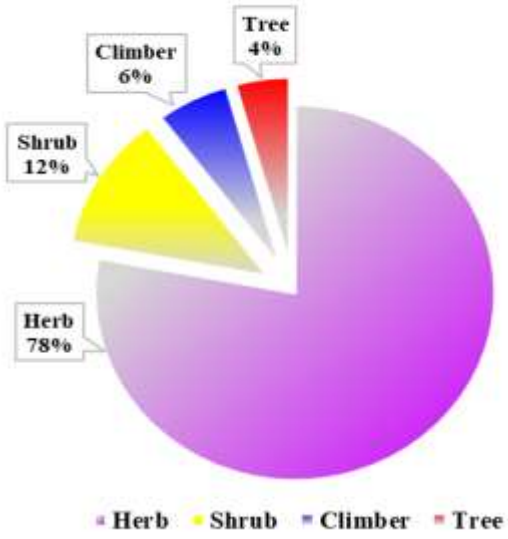

Figure 4. Lifeform-wise analysis of alien species in Anuvavi Hills, Coimbatore District

4. CONCLUSION

The present survey in Anuvavi Hills, Coimbatore district, identified 68 invasive alien species across 29 families and 57 genera, with Asteraceae being the most dominant family. Herbaceous species prevailed, reflecting their abundance in the area. While some species are utilized by locals for various purposes, others pose significant health and environmental risks, such as Alternanthera philoxeroides. Despite some beneficial uses, invasive species threaten native biodiversity and agriculture, as seen with *Parthenium hysterophorus*. Continuous monitoring and control efforts are essential to mitigate their impact and safeguard ecosystems.

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