



## Exotic weeds and native biodiversity: A Kerala story

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### Abstract

An exotic species refers to a plant or an animal species that is non-native and introduced into an area where it does not occur naturally and may have a significant effect on the local ecosystem. However, several exotic plants are deliberately being introduced for cultivation and economic gains, and some others become a nuisance as they accidentally invade and outcompete the native flora in the local ecosystem. Such non-deliberate invasions of exotic plants significantly contribute to severe alterations in the native biodiversity. Kerala, the southernmost State of the country along the western coast of Peninsular India, due to its unique climatic conditions welcomes several exotic plant species including weeds which might have grown, flourished and naturalized in the changed environment. As part of our survey and documentation of the exotic plants of Kerala, we were able to collect some weeds which are encroaching our virgin habitats affecting not only the native plant diversity but also the associated terrestrial and aquatic organisms. Around 30% of the total population in the State depends entirely on agriculture and nearly 0.5 million tribal people living close to our forest areas solely depend on forest-based resources for food and income and the invasion of exotic weeds causes rigorous ecological imbalance to our nature and impose additional trouble to our local and tribal communities. The present attempt is not only to list out the major weeds of Kerala but to understand their role in the loss of our native vegetation and how this disproportionately influences our local communities whose livelihoods depend greatly on forests and agriculture.

**Keywords:** Exotic weeds, invasion, biodiversity loss, Kerala

### Introduction

Biological diversity faces many challenges throughout the world, on account of various bio-physical reasons; the greatest among them is biological invasions by alien or non-native species whose impacts are immense, insidious and usually irreversible. The impact of exotic weeds may be much damaging or little more than habitat degradation leading to species depletion and ecosystem damage (1). A large number of exotic species in India are introduced long back and some has turned into weeds, multiplying fast and causing harm to our pristine environment (2). India has around 1,599 exotic plant species belonging to 842 genera and 161 families of which 225 are invasive weeds (3). References are meager about the exotic flora of Kerala. Out of 4694 species of flowering plants in Kerala, 199 are naturalized exotic species (4). Nazarudeen & Shareef (2008) [5] has recorded 66 exotic fruit species based on their survey and documentation of the fruit species growing in Kerala. Apart from these, Sankaran *et al.* (2012) [6] listed nearly 82 invasive weeds which have been intentionally or inadvertently brought to Kerala, spread fast and are known to impose huge costs in terms of ecological disturbances, economic damage and detrimental social effects including harm to human health. The present document is an updated version on the exotic weed flora of the State.

The impact of exotic plants is multifarious, some introduced plants yielding fruits are difficult to cultivate in certain climatic conditions, others such as certain ornamentals are adapting well in cultivation and still some others especially weeds spread rapidly through seeds, suckers and clones. A subset of species successfully invades to our natural areas where they badly affect, reduce or

eliminate native populations and even change the way the ecosystem functions (7). Invasive weeds are identified as a pressing threat to our biodiversity, livelihood security, food production, hazardous to human and livestock health as well as causing great economic loss in the long run (8). Weeds as 'garden escapes' are one of the major groups of exotic ingredients introduced into the flora of a particular region. Most of the weedy invasions establish themselves along with native flora and may ultimately subdue the natural vegetation, affecting the entire ecosystem fabric of the encroached land mass (9). Even though the overall ecological impact of alien species is widely debated, there is a dearth of analysis with regard to their influence on economic, livelihood and biotechnological aspects, analysis on the risk factors affecting human and livestock health (10).

### Methodology

Exhaustive field surveys were conducted throughout the State to document the exotic elements among angiosperms, particularly the weeds inhabiting natural habitats. Frequent visits were chartered all over the State which include forest areas, wastelands, riverbeds, stream banks, riparian zones, wetlands, marshy areas and floodplains, during May 2024 to July 2026. The collected plant samples were subjected to taxonomic scrutiny, identification, characterization and assessment of their impact on local vegetation and the specific ecosystems in which they grow. The voucher specimens were processed following standard procedures (11) and deposited at TBGT as permanent record for future reference.

## Discussion

The history of plant invasions in India dates back to several centuries as many of the ancient traders and travelers like Ibn Battuta, Abdur Razzaq Samarquandi, Duarte Barbosa etc. had meticulously mentioned about several exotic species of fruits and flowers growing in the ancient India, and some of the travelers intently had brought several exotic plant species from far and wide. Randhawa (1982)<sup>[12]</sup> in his book, *A History of Agriculture in India*, had discussed the alien plant invasion in the agricultural and horticultural land in India during the medieval period. The rise of Mughal Empire in India had resulted parallel development in the field of horticulture, agriculture and gardening, especially between the eighth and eighteenth centuries. The Dutch, Portuguese and the British invasions also had resulted in a spurt in the development and establishment of gardens and orchards in and around their colony and office premises in the country. Exotic plant species like *Anacardium occidentale* L., *Capsicum annum* L., *Carica papaya* L., *Psidium guajava* L., *Annona squamosa* L. etc. are some of the Portuguese introductions to India. Herbert (2011)<sup>[13]</sup> in his book '*Flora's empire: British Gardens in India*' had described some fruits and ornamentals like Cherry, Quince, Apple, Tulips, Anemones, Daffodils, Narcissus etc. growing in the British India. It was during the British period that many gardens like the Calcutta Botanic Garden, Saharanpur Botanic Garden, Madras Government Garden etc., were established, to satisfy principally the aesthetic and economic interests of the East India Company. Several economically important plants were known to have introduced during this

period. The trade and travel during that period had resulted in the rapid growth, spread and naturalization of many exotic plant species. The introduction of the exotic weeds in India has little historic background and not much is known about their introduction during the ancient period.

The State of Kerala, since time immemorial had attracted many traders and travelers, as the Malabar Coast was a promising hub for them during the maritime trade. The Arabs, Chinese, Portuguese, Dutch and English traders intentionally had introduced several exotic plants to this region. The pioneer botanical treatise on the plant wealth of Malabar, the *Hortus Malabaricus*, written during the 17<sup>th</sup> century (1678-1693), by the then Dutch Governor Van Rheede becomes the first written document in which the existence of exotic plants in the State was meticulously mentioned. At least 69 plants mentioned out of 792 species dealt in *Hortus Malabaricus* were exotic in origin (4). Presently, a considerable diversity of exotic plants introduced and naturalized in the State of Kerala over centuries and many of them had turned out into weeds, invading our forest areas, agriculture lands, pasture lands, roadsides, plantations and similar habitats, producing significant ecological, economic and social havocs.

The present investigation has resulted in the collection and documentation of 100 exotic weeds growing in the State of Kerala; many of them are obnoxious weeds as they cause drastic disturbances in its native biodiversity. The weeds which were collected during the study are listed in **Table 1**. Those species superscribed with asterisk are the obnoxious weeds.

**Table 1:** Exotic weeds documented from Kerala

| Sl.No | Species                                                            | Family        | Country of origin                                        | Impacts/ Remarks                                                                                                        |
|-------|--------------------------------------------------------------------|---------------|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| 1.    | <i>Acacia auriculiformis</i><br>A. Cunn. ex Benth.                 | Fabaceae      | Southeast Maluku to<br>New Guinea and North<br>Australia | Tree weed and plantation escape, growing along roadsides,<br>wastelands, agricultural areas and disturbed forest areas. |
| 2.    | <i>Acacia mearnsii</i> De Wild.                                    | Fabaceae      | Southeast Australia                                      | Tree weed, replace native undergrowth.                                                                                  |
| 3.    | <i>Acalypha hispida</i> Burm. f.                                   | Euphorbiaceae | Bismarck Archipelago                                     | Garden escape, spreads to various native habitats.                                                                      |
| 4.    | <i>Acmella radicans</i> (Jacq.)<br>R. K. Jansen*                   | Asteraceae    | Mexico to Northwest<br>Venezuela, Bolivia,<br>Caribbean  | Herbaceous weed, capable of growing and invading all types<br>of habitats.                                              |
| 5.    | <i>Ageratina adenophora</i><br>(Spreng.) R. M. King & H.<br>Rob. * | Asteraceae    | Mexico                                                   | Invades and spreads fast in the outskirts of forests.                                                                   |
| 6.    | <i>Ageratum conyzoides</i> L.*                                     | Asteraceae    | Mexico                                                   | Spreading fast, replacing native plants throughout the plains<br>and forest areas, harmful to livestock.                |
| 7.    | <i>Ageratum houstonianum</i><br>Mill.                              | Asteraceae    | Mexico to Central<br>America                             | Spreads rapidly, especially in high altitude areas.                                                                     |
| 8.    | <i>Alternanthera bettzickiana</i><br>(Regel) G. Nichols.           | Amaranthaceae | West South America to<br>Brazil                          | Spreads quickly in open areas, crop fields, agricultural fields<br>etc.                                                 |
| 9.    | <i>Alternanthera brasiliana</i><br>(L.) Kuntze                     | Amaranthaceae | Mexico to Tropical<br>America                            | Rapidly growing and invading open areas, agricultural fields,<br>roadsides etc.                                         |
| 10.   | <i>Alternanthera ficoidea</i> (L.)<br>P. Beauv.                    | Amaranthaceae | South America                                            | Spreads to occupy abandoned and vacant areas, rapidly<br>outcompeting native plants.                                    |
| 11.   | <i>Alternanthera<br/>philoxeroides</i> (Mart.)<br>Griseb. *        | Amaranthaceae | Trinidad to North<br>Argentina                           | Establishes in the marshy/ riverine vegetation, invading into<br>paddy fields and wetlands.                             |
| 12.   | <i>Amaranthus spinosus</i> L. *                                    | Amaranthaceae | Mexico to Tropical<br>America                            | Rapidly spreads to wastelands and roadsides.                                                                            |
| 13.   | <i>Antigonon leptopus</i> Hook.<br>& Arn.                          | Polygonaceae  | Mexico to Central<br>America                             | Rapidly climbing on trees and invading into all habitats.                                                               |
| 14.   | <i>Argemone mexicana</i> L. *                                      | Papaveraceae  | Mexico to Honduras                                       | Troublesome weed in agricultural lands and waste places in<br>the high-altitude areas, non-palatable to livestock.      |
| 15.   | <i>Aristea ecklonii</i> Baker                                      | Iridaceae     | Cameroon, Uganda,<br>South Africa                        | Invading grasslands and disturbed habitats.                                                                             |

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|-----|-----------------------------------------------------------------|----------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 16. | <i>Asclepias curassavica</i> L.                                 | Apocynaceae    | Tropical America                                    | Garden escape, established along roadsides, agricultural areas, waste lands and forest fringes.                                                                                                   |
| 17. | <i>Brugmansia arborea</i> (L.) Sweet                            | Solanaceae     | Ecuador to North Chile                              | Rapidly establishing on the roadsides and waste lands of high altitudes, in a wide variety of habitats. Harmful to both man and livestock.                                                        |
| 18. | <i>Brugmansia suaveolens</i> (Humb. & Bonpl. ex Willd.) Sweet * | Solanaceae     | Brazil                                              | Invades rapidly replacing native vegetation, especially in the high ranges, harmful to all animals.                                                                                               |
| 19. | <i>Cabomba furcata</i> Schult. & Schult. f.*                    | Cabombaceae    | Tropical America                                    | Densely growing in freshwater habitats, reducing water flow and blocking sunlight for the benthic organisms.                                                                                      |
| 20. | <i>Caladium bicolor</i> (Aiton) Vent. *                         | Araceae        | Central America to Argentina                        | Growing on marshy or moist habitats, roadsides, wastelands, crop fields etc.                                                                                                                      |
| 21. | <i>Calopogonium mucunoides</i> Desv.                            | Fabaceae       | Mexico to Tropical America                          | Vigorous climbers growing on trees, fences, agriculture fields, roadsides etc.                                                                                                                    |
| 22. | <i>Catharanthus roseus</i> (L.) G. Don*                         | Apocynaceae    | Madagascar                                          | Garden escape, invading abandoned lands, roadsides and disturbed forests.                                                                                                                         |
| 23. | <i>Canna indica</i> L.                                          | Cannaceae      | Tropical and Subtropical America                    | Growing mostly in moist soils and establishes themselves by competing with native plants.                                                                                                         |
| 24. | <i>Centratherum punctatum</i> Cass.                             | Asteraceae     | South Tropical America                              | Drought tolerant species, spreading rapidly replacing native flora.                                                                                                                               |
| 25. | <i>Centrosema molle</i> Mart. ex Benth.                         | Fabaceae       | South Mexico to Tropical America                    | Interfere with agricultural land, forest fringes, roadside, wasteland etc.                                                                                                                        |
| 26. | <i>Centrosema pubescens</i> Benth. *                            | Fabaceae       | Mexico to Tropical America                          | Rapidly invading both on barren habitats and crop fields.                                                                                                                                         |
| 27. | <i>Cestrum aurantiacum</i> Lindl.                               | Solanaceae     | Mexico to Venezuela                                 | Encroaches to forest areas, causing serious threat to native vegetation especially in high altitude regions.                                                                                      |
| 28. | <i>Chromolaena odorata</i> (L.) R. M. King & H. Rob*            | Asteraceae     | Tropical and Subtropical America                    | Invading to all types of habitats; exhibits allelopathy, inhibiting germination of nearby native plants thereby reducing fodder availability to livestock; can cause allergic reactions in human. |
| 29. | <i>Cosmos sulphureus</i> Cav.                                   | Asteraceae     | Mexico to Central America                           | Garden escape, growing rapidly in abandoned areas.                                                                                                                                                |
| 30. | <i>Croton bonplandianus</i> Baill. *                            | Euphorbiaceae  | South Bolivia to South Brazil and North Argentina   | Widely established along roadsides, wastelands, marshy areas etc.                                                                                                                                 |
| 31. | <i>Croton hirtus</i> L' Her. *                                  | Euphorbiaceae  | Mexico to Tropical Argentina                        | Compete with native plants along way sides, crop fields, wastelands and marshy areas.                                                                                                             |
| 32. | <i>Cylindropuntia ramoissima</i> (Engelm.) F. M. Knuth          | Cactaceae      | South Nevada to Northwest Mexico                    | Thorny weed in dry areas.                                                                                                                                                                         |
| 33. | <i>Cyperus aromaticus</i> (Ridl.) Mattf. & Kuk.                 | Cyperaceae     | Tropical Africa                                     | Grows along roadsides, crop fields, barren land, riverine and marshy areas.                                                                                                                       |
| 34. | <i>Datura stramonium</i> L.*                                    | Solanaceae     | Mexico                                              | Growing along roadsides, wastelands etc., can cause allergic reactions in both humans and animals.                                                                                                |
| 35. | <i>Deamia testudo</i> (Karw. ex Zucc.) Britton & Rose           | Cactaceae      | South Mexico to Central America                     | Thorny shrub growing and spreading over other vegetation.                                                                                                                                         |
| 36. | <i>Dieffenbachia seguine</i> (Jacq.) Schott*                    | Araceae        | Caribbean to South Tropical America                 | Garden escape, growing rapidly along roadsides and crop fields.                                                                                                                                   |
| 37. | <i>Distimake tuberosus</i> (L.) A. R. Simoes & Staples          | Convolvulaceae | South Mexico to Guyana, Ecuador and Caribbean       | Aggressive climbers, invading all types of vegetation.                                                                                                                                            |
| 38. | <i>Dracaena fragrans</i> (L.) Ker Gawl.                         | Asparagaceae   | Tropical Africa                                     | Growing naturally in cultivated areas. Sometimes planted as fence plant.                                                                                                                          |
| 39. | <i>Duranta erecta</i> L.                                        | Verbenaceae    | Mexico to South America, South Florida to Caribbean | Garden escape, growing and invading abandoned areas.                                                                                                                                              |
| 40. | <i>Epipremnum aureum</i> (Linden & Andre) G. S. Bunting*        | Araceae        | Society Islands (Polynesia)                         | Rapidly climbing and establishing over trees, affecting other epiphytic and parasitic species.                                                                                                    |
| 41. | <i>Erigeron karvinskianus</i> DC.                               | Asteraceae     | Mexico to Venezuela                                 | Invading roadsides, wastelands etc., especially in high altitude regions.                                                                                                                         |
| 42. | <i>Euphorbia heterophylla</i> L.*                               | Euphorbiaceae  | Tropical & Subtropical America                      | Grow rapidly along roadsides, wastelands, agricultural fields etc.                                                                                                                                |
| 43. | <i>Euphorbia hirta</i> L.*                                      | Euphorbiaceae  | Tropical & Subtropical America                      | Common weed, growing along roadsides and establishing in disturbed habitats.                                                                                                                      |
| 44. | <i>Gomphrena celosioides</i> Mart.                              | Amaranthaceae  | Ecuador to North Argentina                          | Invading mainly on roadsides, wastelands, crop fields etc.                                                                                                                                        |
| 45. | <i>Gomphrena globosa</i> L.                                     | Amaranthaceae  | Mexico to Brazil                                    | Garden escape, invading roadsides, wastelands etc.                                                                                                                                                |
| 46. | <i>Heliconia psittacorum</i> L. f.                              | Heliconiaceae  | Panama to South Tropical America                    | Garden escape, grows mainly along roadsides, wastelands, crop fields etc.                                                                                                                         |

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|-----|---------------------------------------------|-----------------|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 47. | <i>Hypoestes phyllostachya</i> Baker        | Acanthaceae     | Madagascar                                         | Rapidly growing along roadsides, wastelands, forest fringes etc.                                                                                                                      |
| 48. | <i>Hyptis capitata</i> Jacq. *              | Lamiaceae       | Florida, Mexico to Tropical America                | Rapidly growing and invading along roadsides and forest outskirts.                                                                                                                    |
| 49. | <i>Ipomoea aquatica</i> Forssk. *           | Convolvulaceae  | Tropical & Subtropical old world to Australia      | Aggressively growing in water bodies, affecting the quality and flow of water.                                                                                                        |
| 50. | <i>Ipomoea carnea</i> Jacq. *               | Convolvulaceae  | Mexico to Tropical America                         | Rapidly growing and invading to wet and marshy areas.                                                                                                                                 |
| 51. | <i>Ipomoea hederifolia</i> L.*              | Convolvulaceae  | Tropical and Subtropical America                   | Aggressively growing and climbing over native habitats.                                                                                                                               |
| 52. | <i>Ipomoea purpurea</i> (L.) Roth*          | Convolvulaceae  | Tropical and Subtropical America                   | Rapidly growing over native plants, interfering with crop plants and cultivated areas.                                                                                                |
| 53. | <i>Ipomoea quamoclit</i> L.*                | Convolvulaceae  | Mexico to Central America                          | Garden escape, climbing over native vegetation.                                                                                                                                       |
| 54. | <i>Jatropha curcas</i> L.                   | Euphorbiaceae   | Mexico to Tropical America                         | Growing naturally in crop fields and cultivated areas, sometimes planted as fence plant.                                                                                              |
| 55. | <i>Jatropha gossypifolia</i> L.             | Euphorbiaceae   | Mexico to Tropical America                         | Garden escape, invading in disturbed habitats.                                                                                                                                        |
| 56. | <i>Lantana camara</i> L.*                   | Verbenaceae     | Central and South America                          | Encroaching forest lands, open areas and way sides, exhibits allelopathy thus having a significant impact on surrounding vegetation, reduces soil quality, and is harmful to animals. |
| 57. | <i>Lemna perpusilla</i> Torr. *             | Araceae         | East Canada to Central and East USA.               | Growing as a dense mat over water bodies thus reducing oxygen and sunlight, can cause eutrophication.                                                                                 |
| 58. | <i>Leucaena leucocephala</i> (Lam.) de Wit  | Fabaceae        | Mexico to Central America                          | Tree weed, spreads rapidly, releases allelopathic compounds, harmful to grazing animals.                                                                                              |
| 59. | <i>Limncharis flava</i> (L.) Buchenau*      | Alismataceae    | Mexico to Tropical America                         | Grows in water bodies, paddy fields etc., competes with native vegetation.                                                                                                            |
| 60. | <i>Ludwigia peruviana</i> (L.) H. Hara      | Onagraceae      | South Mexico to Tropical America                   | Invades to marshy and riverine habitats.                                                                                                                                              |
| 61. | <i>Maesopsis eminii</i> Engl.               | Rhamnaceae      | Liberia to South Sudan and Zambia                  | Tree weed, growing rapidly in plantations and other open areas.                                                                                                                       |
| 62. | <i>Mesosphaerum suaveolens</i> (L.) Kuntze* | Lamiaceae       | Mexico to Tropical America                         | Growing in medium and high-altitude habitats, release allelopathic compounds.                                                                                                         |
| 63. | <i>Miconia crenata</i> (Vahl) Michelang. *  | Melastomataceae | Mexico to Tropical America                         | Encroaches to high altitude forest areas, disrupting grazing lands.                                                                                                                   |
| 64. | <i>Mikania micrantha</i> Kunth*             | Asteraceae      | Tropical & Subtropical America                     | Climbing weed, invading to forest areas, agricultural lands, plantations and other disturbed habitats, affects riverine vegetation, exhibits allelopathy, harmful to animals.         |
| 65. | <i>Mimosa diplotricha</i> C. Wright *       | Fabaceae        | Tropical & Subtropical America                     | Mainly growing along roadsides and forest fringes, invades rapidly replacing native biota.                                                                                            |
| 66. | <i>Mimosa pudica</i> L.*                    | Fabaceae        | Mexico to Tropical America                         | Mostly in all habitats and all altitudes, exhibits dense growth, contain allelopathic compounds and displaces native flora.                                                           |
| 67. | <i>Mirabilis jalapa</i> L.                  | Nyctaginaceae   | Mexico to Nicaragua                                | Garden escape, now growing widely along roadsides, wastelands and crop fields.                                                                                                        |
| 68. | <i>Monstera deliciosa</i> Liebm. *          | Araceae         | Mexico to Guatemala                                | Garden escape, vigorously climbing over trees, invading disturbed forest areas affecting epiphytic and parasitic life forms.                                                          |
| 69. | <i>Muntingia calabura</i> L.                | Elaeocarpaceae  | Mexico to South Tropical America                   | Tree weed, now growing rapidly along roadsides and wastelands.                                                                                                                        |
| 70. | <i>Neltuma juliflora</i> (Sw.) Raf.         | Fabaceae        | Mexico to Venezuela and Bolivia, Caribbean Islands | Tree weed, now growing rapidly along roadsides, plantations, wastelands etc.                                                                                                          |
| 71. | <i>Nymphaea omarana</i> Bisset*             | Nymphaeaceae    | South America                                      | Spreads rapidly in freshwater lakes, causing significant impact on other aquatic plants and organisms.                                                                                |
| 72. | <i>Opuntia elatior</i> Mill.                | Cactaceae       | South Caribbean, Costa Rica to Venezuela           | Thorny weed, forming dense thickets in dry habitats, affecting native vegetation and pasture lands.                                                                                   |
| 73. | <i>Opuntia tuna</i> (L.) Mill.              | Cactaceae       | Mexico to South Jamaica                            | Grows rapidly in dry areas and sandy soils, forming dense thickets.                                                                                                                   |
| 74. | <i>Parthenium hysterophorus</i> L.*         | Asteraceae      | North and South America                            | Rapidly growing in all types of habitats including forest areas; harmful to both humans and animals causing allergic reactions.                                                       |
| 75. | <i>Passiflora foetida</i> L.*               | Passifloraceae  | Tropical and Subtropical America                   | Readily growing over native vegetation in all altitudes.                                                                                                                              |
| 76. | <i>Peperomia pellucida</i> (L.) Kunth*      | Piperaceae      | Tropical and Subtropical America                   | Growing along roadsides, crop fields and barren lands.                                                                                                                                |
| 77. | <i>Petiveria alliacea</i> L. *              | Petiveriaceae   | Tropical and Subtropical America                   | Growing and invading crop fields and open areas of low and medium altitudes.                                                                                                          |
| 78. | <i>Pontederia crassipes</i> Mart. *         | Pontederiaceae  | South Tropical America                             | Rapid invader, causing great threat to aquatic vegetation.                                                                                                                            |

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|------|-------------------------------------------------------|----------------|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| 79.  | <i>Portulaca oleracea</i> L.                          | Portulacaceae  | Africa, Central and South Europe to Arabian Peninsula     | Garden escape, grows along roadsides and wastelands.                                                               |
| 80.  | <i>Physalis angulata</i> L.                           | Solanaceae     | Tropical and Subtropical America                          | Grows rapidly and establishes along with native plants.                                                            |
| 81.  | <i>Phytolacca octandra</i> L.                         | Phytolaccaceae | Mexico to Tropical America                                | Rapidly invading high-altitude areas, on the outskirts of forests.                                                 |
| 82.  | <i>Ricinus communis</i> L.*                           | Euphorbiaceae  | Northeast Tropical Africa                                 | Growing in wastelands, roadsides etc.                                                                              |
| 83.  | <i>Rivina humilis</i> L.*                             | Petiveriaceae  | Tropical and Subtropical America                          | Common weed, growing along roadsides and wastelands.                                                               |
| 84.  | <i>Senna alata</i> (L.) Roxb. *                       | Fabaceae       | Southwest Mexico to Tropical America                      | Shrubby weed, found growing along waysides and abandoned areas; adapted to tolerate vast environmental conditions. |
| 85.  | <i>Senna hirsuta</i> (L.) H. S. Irwin & Barneby       | Fabaceae       | Tropical and Subtropical America                          | Grows well in all types of habitats.                                                                               |
| 86.  | <i>Senna occidentalis</i> (L.) Link*                  | Fabaceae       | Tropical and Subtropical America                          | Rapidly growing and flourishing along agricultural lands, wastelands and open areas.                               |
| 87.  | <i>Senna spectabilis</i> (DC.) H. S. Irwin & Barneby* | Fabaceae       | Southwest Mexico to Tropical America                      | Tree weed, encroaching forest areas and affecting understory vegetation.                                           |
| 88.  | <i>Senna tora</i> (L.) Roxb. *                        | Fabaceae       | Central America                                           | Rapidly growing and invading riverbanks, open areas and forest fringes.                                            |
| 89.  | <i>Sesamum radiatum</i> Thonn. ex Hornem.             | Pedaliaceae    | Cape Verde, West Tropical Africa to Chad and North Angola | Grows along roadsides, wastelands, cultivated areas etc.                                                           |
| 90.  | <i>Solanum aculeatissimum</i> Jacq.                   | Solanaceae     | Southeast Brazil to Southcentral Paraguay                 | Invading agricultural lands, grasslands, waysides and outer forests.                                               |
| 91.  | <i>Solanum sisymbriifolium</i> Lam                    | Solanaceae     | South Tropical America                                    | Grows along roadsides, waste lands, agricultural fields and pasture lands.                                         |
| 92.  | <i>Solanum torvum</i> Sw.                             | Solanaceae     | Mexico to South America, Caribbean, East Brazil.          | Grows rapidly along roadsides and crop fields.                                                                     |
| 93.  | <i>Sphagneticola trilobata</i> (L.) Pruski*           | Asteraceae     | Mexico to South Tropical America and Trinidad             | Rapid invader; grows well in all types of moist habitats including riverine and marshy areas.                      |
| 94.  | <i>Stachytarpheta cayanensis</i> (Rich.) Vahl         | Verbenaceae    | South Mexico to Tropical America                          | Grows along roadsides and open areas.                                                                              |
| 95.  | <i>Stachytarpheta jamaicensis</i> (L.) Vahl*          | Verbenaceae    | Tropical America                                          | Grows rapidly and invades along roadsides, grasslands and agricultural areas.                                      |
| 96.  | <i>Stachytarpheta mutabilis</i> (Jacq.) Vahl          | Verbenaceae    | Mexico to Tropical America                                | Grows along roadsides, open areas, crop fields etc.                                                                |
| 97.  | <i>Synedrella nodiflora</i> (L.) Gaertn*              | Asteraceae     | Tropical and Subtropical America                          | Adaptable to all habitats resulting in their rapid growth and invasion.                                            |
| 98.  | <i>Tithonia diversifolia</i> (Hemsl.) A. Gray*        | Asteraceae     | Mexico to Central America                                 | Invading mainly in open areas, roadsides and wastelands.                                                           |
| 99.  | <i>Tridax procumbens</i> L.*                          | Asteraceae     | Mexico to Tropical America                                | Persistent weed in agricultural lands and crop fields.                                                             |
| 100. | <i>Turnera subulata</i> Sm.                           | Turneraceae    | Windward Islands to South Tropical America                | Grows rapidly in open areas.                                                                                       |

Many invasive weeds encroach into our forest ecosystems disturbing their fragility, adversely affecting the associated living organisms by interrupting their food chains and food webs. To some extent, the weed invasion also indirectly affects the tribal people who depend on forest resources for their livelihood. Many weeds spread rapidly and extensively in both the agriculture lands and plantations, making it difficult to control them and several of them enter the grazing zones, causing health issues for livestock, ultimately causing significant economic loss to farmers. The plants that invade aggressively, driving out native species are generally treated as obnoxious weeds which are mentioned by superscribing with asterisks in Table 1. A total of 51 species is listed in the category of obnoxious weeds during the study. As already stated, such hateful weeds spread rapidly causing significant damage to our native biodiversity. Plate 1 & 2 shows some examples of the species coming in this

category. Aquatic weeds like *Pontederia crassipes*, *Cabomba furcata*, *Nymphaea omarana*, *Limncharis flava*, *Lemna perpusilla* etc. affect both the lentic and lotic ecosystems thereby damaging the equilibrium of such aquatic bodies and causing direct threats to the native aquatic biota. Such weeds reduce the water quality of the aquatic bodies, blocking light, creating threat to the benthic organisms and adversely becoming a breeding ground to mosquitoes. The clogging due to many such weeds interfere tourism, fishing, irrigation etc., thereby damaging the economic fabric of the fishermen community and tourism sector. The present study throws light to address such issues and face the challenges caused by invasive weeds in the State of Kerala. The occurrence of invasive weeds and their distribution needs detailed site-specific mapping, particularly when such threats exist as potential dangers attacking our virgin habitats or natural areas.



**Plate 1:** a) *Chromolaena odorata*, b) *Miconia crenata*, c) *Hypoestes phyllostachya*, d) *Sphagneticola trilobata*, e) *Lantana camara*, f) *Mikania micrantha*



**Plate 2:** a) *Alternanthera philoxeroides*, b) *Cabomba furcata*, c) *Limncharis flava*, d) *Pontederia crassipes*.

## Conclusion

Threats to species can be divided into many different kinds; some are natural and others anthropogenic, some affect individual plants and others affect whole communities. The threat caused by invasive weeds and its severity is difficult to quantify. The degree of threat is generally a subjective concept, simply because until a threat has been in operation for some time, we are unlikely to know precisely how it will affect a target plant, a community or an ecosystem. The State of Kerala also faces multifarious threats triggered by widespread distribution of many invasive weeds, causing significant damage to our environment. Many animals, insects and associated microorganisms are suffering extensive damage due to the ecological imbalances created because of biological invasions.

Apart from the native biota, weeds also adversely affect our agricultural biodiversity, creating problems for the existence of rare cultivar forms or varieties, especially in regions that are not fully surveyed for genetic diversity. Diverse conservation strategies and gentle efforts are therefore detrimental in replacing invasive/ alien weeds by all possible means. An integrated management approach for conserving and restoring our habitats, native vegetation and lesser-known or under-exploited crop genetic diversity is extremely significant in the current scenario.

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