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Invasive alien plant species of West Bengal, India: A review

Tanay Shil[1], Rahul Bhatia[2], Jeewan Singh Jalal[1*]
[1] Department of Central National Herbarium, Botanical Survey of India, Howrah, West Bengal, India
[2] Department of EIACP Cell and Economic Division, Ministry of Environment, Forest and Climate Change, Indira Paryavaran Bhawan, New Delhi, India
Corresponding Author: Jeewan Singh Jalal
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Abstract
Invasive alien plant species (IAPS) are major drivers of biodiversity loss, ecosystem degradation and socio-economic impacts worldwide. Owing to its diverse physiography and climate, West Bengal encompasses ecosystems ranging from the Himalayas and Terai-Duars to the Gangetic plains, coastal regions, and the Sundarbans, making it highly vulnerable to plant invasions. However, an updated and comprehensive inventory of IAPS for the state has been lacking. This study presents a taxonomically validated inventory of 260 invasive alien plant species belonging to 192 genera and 61 families in West Bengal based on published literature, herbarium records, online biodiversity databases, and field observations. Among them 259 species of 191 genera, belonging to 60 families are angiosperms and 1 species (*Salvinia molesta* D.S. Mitch.) of 1 genus belonging to 1 family is pteridophyte. Dicotyledonous and monocotyledonous comprise 236 species, 173 genera, 53 families and 23 species and 18 genera and 7 families respectively. Dicotyledonous and monocotyledonous species are represented by 91% and 9% respectively. As far as habit is concerned, it was found that herbs, shrubs, trees, climbers, liana and bamboo occupy 60%, 15%, 18%, 4%, 1% and 2% of the total invasive plant species respectively. The recorded species occur across forests, wetlands, agricultural lands, grasslands, riverbanks, roadsides, urban areas, and other disturbed habitats, threatening native biodiversity, ecosystem functioning, and agricultural productivity. This updated inventory provides a valuable baseline for biodiversity assessment, ecological monitoring, invasion risk analysis, and the development of evidence-based management strategies. It also emphasizes the need for continuous surveillance, early detection, and coordinated management to reduce the ecological impacts of invasive alien plants in West Bengal.

Keywords: Invasive alien plants, biological invasion, checklist, biodiversity conservation, floristic inventory, West Bengal, India, alien flora, invasion ecology

Introduction

Biological invasion, a form of biological pollution that is often considered more destructive than chemical pollution (Khan *et al*. 2010) [9], is recognized as the second greatest global threat to biodiversity after habitat destruction (Reddy, 2008) [24], with invasive species occurring across nearly all ecosystems and taxonomic groups worldwide, particularly plants, mammals, and insects in terrestrial environments (Raghubanshi *et al*. 2005 [23]; Hoenicka & Fladung, 2006 [4]. The invasion of alien plant species poses a serious threat to native plant diversity and ecosystems worldwide by causing habitat degradation and biodiversity loss, while also imposing substantial economic costs and adversely affecting human and animal health (Yadav *et al*. 2016 [31]). Invasive alien plant species (IAPS) establish and spread rapidly outside their native ranges, displacing native vegetation, altering ecosystem processes, reducing agricultural productivity, and affecting ecosystem services (Richardson *et al*. 2000 [25]; Pyšek & Richardson, 2010 [22]; IPBES, 2023 [5]. In India, the alien flora comprises species originating primarily from the Americas (55%), followed by Asia and Malaysia (20%), Europe and Central Asia (15%), and other parts of Asia (10%) (Nayar, 1977 [17]. In India, alien weeds constitute approximately 42% of the weed flora in crop fields and are estimated to cause nearly 30% losses in crop production (Singh, 1996 [28])

The increasing movement of species through globalization, trade, agriculture, forestry, and horticulture has accelerated plant invasions across the globe. India, one of the world's megadiverse countries, has witnessed a steady increase in invasive alien plants over the past centuries. Many species introduced for ornamental, forestry, fodder, or agricultural purposes have escaped cultivation and become invasive. West Bengal is particularly vulnerable to plant invasions because of its exceptional physiographic and climatic diversity. Stretching from the Eastern Himalaya to the Bay of Bengal, the state encompasses forests, Terai-Duars, Gangetic plains, lateritic uplands, wetlands, riverine ecosystems, coastal habitats, and the Sundarbans mangrove forests. These diverse ecosystems, together with rapid urbanization, agricultural expansion, habitat disturbance, and infrastructure development, provide favourable conditions for the establishment and spread of invasive alien plants. Several invasive species, have become widespread across forests, wetlands, agricultural lands, tea gardens, grasslands, roadsides, riverbanks, and urban habitats. These species threaten native biodiversity, hinder forest regeneration, degrade wetlands, reduce crop productivity, and impair ecosystem services.

An authoritative database of alien and invasive alien plant species is essential for monitoring their distribution and impacts, formulating effective management strategies, and accurately distinguishing native from alien taxa, as most state and regional floras in India often indicate species'

origin, leading to the misidentification of some naturalized alien species as native (Khuroo *et al*. 2012 [10])

According to Reddy (2008) [24] 173 invasive alien species representing 117 genera and 44 families were recorded in India. Nearly 80% of these species originated from the Neotropics, predominantly from Tropical America (74%) and Tropical Africa (11%). Based on growth habit, herbaceous species dominated the invasive flora (151 species), followed by shrubs (14), climbers (5), and trees (3). Maheshwari & Paul (1975) [12] studied 209 exotic species and varieties of gymnosperms and angiosperms that are cultivated or naturalized in Ranchi district. Negi & Hajra (2007) [18] identified and catalogued 308 woody and 128 herbaceous invasive alien species from Doon valley, Northwest Himalaya. Sourabh *et al*. (2008) [29] reported 155 species of alien flora of Bihar and Jharkhand states. Chandra Sekar (2012) [2] compiled a comprehensive list of 190 invasive alien species belonging to 112 genera and 47 families from the Indian Himalayan region. Singh & Dangwal (2014) [27] reported a total of 26 noxious weeds from Rajouri district of Jammu and Kashmir.

Several studies have documented the occurrence and distribution of invasive alien plant species in different regions of West Bengal; however, a comprehensive checklist for the state is still lacking. Biswas *et al*. (2014) [1] reported the occurrence of 103 alien angiosperm species belonging to 32 families from Uttarpara in Hooghly district. Jana (2016) [7] recorded 19 invasive plant species representing 14 families in Purba Medinipur district. Nayak *et al*. (2019) [16] documented 27 invasive alien plant species, belonging to 26 genera and 17 families, from five sacred groves in Bankura district. Karthigeyan *et al*. (2020) [8] recorded 61 invasive alien plant species representing 50 genera and 29 families in the East Kolkata Wetlands (EKW). Mandal *et al.* (2023) [13] documented 65 invasive plant species belonging to 55 genera and 26 families from different parts of West Bengal. More recently, Panda *et al*. (2024) [19] enumerated 49 invasive plant species, representing 43 genera and 32 families, from the Acharya Jagdish Chandra Bose Indian Botanic Garden, Howrah. Despite these regional investigations, a detailed and comprehensive checklist of invasive alien plant species for the entire state of West Bengal remains unavailable. Hence, the present study compiles a taxonomically validated inventory of invasive alien plant species of West Bengal based on published literature, authenticated herbarium records, biodiversity databases, and field observations. The inventory provides updated information on taxonomy, family, growth habit, life form, native range, habitat, and distribution, offering an important baseline for biodiversity assessment, ecological monitoring, invasion risk analysis, and the development of effective management and conservation strategies.

Materials and Method

A comprehensive inventory of invasive alien plant species (IAPS) of West Bengal was prepared by compiling published information spanning the period 1950–2026 (76 years). Relevant data were gathered through an extensive review of scientific publications, including research articles, books, floras, monographs, reports, and other taxonomic and floristic literature. Herbarium specimens deposited at the Central National Herbarium (CAL), Botanical Survey of India, Howrah, were critically examined to verify the occurrence and distribution of species within the state. In addition, authenticated records from online biodiversity databases were consulted to supplement historical and contemporary distributional information. To validate literature records and document the current status of invasive alien plant species, extensive field surveys were conducted across West Bengal during the summer, monsoon, and winter seasons between 2023 [13] and 2026. Botanical explorations covered diverse ecosystems and habitat types, including natural forests, protected areas, grasslands, agricultural fields, plantations, wastelands, wetlands, aquatic habitats, riverbanks, roadsides, railway corridors, urban landscapes, and other disturbed habitats. Plant nomenclature was updated following Plants of the World Online (POWO, 2026) [21] and verified using the International Plant Names Index (IPNI, 2026) [6] to ensure current taxonomic accuracy. The nativity, invasion status, and distribution of each species were confirmed through critical examination of published literature and authoritative online databases. For each recorded species, information on scientific name, common name, family, growth habit, native range, habitat, and documented economic or ethnobotanical uses was compiled. The compiled dataset was subsequently analysed to assess taxonomic diversity, life-form composition, geographic origin, and utilization patterns of invasive alien plant species occurring in West Bengal.

Result & Discussion

All invasive alien plant species recorded from West Bengal are enumerated in Table 1 (Plate 1 & 2). For each species, the accepted botanical name is provided along with its common name, family, native region (source of introduction), growth habit, and documented uses.

Table 1: List of Invasive Plant Species of West Bengal

No.	Common Name	Scientific Name (with Author)	Family	Native Region	Habit	Uses
1.	Lady's Finger	*Abelmoschus esculentus* (L.) Moench	Malvaceae	Africa	Herb	Fruits are cooked as vegetables.
2.	Earleaf Acacia	*Acacia auriculiformis* A. Cunn. ex Benth.	Fabaceae	Australia	Tree	Timber
3.	Bristly Starbur	*Acanthospermum hispidum* DC.	Asteraceae	Brazil	Herb	Medicinal
4.	Prickly chaff flower	*Achyranthes aspera* L.	Amaranthaceae	Tropical America	Herb	Medicinal
5.	White Spot Flower	*Acmella radicans* (Jacq.) R.K. Jansen	Asteraceae	Tropical America	Herb	Medicinal
6.	Desert Cotton	*Aerva javanica* (Burm.f.) Juss. ex Schult.	Amaranthaceae	Tropical America	Herb	Medicinal

7.	Mountain Knot Grass	*Aerva lanata* (L.) Juss. ex Schult.	Amaranthaceae	Tropical America	Herb	Medicinal
8.	Shola Pith Plant	*Aeschynomene aspera* L.	Fabaceae	Asia	Herb	Used for making handicrafts.
9.	Century Plant	*Agave americana* L.	Asparagaceae	America	Shrub	Medicinal
10.	Mexican Devil	*Ageratina adenophora* (Spreng.) R.M. King & H. Rob.	Asteraceae	Mexico	Shrub	Medicinal
11.	Goat Weed	*Ageratum conyzoides* L.	Asteraceae	Central America	Herb	Medicinal
12.	Golden Trumpet	*Allamanda cathartica* L.	Apocynaceae	Brazil	Climber	Ornamental garden plant
13.	Smooth Chaff Flower	*Alternanthera paronychioides* A.St.-Hil	Amaranthaceae	Tropical America	Herb	Tender shoots are cooked as vegetables.
14.	Alligator Weed	*Alternanthera philoxeroides* (Mart.) Griseb.	Amaranthaceae	America	Aquatic/ wetland herb	Tender shoots are cooked as vegetables.
15.	Khaki Weed	*Alternanthera pungens* Kunth	Amaranthaceae	Tropical America	Herb	Medicinal
16.	Stalkless joyweed	*Alternanthera sessilis* (L.) DC.	Amaranthaceae	Tropical America	Herb	Tender shoots are cooked as vegetables.
17.	Love-lies-bleeding	*Amaranthus caudatus* L.	Amaranthaceae	Uncertain	Herb	Tender leaves are cooked as vegetables.
18.	Spiny Amaranth	*Amaranthus spinosus* L.	Amaranthaceae	Tropical America	Herb	Tender leaves are cooked as vegetables.
19.	Garden dill	*Anethum graveolens* L.	Apiaceae	South and South west Asia	Herb	Medicinal
20.	Coral Vine	*Antigonon leptopus* Hook. & Arn.	Polygonaceae	Tropical America	Climber	Ornamental Garden Plant
21.	Common snapdragon	*Antirrhinum majus* L.	Plantaginaceae	Europe, Syria, America	Herb	Medicinal
22.	Mexican prickly poppy	*Argemone mexicana* L.	Papavaraceae	Tropical America	Herb	Source of biodesel.
23.	Pale Mexican Poppy	*Argemone ochroleuca* Sweet	Papavaraceae	Mexico	Herb	Medicinal
24.	Elegant Dutchman's Pipe	*Aristolochia littoralis* Parodi	Aristolochiaceae	South America	Climber	Ornamental garden plant
25.	Tropical Milkweed	*Asclepias curassavica* L.	Apocynaceae	Tropical America	Herb	Ornamental garden plant
26.	Oats	*Avena sativa* L.	Poaceae	Eurasia, Africa	Herb	Food and fodder.
27.	Neem Tree	*Azadirachta indica* A. Juss.	Meliaceae	Myanmar	Tree	Medicinal
28.	Hedge Bamboo	*Bambusa multiplex* (Lour.) Raeusch. ex Schult.f.	Poaceae	China	Bamboo	Used in making handicrafts.
29.	Common Bamboo	*Bambusa vulgaris* Schrad. ex J.C. Wendl.	Poaceae	Assam to China (Yunnan) and Indo-China	Bamboo	Used in making handicrafts.
30.	Beggar Tick	*Bidens pilosa* L.	Asteraceae	Tropical America	Herb	Medicinal
31.	Bishop Wood	*Bischofia javanica* Blume	Phyllanthaceae	Indonesia	Tree	Medicinal
32.	Lipstick Tree	*Bixa orellana* L.	Bixaceae	Brazil	Tree	Medicinal
33.	Lettuce Leaf Knob Bush	*Blumea lacera* (Burm.f.) DC.	Asteraceae	Tropical America	Herb	Medicinal
34.	Erect Spiderling	*Boerhavia erecta* L.	Nyctaginaceae	Tropical America	Herb	Tender leaves are cooked as vegetables.
35.	Palmyra Palm	*Borassus flabellifer* L.	Arecaceae	Tropical America	Tree	Fruit pulps are edible.
36.	Indian Mustard	*Brassica* × *juncea* (L.) Czern.	Brassicaceae	Continental Asia	Herb	Leaves, flowers are cooked as vegetables. Seeds are used as spices in cooking.
37.	Wild cabbage	*Brassica oleracea* L.	Brassicaceae	Western and Southern Europe	Herb	Leaves, flowers are cooked as vegetables.
38.	Field Mustard	*Brassica rapa* L.	Brassicaceae	Mediterranean region	Herb	Leaves, flowers are cooked as vegetables.
39.	Paper mulberry	*Broussonetia papyrifera* (L.) L'Hér. ex Vent.	Moraceae	China/Japan	Tree	Medicinal
40.	Pride of Barbados	*Caesalpinia pulcherrima* (L.) Sw.	Fabaceae	Brazil	Shrub	Medicinal
41.	Red Powder Puff	*Calliandra haematocephala* Hassk.	Fabaceae	Brazil	Shrub	Ornamental landscaping plant.
42.	Crown Flower	*Calotropis gigantea* (L.) W.T. Aiton	Apocynaceae	Tropical Africa	Shrub	Medicinal
43.	Rubber Bush	*Calotropis procera* (Aiton) W.T. Aiton	Apocynaceae	Tropical Africa	Shrub	Medicinal

44.	Tea Plant	*Camellia sinensis* (L.) Kuntze	Theaceae	China	Shrub	Tea plant
45.	Trumpet Vine	*Campsis radicans* (L.) Bureau	Bignoniaceae	North America	Shrub	Ornamental garden plant.
46.	Marijuana	*Cannabis sativa* L.	Cannabaceae	Tropical America	Herb	Medicinal
47.	Balloon Vine	*Cardiospermum halicacabum* L.	Sapindaceae	Tropical America	Climber	Medicinal
48.	Yellow oleander	*Cascabela thevetia* (L.) Lippold	Apocynaceae	Mexico to S. Tropical America	Tree	Ornamental garden plant.
49.	Pink Shower Tree	*Cassia javanica* L.	Fabaceae	Indonesia (Java)	Tree	Ornamental landscaping plant.
50.		*Cassia javanica* subsp. *nodosa* (Buch. Ham. ex Roxb.) K. Larsen & S.S. Larsen	Fabaceae	Myanmar, Malyasia	Tree	Ornamental landscaping plant.
51.	Tiny Periwinkle	*Catharanthus pusillus* G. Don	Apocynaceae	Tropical America	Herb	Medicinal
52.	Madagascar periwinkle	*Catharanthus roseus* (L.) G. Don	Apocynaceae	West Indies	Herb	Medicinal
53.	Hairy Bitter Cress	*Cardamine hirsuta* L.	Brassicaceae	Tropical America	Herb	Fresh green salads.
54.	Napier Grass	*Cenchrus purpureus* (Schumach.) Morrone	Poaceae	Tropical America	Herb	Fodder
55.	Tinwa Bamboo	*Cephalostachyum pergracile* Munro	Poaceae	Myanmar	Bamboo	Used in making handicrafts.
56.	Hornwort	*Ceratophyllum demersum* L.	Ceratophyllaceae	Europe	Herb	Medicinal
57.	Night blooming jasmine	*Cestrum nocturnum* L.	Solanaceae	West Indies, America	Shrub	Ornamental landscaping plant.
58.	Orchid Vine	*Cheniella corymbosa* (Roxb. ex DC.) R. Clark & Mackinder	Fabaceae	China	Climber	Ornamental garden plant
59.	White goosefoot	*Chenopodium album* L.	Amaranthaceae	Europe	Herb	Tender shoots are cooked as vegetables.
60.	Swollen Finger Grass	*Chloris barbata* Sw.	Poaceae	Tropical America	Herb	Fodder
61.	Siam Weed	*Chromolaena odorata* (L.) R.M. King & H. Rob.	Asteraceae	South America	Herb	Medicinal
62.	Rottler's Chrozophora	*Chrozophora rottleri* (Geiseler) Spreng.	Euphorbiaceae	Tropical Africa	Herb	Medicinal
63.	African Spider Flower	*Cleome gynandra* L.	Cleomaceae	Tropical America	Herb	Medicinal
64.	Spindle Pod	*Cleome monophylla* L.	Cleomaceae	Tropical America	Herb	Medicinal
65.	Fringed Spider Flower	*Cleome rutidosperma* DC.	Cleomaceae	Tropical America	Herb	Medicinal
66.	Asian Spider flower	*Cleome viscosa* L.	Cleomaceae	Tropical America	Herb	Medicinal
67.	Adaly Millet	*Coix lacryma-jobi* L.	Poaceae	S.E. Asia	Herb	Seeds are used for making crafts.
68.	East Indian Mallow	*Corchorus aestuans* L.	Malvaceae	Tropical America	Herb	Medicinal
69.	Coriander	*Coriandrum sativum* L.	Apiaceae	Mediterranean region	Herb	Seeds are used as spices in cooking.
70.	Smooth Rattlepod	*Crotalaria pallida* Aiton	Fabaceae	Tropical America	Herb	Medicinal
71.	Rattleweed	*Crotalaria retusa* L.	Fabaceae	Tropical America	Herb	Medicinal
72.	Jungle Tulsi	*Croton bonplandianus* Baill.	Euphorbiaceae	South America	Herb	Medicinal
73.	Rubber Vine	*Cryptostegia grandiflora* R.Br.	Apocynaceae	Tropical Africa (Madagascar)	Climber	Medicinal
74.	Devil's trumpet	*Ctenodon minimus* (Martyn) Wajer & Mabb.	Fabaceae	Mexico	Shrub	Medicinal
75.	Amar Bel	*Cuscuta reflexa* Roxb.	Convolvulaceae	Mediterranean	Climber	Medicinal
76.	Little Ironweed	*Cyanthillium cinereum* (L.) H. Rob.	Asteraceae	Temperate America	Herb	Medicinal
77.	Bermuda Grass	*Cynodon dactylon* (L.) Pers.	Poaceae	Africa	Herb	Fodder, Medicinal, religious plant.
78.	Common nut sedge	*Cyperus rotundus* L.	Cyperaceae	Africa, S. Europe	Herb	Medicinal
79.	Scotch broom	*Cytisus scoparius* (L.) Link	Fabaceae	Europe	Herb	Medicinal
80.	Downy thorn	*Datura innoxia* Mill.	Solanaceae	Tropical America	Shrub	Medicinal

	apple					
81.	Devil's trumpet	*Datura metel* L.	Solanaceae	Tropical America	Shrub	Medicinal
82.	Flumboyant tree	*Delonix regia* (Bojer ex Hook.) Raf.	Fabaceae	Madagascar	Tree	Ornamental landscaping plant.
83.	Giant Bamboo	*Dendrocalamus giganteus* Munro	Poaceae	Malaya, Myanmar	Bamboo	Used in making handicrafts.
84.	Solid Bamboo	*Dendrocalamus strictus* (Roxb.) Nees	Poaceae	Myanmar	Bamboo	Used in making handicrafts.
85.	Creeping Dentella	*Dentella repens* (L.) J.R. Forst. & G. Forst.	Rubiaceae	E. Asia, Australia	Herb	Tender shoots are cooked as vegetables.
86.	China pink	*Dianthus chinensis* L.	Caryophyllaceae	Eastern Asia	Herb	Ornamental garden plant
87.	Panicled Foldwing	*Dicliptera paniculata* (Forssk.) I.Darbysh.	Acanthaceae	Tropical America	Herb	Fodder
88.	False Amaranth	*Digera muricata* Mart.	Amaranthaceae	S.W. Asia	Herb	Tender leaves are cooked as vegetables.
89.	Golden Dew Drop	*Duranta erecta* L.	Verbenaceae	Mexico	Shrub	Ornamental garden plant
90.	Yellow cone flower	*Echinacea paradoxa* Britton	Asteraceae	Europe	Herb	Medicinal
91.	Awnless barnyard Grass	*Echinochloa colona* (L.) Link	Poaceae	Tropical South America	Aquatic/ wetland Herb	Fodder
92.	Barnyard Grass	*Echinochloa crus-galli* (L.) P. Beauv.	Poaceae	Tropical South America	Herb	Fodder
93.	False Daisy	*Eclipta prostrata* (L.) L.	Asteraceae	Tropical America	Herb	Medicinal
94.	Loquat	*Eriobotrya japonica* (Thunb.) Lindl.	Rosaceae	Japan/China	Tree	Fruits are edible.
95.	Arugula	*Eruca sativa* Mill.	Brassicaceae	Mediterranean region	Herb	Culinary salads
96.	Sawtooth coriander	*Eryngium foetidum* L.	Apiaceae	South America	Herb	Medicinal
97.	River Red Gum	*Eucalyptus camaldulensis* Dehnh.	Myrtaceae	Australia	Tree	Medicinal
98.	Forest Red Gum	*Eucalyptus tereticornis* Sm.	Myrtaceae	Australia	Tree	Medicinal
99.	Wild Poinsettia	*Euphorbia heterophylla* L.	Euphorbiaceae	Tropical America	Herb	Medicinal
100.	Asthma Plant	*Euphorbia hirta* L.	Euphorbiaceae	Tropical America	Herb	Fodder
101.	Crown of Thorns	*Euphorbia milii* Des Moul.	Euphorbiaceae	Madagascar	Shrub	Ornamental garden plant.
102.	Prostrate sandmat	*Euphorbia prostrata* Aiton	Euphorbiaceae	Tropical America	Herb	Medicinal
103.	Poinsettia	*Euphorbia pulcherrima* Willd. ex Klotzsch	Euphorbiaceae	Mexico	Shrub	Medicinal
104.	Pencil tree	*Euphorbia tirucalli* L.	Euphorbiaceae	Kenya	Shrub	Medicinal
105.	Roundleaf Blindweed	*Evolvulus nummularius* (L.) L.	Convolvulaceae	America	Herb	Medicinal
106.	Common fennel	*Foeniculum vulgare* Mill.	Apiaceae	Southern Europe	Herb	Leaves are cooked as vegetables. Seeds are used as spices in cooking.
107.	Indian Fumitory	*Fumaria indica* (Hausskn.) Pugsley	Papavaraceae	Pakistan, Afghanistan	Herb	Medicinal
108.	Gallant soldier	*Galinsoga parviflora* Cav.	Asteracea		Herb	Medicinal
109.	Gold Shower	*Galphimia gracilis* Bartl.	Malpighiaceae	Mexico	Shrub	Ornamental garden plant
110.	Cudweed	*Gamochaeta americana* (Mill.) Wedd.	Asteraceae	Tropical America	Herb	Fodder
111.	Pensylvania cudweed	*Gamochaeta pensylvanica* (Willd.) Cabrera	Asteraceae	America	Herb	Fodder
112.	Crown Daisy	*Glebionis coronaria* (L.) Cass. ex Spach	Asteraceae	Mediterranean region	Herb	Edible leafy green vegetable.
113.	Chinese honey locust	*Gleditsia sinensis* Lam.	Fabaceae	China	Tree	Medicinal
114.	Prostrate globe Amaranth	*Gomphrena celosioides* Mart.	Amaranthaceae	South America	Herb	Medicinal
115.	Globe Amaranth	*Gomphrena globosa* L.	Amaranthaceae	Tropical America	Herb	Medicinal
116.	Prostrate globe Amaranth	*Gomphrena serrata* L	Amaranthaceae	Tropical America	Herb	Fodder
117.	Upland Cotton	*Gossypium hirsutum* L.	Malvaceae	Central America	Tree	Used for textile fibre.
118.	Silky Oak	*Grevillea robusta* A. Cunn. ex R.Br.	Proteaceae	Australia	Tree	Ornamental landscaping plant.

119.	Logwood	*Haematoxylum campechianum* L.	Fabaceae	Mexico	Tree	Medicinal
120.	Firebush	*Hamelia patens* Jacq.	Rubiaceae	Brazil	Shrub	Medicinal
121.	Sunflower	*Helianthus annuus* L.	Asteraceae	North America	Herb	Ornamental garden plant; cooking oil production.
122.	Chinese Hibiscus	*Hibiscus rosa-sinensis* L.	Malvaceae	China	Shrub	Ornamental garden plant; medicinal.
123.	Deccan Hemp	*Hibiscus cannabinus* L.	Malvaceae	Tropical America	Herb	Medicinal
124.	Cotton Rose	*Hibiscus mutabilis* L.	Malvaceae	China	Shrub	Ornamental garden plant.
125.	Rose of Sharon	*Hibiscus syriacus* L.	Malvaceae	S. China, Taiwan	Shrub	Ornamental garden plant.
126.	American Mint	*Hyptis suaveolens* (L.) Poit.	Lamiaceae	Tropical America	Herb	Aromatic
127.	Garden Balsam	*Impatiens balsamina* L.	Balsaminaceae	Tropical America	Herb	Ornamental garden plant
128.	Cogon Grass	*Imperata cylindrica* (L.) Raeusch.	Poaceae	Tropical America	Herb	Medicinal
129.	Silky Indigo	*Indigofera astragalina* DC.	Fabaceae	Tropical America	Herb	Cloth washing
130.	Narrowleaf Indigo	*Indigofera linifolia* (L.f.) Retz.	Fabaceae	Tropical America	Herb	Medicinal
131.	Water Morning Glory	*Ipomoea aquatica* Forssk.	Convolvulaceae	Tropical America	Herb	Tender shoots are cooked as vegetables.
132.	Mile-a-minute vine	*Ipomoea cairica* (L.) Sweet	Convolvulaceae	Tropical & S. Africa, West Asia to Taiwan	Herb	Medicinal
133.	Bush Morning Glory	*Ipomoea carnea* Jacq.	Convolvulaceae	Tropical Africa	Shrub	Stems are source of firewood.
134.	The Morning Glory	*Ipomoea eriocarpa* R.Br.	Convolvulaceae	Tropical Africa	Climber	Medicinal
135.	Scarlet morning glory	*Ipomoea hederifolia* L.	Convolvulaceae	Tropical & Subtropical America	Herb	Medicinal
136.	Tiger Foot Morning Glory	*Ipomoea pes-tigridis* L.	Convolvulaceae	T.E. Africa	Climber	Medicinal
137.	Cypress vine	*Ipomoea quamoclit* L.	Convolvulaceae	Mexico to Central America	Herb	Ornamental garden plant
138.	Blue jacaranda	*Jacaranda mimosifolia* D.Don	Bignoniaceae	Bolivia to NW. Argentina	Tree	Ornamental landscaping plant.
139.	Barbados Nut	*Jatropha curcas* L.	Euphorbiaceae	Mexico to Tropical America	Shrub	Medicinal
140.	Bellyache bush	*Jatropha gossypiifolia* L.	Euphorbiaceae	Mexico to Tropical America	Shrub	Medicinal
141.	Peregrina	*Jatropha integerrima* Jacq.	Euphorbiaceae	W. Cuba	Shrub	Ornamental landscaping plant
142.	African Sausage Tree	*Kigelia africana* (Lam.) Benth.	Bignoniaceae	Tropical & S. Africa	Tree	Medicinal
143.	Crape myrtle	*Lagerstroemia indica* L.	Lythraceae	Himalaya to S. China and Indo-China	Tree	Ornamental landscaping plant.
144.	Lantana	*Lantana camara* L.	Verbenaceae	Mexico to Tropical America	Shrub	Medicinal
145.	Yellow Pea	*Lathyrus aphaca* L.	Fabaceae	Mediterranean	Herb	Pulse
146.	Grass Pea	*Lathyrus sativus* L.	Fabaceae	Mediterranean	Herb	Pulse
147.	Lion’s ear	*Leonotis nepetifolia* (L.) R.Br.	Lamiaceae	Tropical Africa	Herb	Medicinal
148.	Lesser swine-cress	*Lepidium didymum* L.	Brassicaceae	South America	Herb	Edible wild green.
149.	Virginia pepperweed	*Lepidium virginicum* L.	Brassicaceae	Canada to Central America, and Caribbean	Herb	Edible wild green.
150.	River Tamarind	*Leucaena leucocephala* (Lam.) de Wit	Fabaceae	Tropical America	Tree	Used for making basket
151.	Lychee	*Litchi chinensis* Sonn.	Sapindaceae	China (SW. Guangdong) to Southeast Asia	Tree	Fruits are edible.
152.	Chinese Fan Palm	*Livistona chinensis* (Jacq.) R.Br. ex Mart.	Arecaceae	S. Japan to China (Guangdong)	Tree	Ornamental landscaping plant.
153.	Water Primrose	*Ludwigia adscendens* (L.) H. Hara	Onagraceae	Tropical America	Herb	Medicinal
154.	Perennial Water Primrose	*Ludwigia perennis* L.	Onagraceae	Tropical America	Herb	Medicinal
155.	Scarlet Pimpernel	*Lysimachia arvensis* (L.) U. Manns & Anderb.	Primulaceae	Europe	Herb	Medicinal
156.	Southern magnolia	*Magnolia grandiflora* L.	Magnoliaceae	SE. U.S.A. to Texas	Tree	Ornamental garden plant
157.	Brazil Jute	*Malachra capitata* L.	Malvaceae	Tropical America	Herb	Medicinal
158.	Threelobe false mallow	*Malvastrum coromandelianum* (L.) Garcke	Malvaceae	New World	Shrub	Medicinal
159.	Turk's cap	*Malvaviscus arboreus* Dill. ex Cav.	Malvaceae	Mexico to Trinidad and	Shrub	Medicinal

				Peru		
160.	Baby Jump Up	*Mecardonia procumbens* (Mill.) Small	Plantaginaceae	Tropical N. America	Herb	Medicinal
161.	Bur clover	*Medicago polymorpha* L.	Fabaceae	Macaronesia, N. & NE. Tropical Africa, Southern Europe to Central Asia and W. Nepal	Herb	Edible nutritious plant; medicinal.
162.	White Sweetclover	*Melilotus albus* Medik.	Fabaceae	Europe	Herb	Insecticide
163.	Chocolate Weed	*Melochia corchorifolia* L.	Malvaceae	Tropical America	Herb	Medicinal
164.	American Mint	*Mesosphaerum suaveolens* (L.) Kuntze	Lamiaceae	Mexico to Tropical America	Herb	Medicinal
165.	Mile-a-minute weed	*Mikania micrantha* Kunth	Asteraceae	Central and South America	Climber	Medicinal
166.	Indian Cork Tree	*Millingtonia hortensis* L.f.	Bignoniaceae	S. Central China to Malesia	Tree	Ornamental landscaping plant.
167.	Touch-me-not	*Mimosa pudica* L.	Fabaceae	Mexico to Tropical America	Herb	Medicinal
168.	Four O'clock Flower	*Mirabilis jalapa* L.	Nyctaginaceae	Tropical America	Herb	Ornamental Garden plant
169.	Tapeworm Plant	*Muehlenbeckia platyclada* (F. Muell.) Meisn.	Polygonaceae	Papuasia	Shrub	Medicinal
170.	Jamaica Cherry	*Muntingia calabura* L.	Muntingiaceae	Tropical America	Tree	Medicinal
171.	Algaroba	*Neltuma juliflora* (Sw.) Raf.	Fabaceae	Tropical S. America	Tree	Wood
172.	Tex-Mex tobacco	*Nicotiana plumbaginifolia* Viv.	Solanaceae	Texas to Guatemala	Herb	Medicinal
173.	Aztec tobacco	*Nicotiana rustica* L.	Solanaceae	Peru	Herb	Medicinal
174.	Tobacco	*Nicotiana tabacum* L.	Solanaceae	Bolivia	Herb	Dried and cured leaves are processed into cigarettes, cigars.
175.	Kalonji	*Nigella sativa* L.	Ranunculaceae	Romania to W. & SW. Iran	Herb	Medicinal seeds are used as spices in cooking.
176.	Sweet Basil	*Ocimum basilicum* L.	Lamiaceae	Tropical America	Herb	Medicinal
177.	Prickly Pear	*Opuntia elatior* Mill.	Cactaceae	Tropical America	Shrub	Medicinal
178.	Prickly pear	*Opuntia ficus-indica* (L.) Mill.	Cactaceae	Mexico	Shrub	Medicinal
179.	Erect Prickly Pear	*Opuntia stricta* (Haw.) Haw.	Cactaceae	Tropical America	Herb	Medicinal
180.	Creeping woodsorrel	*Oxalis corniculata* L.	Oxalidaceae	Europe	Herb	Medicinal
181.	Pink woodsorrel	*Oxalis debilis* Kunth	Oxalidaceae	Central America to Guyana and Paraguay	Herb	Leaves are edible.
182.	Jerusalem thorn	*Parkinsonia aculeata* L.	Fabaceae	Mexico to N. Argentina, Caribbean	Shrub	Medicinal
183.	Carrot Weed	*Parthenium hysterophorus* L.	Asteraceae	Central America	Herb	Medicinal
184.	Dalla Grass	*Paspalum dilatatum* Poir.	Poaceae	Tropical America	Herb	Fodder
185.	Passion fruit	*Passiflora edulis* Sims	Passifloraceae	Brazil to NE. Argentina	Herb	Fruits are edible.
186.	Purple passionflower	*Passiflora incarnata* L.	Passifloraceae	Central & E. U.S.A., Bermuda	Herb	Medicinal
187.	Corky passion vine	*Passiflora suberosa* L.	Passifloraceae	Tropical & Subtropical America	Herb	Medicinal
188.	Egyptian Starflower	*Pentas lanceolata* (Forssk.) Deflers	Rubiaceae	Ethiopia to Mozambique, Comoros, Arabian Peninsula	Shrub	Ornamental garden plant.
189.	Pepper elder	*Peperomia pellucida* (L.) Kunth	Piperaceae	Tropical & Subtropical America, Tropical Africa, Madagascar	Herb	Medicinal
190.	Barbados gooseberry	*Pereskia aculeata* Mill.	Cactaceae	Panama to S. Tropical America	Tree	High protein leafy vegetable.
191.	Bearded knotweed	*Persicaria barbata* (L.) H. Hara	Polygonaceae	S.E. Asia	Herb	Medicinal
192.	Chinese Knotweed	*Persicaria chinensis* (L.) H. Gross	Polygonaceae	Tropical & Subtropical Asia	Herb	Medicinal
193.	Water Pepper	*Persicaria hydropiper* (L.) Delarbre	Polygonaceae	S.E. Asia	Herb	Medicinal
194.	Purple Wreath	*Petrea volubilis* L.	Verbenaceae	Tropical & Subtropical America	Liana	Medicinal
195.	Mung Bean	*Phaseolus aureus* Roxb.	Fabaceae	Tropical America	Herb	Tender shoots are cooked as vegetables; Pulse.

196.	Gulf Leaf Flower	*Phyllanthus fraternus* G.L. Webster	Phyllanthaceae	Tropical America	Herb	Medicinal
197.	Mountain Coffee Bush	*Phyllanthus vitis-idaea* (Burm.f.) J. Koenig ex Roxb.	Phyllanthaceae	West Indies	Shrub	Medicinal
198.	Cutleaf Ground Cherry	*Physalis angulata* L.	Solanaceae	Tropical America	Herb	Medicinal
199.	Gunpowder Plant	*Pilea microphylla* (L.) Liebm.	Utricaceae	Tropical America	Herb	Medicinal
200.	Water Lettuce	*Pistia stratiotes* L.	Araceae	Tropical America	Herb	Medicinal
201.	Madras Thorn	*Pithecellobium dulce* (Roxb.) Benth.	Fabaceae	Tropical America	Tree	Medicinal
202.	White Frangipani	*Plumeria alba* L.	Apocynaceae	Puerto Rico to Windward Islands	Tree	Ornamental garden plant; medicinal.
203.	Red Frangipani	*Plumeria rubra* L.	Apocynaceae	Mexico to Venezuela	Tree	Ornamental garden plant; medicinal.
204.	Water Hyacinth	*Pontederia crassipes* Mart.	Pontederiaceae	Tropical America	Herb	Used for making handicrafts.
205.	Arrow leaf pondweed	*Pontederia hastata* L.	Pontederiaceae	Tropical America	Herb	Used for making handicrafts.
206.	Oval Leaf Pondweed	*Pontederia vaginalis* Burm.f.	Pontederiaceae	Tropical America	Herb	Medicinal
207.	Moss rose	*Portulaca grandiflora* Hook.	Portulacaceae	Peru to Brazil and Argentina	Herb	Ornamental garden plant
208.	Common purslane	*Portulaca oleracea* L.	Portulacaceae	Macaronesia, Africa, E. Central & S. Europe to Pakistan and Arabian Peninsula	Herb	Cooked as leafy vegetables.
209.	Hairy pigweed	*Portulaca pilosa* L.	Portulacaceae	Central & S. U.S.A. to Tropical & Subtropical America	Herb	Medicinal
210.	Peach	*Prunus persica* (L.) Batsch	Rosaceae	N. Central China	Tree	Fruits are edible.
211.	Guava	*Psidium guajava* L.	Myrtaceae	Peru	Tree	Fruits are edible.
212.	Pomegranate	*Punica granatum* L.	Lythraceae	NE. Türkiye to W. & N. Pakistan	Tree	Fruits are edible.
213.	Orange Trumpet Vine	*Pyrostegia venusta* (Ker Gawl.) Miers	Bignoniaceae	Mexico to S. Tropical America	Liana	Ornamental garden plant.
214.	Castor bean	*Ricinus communis* L.	Euphorbiaceae	NE. Africa	Shrub	Castor oil plant.
215.	Bloodberry	*Rivina humilis* L.	Petiveriaceae	Tropical & Subtropical America	Herb	Ornamental garden plant.
216.	Popping Pod	*Ruellia tuberosa* L.	Acanthaceae	Tropical S. America	Herb	Medicinal
217.	Firecracker plant	*Russelia equisetiformis* Schltdl. & Cham.	Plantaginaceae	Mexico	Shrub	Ornamental landscaping plant.
218.	Thatch Grass	*Saccharum spontaneum* L.	Poaceae	Tropical West Asia	Herb	Used for making handicrafts.
219.	Giant Salvinia	*Salvinia molesta* D.S.Mitch.	Salviniaceae	Tropical America	Herb	Fodder
220.	Brazilian Fern Tree	*Schizolobium parahyba* (Vell.) S.F. Blake	Fabaceae	S. Mexico to S. Tropical America	Tree	Timber
221.	Sweet Broom Weed	*Scoparia dulcis* L.	Plantaginaceae	Tropical America	Herb	Medicinal
222.	Candle Bush	*Senna alata* (L.) Roxb.	Fabaceae	West Indies	Shrub	Medicinal
223..	November Shower	*Senna multijuga* (Rich.) H.S. Irwin & Barneby	Fabaceae	America, Malaysia	Tree	Ornamental landscaping plant.
224.	Coffee Senna	*Senna occidentalis* (L.) Link	Fabaceae	South America	Tree	Medicinal
225.	Sophera Senna	*Senna sophera* (L.) Roxb.	Fabaceae	Tropical South America	Herb	Medicinal
226.	Vegetable Humingbird	*Sesbania grandiflora* (L.) Poir.	Fabaceae	Tropical America	Tree	Flowers are cooked as vegetable.
227.	Common wirewood	*Sida acuta* Burm.f.	Malvaceae	Tropical America	Herb	Plants are used as broom.
228.	Devil's-fig	*Solanum asperolanatum* Ruiz & Pav.	Solanaceae	Mexico to Guatemala, W. South America	Shrub	Medicinal
229.	Black Nightshade	*Solanum nigrum* L.	Solanaceae	Tropical America	Herb	Medicinal
230.	Sticky Nightshade	*Solanum sisymbriifolium* Lam.	Solanaceae	S. America	Herb	Medicinal
231.	Turkey berry	*Solanum torvum* Sw.	Solanaceae	Mexico to N. South America, Caribbean, E. Brazil	Shrub	Fruits are cooked as vegetables.
232.	Tropical Soda	*Solanum viarum* Dunal	Solanaceae	Tropical America	Herb	Medicinal

	Apple					
233.	Thorny Nightshade	*Solanum virginianum* L.	Solanaceae	Tropical America	Shrub	Medicinal
234.	Sow Thistle	*Sonchus oleraceus* L.	Asteraceae	Mediterranean	Herb	Tender leaves are cooked as vegetables.
235.	Shaggy Buttonweed	*Spermacoce hispida* L.	Rubiaceae	Tropical America	Herb	Medicinal
236.	African Tulip Tree	*Spathodea campanulata* P. Beauv.	Bignoniaceae	W. Tropical Africa to Uganda and Angola	Tree	Medicinal
237.	Chinese Wedelia	*Sphagneticola calendulacea* (L.) Pruski	Asteraceae	S.E. Asia	Herb	Medicinal
238.	Blue Porterweed	*Stachytarpheta jamaicensis* (L.) Vahl	Verbenaceae	Tropical America	Herb	Medicinal
239.	Big-leaf mahogany	*Swietenia macrophylla* King	Meliaceae	Mexico to Bolivia and Brazil	Tree	Timber
240.	Mahogany	*Swietenia mahagoni* (L.) Jacq.	Meliaceae	S. Florida to Caribbean	Tree	Timber
241.	Cinderella Weed	*Synedrella nodiflora* (L.) Gaertn.	Asteraceae	West Indies	Herb	Medicinal
242.	Pink Trumpet Tree	*Tabebuia heterophylla* (DC.) Britton	Bignoniaceae	Caribbean	Tree	Timber
243.	Marigold	*Tagetes erecta* L.	Asteraceae	Mexico to Guatemala	Herb	Ornamental garden plant.
244.	Tamarind	*Tamarindus indica* L.	Fabaceae	Comoros, Madagascar	Tree	Fruits are edible.
245.	Yellow Bells	*Tecoma stans* (L.) Juss. ex Kunth	Bignoniaceae	Tropical & Subtropical America	Shrub	Ornamental landscaping plant.
246.	Common Tephrosia	*Tephrosia purpurea* Pers.	Fabaceae	Tropical America	Herb	Medicinal
247.	Wishbone Flower	*Torenia fournieri* Linden ex Fourn.	Linderniaceae	Australia	Herb	Ornamental landscaping plant.
248.	Water Chestnut	*Trapa natans* L.	Lythraceae	Europe	Herb	Fruits are edible.
249.	Chinese tallow tree	*Triadica sebifera* (L.) Small	Euphorbiaceae	Central & S. China to Vietnam and Temp. E. Asia	Tree	Medicinal
250.	Burr Bush	*Triumfetta rhomboidea* Jacq.	Malvaceae	Tropical America	Herb	Medicinal
251.	Indian Charcoal Tree	*Trema orientale* (L.) Blume	Cannabaceae	S.E. Asia	Tree	Medicinal
252.	Tridax Daisy	*Tridax procumbens* L.	Asteraceae	Tropical America	Herb	Medicinal
253.	Yellow Alder	*Turnera ulmifolia* L.	Passifloriaceae	Tropical America	Herb	Medicinal
254.	Lesser Indian Reedmace	*Typha domingensis* Pers.	Typhaceae	Tropical America	Herb	Used for making handicrafts.
255.	Caesarweed	*Urena lobata* L.	Malvaceae	Tropical America	Herb	Medicinal
256.	Mimosa Bush	*Vachellia farnesiana* (L.) Wight & Arn.	Fabaceae	Tropical America	Tree	Commercial perfumery.
257.	Lentil	*Vicia lens* (L.) Coss. & Germ.	Fabaceae	W. Medit., Iraq to W. Himalaya	Herb	Cooked as leafy vegetables.
258.	Wild Moong	*Vigna radiata* var. *sublobata* (Roxb.) Verdc.	Fabaceae	S.E. Asia	Herb	Pulse
259.	Common Cocklebur	*Xanthium strumarium* L.	Asteraceae	Tropical America	Herb	Medicinal
260.	Oriental Hawkweed	*Youngia japonica* (L.) DC.	Asteraceae	S. America	Herb	Medicinal

The present study documents a total of 260 invasive alien plant species, representing 192 genera and 61 families, from West Bengal. Of the 260 invasive alien plant species recorded from West Bengal, 259 species representing 191 genera and 60 families belong to the angiosperms, while only one species, *Salvinia molesta* D. S. Mitch., representing a single genus and family, belongs to the pteridophytes. Among the angiosperms, dicotyledons constitute the dominant group, comprising 236 species under 173 genera and 53 families, whereas monocotyledons are represented by 23 species belonging to 18 genera and 7 families (Figure 1). Thus, dicotyledons account for approximately 91% of the total invasive alien flora, while monocotyledons contribute only 9%, indicating a pronounced dominance of dicotyledonous taxa in the invasive flora of the state.

Family-wise analysis revealed that Fabaceae is the most species-rich and genus-rich family (Figure 2), represented by 34 species under 28 genera, followed by Asteraceae (23 species, 23 genera), Poaceae (15 species, 12 genera), Malvaceae (14 species, 11 genera), Amaranthaceae (14 species, 7 genera), Euphorbiaceae (13 species, 7 genera), and Solanaceae (13 species, 5 genera). The predominance of Fabaceae and Asteraceae is likely attributable to their broad ecological adaptability, efficient reproductive strategies, high seed production, and effective dispersal mechanisms, all of which facilitate their successful establishment and spread across a wide range of habitats.

Analysis of growth forms indicated that herbs constitute the largest proportion of the invasive alien flora (Figure 3), accounting for 60% of the total species, followed by trees (18%), shrubs (15%), climbers (4%), bamboos (2%), and lianas (1%). The dominance of herbaceous species suggests

that short life cycles, rapid growth, prolific seed production, and efficient dispersal enable these plants to colonize disturbed habitats more successfully than woody species. The comparatively lower representation of shrubs, trees, climbers, lianas, and bamboos may reflect their relatively longer establishment periods and more specific habitat requirements. Overall, the observed taxonomic and life-form composition indicates that the invasive alien flora of West Bengal is predominantly composed of fast-growing herbaceous dicotyledonous species, which possess high ecological plasticity and competitive ability, enabling them to invade a wide range of natural and anthropogenically disturbed ecosystems.

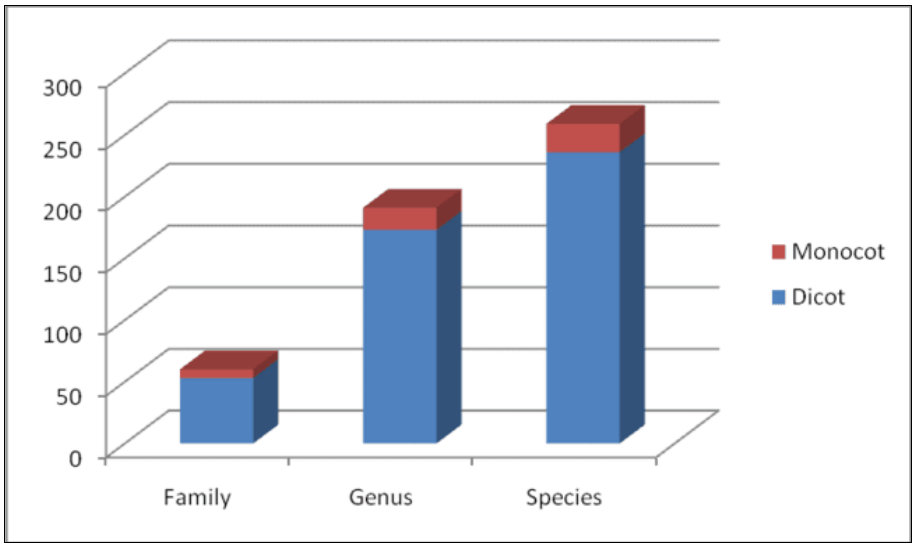

Fig 1: Distribution of Dicot and Monocot species

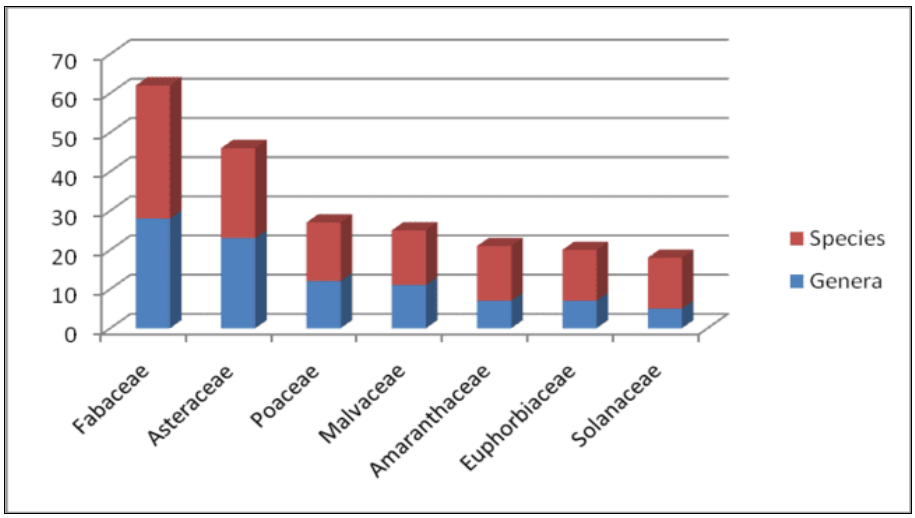

Fig 2: Dominat Angiosperm Plant Families

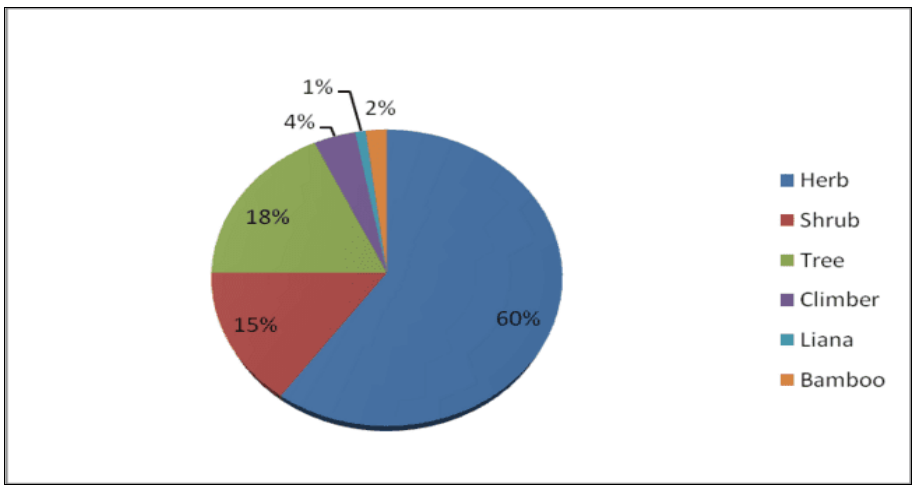

Fig 3: Different habits of Invasive Plant Species

Species such as *Lantana camara* L., *Parthenium hysterophorus* L., *Chromolaena odorata* (L.) R.M. King & H. Rob., *Mikania micrantha* Kunth, *Pontederia crassipes* Mart., and *Ageratum conyzoides* L. are now widespread and have caused significant ecological and economic impacts. These species were recorded from both forest-edge habitats and the interior of forests, indicating their successful establishment across a range of forest environments. There are several invasive alien plant species recorded from West Bengal possess significant economic potential despite their well-documented adverse effects on native biodiversity and ecosystem functioning. These species are utilized in a variety of sectors, including traditional medicine, handicrafts, paper and pulp production, biomass energy, organic farming, phytoremediation, and the manufacture of value-added products. Their utilization can contribute to biomass management and provide alternative livelihood opportunities, particularly for rural communities. However, any commercial exploitation of invasive alien plants should be integrated with appropriate management strategies to prevent their intentional cultivation, propagation, or further spread into uninvaded areas. Sustainable utilization should therefore be viewed as a complementary management approach rather than a means of promoting these species. The major commercially useful invasive alien plant species recorded from West Bengal, along with their principal uses and potential industrial applications, are presented in Table 2.

The history of invasive alien plant introductions in India demonstrates how several species, initially introduced for ornamental purposes, subsequently escaped cultivation and became widespread invaders. A notable example is *Lantana camara* L., which was introduced into India in 1807 as an ornamental hedge plant at the Royal Botanic Garden, Calcutta (now the Acharya Jagadish Chandra Bose Indian Botanic Garden) (Hakimuddin, 1929 [3] Kohli *et al*., 2006 [11] Owing to its colourful inflorescences, prolonged flowering period, and ease of cultivation, the species gained popularity and was extensively planted in gardens, parks, estates, and along roadsides. Over time, however, it escaped cultivation and spread rapidly into natural and semi-natural ecosystems through prolific seed production, efficient dispersal by birds and mammals, and its remarkable ecological adaptability. Today, *L. camara* has become fully naturalized throughout India and is regarded as one of the country's most aggressive invasive alien plant species, colonizing roadsides, railway embankments, forest margins, open woodlands, abandoned agricultural lands, and other disturbed habitats. A similar invasion history is observed in *Pontederia crassipes* Mart. (formerly *Eichhornia crassipes*), which was introduced into Bengal (present-day West Bengal and Bangladesh) around 1890 and was first cultivated in the Royal Botanic Garden, Calcutta (Morgan, 2017 [14]). Its striking lavender flowers and ornamental appeal encouraged its widespread distribution by horticultural enthusiasts into private gardens across East Bengal. During the late nineteenth and early twentieth centuries, the species escaped cultivation and rapidly invaded ponds, lakes, rivers, canals, and wetlands throughout the region (Wilson *et al*. 2005 [30]). Its extraordinary invasive success has been attributed to rapid vegetative multiplication through stolons, prolific biomass production, and the formation of persistent seed banks, with seeds remaining viable for more than 28 years (Patel, 2012 [20]). These historical accounts clearly illustrate that the introduction of exotic ornamentals through botanical gardens and horticultural practices, although undertaken with aesthetic and economic intentions, inadvertently created pathways for biological invasions.

The Government of West Bengal has also undertaken several measures to manage invasive aquatic weeds, particularly *P. crassipes*, in wetlands, rivers, canals, and irrigation systems. Management practices primarily include the mechanical removal of dense infestations by municipal bodies, irrigation authorities, and local self-government institutions to maintain water flow, navigation, fisheries, and ecosystem services. In selected wetlands, periodic manual harvesting involving local communities has also been adopted to reduce weed biomass. Furthermore, wetland conservation programmes and restoration initiatives implemented through state agencies emphasize the removal of invasive aquatic vegetation as part of integrated ecosystem management. Public awareness campaigns and community participation have increasingly been encouraged to improve the long-term effectiveness of invasive species management.

The concept of "Wetland Eco-Industrialization" has emerged as an innovative and sustainable approach for managing invasive aquatic weeds by converting their biomass into economically valuable products. Under this model, Pontederia crassipes Mart. (water hyacinth), together with other invasive aquatic macrophytes, is harvested from wetlands and transformed into a wide range of marketable commodities, thereby simultaneously reducing weed infestation, restoring wetland health, and generating livelihood opportunities for local communities. This approach has been recognized as an effective nature-based solution that links ecological restoration with rural entrepreneurship and circular bioeconomy principles. A notable example is the voluntary organization 'Bengal Eco-Craft', which has been operating in Kolkata and the Nadia district of West Bengal since November 2019 (Mukherjee *et al*. 2025 [15, 16]). The organization utilizes harvested water hyacinth to manufacture a variety of eco-friendly products, including Rakhi, badges, ropes, handbags, purses, mats, brooms, handicrafts, and decorative items, while the residual biomass is utilized as green manure and fuel, creating additional economic value (Shil & Maurya, 2021 [26]). Such initiatives demonstrate that the sustainable utilization of invasive alien plants can contribute to wetland restoration, waste biomass management, employment generation, and income diversification without encouraging their deliberate cultivation.

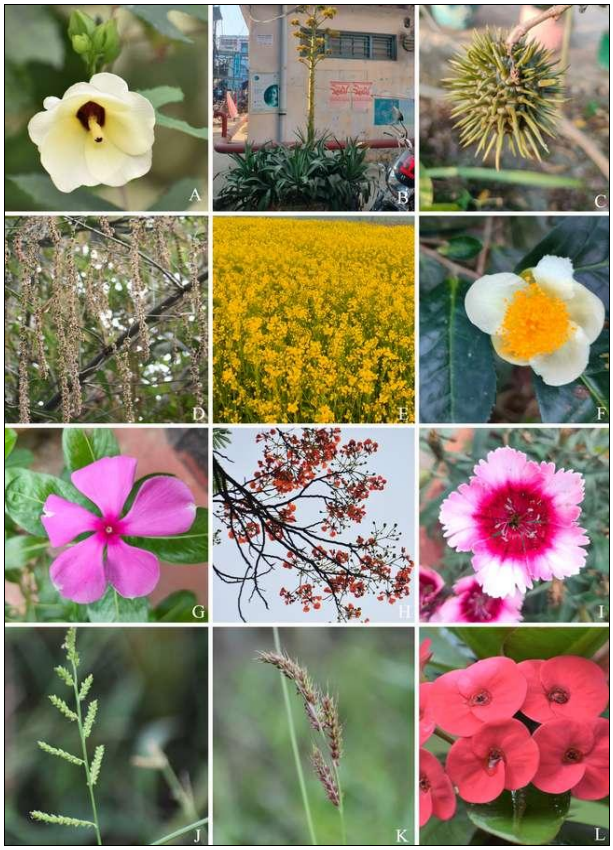

Plate 1: A. Abelmoschus esculentus (L.) Moench B. Agave americana L. C. Allamanda cathartica L. D. Bambusa vulgaris Nees E. Brassica rapa L. F. Camellia sinensis (L.) Kuntze G. Catharanthus roseus (L.) G. Don H. Delonix regia (Bojer) Raf. I. Dianthus chinensis L. J. Echinochloa colona (L.) Link K. Echinochloa crus-galli L. L. Euphorbia milii Des Moul.

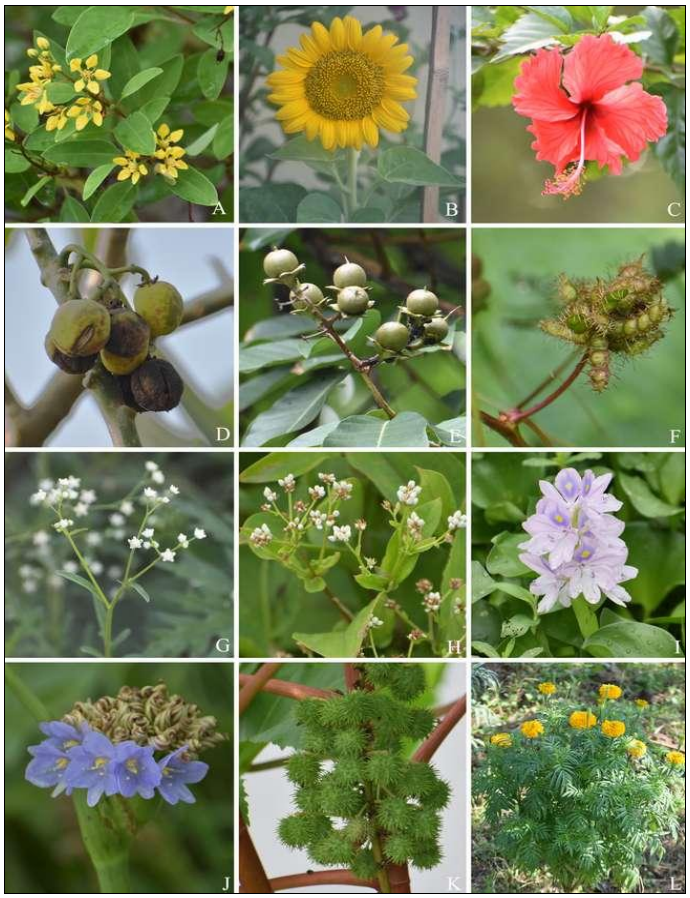

Plate 2: A. Galphimia gracilis Bartl. B. Helianthus annuus L. C. Hibiscus rosa-sinensis L. D. Jatropha curcas L. E. Lagerstroemia indica L. F. Mimosa pudica L. G. Parthenium hysterophorus L. H. Persicaria chinensis (L.) H.Gross I. Pontederia crassipes Mart. J. Pontederia hastata L. K. Ricinus communis L. L. Tagetes erecta L.

Table 2: List of Invasive species used for commercial purposes.

Sl No.	Invasive Species	Commercial Uses	Potential industries
1.	*Ageratum conyzoides* L.	Essential oil, traditional medicine, botanical insecticide.	Herbal medicine, essential oil industry.
2.	*Alternanthera philoxeroides (*Mart.) Griseb.	Compost, biogas feedstock.	Organic farming.
3.	*Amaranthus spinosus* L.	Leafy vegetable (young shoots), medicinal preparations.	Local vegetable markets, herbal medicine.
4.	*Argemone mexicana* L.	Medicinal alkaloids (industrial research), bioactive compounds.	Pharmaceutical research.
5.	*Chromolaena odorata* (L.) R. M. King & H. Rob.	Organic manure, compost, green mulch, medicinal products (traditional), biopesticide research.	Organic agriculture, herbal products.
6.	*Ipomoea carnea* Jacq.	Handmade paper, fibre board, biogas, compost.	Paper and biomass industry.
7.	*Lantana camara* L.	Furniture, handicrafts, baskets, decorative articles, bio-briquettes, charcoal.	Handicraft, furniture, biomass energy.
8.	*Leucaena leucocephala* (Lam.) de Wit	Fuelwood, charcoal, timber, pulpwood, fodder (processed), green manure.	Paper, biomass energy, agroforestry.
9.	*Mikania micrantha* Kunth	Compost, vermicompost, green manure, biogas substrate.	Organic farming, renewable energy.
10.	*Parthenium hysterophorus* L.	Vermicompost (after proper treatment), biochar, paper pulp (experimental), enzyme production.	Organic manure, bioenergy, biotechnology.
11.	*Pontederia crassipes* Mart.	Handicrafts, mats, baskets, ropes, paper pulp, compost, vermicompost, biogas, bioethanol, phytoremediation	Cottage industry, paper, biofuel, organic farming.

Conclusion

The invasion of exotic plant species has emerged as a major global environmental issue, posing serious threats to natural vegetation, biodiversity, ecosystem functioning, and agricultural systems. The establishment and spread of alien plant species are governed by a complex interplay of ecological, biological, and anthropogenic factors. To explain the mechanisms responsible for the successful invasion of exotic plants, numerous hypotheses have been proposed, each emphasizing different aspects of the invasion process. Raising public awareness is essential for addressing environmental change and biodiversity loss. Greater emphasis should be placed on educating communities about sustainable land-use practices and the ecological and economic impacts of invasive alien plant species on native flora, biodiversity, and ecosystem stability. Despite these efforts, the persistent spread of invasive alien plants necessitates more comprehensive and science-based management strategies. Strengthening risk assessment protocols before introducing non-native ornamental and horticultural species, promoting ecological restoration using native plant species following weed removal, and integrating biological, mechanical, and habitat-based control methods are essentials.

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