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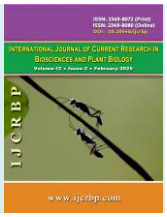

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Studies on Invasive Allien Species of Wetlands of Eastern Uttar Pradesh, India

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Abstract

Invasive alien plant species are commonly exposed to attack and recognized as pressures moving the ecosystem properties and enemy with natural flora of wetlands. During the inspection of a total of 78 invasive alien species belonging to 60 genera under 28 families were recorded. The dicots represented by 68 species and monocots represented by 10 species among these 90% of herbs, 9% of shrubs and 1% small tree. Asteraceae was the most dominant family with 14 species followed by Amaranthaceae of 8 species, Malvaceae of 7 species, Solanaceae of 6, Euphorbiaceae of 5, Cyperaceae of 5, Fabaceae of 4, Poaceae of 3 and Apiaceae of 2 etc. On the basis of their nativity of all the taxa have been categorised into major groups viz., America, Australia. Africa, Asia, Brazil, China, Europe, Eurasia, Mediterrenian and Mexico etc. The present study deals with inclusive list and status of invasive plant species of Eastern Uttar Pradesh along with their life form, nativity, uses, habitat, categories etc.

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Introduction

Invasive alien species are introduced consciously exterior their natural territories into new areas where they express the competence to launch, occupy and out contest native species (Sujay et al 2010, Pant and Sharma 2010, McGeoch et al 2010). In current centuries, the tricky of invasive aliens has fascinated abundant consideration both at the international and national levels (Nair, 1988; Drake *et al.,* 1989; Muniappan & Viraktamath, 1993; Mantri *et al.,2002;* Kohli *et al.,* 2004; Sharma *et al.,* 2005; Rai and Gaur, 2006; Khuroo *et al.,* 2007; Reddy, 2008). Most of the proposed herbaceous and shrubs by plants multiply in a limited period of time and finish the widespread and native flora (Negi and Hajra 2007). Humans are core course for both intentional and unintentional overview of alien plant species and they reach high masses and biomass (Hurka et al 2003, Parthasarathy et al 2012). Invasion by exotic plant species is one of the major causes and harm of biodiversity (Richardson et al 2000). Thus, invasive plant species are a serious obstruction for conservation and sustainable usage of biodiversity. The International Union for Conservation of Nature and Natural Resources (IUCN) defines "invasive alien species" as an alien species which becomes recognized in natural or seminatural ecosystems as mediator of modification and appal native plant diversity. Invasion of alien species in current times has been recognized as the second nastiest risk after environment destruction.

Identifying the progressions that determine the circulation and variety of exoti plant species is a main area of research in plant taxonomy because exotics execute important economic, social, and environmental costs, including people fitness. This paper presents observations on the habit and nativity of invaders of eastern Uttar Pradesh and their impact on the diversity of native plants.

Materials and methods

Study area

The eastern part of Uttar Pradesh has been considered as a structural thing on the basis of topography, climate, soil, geography and sociocultural shape. It is one of the richest and exciting regions and has quite varied flora. The area is surrounded by Bihar in the east, Madhya Pradesh in the south, Banda, Fatehpur, Unnao, Lucknow, Barabanki, Bahraich, and Sravasti district of Uttar Pradesh in the west and Nepal in the north. It lies between about 23º 52′ N to 27º N latitude and about 82º E to 84º 39′ E longitude. However, some regions of Mirzapur and Sonbhadra range from 300-600m. The studied area is spread over 83,845 km^2 which comprises 26 districts viz. Sonbhadra, Mirzapur, Allahabad, Kausambi, Sant Ravi Das Nagar, Jaunpur, Chandauli, Varanasi, Pratapgarh, Raebareli, Sultanpur, Faizabad, Azamgarh, Ghazipur, Ballia, Basti, Ambedkarnagar, Gonda, Siddarthnagar, Maharajganj, Kusinagar, Deoria, Sant Kabir Nagar, Gorakhpur, Mau, Balrampur are the eastern part of Uttar Pradesh (Fig:1).

Field survey

Intensive field studies were carried out to record the invasive alien plant species from May 2020 to April 2025. Plant specimens were collected and preserved as voucher specimens following standard procedures and deposited in St. Andrew's College Gorakhpur.The identification of plants was done with the help of Flora publications (Hooker 1872-1897). The invasive alien species are listed alphabetically followed by family, life-form, origin country and use values in which it occurs.

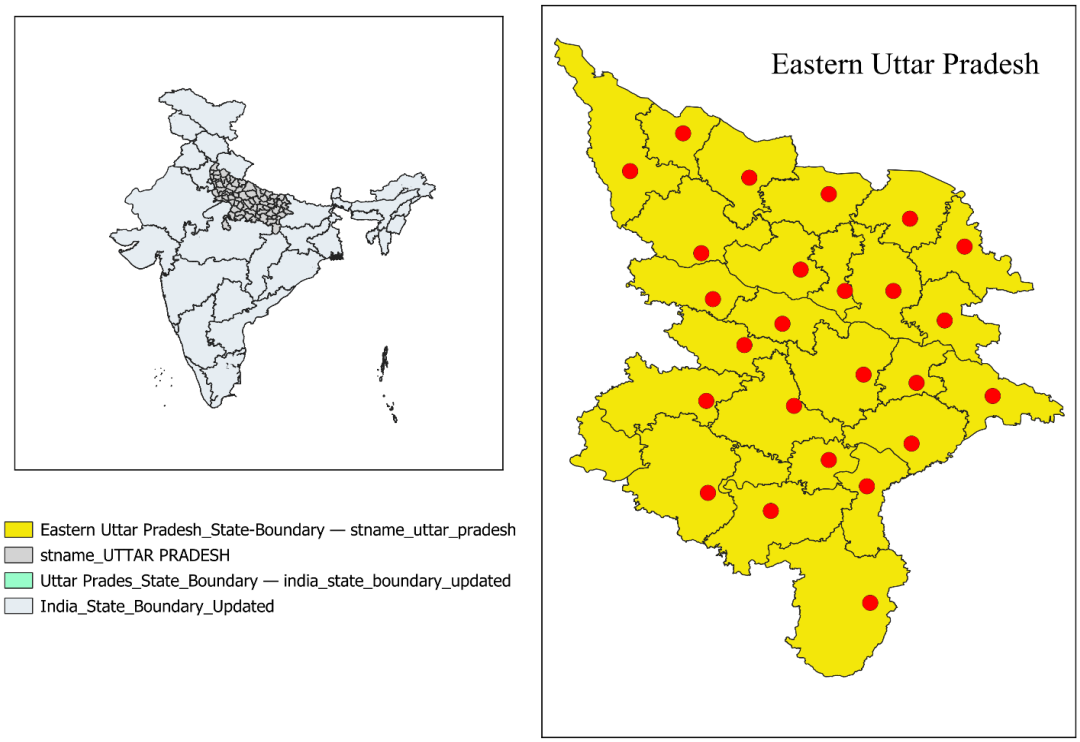

Fig.1 Study area of Eastern Uttar Pradesh

Results and discussion

A total 78 invasive alien plant species belonging to genera 60 and 28 families were recorded in the eastern uttar pradesh, (Table 1). The dicots represented by 68 species and monocots represented by 10 species among these 90% of herbs, 9% of shrubs and 1% small tree (Fig:2). Asteraceae was the most dominant family with 14 species followed by Amaranthaceae of 8 species, Malvaceae of 7 species, Solanaceae of 6, Euphorbiaceae of 5, Cyperaceae of 5, Fabaceae of 4, Poaceae of 3 and Apiaceae of 2 (Fig:3) etc. On the basis of their nativity of all the taxa have been categorised into major groups viz., America, Australia. Africa, Asia, Brazil, China, Europe, Eurasia, Mediterrenian and Mexico etc. The expansion of invasive alien species such as *Acmella uliginosa* (Sw.) Cass., *Achyranthes aspera* L., *Ageratum conyzoides* L., *Ageratum houstonianum* Mill., *Alternanthera sessilis* (L.) DC, *Alternanthera philoxeroides* (Mart.) Griseb., *Amaranthus spinous* L, *Amaranthus viridis* L., *Anagallis arvensis* L, *Argemone mexicana* L., *Berula erecta* (Huds.) Coville, *Basella alba* L., *Blumea lacera* (Burm.f.) DC., *Calotropis gigantea* (L.) Dryand., *Calotropis procera* (Aiton) W.T. Aiton, *Cannabis sativa* L., *Chenopodium album* L., *Chenopodium murale* (L.) S.Fuentes, Uotila & Borsch, *Chloris barbata* Sw, *Chrozophora tinctoria* (L.) A. Juss., *Cleome viscosa* L., *Cleome gynandra* L. , *Corchorus fascicularis* L., *Corchorus oliotorius* L., *Croton bonplandianus* Baill., *Cuscuta reflexa Roxb.*, *Cynodon dactylon (L.) Pers.*, *Cyperus difformis L.*, *Cyperus flabelliformis Rottb.*, *Cyperus iria L.*, *Cyperus cyperinus (Retz.) Valck.Sur.*, *Cyperus rotundus L.*, *Datura metel L.*, *Datura stramonium L*, *Digera muricata (L.) Mart.*, *Eclipta prostrata* L., *Eichhornia crasipes* (Mart.) Solms, *Erigeron bonariensis* L., *Erigeron canadensis* L., *Euphorbia hirta* L., *Euphorbia prostrata* Aiton, *Gnaphalium affine* D.Don, *Grangea maderaspatana* (L.) Poir., *Heliotropium indicum* L., *Lantana camara* L., *Lippia alba* (Mill.) N.E. Br., *Ludwigia adscendens* L H.Hara., *Ludwigia octovalvis* (Jacq) P.H. Raven, *Malvastrum coromandelianum* (L.) Garcke, *Mecardonia procambens* (Mill.) Small, *Melochia corchorifolia* L., *Mimosa pudica* L, *Nicotiana plumbiginifolia* Viv., *Oenanthe javanica* (Blume) DC., *Oldenlandia corymbosa* L., *Ocimum tenuiflorum* L., *Oxalis corniculata* L., *Parthenium hysterophorus* L., *Physalis minima* L., *Physalis pruinosa* L., *Pistia stratiotes* L., *Portulaca oleracea* L., *Portulaca quadrifida* L., *Ricinus communis* L., *Ruellia tuberosa* L., *Rumex dentatus* L., *Saccharum spontaneum* L. *Senna occidentalis* (L.) Link, *Senna tora* (L.) Roxb., *Sesbania bispinosa* (jocq.) W.Wight , *Sida acuta* Burm.f., *Sida cordifolia L.*, *Solanum nigrum* L. , *Soliva anthemifolia* (Juss.) Sweet, *Sonchus arvensis* L., *Tridax procumbens* L, *Urena lobata* L., *Xanthium strumarium* L. etc. Majority of the invasive alien species recorded in the Eastern Uttar Pradesh, have use values for peoples. Plants parts uses values reported from included medicinal, fodder, ornamental, vegetable, fuel wood, fibre, edible, timber and manure. According to Prakash and Balasubramanian (2018) also reported that most of the invasive alien species are used in various purposes in the nearest area.

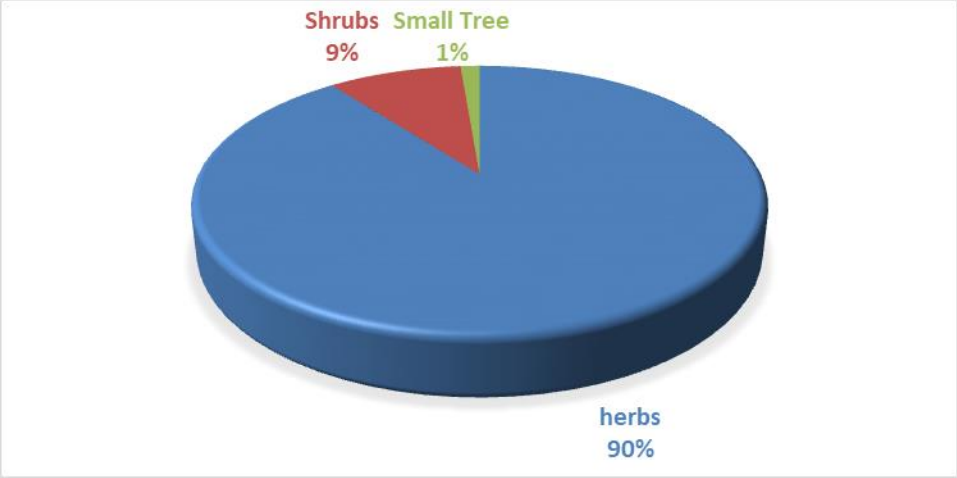

Fig. 2: Habit representation of IAS of Eastern U.P..

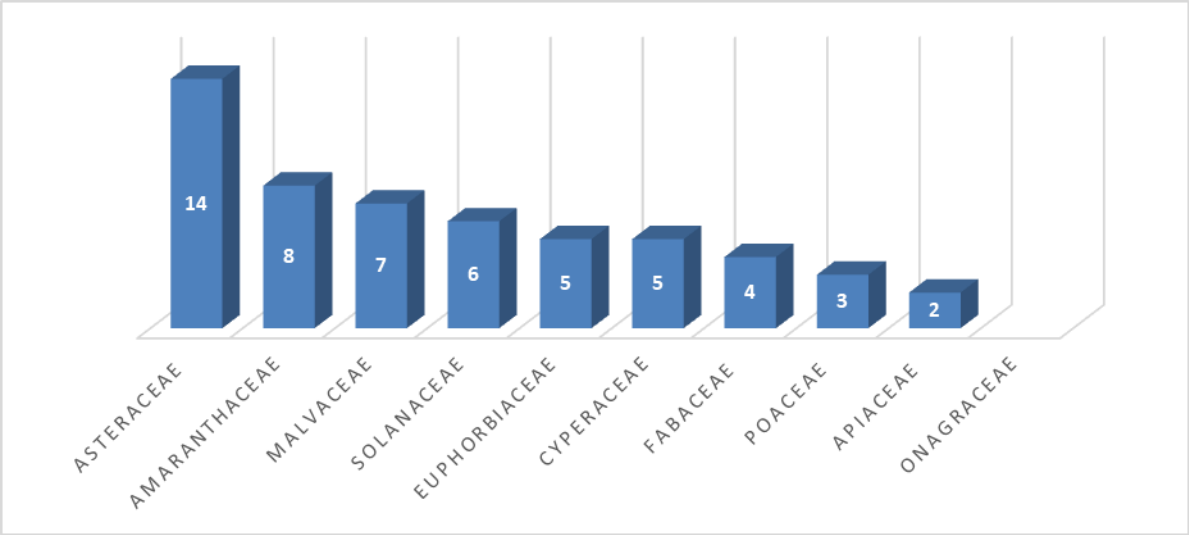

Fig. 3: Top 10 IAS Family Dominant in Eastern Uttar Pradesh

Table:1 Invasive Allien Species of Wetlands of Eastern Uttar Pradesh

S.N.	Botanical Name	Family	Habit	Native	Invasive status
1.	*Acmella uliginosa* (Sw.) Cass.	Asteraceae	Herb	China, Philippines, India, and Africa	Naturalized
2.	*Achyranthes aspera* L.	Amaranthaceae	Herb	Tropical and subtropical region Asia and Australia	Naturalized
3.	*Ageratum conyzoides* L.	Asteraceae	Herb	Central and south America and the West Indies	Invasive
.4.	*Ageratum houstonianum* Mill.	Asteraceae	Herb	Mexico and central America	Invasive
5.	*Alternanthera sessilis* (L.) DC	Amaranthaceae	Herb	South America, Asia, Africa and Australia	Invasive
6.	*Alternanthera philoxeroides* (Mart.) Griseb	Amaranthaceae	Herb	South America	Invasive
7.	*Amaranthus spinous* L.	Amaranthaceae	Herb	Central and south America	Invasive
8.	*Amaranthus viridis* L.	Amaranthaceae	Herb	South America	Naturalized
9.	*Anagallis arvensis* L	Primulaceae	Herb	Europe, Western Asia, and North Africa	Invasive
10.	*Argemone mexicana* L.	Papaveraceae	Herb	Mexico and Central America	Invasive
11.	*Berula erecta* (Huds.) Coville	Apiaceae	Herb	Europe, Asia and North America	Invasive
12.	*Basella alba* L.	Basellaceae	Herb	Tropical Asia and Srilanka	Invasive
13.	*Blumea lacera* (Burm.f.) DC.	Asteraceae	Herb	Tropical and subtropical Asia	Naturalized
14.	*Calotropis gigantea* (L.) Dryand.	Apocynaceae	Shrubs	China and Tropical Asia	Invasive
15.	*Calotropis procera* (Aiton) W.T. Aiton	Apocynaceae	Shrubs	Northern and Tropical Africa, Western Asia, and Indochina	Naturalized and noxious
16.	*Cannabis sativa* L.	Cannabaceae	Herb	Eastern Asia	Naturalized
17.	*Chenopodium album* L.	Amaranthaceae	Herb	Europe and part of Aisa	Invasive
18.	*Chenopodium murale* (L.) S.Fuentes, Uotila & Borsch	Amaranthaceae	Herb	Europe, Asia, North Africa	Invasive
19.	*Chloris barbata* Sw.	Poaceae	Herb	Central and south America	Invasive

20.	*Chrozophora tinctoria* (L.) A. Juss.	Euphorbiaceae	Herb	Mediterranean, the middle East, India, Pakistan and Central Asia	Invasive
21.	*Cleome viscosa* L.	Cleomaceae	Herb	Tropical and subtropical region across the Africa, America and Oceania	Invasive
22.	*Cleome gynandra* L.	Cleomaceae	Herb	Sub-Saharan Africa and southest Asia	Invasive
23.	*Corchorus fascicularis* L.	Malvaceae	Herb	Tropical Africa, Arabian Peninsula, India and Northern Australia	Naturalized
24.	*Corchorus oliotorius* L.	Malvaceae	Herb	Central and South China	Naturalized
25.	*Croton bonplandianus* Baill.	Euphorbiaceae	Herb	Southern Bolivia, Paragauy, Southern Brazil, and Northern Argentina	Invasive
26.	*Cuscuta reflexa Roxb.*	Convolvulaceae	Herb	Afghanistan to Eastern China and South India	Invasive
27.	*Cynodon dactylon (L.) Pers.*	Poaceae	Herb	Europe, Africa, Australia and Asia	Invasive
28.	*Cyperus difformis L.*	Cyperaceae	Herb	Southern Europe, Africa, Asia, and Australia	Naturalized
29.	*Cyperus flabelliformis Rottb.*	Cyperaceae	Herb	Tropical Africa, Madagascar, and Arabian Peninsula	Naturalized
30.	*Cyperus iria L.*	Cyperaceae	Herb	West Africa, Central and Eastern Asia, Guinea and Australia	Invasive
31.	*Cyperus cyperinus (Retz.) Valck.Sur.*	Cyperaceae	Herb	Asia and Oceania	Invasive
32.	*Cyperus rotundus L.*	Cyperaceae	Herb	Tropical Eurasia, Africa, southern and central 33Europe and Southern Asia	Invasive
33.	*Datura metel L.*	Solanaceae	Shrubs	Southest Asia	Invasive
34.	*Datura stramonium L.*	Solanaceae	Shrubs	Central America	Invasive
35.	*Digera muricata (L.) Mart.*	Amaranthaceae	Herb	Tropical Africa and Asia	Invasive
36.	*Eclipta prostrata* L.	Asteraceae	Herb	Asia and North and South America	Nuturalized
37.	*Eichhornia crasipes* (Mart.) Solms	Pontederiaceae	Herb	South America, Amazon basin and Brazil	Invasive
38.	*Erigeron bonariensis* L.	Asteraceae	Herb	South America and tropical America	Invasive
39.	*Erigeron canadensis* L.	Asteraceae	Herb	North and Central America	Invasive
40.	*Euphorbia hirta* L.	Euphorbiaceae	Herb	Tropical and subtropical America	Invasive
41.	*Euphorbia prostrata* Aiton	Euphorbiaceae	Herb	Central and southern America	Naturalized and causal
42.	*Gnaphalium affine* D.Don	Asteraceae	Herb	South Asia	Invasive
43.	*Grangea maderaspatana* (L.) Poir.	Asteraceae	Herb	Africa, India, Srilanka, Nepal, China, and Indochina	Invasive
44.	*Heliotropium indicum* L.	Boraginaceae	Herb	Asia, Africa and America	Naturalized
45.	*Lantana camara* L.	Verbenaceae	Herb	Central and South America	Invasive
46.	*Lippia alba* (Mill.) N.E. Br.	Verbenaceae	Herb	Mexico, Caribbean, Central and North America	Invasive

47.	*Ludwigia adscendens* L H.Hara.	Onagraceae	Herb	Continental Asia, Malesia and Australia	Invasive
48.	*Ludwigia octovalvis* (Jacq) P.H. Raven	Onagraceae	Herb	Central and South America, Caribbean, Africa, Asia and Australia	Naturalized
49.	*Malvastrum coromandelianum* (L.) Garcke	Malvaceae	Herb	North and South America	Invasive
50.	*Mecardonia procambens* (Mill.) Small	Plantaginaceae	Herb	Mexico and Central and South America	Invasive
51.	*Melochia corchorifolia* L.	Malvaceae	Herb	Southeastern region of America, Africa, Asia and Australia	Invasive
52.	*Mimosa pudica* L.	Fabaceae	Herb	Tropical central and Southern America	Naturalized
53.	*Nicotiana plumbiginifolia* Viv.	Solanaceae	Herb	Mexico, South America and part of Caribbean	Invasive
54.	*Oenanthe javanica* (Blume) DC.	Apiaceae	Herb	East Asia and Australia	Invasive
55.	*Oldenlandia corymbosa* L.	Rubiaceae	Herb	Tropical Africa and Madagascar	Invasive
56.	*Ocimum tenuiflorum* L.	Lamiaceae	Herb	Tropical and subtropical region of Aisa	Invasive
57.	*Oxalis corniculata* L.	Oxalidaceae	Herb	South-east Asia and Philippines	Invasive
58.	*Parthenium hysterophorus* L.	Asteraceae	Herb	Maxico, Central and South America	Invasive
59.	*Physalis minima* L.	Solanaceae	Herb	Tropical and subtropical region of Asia including India and Australia	Invasive
60.	*Physalis pruinosa* L.	Solanaceae	Herb	Mexico and Venezuela	Invasive
61.	*Pistia stratiotes* L.	Araceae	Herb	America, Africa, and Asia	Invasive
62.	*Portulaca oleracea* L.	Portulacaceae	Herb	North Africa and India	Invasive
63.	*Portulaca quadrifida* L.	Portulacaceae	Herb	Africa and Western Asia	Invasive
64.	*Ricinus communis* L.	Euphorbiaceae	Small tree	Tropical east Africa and Ethiopia	Invasive
65.	*Ruellia tuberosa* L.	Acanthaceae	Herb	Central America and Caribbean	Invasive
66.	*Rumex dentatus* L.	Polygonaceae	Herb	Tunisia to Indochina, Eurasia and North Africa	Naturalized
67.	*Saccharum spontaneum* L.	Poaceae	Herb	Asia, Africa and Northern Australia	Invasive
68.	*Senna occidentalis* (L.) Link	Fabaceae	Herb	Mexico and South America	Invasive
69.	*Senna tora* (L.) Roxb.	Fabaceae	Herb	South America	Invasive
70.	*Sesbania bispinosa* (jocq.) W.Wight	Fabaceae	Shrubs	Asia and North Africa	Cultivated
71.	*Sida acuta* Burm.f.	Malvaceae	Herb	Central America	Invasive
72.	*Sida cordifolia L.*	Malvaceae	Herb	Africa, Asia and India	Invasive
73.	*Solanum nigrum* L.	Solanaceae	Herb	Eurasia, America, Australia and South Africa	Naturalized
74.	*Soliva anthemifolia* (Juss.) Sweet	Asteraceae	Herb	South tropical America	Invasive
75.	*Sonchus arvensis* L.	Asteraceae	Herb	Europe and Temperate Asia	Invasive
76.	*Tridax procumbens* L.	Asteraceae	Herb	Mexico, Central and South America	Invasive

77.	*Urena lobata* L.	Malvaceae	Shrubs	Tropical and subtropical region of Asia	Invasive
78.	*Xanthium strumarium* L.	Asteraceae	Shrubs	Southern Europe and Asia	Invasive

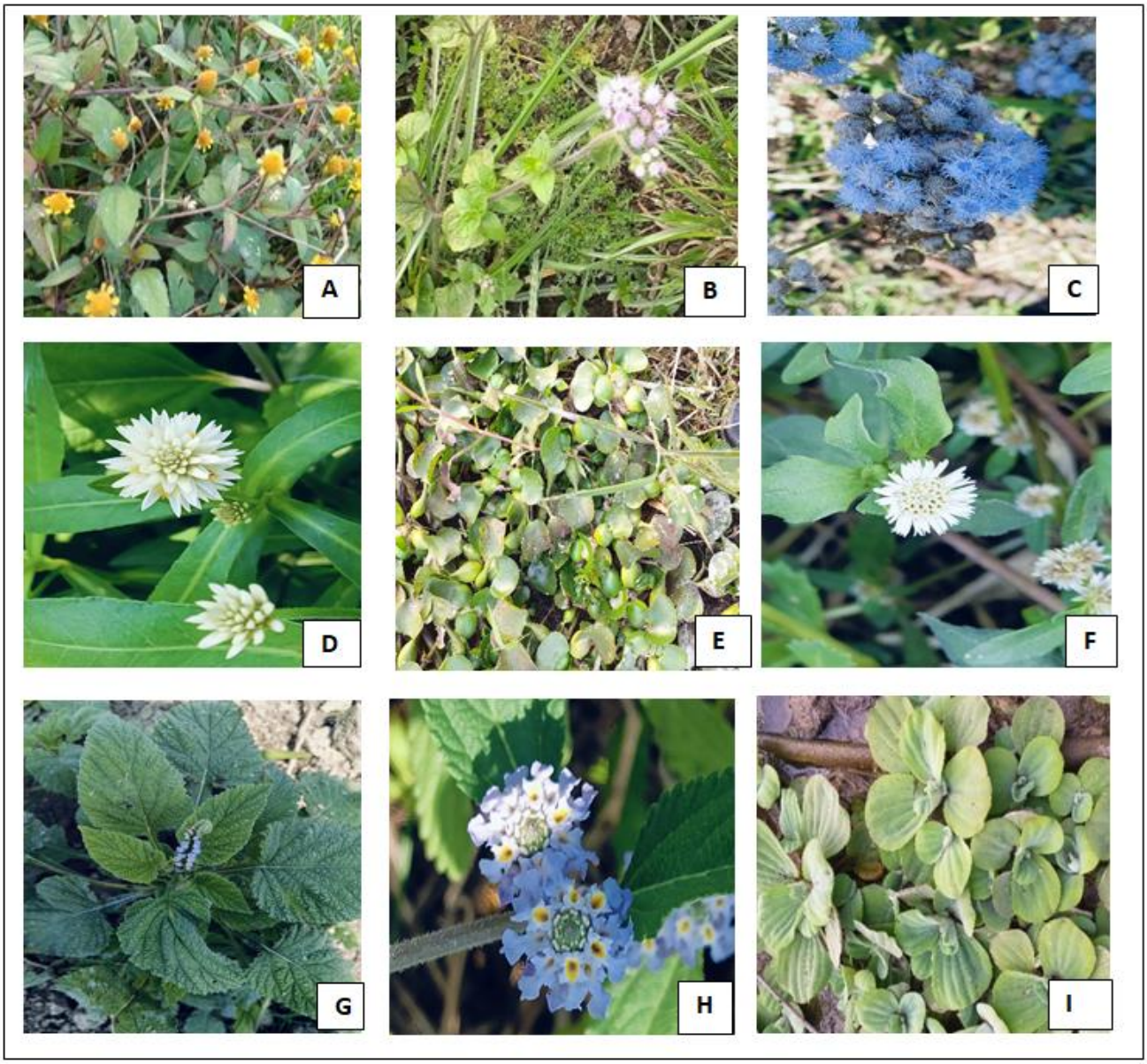

Plate: 1- A. *Acmella uliginosa* (Sw.) Cass., **B**. *Ageratum conyzoides* L., **C**. *Ageratum houstonianum* Mill., **D**. *Alternanthera philoxeroides* (Mart.), **E**. *Eichhornia crasipes* (Mart.) Solms., **F.** *Eclipta prostrata* L., **G**. *Heliotropium indicum* L., **H.** *Lippia alba* (Mill.) N.E. Br., **I**. *Pistia stratiotes* L.

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Conflict of interest statement

Authors declare that they have no conflict of interest.

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