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Diversity of Invasive alien plant species in district Yamuna Nagar of Haryana, India

Amarjit Singh* and Inam Mohammed**
**Associate Professor Department of Environmental Science*
Guru Nanak Khalsa College, Yamuna Nagar, (Haryana), INDIA
***Assistant Professor, Department of Botany*
Guru Nanak Khalsa College, Yamuna Nagar, (Haryana), INDIA

(Corresponding author: Inam Mohammed)
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ABSTRACT: A study of diversity of invasive alien plant species in district Yamuna Nagar of Haryana has been carried out from September 2014 to August 2015. During this session, a total of 148 plants were screened for their nativity, 90 species were found to be of exotic origin belonging to 77 genera and 42 families in the study area. Majority of invasive species are naturalized, followed by invasive and casual. The authors have observed and reported that anthropogenic pressure, habitat loss of native species and climate change are the main causes of invasion of these species.

Keywords: Invasion, Anthropogenic pressure, Habitat loss and Yamuna Nagar.

INTRODUCTION

Invasive species are emerging as one of the major threats to sustainable development, on par with global warming and destruction of life–support systems. These alien species come in the form of plants, animals and microbes that have been introduced into an area from other parts of the world, and have been able to displace the indigenous species (Preston and Williams, 2003). The invasive species are widely distributed among all categories of living organisms as well as all kinds of ecosystems throughout the world (Hobbs and Humphries, 1995).

Convention on Biodiversity (CBD, 2010) visualized that invasion by the exotic species is one of the leading threat to native wildlife. Several characteristics of the species help them to be invasive. Most important among them are the large quantity of seeds they produce which are mostly very small so as to be carried away to long distances by wind and water (Khare, 1980; Enserink, 1999). Many invasive plants produce allelochemicals which halt the native plants from establishing in its vicinity (Callaway and Aschehoug, 2000). Alien invasive weeds alter ecosystem processes, nutrient dynamics and natural disturbance patterns (Martin *et al*, 2010; Maguire *et al* 2011; Marwat *et al* 2010). Once the invasive weeds are established in the new region, re -establishment of native species is rarely successful (Davies and Shelley, 2011).

Botanical Survey of India (Singh *et al* 2010) identified 152 invasive alien species in Uttar Pradesh belonging to 109 genera and 44 families. Sekar (2012) prepared a comprehensive list of invasive alien plants of Indian Himalayan region with background information on family, habit and nativity. Based on field surveys and using a risk assessment protocol, Sanjeev *et al* (2012) reported 38 alien invasive species in the forests of Kerala, India. The alien flora of Himachal Pradesh comprised 497 species (Jaryan *et al* 2013). Kour *et al* (2014) dealt with the first ever inventorisation and documentation of aquatic invasive plant species of Jammu region. An exhaustive floristic survey to assess the diversity, nativity and uses of invasive alien plants was carried out by Kumar and Bihari (2015) in the Dhen-kanal district of Odisha state of India. Wagh and Jain (2015) prepared the comprehensive list and status of invasive alien species of Jhabua district of Madhya Pradesh, India, with 102 invasive alien plants belonging to 80 genera and 39 families.

MATERIAL AND METHODS

Monthly surveys were carried out within the 2 km area on the both sides of four major roads diverging from Yamuna Nagar to Kalesar, Ladwa, Thana-Chhappar and Kalanour. This area belongs to the fertile Indo-Gengetic Plains and is ecologically fragile as extensive agriculture, illegal mining and encroachments are some common features responsible for the destruction of biodiversity in this area. To document the invasion status, the alien plant species were grouped into casual (Ca), naturalized (Nt), and invasive (In) categories as proposed by Richardson *et al* (2000) and Pysek *et al* (2002, 2004).

OBSERVATIONS AND RESULTS

In the study area, a total of 148 plants were screened for their nativity.

The plants were collected and identified with the help of available literature, floras and herbarium of Forest Research Institute (DD) and Botanical Survey of India (BSD) Dehradun. Invasive plants have been arranged alphabetically with their binomial, family, local name, life form, nativity and mode of introduction. Out of 148 plants, 90 plants species were found to be of exotic origin belonging to 77 genera and 42 families. Asteraceae and Poaceae families are found to be the most dominant families with 10 species each (Table 1). A total of 90 species, 32 annual herbs, 30 perennial herbs, 7 annual shrubs, 13 perennial shrubs, 3 perennial trees, 2 annual climbers and 3 perennial climbers have been included (Table 2). In this study, most of invasive species are naturalized (55%), followed by invasive (30%) and casual (7%) (Table 3).

Table 1: Invasive alien plant species in district Yamuna Nagar of Haryana, India.

S. No.	Binomial	Family Name	Vernacular name	Growth form	Nativity	Mode of Introduction	Invasive status
1	*Adiantum capillus-veneris* L.	Pteridaceae	Hansraj	PH	Trop America	Ui	Nt
2	*Aerva lanata* (L.) A. L. Juss. ex Schultes	Amaranthaceae	Bui	PH	Africa	Ui	Nt
3	*Ageratum conyzoides* L.	Asteraceae	Jangli gobhi	PH	South America	Ui	In
4	*Alternanthera sessilis* (L.) R. Br. ex DC	Amaranthaceae	Guroo sag	PH	South America	Ui	In
5	*Anagallis arvensis* L.	Primulaceae	Phooli	AH	Europe	Ui	Nt
6	*Argemone maxicana* L.	Papaveraceae	Pili Kantili	AH	North America	Md	In
7	*Argemone ochroleuca* Sweet	Papaveraceae	Satyanasi	AH	North America	Ui	In
8	*Artemisia vulgaris* L.	Asteraceae	Nagadona	PS	America	Ui	Nt
9	*Arundo donax* L.	Poaceae	Narsal	PS	Africa / Europe	Ui	Nt
10	*Basella rubra* L.	Basellaceae	Poi	PC	East Indies	Ui	Nt
11	*Bidens pilosa* L.	Asteraceae	Spanish needle	AH	South America	Ui	In
12	*Boerhavia diffusa* L.	Nyctaginaceae	Punarva	PH	Africa	Ui	Nt
13	*Broussonetia papyrifera* (L.) L' Her. ex Vent	Moraceae	Jangli toot	PT	East Asia	In	In
14	*Calotropis gigentea* (L.) Dryand.	Apocynaceae	Safed Akh	PS	Tropical Africa	Ui	Nt
15	*Calotropis procera* (Ait.) R.Br.	Apocynaceae	Akh/ Madar	PS	Tropical Africa	Ui	Nt
16	*Cannabis sativa* L.	Cannabinaceae	Bhang	PS	Central Asia	Ui	In
17	*Cassia occidentalis* L.	Caesalpiniaceae	Kasoundhi	PS	Tropical South America	Ui	In
18	*Cassia tora* L.	Caesalpiniaceae	Panvad	PS	Tropical South America	Ui	Nt
19	*Celosia argentea* L.	Amaranthaceae	Jangli murga	AH	South America	Fd	Ca
20	*Chenopodium album* L.	Chenopodiaceae	Bathua	AH	Europe	Fd	In
21	*Chenopodium ambrosoides* L.	Chenopodiaceae	Bhangra	AH	Central America	Md	Nt
22	*Circium arvense* (L.) Scop.	Asteraceae	kandri	PH	Asia	Ui	In
23	*Cissampelos pareira* l.	Manispermaceae	Patha	PC	South America	In	Nt
24	*Cleome viscosa* L.	Capparaceae	Pili Hulhul	AH	Tropical America	Ui	Nt
25	*Coix lacryma-jobi* L.	Poaceae	Gurlu/ Moti	AS	Tropical Asia	Ui	Nt
26	*Convolvulus arvensis* L.	Convolvulaceae	Sankhpuspi	AC	Europe	Ui	Nt
27	*Corchorus acutangularis* Lam.	Tiliaceae	Jangli Jute	AS	South America	Ui	Nt
28	*Cynodon dactylon* (L.) Pers.	Poaceae	Doob Ghass	PH	Africa	Ui	In

S. No.	Binomial	Family Name	Vernacular name	Growth form	Nativity	Mode of Introduction	Invasive status
29.	*Cyperus iria* L.	Cyperaceae	Motha	PH	Asia/ Africa	Ui	Nt
30.	*Cyperus rotundus* L.	Cyperaceae	Motha	PH	Europe	Ui	In
31.	*Datura innoxia* Mill.	Solanaceae	Kala Datura	AS	South America	Ui	Ca
32.	*Datura metel* L.	Solanaceae	Safed Datura	AS	South America	Ui	Ca
33.	*Digera muricata* (L.) Mart.	Amaranthaceae	Saag Phool	AH	South West	Ui	Nt
34.	*Echinochloa colona* (L.) Link	Poaceae	Jangli Saavak	PH	Europe	Ui	Nt
35.	*Eclipta alba* (L.) Hassk.	Asteraceae	Bhringraj	AH	America	In	Nt
36.	*Eichhornia crassipes* (Mart.) Solms	Pontederiaceae	Samundrasokh	PH	South America	Ui	In
37.	*Epilobium hirsutum* L.	Onagraceae	Gulabi	AS	America	Ui	In
38.	*Equisetum giganteum* L.	Equisetaceae	Jod-Tod	PH	South America	Ui	Ca
39.	*Eupatorium odoratum* L.	Asteraceae	Bhagh dhoka	PS	North America	Ui	In
40.	*Euphorbia pilosa* L.	Euphorbiaceae	Pili mimli	PH	North Asia	Or	Nt
41.	*Galium aparine* L.	Rubiaceae	Kuri	PH	Africa	Ui	In
42.	*Gomphrena celasioides* Mart.	Amaranthaceae	Chota murga	AH	South America	Ui	Nt
43.	*Grangea madarasptana* (L.) Desf.	Asteraceae	Mundi	PH	South America	Ui	Nt
44.	*Imperata cylindrica* (L.) Raeusch	Poaceae	Dab-sui	PH	Tropical America	Ui	In
45.	Indigofera linnaei Ali	Papilionaceae	Neel	PH	Tropical Africa	Ui	In
46.	*Ipomoea fistulosa* Mart. ex Choisy	Convolvulaceae	Gulbansa	PS	South America	Ui	In
47.	*Ipomoea hederifolia* L.	Convolvulaceae	Lal bel	AC	Tropical America	Ui	Nt
48.	*Ipomoea vitifolia* (Burm. F.) Blume	Convolvulaceae	Bachaya	PC	Tropical America	Ui	Nt
49.	*Lantana camara* L.	Verbenaceae	Chamari	PS	South America	Or	In
50.	*Leucaena leucophloa* (Lam.) de Wit.	Mimosaceae	Su-Babul	PT	South America	Or	In
51.	*Malva parviflora* L.	Malvaceae	Panirak	AH	North Africa	Ui	Nt
52.	*Malvastrum coromandelianum* (L.) Garcke	Malvaceae	Jhadu ghass	PH	Tropical America	Ui	Nt
53.	*Marsilea qadrifolia* L.	Marsileaceae	Shunishamala	PH	Europe	Ui	Nt
54.	*Melilotus indicus* (L.) Ali	Papilionaceae	Ban Methi	AH	Europe	Ui	Nt
55.	*Nepeta cataria* L.	Lamiaceae	Billi Podina	PS	Europe	Ui	Nt

S.No.	Binomial	Family Name	Vernacular name	Growth form	Nativity	Mode of Introduction	Invasive status
56.	*Nicotiana plumbaginifolia* Viv.	Solanaceae	Ban Tambaku	AH	Tropical America	Ui	Nt
57.	*Oenothera rosea* L ' Her. ex Aiton	Onagraceae	Lal phool	PH	South America	Ui	Nt
58.	*Oxalis corniculata* L.	Oxalidaceae	Khatti buti	AH	Europe	Ui	Nt
59.	*Oxalis dehradunensis* Raizada	Oxalidaceae	Badi khatti Buti	AH	North America	Ui	Nt
60.	*Oxalis latifolia* Kunth	Oxalidaceae	Amlapatti	AH	North America	Ui	Nt
61.	*Panicum maximum* L.	Poaceae	Bheas ghas	AH	Africa	Fr	In
62.	*Parthenium hysterophorus* (L.) Hepper	Asteraceae	Gajar ghas	PH	South America	Ui	In
63.	*Paspalum dilatatum* Poir.	Poaceae	Chota bekas	PH	South America	Ui	Nt
64.	*Paspalum paspaloides* (Michx.) Scribn.	Poaceae	Bakas	PH	Africa	Ui	Nt
65.	*Physalis peruviana* L.	Solanaceae	Rasbari	PH	South America	Ht	In
66.	*Pilea microphylla* (L.) Liebm.	Urticaceae	Gunpowder	PH	Tropical America	Ui	Nt
67.	*Plumbago zeylanica* L.	Plumbaginaceae	Chitrak	AS	Africa	Or	Ca
68.	*Poa annua* L.	Poaceae	Nili ghass	PH	Europe	Ui	Nt
69.	*Polygonum hydropiper* L.	Polygonaceae	Geedar mirch	PS	Eurasia	Ui	In
70.	*Polypogon monspeliensis* (L.) Desf.	Poaceae	Ghass	AH	Europe	Ui	Nt
71.	*Potamogeton natans* L.	Potamogetonaceae	Balsan	PH	Asia/Europe	Ui	Nt
72.	*Potentilla supina* L.	Rosaceae	Jangli rashbhari	AH	Africa/ Europe	Ui	Nt
73.	*Prosopis juliflora* (Sw.) DC.	Mimosaceae	Jhau	PT	Mexico	Af	In
74.	*Ranunculus scleratus* L.	Ranunculaceae	Jal dhania	AH	Europe	Ui	In
75.	*Ricinus communis* L.	Euphorbiaceae	Arand	PS	Africa	Ui	In
76.	*Rumex dantatus* L.	Polygonaceae	Jangli palak	AH	Eurasia & North Africa	Ui	Nt
77.	*Saussurea heteromala* (D. Don) Hand.-Mazz.	Asteraceae	Kantili	AH	Asia/ Europe	Ui	Nt
78.	*Sida acuta* Burm.f.	Malvaceae	Atibala	PH	Tropical America	Ui	In
79.	*Sida rhombifolia* Burm.f.	Malvaceae	Bala	PH	Tropical America	Ui	Nt
80.	*Solanum nigrum* L.	Solanaceae	Makoi	AH	South America	Ui	In
81.	*Trianthema monogyna* L.	Aizoaceae	Nammakka	AH	California	Ui	In
82.	*Tribulus terrestris* L.	Zygophyllaceae	Gokhru	PH	South America	Ui	Nt
83.	*Trifolium resupinatum* L.	Papilionaceae	Jangli barseem	AH	America	Ui	Nt
84.	*Triumfeta rhomboidea* Jacq.	Tiliaceae	Bhar	AS	South America	Ui	Nt
85.	*Typha angustata* Bory. & Choub.	Typhaceae	Patera	PH	Tropical America	Ui	In
86.	*Urena lobata* L.	Malvaceae	Bachita	PS	Africa	Ui	Nt
87.	*Veronica anagalis-aquatica* L.	Scrophulariaceae	Mimli	AH	Asia	Ui	Nt
88.	*Vicia hirsuta* (L.) Gray	Papilionaceae	Kali matar	AC	Europe/America	Ui	Nt
89.	*Vitis trifolia* L.	Vitaceae	Jangli angur	PC	Europe	Ui	Nt
90.	*Xanthium strumarium* L.	Asteraceae	Kutta	PS	South America	Ui	In

[Abbreviations used: AH= Annual Herb; AC = Annual Climber; PH = Perennial Herb; PS = Perennial Shrub; *PC* = Perennial Climber; PT = Perennial Tree; AS= Annual Shrub ; Ui = Unintentional; In= Intentional; Nt= Naturalized; Ca= Casual; Fd= Food; Md= Medicinal; Or= Ornamental; Ht= Horticulture; Af=Agro-Forestry; Fr=Fodder].

Table 2: Growth form wise distribution of Species in the study area.

S. No.	Growth form	Number of Species	Percentage (%)
1.	AC	2	2
2.	AH	32	36
3.	AS	7	8
4.	PC	3	3
5.	PH	30	33
6.	PS	13	15
7.	PT	3	3
8.	Total Species	90	100

Table 3: Number of species and percentage contribution as per different invasive status of the plants in study area.

S. No.	Invasive Status	Number of Species	Percentage (%)
1.	Ca	6	7
2.	Nt	50	55
3.	In	34	38

DISCUSSION

Changes in competitive dynamics will not be uniform globally in the changing environmental conditions. The shift in global floral diversity may not be on expected lines. Therefore, the studies on invasive plant species shall be important to understand the future vegetation distribution patterns. This study on invasive plant species of Yamuna Nagar, Haryana shall be helpful in maintaining the record/ databases of native and non-native flora. The study will be helpful to the students of ecology, phyto-diversity, and agro-biodiversity and conservation biology for a better understanding of the invasion processes.

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