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Invasive Alien Angiosperms of Uttar Pradesh

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ABSTRACT: The paper deals with an enumeration of 153 invasive alien taxa of angiosperms naturalised in the flora of Uttar Pradesh. Data on correct botanical name, family name, nativity and habit of each taxa have been provided. On the basis of their nativity, all the taxa have been categorised into 7 major groups *viz*., Australian, African, European, Eurasian, Mediterranean, Neo-tropical and Pan-tropical. It has been observed that some of the taxa are highly invasive in the state and have invaded even into the protected forests. Such species have not only caused negative effect in the natural ecosystems, habitats but also threatened the indigenous flora including endemic species and germplasm of economic plants. It is suggested that strict measures at governmental and non-governmental levels including public awareness should be taken up to control the population of invasive alien species in order to conserve the indigenous flora of the state.

Keywords: Invasive alien plants, angiosperms, Uttar Pradesh

INTRODUCTION

Invasive alien species are those alien species which are noxious and cause negative impact in the environment, ecosystems, habitats, native biodiversity, economics and even human health. Such species are either introduced deliberately or get introduced inadvertently outside their natural habitats and are usually fast growing, compete, get naturalised in the new environment, dominate and establish themselves as an important component of the ecosystems. The population of such species often outbreaks to the extent that they cause havoc and highly pose threat to the biodiversity of that area. It is now considered that alien invasion is next to the habitat disturbances as a cause of the biodiversity loss leading to the extinction or rarity of certain taxa. In recent years, the problem of invasive aliens has attracted much attention both at the international and national levels (Nair, 1988; Drake *et al.*, 1989; Muniappan & Viraktamath, 1993; Cox, 1999; Huxel, 1999; Meyer, 2000; Mooney and Hobbs, 2000; Almeilla & Freitas, 2001; McNeely *et al*., 2001; Mantri *et al*., 2002; Kohli *et al*., 2004; Sharma *et al*., 2005; Rai and Gaur, 2006; Khuroo *et al*., 2007; Reddy, 2008). Article 8h of the Convention on Biological Diversity (CBD) emphasizes to prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species. A Global Invasive Species Programme (GISP) has also been launched in collaboration with the World Conservation Union and the CAB-International to assemble and identify practices for the prevention and management of invasive alien species.

Uttar Pradesh, at present, the fourth largest state of India lies between 23º52' - 30º25' N latitude and 77º3' - 84º39' E longitude. The state covers a geographical area of 2,36,286 sq km and is divided into 70 districts. It is bounded in the north by the international boundary of Nepal, in the south by Madhya Pradesh, in the east by Bihar and Jharkhand and in the north-west, west and south-west by Uttarakhand, Haryana, Delhi and Rajasthan. The state can be physically divided into three regions *viz.*, Terai, Gangetic plain and Deccan plateau. The soil near the foothills in the Terai region is known as terai soil. This soil is fertile, clayey in composition, rich in humus content and has high water retaining capacity. The major portion of the state *i.e.* the Gangetic plain has alluvial soil derived from the silt laid down by the rivers originating in the Himalayas. Besides, black cotton soil and red soil are also prevalent in the Deccan plateau region. According to Champion and Seth (1968) the forests of the state is typical of northern dry deciduous type and can be broadly divided into dry deciduous forests, mixed forests, sal forests, scrub forests, grasslands and aquatic vegetation. There are ten taxa which are endemic to the state. They are *Rorippa pseudoislandica*, *Derris kanjilalii*, *D. macrocarpa*, *D. scandens* var. *saharanpurensis*, *Indigofera thothathrii*, *Diospyros holeana*, *Brachystelma laevigatum*, *B. pauciflorum*, *Alectra chitrakutensis* and *Cymbopogon flexuosus* var. *microstachys*.

As a matter of fact that the state has different types of forests including a number of endemic taxa and is facing threat of invasive alien species due to fast trading, travel, tourism and exchange of goods, an attempt has been made to work out the status of invasive alien species of angiosperms in Uttar Pradesh in order to chalk out strategies for their prevention and management that can ultimately help in the conservation of indigenous flora. The findings are based on the extensive survey of the state by the author for the last 22 years as well as literature.

ENUMERATION

All the invasive alien species have been enumerated in Table 1. Each botanical name is followed by family name, name of the native country (origin) and habit of the plant.

Table 1: Invasive alien angiosperms in Uttar Pradesh.

Species	Family	Origin	Habit
Acacia farnesiana (L.) Willd.	Mimosaceae	Tropical South America	Small tree
Acanthospermum hispidum DC.	Asteraceae	Brazil	Herb
Aerva javanica (Burm.f.) Juss. ex Schult.	Amaranthaceae	Tropical America	Herb
Aeschynomene americana L.	Fabaceae	Tropical America	Herb
Ageratum conyzoides L.	Asteraceae	Tropical America	Herb
Ageratum houstonianum Mill.	Asteraceae	Tropical America	Herb
Alternanthera paronychioides St. Hill.	Amaranthaceae	Tropical America	Herb
Alternanthera philoxeroides (Mart.) Griseb.	Amaranthaceae	Tropical America	Herb
Alternanthera pungens Kunth	Amaranthaceae	Tropical America	Herb
Alternanthera sessilis (L.) R.Br. ex DC.	Amaranthaceae	Tropical America	Herb
Anagallis arvensis L.	Primulaceae	Europe	Herb
Antigonon leptopus Hook. & Arn.	Polygonaceae	Tropical America	Climber
Argemone mexicana L.	Papaveraceae	Tropical South America	Herb
Argemone ochroleuca Sweet	Papaveraceae	Central America	Herb
Asclepias curassavica L.	Asclepiadaceae	Tropical America	Herb
Asphodelus tenuifolius Cav.	Liliaceae	Tropical America	Herb
Bidens pilosa L.	Asteraceae	Tropical America	Herb
Blainvillea acmella (L.) Philipson	Asteraceae	Tropical America	Herb
Blumea eriantha DC.	Asteraceae	Tropical America	Herb
Blumea lacera (Burm.f.) DC.	Asteraceae	Tropical America	Herb
Blumea obliqua (L.) Druce	Asteraceae	Tropical America	Herb
Caldesia oligococca (F.v.Muell.) Buchenau	Alismataceae	Australia	Herb
Calotropis gigantea (L.) R.Br.	Asclepiadaceae	Tropical Africa	Shrub
Calotropis procera (Aiton) R.Br.	Asclepiadaceae	Tropical Africa	Shrub
Cassytha filiformis L.	Lauraceae	Australia	Twiner
Catharanthus pusillus (Murray) G.Don	Apocynaceae	Tropical America	Herb
Celosia argentea L.	Amaranthaceae	Tropical Africa	Herb
Ceratophyllum demersum L.	Ceratophyllaceae	Tropical America	Herb
Chamaecrista absus (L.) Irwin & Barneby	Caesalpiniaceae	Tropical America	Herb
Chamaecrista pumila (Lam.) V.Singh	Caesalpiniaceae	Tropical America	Herb
Chloris barbata Sw.	Poaceae	Tropical America	Herb
Chrozophora rottleri (Geis.) Spreng.	Euphorbiaceae	Tropical Africa	Herb
Cleome gynandra L.	Capparaceae	Tropical America	Herb
Cleome monophylla L.	Capparaceae	Tropical Africa	Herb
Cleome rutidosperma DC.	Capparaceae	Tropical America	Herb
Cleome viscosa L.	Capparaceae	Tropical America	Herb
Conyza canadensis (L.) Cronq.	Asteraceae	South America	Herb
Corchorus aestuans L.	Tiliaceae	Tropical America	Herb
Corchorus fascicularis Lam.	Tiliaceae	Tropical America	Herb
Corchorus olitorius L.	Tiliaceae	Pantropical	Herb

Corchorus tridens L.	Tiliaceae	Tropical Africa	Herb
Corchorus trilocularis L.	Tiliaceae	Tropical Africa	Herb
Crassocephalum crepidioides (Benth.) S.Moore	Asteraceae	Tropical America	Herb
Crotalaria pallida Aiton	Fabaceae	Tropical America	Herb
Crotalaria retusa L.	Fabaceae	Tropical America	Undershrub
Croton bonplandianus Baill.	Euphorbiaceae	Temperate South America	Herb
Cryptostegia grandiflora R.Br.	Asclepiadaceae	Madagascar	Liana
Cuscuta chinensis Lam.	Cuscutaceae	Mediterranean region	Climber
Cuscuta reflexa Roxb.	Cuscutaceae	Mediterranean region	Climber
Cyperus difformis L.	Cyperaceae	Tropical America	Herb
Cyperus iria L.	Cyperaceae	Tropical America	Herb
Cytisus scoparius (L.) Link	Fabaceae	Eurasia	Undershrub
Datura innoxia Mill.	Solanaceae	Tropical America	Shrub
Datura metel L.	Solanaceae	Tropical America	Shrub
Digera muricata (L.) Mart.	Amaranthaceae	North America	Herb
Dinebra retroflexa (Vahl) Paz.	Poaceae	Tropical America	Herb
Echinochloa colona (L.) Link	Poaceae	Tropical South America	Herb
Echinochloa crusgalli (L.) P.Beauv.	Poaceae	Tropical South America	Herb
Echinops echinatus Roxb.	Asteraceae	Afghanistan	Herb
Eichhornia crassipes (Mart.) Solms	Pontederiaceae	Tropical America	Herb
Emilia sonchifolia (L.) DC.	Asteraceae	Tropical America	Herb
Euphorbia cyathophora Murray	Euphorbiaceae	Tropical America	Undershrub
Euphorbia heterophylla L.	Euphorbiaceae	Tropical America	Herb
Euphorbia hirta L.	Euphorbiaceae	Tropical America	Herb
Euphorbia indica Lam.	Euphorbiaceae	Tropical South America	Herb
Euphorbia thymifolia L.	Euphorbiaceae	Tropical America	Herb
Evolvulus nummularius (L.) L.	Convolvulaceae	Tropical America	Herb
Flaveria trinervia (Spreng.) C.Mohr.	Asteraceae	Tropical Central America	Herb
Fuirena ciliaris (L.) Roxb.	Cyperaceae	Tropical America	Herb
Galinsoga parviflora Cav.	Asteraceae	Tropical America	Herb
Glossocardia bosvallea (L.f.) DC.	Asteraceae	West Indies	Herb
Gnaphalium pensylvanicum Willd.	Asteraceae	Tropical America	Herb
Gnaphalium polycaulon Pers.	Asteraceae	Tropical America	Herb
Gomphrena celosioides Mart.	Amaranthaceae	Tropical America	Herb
Grangea maderaspatana (L.) Poir.	Asteraceae	Tropical South America	Herb
Hyptis suaveolens (L.) Poit.	Lamiaceae	South America	Herb
Imperata cylindrica (L.) Raeusch.	Poaceae	Tropical America	Herb
Indigofera astragalina DC.	Fabaceae	Tropical America	Herb
Indigofera glandulosa Wendl.	Fabaceae	Tropical America	Herb
Indigofera linifolia (L.f.) Retz.	Fabaceae	Tropical South America	Herb
Indigofera linnaei Ali	Fabaceae	Tropical Africa	Herb
Indigofera trita L.f.	Fabaceae	Tropical Africa	Herb

Ipomoea carnea Jacq.	Convolvulaceae	Tropical America	Shrub
Ipomoea eriocarpa R.Br.	Convolvulaceae	Tropical Africa	Twiner
Ipomoea hederifolia L.	Convolvulaceae	Tropical America	Twiner
Ipomoea obscura (L.) Ker-Gawl.	Convolvulaceae	Tropical Africa	Twiner
Ipomoea pes-tigridis L.	Convolvulaceae	Tropical East Africa	Twiner
Ipomoea quamoclit L.	Convolvulaceae	Tropical America	Climber
Lagascea mollis Cav.	Asteraceae	Tropical Central America	Herb
Lantana camara L. var. *aculeata* (L.) Moldenke	Verbenaceae	Tropical America	Shrub
Lemna perpusilla Torr.	Lemnaceae	North America	Herb
Leonotis nepetifolia (L.) R.Br.	Lamiaceae	Tropical Africa	Herb
Leucaena latisiliqua (L.) Gillis	Mimosaceae	Tropical America	Small tree
Ludwigia adscendens (L.) Hara	Onagraceae	Tropical America	Herb
Ludwigia octovalvis (Jacq.) Raven	Onagraceae	Tropical Africa	Herb
Ludwigia perennis L.	Onagraceae	Tropical Africa	Herb
Malachra capitata (L.) L.	Malvaceae	Tropical America	Herb
Malvastrum coromandelianum (L.) Garcke	Malvaceae	Tropical America	Herb
Martynia annua L.	Martyniaceae	Tropical America	Herb
Melilotus alba Medik. ex Desr.	Fabaceae	Europe	Herb
Melochia corchorifolia L.	Sterculiaceae	Tropical America	Herb
Merremia aegyptia (L.) Urb.	Convolvulaceae	Tropical America	Climber
Mikania micrantha Kunth	Asteraceae	Tropical America	Twiner
Mimosa pudica L.	Mimosaceae	Brazil	Herb
Mirabilis jalapa L.	Nyctaginaceae	Peru	Herb
Monochoria vaginalis (Burm.f.) K.Presl	Pontederiaceae	Tropical America	Herb
Nicotiana plumbaginifolia Viv.	Solanaceae	Tropical America	Herb
Opuntia stricta (Haw.) Haw. var. *dillenii* (Ker-Gawl.) Benson	Cactaceae	Tropical America	Shrub
Oxalis corniculata L.	Oxalidaceae	Europe	Herb
Parthenium hysterophorus L.	Asteraceae	Tropical North America	Herb
Passiflora foetida L.	Passifloraceae	Tropical South America	Climber
Pedalium murex L.	Pedaliaceae	Tropical America	Herb
Pennisetum purpureum Schum.	Poaceae	Tropical America	Herb
Peperomia pellucida (L.) Kunth	Piperaceae	Tropical South America	Herb
Peristrophe paniculata (Forssk.) Brummitt	Acanthaceae	Tropical America	Herb
Physalis angulata L.	Solanaceae	Tropical America	Herb
Physalis minima L.	Solanaceae	Tropical America	Herb
Pilea microphylla (L.) Liebm.	Urticaceae	Tropical South America	Herb
Pistia stratiotes L.	Araceae	Tropical America	Herb
Portulaca oleracea L.	Portulacaceae	Tropical South America	Herb
Portulaca quadrifida L.	Portulacaceae	Tropical America	Herb
Prosopis glandulosa Torr.	Mimosaceae	South America	Tree
Prosopis juliflora (Sw.) DC.	Mimosaceae	Mexico	Small tree
Ruellia tuberosa L.	Acanthaceae	Central America	Herb

Scoparia dulcis L.	Scrophulariaceae	Tropical America	Herb
Senna alata (L.) Roxb.	Caesalpiniaceae	West Indies	Shrub
Senna obtusifolia (L.) Irwin & Barneby	Caesalpiniaceae	Tropical America	Undershrub
Senna occidentalis (L.) Link	Caesalpiniaceae	South America	Undershrub
Senna tora (L.) Roxb.	Caesalpiniaceae	South America	Herb
Sesbania bispinosa (Jacq.) W.Wight	Fabaceae	Tropical America	Herb
Setaria glauca (L.) P.Beauv.	Poaceae	Europe	Herb
Sida acuta Burm.f.	Malvaceae	Tropical America	Herb
Solanum seaforthianum Andrews	Solanaceae	Brazil	Shrub
Solanum torvum Sw.	Solanaceae	West Indies	Shrub
Solanum viarum Dunal	Solanaceae	Tropical America	Shrub
Sonchus asper (L.) Hill	Asteraceae	Mediterranean region	Herb
Sonchus oleraceus L.	Asteraceae	Mediterranean region	Herb
Sorghum halepense (L.) Pers.	Poaceae	Mediterranean region	Herb
Spermacoce hispida L.	Rubiaceae	Tropical America	Herb
Spilanthes radicans Jacq.	Asteraceae	Tropical South America	Herb
Stachytarpheta jamaicensis (L.) Vahl	Verbenaceae	Tropical America	Herb
Synedrella nodiflora (L.) Gaertn.	Asteraceae	West Indies	Herb
Torenia fournieri Linden ex Fourn.	Scrophulariaceae	Australia	Herb
Tribulus lanuginosus L.	Zygophyllaceae	Tropical America	Herb
Tridax procumbens L.	Asteraceae	Tropical Central America	Herb
Triumfetta rhomboidea Jacq.	Tiliaceae	Tropical America	Herb
Turnera ulmifolia L. var. *angustifolia* (Mill.) Willd.	Turneraceae	Tropical America	Undershrub
Typha angustifolia L.	Typhaceae	Tropical America	Herb
Urena lobata L.	Malvaceae	Tropical America	Herb
Veronica anagallis-aquatica L.	Scrophulariaceae	Africa, Eurasia	Herb
Waltheria indica L.	Sterculiaceae	Tropical America	Undershrub
Xanthium indicum Koenig	Asteraceae	Tropical America	Herb
Youngia japonica (L.) DC.	Asteraceae	Tropical South America	Herb

DISCUSSION AND CONCLUSION

An analysis of data indicates that 153 taxa under 107 genera belonging to 45 families are invasive alien angiosperms in the state. Out of 153 taxa, 118 are herbs, 13 climbers/twiners, 11 shrubs, 7 undershrubs and 4 small trees. On the basis of their nativity, they can be broadly categorised into 7 major groups *viz.*, Australian, African, European, Eurasian, Mediterranean, Neo-tropical and Pan-tropical. It is interesting to note that most of the species are Neo-tropical. Further, it has been observed that few species like *Parthenium hysterophorus, Lantana camara var. aculeata, Ageratum conyzoides, Prosopis juliflora, Eichhornia crassipes, Lemna perpusilla, Sorghum halepense, Tridax procumbens, Ipomoea carnea* and *Xanthium indicum* are highly invasive and have invaded not only the non-forested areas but also the forested areas including protected ones. In addition, these species have been noticed both on the outskirts of forests as well as inside the reserve forests. This situation is alarming in view of the fact that the state has 1 National Park and 23 Wildlife sanctuaries and these serve as store houses of plant resources of the state.

It is noteworthy that such aliens have not only disturbed the environment and ecosystems but have also threatened the indigenous flora of the state as a number of plants are getting rare. It has been recorded that the state has 10 endemic taxa (Khanna, 2001), about 500 rare taxa and germplasm of a number of economic plants including wild relative of crop plants *viz.*, cereals, millets, legumes, fruits and vegetables. Hence, there is every possibility that if the invasion of aliens will continue to operate unchecked, the endemic species may get extinct, and the germplasm of economic plants may become rare or even vanish.

Thus, it may be concluded that strict measures both at the governmental and non-governmental levels should be taken up to face the problem of invasive aliens in the state. Although the conventional methods viz., manual, mechanical, chemical and biological are available but each has its own limitations. Therefore, it is suggested that there is urgent need of concerted research to develop suitable and eco- friendly control measures. Apart from conventional preventive measures, public awareness about such plants amongst the rural and tribal people is most important, and in order to create this, exhibitions, training camps and workshops at the village level involving persons of botanists, agriculturists and forest department should be organised.

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