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Invasion of Alien Angiosperm Species in Wetlands of Shaheed Chandra Shekhar Azad Bird Sanctuary (SCSABS), Uttar Pradesh, India

The expansion of invasive alien species in wetlands leads to a reduction in native plant diversity. Invasive weeds are also responsible for the shrinking of water bodies, and becoming a severe environmental problem. In this context, plant diversity of wetlands in the Shaheed Chandra Shekhar Azad Bird Sanctuary (SCSABS), Unnao, Uttar Pradesh, was surveyed. Eighty five species of higher plants have been listed of which 71 were dicots followed by 14 monocots, belongs to 39 different families. Amarantheaceae is the dominant family with 7 species followed by Asteraceae, Fabaceae, Poaceae (6), Mimosaceae (5), Malvaceae (4), Convolvulaceae, Cyperaceae, Euphorbiaceae, Onagraceae, Solanaceae (3), Acanthaceae, Asclepidiaceae, Moraceae, Myrtaceae, Oxilidaceae, Pontederiaceae, Scrophulariaceae, Tileaceae (2) and rest twenty families represented by only one species. The presence of Eichhornia crassipes, Typha angustata, Prosopis juliflora and Ipomoea carnea are considered as one of the most serious threat to the Shaheed Chandra Shekhar Azad Bird Sanctuary (SCSABS) wetland. A better planning in the form of early identification and reporting of identification and spread of noxious weeds is needed for their control.

Key words: Bird sanctuary, Wetland, Alien invasive species, Angiosperm, Conservation.

Early reporting of identification and spread of noxious weeds is needed to control them in Shaheed Chandra Shekhar Azad Bird Sanctuary, Unnao (U.P.).

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Introduction

The Shaheed Chandra Shekhar Azad Bird Sanctuary (SCSABS) is situated in the Unnao district of Uttar Pradesh on the Lucknow – Kanpur National Highway, about 45 km from Lucknow and almost the same distance from Kanpur (26°27'9.0696 N Latitude and 80°39'11.2356 E longitude). The sanctuary possesses a natural permanent water reservoir that recurrently fills up during rainy days. It is a convergence center of resident as well as migratory birds. The clayey soil of the wetland, with rich humus content and high water retaining capacity is fertile and favorable for plant growth including the invasive species. Wetland habits get enriched with floral components comprising of wetland plant species that are adapted to water logged soil and constitute the world's most productive ecosystems providing a crucial and wide variety of benefits to mankind, society and nature. Invasion of alien plant species in recent times has been recognized as the second worst thread after habitat distraction (Convention on Biological Diversity, 1992).

According to IUCN, alien invasive species are those alien species which become established in natural or semi-natural ecosystems or habitats, outside their natural distributional range and act as an agent of change causing threats to native biological diversity. The spread of non-native or alien or exotic species has emerged in recent years as one of the most serious threats to biodiversity, undermining the ecological integrity of many native habitats and pushing some rare species to the edge of extinction, second only to habitat loss.

The introduction of invasive alien species is considered to be a leading cause of species endangerment and extinction in fresh water

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systems (Claudi and Leach, 1999; Harrison and Stiassny, 1999; Sala *et al*., 2000). It can produce profound and irreversible changes to ecosystem structure and function (Mooney and Hobbs, 2000; Sakai *et al*., 2001). It competes with native species and causes severe economic losses (Dukes and Mooney, 2004; Antonio and Hobbie (2005); Sharma *et al*., 2005; Khanna, 2009; Pant and Sharma, 2011). The present study aims to document the alien invasive plants species along with their habit, phenology, categories, risk rank, native country and also review the probable impact risk by invasive plants to the ecosystem of (SCSABS). No authentic reports are available regarding the invasive plants of the sanctuary.

Material and Methods

Surveys were made in the Shaheed Chandra Shekhar Azad Bird Sanctuary, Uttar Pradesh during the years 2023–2025, covering the summer, pre-monsoon and post monsoon seasons. Plant specimens were collected, dried, poisoned, mounted and identified by the usual taxonomic procedures and deposited in department of the college. The alien invasive species were listed, along with their accepted name, family, habit, phenology, collection number, categories (Noxious, Interfering and Naturalized), Fig. 3 risk rank which grouped into four risk ranks *viz*., high risk, medium risk, low risk and insignificant risk based (Fig. 2) (Table 1) on the Invasive species assessment protocol and field observations were recorded on the spread of the invasive species within the sanctuary. These were identified with the help of important floras (Hooker, 1872–1897, Duthie, 1903–1929 etc.) assisted by matching with the available identified specimens for authentication and characterisation, Origin or nativity of the invasive species were established with the help of literature (Negi and Hajra, 2007; Tomar *et al*., 2008; Singh, 2011; Naithani *et al*., 2017; Naithani, 2024) as well through authentic websites. Enumeration is made as per the Bentham & Hooker (1862-83).

Results and Discussion

In the present study eighty five invasive plant species were obtained in Shaheed Chandra Shekhar Azad Bird Sanctuary (SCSABS) and these invasive plant species of higher plants have been listed of which 71 were dicots followed by 14 monocots. These species are distributed in 68 genera and belongs to 39 families (33 dicot and 06 monocot families) (Fig. 1). Amarantheaceae is the dominant family with 7 species followed by Asteraceae, Fabaceae, Poaceae (6), Mimosaceae (5), Malvaceae (4), Convolvulacae, Cyperaceae, Euphorbiaceae, Onagraceae, Solanaceae (3), Acanthaceae, Asclepidiaceae, Moraceae, Myrtaceae, Oxilidaceae, Pontederiaceae, Scrophulariaceae, Tileaceae (2) and rest twenty families represented by only one species. These families plants were categorised into 4 group *viz*., high risk, medium

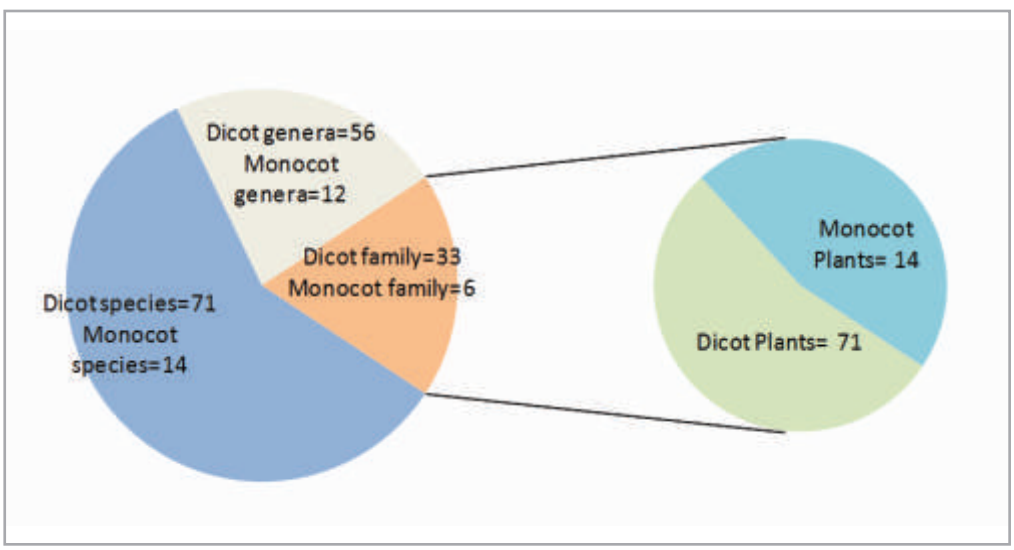

Fig. 1: Schematic representation of taxonomic categories of the alien invasive species of Dicots and Monocots

Table 1: Description of invasive risk rank used in the study

Risk rank	Description
High	Species represents a severe threat to native species and ecological communities
Medium	Species represents moderate threat to native species and ecological communities
Low	Species represents a significant but relatively low threat to native species and ecological communities
Insignificant	Species represents an insignificant threat to native species and ecological communities

risk, low risk and insignificant, based on the probable impact risk. Among them 12 are in high risk category. They need special attention in terms of control measures. Numbers of plants in medium risk and low risk are 13 and 58 respectively and 02 insignificant as per the risk assessment (Table 2).

Constant monitoring is needed to prevent further spread and new intrusions because 07 invasive plants are noxious, 18 are interfering and 60 are naturalized. Out of the 85 plants species, 10 species are tree, 10 species are shrubs, 62 species are herbs, 2 species are climbers and one species is twiner plant (Fig. 4). The spread of species such as *Ageratum conyzoides* L., *A. houstonianum* Mill., *Albizia lebbeck* (L.) Benth., *Amaranthus spinosus* L., *Calotropis procera* (Aiton) R.Br., *Cyperus alopecuroides* Rottb., *C. difformis* L., *Digitaria ciliaris* (Retz.) Koeler, *Echinochloa colonum* (L.) Link., *Eichhornia crassipes* (Mart.) Solms, *Eragrostis atrovirens* (Desf.) Trin. ex Steud., *Imperata cylindrica* (L.) Raeusch., *Oxalis corniculata* L., *Parthenium hysterophorus* L., *Pistia stratiotes* L., *Prosopis juliflora* (Swartz) D C., *Ricinus communis* L., *Setaria verticillata* (L.) P. Beauv., *Typha angustifolia* L. and *Xanthium strumarium* L., throughout the sanctuary, including wet and terrestrial areas of pond and it's periphery, as well as the wastelands, is alarming as 39.72% of the sanctuary flora is covered under the alien invasive, posing threat to natural ecosystem within the sanctuary and if left unchecked, their further spread is likely to suppress the native germplasm of many economically potential species *viz. Chenopodium album* L., *Solanum nigrum* L., *Psidium guajava* L., *Marus alba* L., *Ficus racemosa* L. etc., which often also contribute to Avian food. The gregarious spread, decay, decomposition and deposition of many noxious aquatic weeds *viz. Eichhornia crassipes* (Mart.) Solms, *Ipomoea carnea* subsp. *fistulosa* (Mart. ex Choisy) D. F. Austin, *Nymphaea nouchali* Burm.f. and *Typha angustifolia* L., may lead to biomass accumulation in the pond causing shrinkage and shallowness of the water body and reduced oxygen contents in water. Hence invasion of alien weeds into the sanctuary is detrimental for the entire wetland which in tum may lead to diminished migration of birds into the sanctuary. However many species such as *Acacia nilotica* subsp. *indica* (L.) Willd. ex Delile, *Echinochloa crusgalli* (L.) P. Beauv., *Echinochloa colonum* (L.) Link, *Prosopis juliflora* (Swartz) DC. etc. have also become essential components of the sanctuary as they provide nesting space, nest building material and bird food. Most introductions were intentional. The invasive plants exert both direct and indirect effects on the forest ecosystem. Immediate measures are to be taken to restore habitats

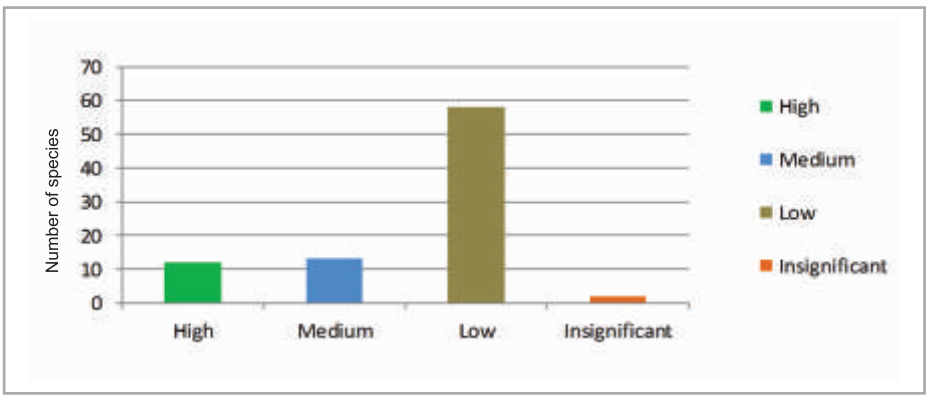

Fig. 2 : Schematic representation of risk rank of the alien invasive species

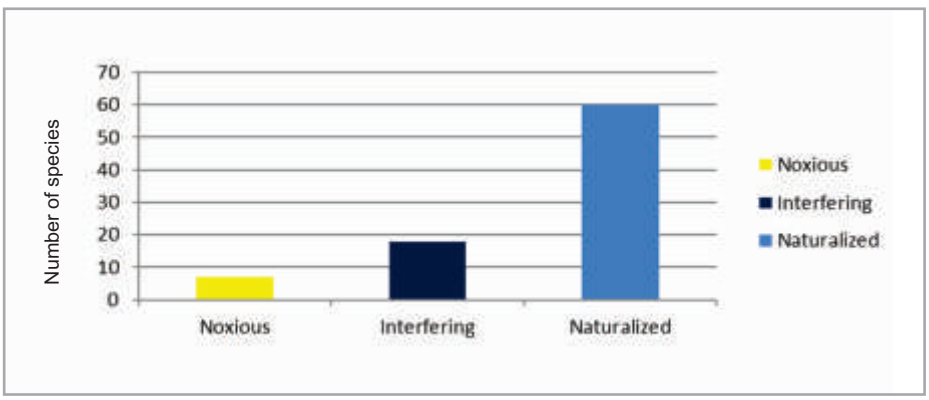

Fig. 3 : Species number under three different categories of alien invasive plants

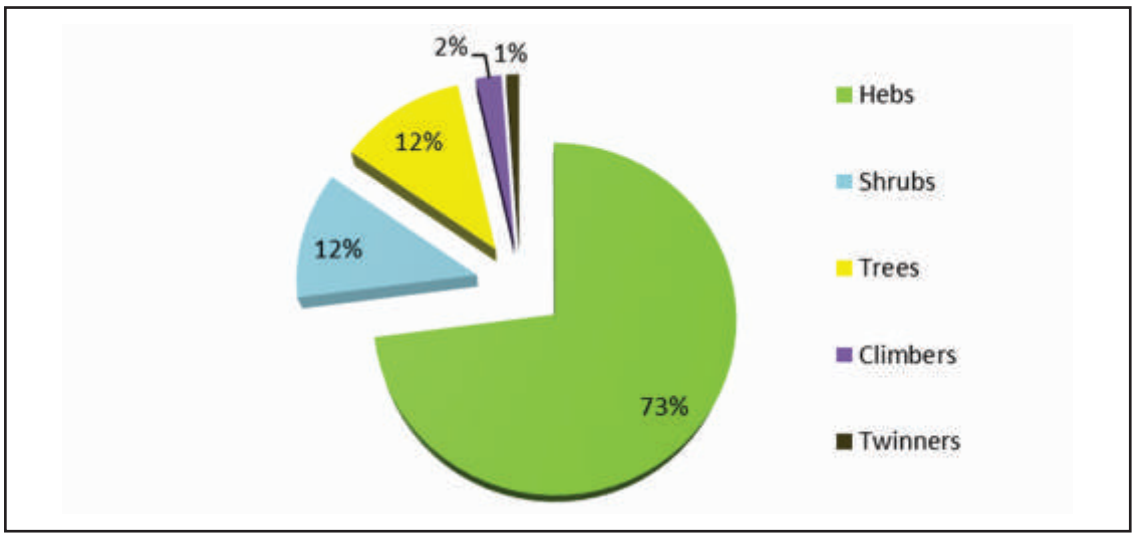

Fig. 4 : Life forms of the alien invasive species.

Table 2 : List of alien Invasive species of Shaheed Chandra Shekhar Azad Bird Sanctuary, U.P. India

S. No.	Species	Family	Country of origin	Habit	Phenology	Categories	Risk rank	Collection No.
1.	*Acacia auriculiformis* A. Cunn. ex Benth.	Mimosaceae	Australia	Tree	Aug.-May	Naturalized	Low	196
2.	*Acacia nilotica* subsp. *indica* (L.) Willd. ex Delile	Mimosaceae	North Africa & Arabia	Tree	Jan.-April	Naturalized	Low	70
3.	*Achyranthes aspera* L.	Amaranthaceae	Tropical America	Herb	Whole year	Naturalized	Low	11
4.	*Aeschynomene indica* L.	Fabaceae	North & Central America	Herb	Oct.-Nov.	Naturalized	Low	217
5.	*Ageratum houstonianum* Mill.)	Asteraceae	Mexico	Herb	Dec.-June	Interfering	Medium	199
6.	*Ageratum conyzoides* L.	Asteraceae	South America	Herb	Sept-March	Noxious	High	25
7.	*Argemone maxicana* L.	Papaveraceae	Tropical South America	Herb	Feb.-June	Noxious	High	84
8.	*Albizia lebbeck* (L.) Benth.	Fabaceae	Australia	Tree	March-Oct.	Naturalized	Low	136
9.	*Alternanthera pungens* Kunth	Amaranthaceae	Tropical America	Herb	Aug.-May	Naturalized	Low	99
10.	*Alternanthera paronychioides* St. Hil.	Amaranthaceae	South America & West Indies	Herb	March-Oct.	Naturalized	Insigni-ficant	149
11.	*Alternanthera philoxeroides* (Mart.) Grise.	Amaranthaceae	South America	Herb	April-Nov.	Naturalized	Insigni-ficant	145
12.	*Alternanthera sessilis* (L.) R. Br. ex DC.	Amaranthaceae	Tropical America	Herb	Aug.-May	Naturalized	Low	26
13.	*Amaranthus spinosus* L.	Amaranthaceae	Tropical America	Herb	Whole year	Naturalized	Low	230
14.	*Amaranthus viridis* L.	Amaranthaceae	Pantropical	Herb	Whole year	Naturalized	Low	34
15.	*Anagallis arvensis* L.	Primulaceae	Mediterranean Europe	Herb	Dec.-March	Naturalized	Low	159
16.	*Azadirachta indica* A. Juss.	Meliaceae	Asia Minor	Tree	April-June	Naturalized	Low	16
17.	*Bacopa monnieri* (L.) Pennell.	Scrophulariaceae	Tropical America	Herb	July-Dec.	Naturalized	Low	128
18.	*Bauhinia variegata* L.	Caesalpiniaceae	South East Asia	Tree	Sept-April	Naturalized	Low	10
19.	*Bougainvillea spectabilis* Willd.	Nyctaginaceae	Brazil	Climber	Hot season	Naturalized	Low	109
20.	*Callistemon lanceolatus* DC.	Myrtaceae	Australia	Tree	March-Aug.	Naturalized	Low	27

S. No.	Species	Family	Country of origin	Habit	Phenology	Categories	Risk rank	Collection No.
21.	*Calotropis gigantea* (L.) R. Br.	Asclepiadaceae	Tropical Africa	Shrub	March-May	Interfering	Medium	123
22.	*Calotropis procera* (Aiton) R.Br.	Asclepiadaceae	Tropical Africa	Shrub	March-May	Interfering	Medium	124
23.	*Cannabis sativa* L.	Cannabaceae	Central Asia	Herb	March-Nov.	Interfering	Medium	74
24.	*Ceratophyllum demersum* L.	Ceratophyllaceae	Tropical America	Herb	Oct.-Feb.	Naturalized	Low	46
25.	*Chenopodium album* L.	Chenopodiaceae	Paleotropical	Herb	Sept.-March	Interfering	Medium	150
26.	*Corchorus aestuans* L.	Malvaceae	Tropical America	Herb	Sept.-Jan.	Naturalized	Low	214
27.	*Corchorus capsularis* L.	Malvaceae	Tropical America	Herb	Sept.-Nov.	Naturalized	Low	132
28.	*Cyperus alopecuroides* Rottb.	Cyperaceae	Paleotropical	Herb	July-Dec.	Naturalized	Low	89
29.	*Cyperus difformis* L.	Cyperaceae	Tropical America	Herb	July-April	Naturalized	Low	154
30.	*Datura metel* L.	Solanaceae	Tropical America	Shrub	July-Sept.	Interfering	Medium	164
31.	*Digitaria ciliaris* (Retz.) Koeler	Poaceae	Australia	Herb	Aug.-Nov.	Interfering	Medium	113
32.	*Echinochloa crusgalli* (L.) P. Beauv.	Poaceae	Paleotropical	Herb	Aug.-Nov.	Noxious	High	30
33.	*Echinochloa colonum* (L.) Link.	Poaceae	Paleotropical	Herb	Aug.-April	Naturalized	Low	185
34.	*Eclipta prostrata* (L.) L.	Asteraceae	South America	Herb	Whole year	Naturalized	Low	122
35.	*Eichhornia crassipes* (Mart.) Solms	Pontederiaceae	Brazil	Herb	April -Nov.	Noxious	High	13
36.	*Eragrostis atrovirens* (Desf.) Trin. ex Steud	Poaceae	Western Africa	Herb	Aug.-Nov.	Naturalized	Low	114
37.	*Euphorbia heterophylla* L.	Euphorbiaceae	Mexico	Herb	Sept-Oct.	Naturalized	Low	100
38.	*Euphorbia hirla* L.	Euphorbiaceae	Tropical America	Herb	Aug.-Oct.	Naturalized	Low	118
39.	*Ficus racemosa* L.	Moraceae	South East Asia	Tree	Feb.-Sept.	Naturalized	Low	80
40.	*Fimbristylis littoralis* Gaud.	Cyperaceae	Pantropical	Herb	Sept-April	Naturalized	Low	253
41.	*Gnaphalium polycaulon* Pers.	Asteraceae	West Indies	Herb	March-april	Interfering	Medium	175
42.	*Heliotropium indicum* L.	Boraginaceae	South America	Herb	Whole year	Naturalized	Low	206
43.	*Hyptis suaveolens* (L.) Poit	Lamiaceae	South America	Herb	Whole year	Interfering	Medium	108
44.	*Imperata cylindrica* (L.) Raeusch.	Poaceae	Mediteranean region	Herb	Aug.-April	Naturalized	Low	236
45.	*Ipomoea cairica* (L.) Sweet	Convolvulaceae	Tropical Africa	Climber	June-Dec.	Interfering	High	162
46.	*Ipomoea carnea* Jacq. ssp. *Fistulosa* (Mart. ex Choisy) Austin	Convolvulaceae	South America	Shrub	Whole year	Interfering	High	05
47.	*Ipomoea obscura* (L.) Ker- Gawl.	Convolvulaceae	Paleotropical	Twiner	July-Feb.	Interfering	High	163
48.	*Kigelia africana* (Lam.) Benth.	Bignoniaceae	Tropical Africa	Tree	March-Dec.	Naturalized	Low	79
49.	*Lantana camara* var. *aculeata* (L.) Moldenke	Verbenaceae	Tropical America	Shrub	April-June	Noxious	High	83
50.	*Lathyrus sativus* L.	Fabaceae	Mediterranean Europe	Herb	Jan.-March	Naturalized	Low	170
51.	*Ludwigia octovalvis* (Jacq.) Raven	Onagraceae	Tropical Africa	Herb	Nov.-Jan.	Naturalized	Low	156
52.	*Ludwigia adscendens* (L.) Hara	Onagarceae	Tropical America	Herb	Jan.-June	Naturalized	Low	119
53.	*Ludwigia perennis* L.	Onagraceae	Tropical Africa	Herb	Nov.-Jan.	Naturalized	Low	88
54.	*Marus alba* L.	Moraceae	China	Tree	Jan.-May	Naturalized	Low	247
55.	*Medicago polymorpha* L.	Fabaceae	Europe	Herb	Jan.-Feb.	Naturalized	Low	220

S. No.	Species	Family	Country of origin	Habit	Phenology	Categories	Risk rank	Collection No.
56.	*Melilotus alba* Desr.	Fabaceae	Europe & West Asia	Herb	Feb.-April	Naturalized	Low	194
57.	*Melochia corchorifolia* L.	Sterculiaceae	Tropical America	Herb	May-Sept.	Naturalized	Low	131
58.	*Monochoria vaginalis* (Burm.f.) K. Presl	Pontederiaceae	South East Asia	Herb	July-Nov.	Naturalized	Low	50
59.	*Neriuin oleander* L.	Apocynaceae	China	Shrub	April –June	Naturalized	Low	204
60.	*Nicotiana plumbaginifolia* Viv.	Solanaceae	Tropical America	Herb	Nov.-March	Naturalized	Low	1
61.	*Nymphaea nouchali* Burm.f.	Nymphaeaceae	South East Asia	Herb	May-Nov.	Naturalized	Low	39
62.	*Nymphoides indica* (L.) Kuntze	Menyanthaceae	Tropical Asia	Herb	Aug.-Oct.	Naturalized	Low	45
63.	*Oxalis debilis* var. corymbosa DC. Lourt.	Oxalidaceae	South America	Herb	April-June	Naturalized	Low	42
64.	*Oxalis corniculata* L.	Oxalidaceae	Europe	Herb	Jan.-Dec.	Naturalized	Low	41
65.	*Parthenium hysterophorus* L.	Asteraceae	Central America	Herb	Sept.-Oct.	Noxious	High	82
66.	*Peristrophe paniculata* (Forssk.) Brummitt	Acanthaceae	Tropical America	Herb	Sept-April	Interfering	Medium	226
67.	*Pistia stratiotes* L.	Araceae	North America	Herb	Aug.-Oct.	Naturalized	Low	51
68.	*Pithecellobium dulce* (Roxb.) Benth.	Mimosaceae	Central America	Tree	Jan.-April	Interfering	Medium	138
69.	*Polygonum hydropiper* L.	Polygonaceae	Temperate Europe	Herb	Aug.-April	Naturalized	Low	240
70.	*Potamogeton crispus* L.	Potamogeto naceae	Temperate Europe	Herb	Jan.-April	Naturalized	Low	62
71.	*Prosopis juliflora* (Swartz) DC.	Mimosaceae	Mexico	Shrub	Feb.-Oct.	Naturalized	High	139
72.	*Psidium guajava* L.	Myrtaceae	Tropical America	Shrub	Whole year	Naturalized	Low	140
73.	*Ricinus communis* L.	Euphorbiaceae	Tropical Africa	Shrub	Sept.-May	Interfering	Medium	101
74.	*Ruellia tuberosa* L.	Acanthaceae	Tropical America	Herb	July-Sept.	Naturalized	Low	71
75.	*Setaria verticillata* (L.) P.Beauv.	Poaceae	Europe	Herb	Aug.-Oct.	Naturalized	Low	180
76.	*Sida cordata* (Burm.f.) Borss.	Malvaceae	Tropical America	Herb	Whole year	Naturalized	Low	168
77.	*Sida acuta* Burm.f	Malvaceae	Pantropical	Herb	Aug.-Jan.	Naturalized	Low	212
78.	*Sida rhombifolia* L	Malvaceae	Pantropical	Herb	Sept.-April	Naturalized	Low	213
79.	*Solanum nigrum* L.	Solanaceae	Europe, Northern	Herb	Sept.-Feb.	Naturalized	Low	127
80.	*Trifolium alexandrium* L.	Fabaceae	West Asia & Asia Minor	Herb	April-Sept.	Naturalized	Low	171
81.	*Typha angustifolia* L.	Typhaceae	Europe	Herb	Oct-April	Naturalized	High	14
82.	*Urena lobata* L.	Malvaceae	Tropical Africa	Shrub	Whole year	Interfering	Medium	192
83.	*Veronica anagallis-aquatica* L.	Scrophulariaceae	Temperate Eurasia	Herb	Jan.-April	Naturalized	Low	208
84.	*Vicia hirsuta* (L.) S. F. Gray	Fabaceae	Europe, Western Africa	Herb	Nov.-March	Naturalized	Low	172
85.	*Xanthium strumarium* L.	Asteraceae	Tropical America	Herb	Sept.-Nov.	Noxious	High	23

from alien invasive plants and eradicate the plants that are in the early phase of establishment. Also their further spread, in terms of new introductions and already established are to be strictly checked. Such a documentation study of invasive angiosperm species will definitely help a protected area like Shaheed Chandra Shekhar Azad Bird Sanctuary to develop conservation strategies of native flora.

Conclusion

This study provides a primary data towards the invasive plants of Shaheed Chandra Shekhar Azad Bird Sanctuary. Plant invasions in the new areas alter indigenous community composition, deplete species

diversity, affect ecosystem process and thus cause huge economic and ecological imbalance. A quick inventory and plant identification network are therefore, needed for early detection and reporting of noxious and naturalized weeds in order to control the spread of invasive plant species. It is suggested that strict measures at government and non-government 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 sanctuary. There is every possibility that if the invasion of aliens will continue to operate unchecked, the endemic species may get extinct and germplasm of economic plants may become rare or even vanish. Action plans are to be developed for the eradication of high risk species. Being a tourist destination, thorough checking of the belongings of tourists is needed to prevent spread and further introduction.

Future scope

Quantitative study is needed to assess the actual state of invasion. Continuous monitoring is to be ensured to prevent further spread. Programmers that raise awareness among tourists about biological invasions are to be designed, like placing boards etc. but no effective strategy has been developed till date. Therefore, it is suggested that there is urgent need of concerted research to develop suitable and eco-friendly control measures.

शहीद चंद्र शेखर आजाद पक्षी अभयारण्य (SCSABS), उत्तर प्रदेश, भारत की आर्द्रभूमियों में विदेशी एंजियोस्पर्म प्रजातियों का आक्रमण

विनय कुमार प्रजापति एवं एम.पी.वी. विक्रम सिंह

सारांश

आर्द्रभूमियों में आक्रामक विदेशी प्रजातियों के विस्तार से स्थानीय पादप विविधता में कमी आ रही है। आक्रामक खरपतवार जल निकायों के सिकुड़ने और एक गंभीर पर्यावरणीय समस्या बनने के लिए भी जिम्मेदार हैं। इस संदर्भ में, शहीद चंद्र शेखर आजाद पक्षी अभयारण्य (SCSABS), उन्नाव, उत्तर प्रदेश में आर्द्रभूमियों की पादप विविधता का सर्वेक्षण किया गया। उच्च पौधों की 85 प्रजातियों को सूचीबद्ध किया गया है, जिनमें से 71 द्विबीजपत्री और 14 एकबीजपत्री हैं, जो 39 विभिन्न कुलों से संबंधित हैं। अमरेन्थियासी 7 प्रजातियों वाला प्रमुख परिवार है, इसके बाद एस्टेरेसी, फैबेसी, पोएसी (6), मिमोसेसी (5), मालवेसी (4), कॉन्वोल्वुलेसी, साइपरेसी, यूफोरबियासी, ओनाग्रेसी, सोलानेसी (3), एकेंथेसी, एस्क्लेपिडियासी, मोरेसी, मायर्टेसी, ऑक्सिलिडेसी, पोंटेडेरियासी, स्क्रोफुलेरेसी, टाइलेसी (2) और बाकी बीस परिवार केवल एक प्रजाति द्वारा दर्शाए जाते हैं। *इचोर्निया क्रैसिपेस, टाइफा एंगुस्टाटा, प्रोसोपिस जूलीफ्लोरा* और *इपोमिया कार्नेया* की उपस्थिति को शहीद चंद्रशेखर आजाद पक्षी अभयारण्य (एससीएसएबीएस) वेटलैंड के लिए सबसे गंभीर खतरों में से एक माना जाता है।

References

Antonio C.M. and Hobbie S.E. (2005). Plant species effect on ecosystem processes. In: Sax D.F., Stachowicz J.J. and Gaines S.D. (eds.) Species invasions: insights from ecology, evolution and biogeography. Sunderland, MA, USA, 65-84.

C.B.D. (1992). *Invasive Alien Species*, Conservation on Biological Diversity. http://www.biodiv.org/programmes/cross-cut- tings/Alien.

Claudi R. and Leach J.H. (1999). Non-indigenous Freshwater Organisms: Vectors, Biology, and Impacts. Lewis Publishers, Boca Raton, *Florida*.

Dukes J.S. and Mooney H.A. (2004). Disruption of ecosystem processes in western North America by invasive species. *Revista Chilena de Historia Natural*, **77**: 411-437.

Duthie J.F. (1903-1929). Flora of Upper Gangetic Plain and Adjacent Siwalik and Sub-Himalayan Tracts. Vols 1-3. (Rep. 1994). *Bishen Singh Mahendra Pal Singh*, Dehradun.

Harrison I.J. and Stiassny M.L.J. (1999). The Quiet Crisis: A Preliminary Listing of the Freshwater Fishes of the World that is Extinct or "Missing in Action". Extinctions in Near Time. *Kluwer Academic Publishers*, MacPhee, New York, 271-331. IUCN.

Hooker J.D. (1872-1897). *The Flora of British India.* Vol. I-VII. Rep. 1994-2003. Bishen Singh Mahendra Pal Singh, Dehradun.

Khanna K.K. (2009). Invasive Alien Angiosperms of Uttar Pradesh. *Biological Forum -An int. J.,* **1**(2): 41-46

Mooney H.A. and Hobbs R.J. (2000). *Invasive Species in a Changing World*. Island Press, Washington DC.

Naithani B. (2024). Invasive Weeds of Meghalaya Forest and Environment Separtment, Meghalaya, Shillong.

Naithani B. Saha R. and Rasaily S.S. (2017). Study on Qualitative and Quantitative Survey of Invasive Species in Dehradun District. Uttarkhand Biodiversity Board, Deradun.

Negi P.S. and Hajra P.K. (2007). Alien Flora of Doon Valley. *Curr. Sci*., **92**(7): 968-978.

Pant, H.M. and Sharma N. (2011). Invasive Alien Species: A Global Scenario. *Res. J. Agri. Sci.,* **2**(1): 180-184.

Sakai A.K., Allendorf F.W., Holt J.S., Lodge D.M., Molofsky J.K.A., Baughman S., Cabin R.J., Cohen J.E., Ellstrand N.C., McCauley D.E., O'Neil P., Parker I.M., Thompson J.N. and Weller S.G. (2001). The population biology of invasive species. *Annual Review of Ecology and Systematics*, **32**: 305-332.

Sala O.E., Chapin III F.S., Armesto J.J., Bloomfield J., Dirzo R., Huber-Sanwald E., Huenneke L.F., Jackson R.B., Kinzig A., Leemans R., Lodge D., Mooney H.A., Oesterheld M., Proff N.L. Sykes M.T., Walker B.H., Walker M. and Wall D.H. (2000). Global biodiversity scenarios for the year 2100. *Science*, **287**: 1770-1774.

Sharma G.P., Singh J.S. and Raghubanshi A.S. (2005). Plant Invasions: Emerging Trends and Future Implications. *Curr.* Sci., **88**(5): 726-734.

Singh A. (2011). Exotic Flora of Banaras Hindu University Main Campus, India. *Journal of Ecology and the Natural Environment,* **3**(10): 337-343.

Tomar A., Singh H. and Singh V. (2008). Exotic element in the flora of Baghpat, District. *Indian J. Forestry,* **31**(3): 463-471.

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