



# STUDIES ON THE OCCURRENCE AND DISTRIBUTION OF THE INVASIVE ALIEN ANGIOSPERMIC PLANT SPECIES IN PILIBHIT TIGER RESERVE, PILIBHIT, U.P., (INDIA)

Deepak Singh\* and Alok Kumar Khare

Department of Botany, Bareilly College, Bareilly (U.P.), India

## Abstract

In a survey conducted in the year 2016-2018, for the record of invasive alien Angiospermic plant species of Pilibhit Tiger Reserve, a total 64 species belonging to 29 families were recorded, among these Dicotyledons represented by 57 species whereas monocots with 7 species. Among all Alien species, the maximum number of species (13) were from the family Asteraceae, followed by Amaranthaceae (05), Euphorbiaceae and Papilionaceae (04), Caesalpiaceae (03), Convolvulaceae and Poaceae (03). The data revealed that herbs accounted for 45 species, undershrubs 6 species, shrubs 5 species, climbers 1 species, trees 2 species, grasses 3 species and sedges represented with 2 species.

**Key words:** Invasive Alien Species, Pilibhit Tiger Reserve.

## Introduction

India is the 7<sup>th</sup> largest country and one of the mega diversity nations on globe out of 17 most biodiversity rich countries. Varied climatic conditions coupled with a big variety of habitats and environmental conditions make it more susceptible for the out break of invasive alien plant species. After introduction they can expand their population and create mono specific thickets. The District of Pilibhit is the north-eastern most district of Rohilkhand division which is situated in the sub Himalayan belt on the boundary of Nepal. Pilibhit wild life sanctuary under Pilibhit forest division & some area of Shahjahanpur has been notified as Pilibhit Tiger Reserve by the state government in the year 2014. The Tiger Reserve is located in terai region which is known for its complex of sal forest, tall grasslands and swamps maintained periodic flooding, is one of the most threatened ecosystem in India. The total area of the reserve forest is 73024.98 ha out of which 60279.80 ha is the core and rest 12745.18 ha is the buffer zone. The Tiger Reserve comprises with the five ranges viz., Mala, Mahof, Barahi, Haripur and Deoria and part of Khutar range. Administratively the area is comprised into single protected area as Pilibhit Tiger Reserve. The headquarters of P.T.R. (Pilibhit Tiger Reserve) is located at Pilibhit district. The temperature

ranges between a minimum of 5°C (average) in winter to maximum temperature of up to 40-44°C in peak summer. The record of the average annual rainfall value is 612.59 mm. A survey of the literature reveals that except a few old contributions viz., Duthie, (1922) and Kanjilal, (1933), little work has been carried out on the taxonomy and distribution of angiosperms in Pilibhit forest. Alien species are a major threat to biodiversity of Tiger Reserve. Human actions have significant impact on the dispersal of exotic plants and enhance the prevalence of the past alien species in general. Biological invasion greatly influence the ecological and economic perspectives. Alien invasive species not only compete for nutrients, moisture and light but also for space. These species can affect biodiversity pattern and community structure (Huxel, 1999). Invasive species are one of our most pressing environment concerns (Cox, 2004; Charls *et al.*, 2005) and humans have been identified as a major vector in the dispersal of invasive species throughout the world (Sharma *et al.*, 2005). The problem of invasive alien plant species has attracted much attention at the international and national levels so before the study of invasive alien plant species, a number of research papers and related literature was studied (Elton, 1958; Mishra, 1968; Maheshwari and Paul, 1975; Babu, 1977; Bhattacharya, 1982; Nair, 1988; Gaur, 1999; Sax *et al.*, 2002; Biswas *et al.*, 2004; Cox, 2004; Kohli *et al.*, 2004; Sharma *et al.*;

\*Author for correspondence : E-mail: deepumay1984@gmail.com

2005; Raghuvanshi *et al.*, 2005; Negi and Hajra, 2007; Reddy, 2008; Beena Kumari, 2009; Dixit, 2009; Khanna, 2009; Joshi and Rawat, 2011; Balakrishan *et al.*, 2012; Chandra Sekar *et al.*, 2012; Gaur and Rawat, 2013; Rastogi *et al.*, 2015; Beena Kumari *et al.*, 2016). Invasive alien species of Pilibhit Tiger Reserve has not been studied so far as such the present study has been undertaken to record the status of invasive alien plant species in Pilibhit Tiger Reserve area.

**Materials and Methods**

The present investigation was accomplished in Pilibhit Tiger Reserve. Intensive field studies were carried out repeatedly in different seasons from 2016-2018 to get maximum data of invasive alien plant species (IAPS).

Total geographical area of P.T.R. was surveyed. Plant samples were collected from various habitats to enlist all the invasive alien species of the study area. The collected specimens were identified using different regional floras and literature (Duthie, 1903-29; Maheshwari, 1963; Raizada, 2007; Dixit, 2009; Kumar Rajesh, 2011) and preserved according to standard herbarium techniques in the Department of Botany, Bareilly College, Bareilly. Herbaria of BSI, Dehradun, Forest Research Institute, Dehradun and National Botanical Research Institute, Lucknow were consulted for confirmation and documentation of invasive alien species.

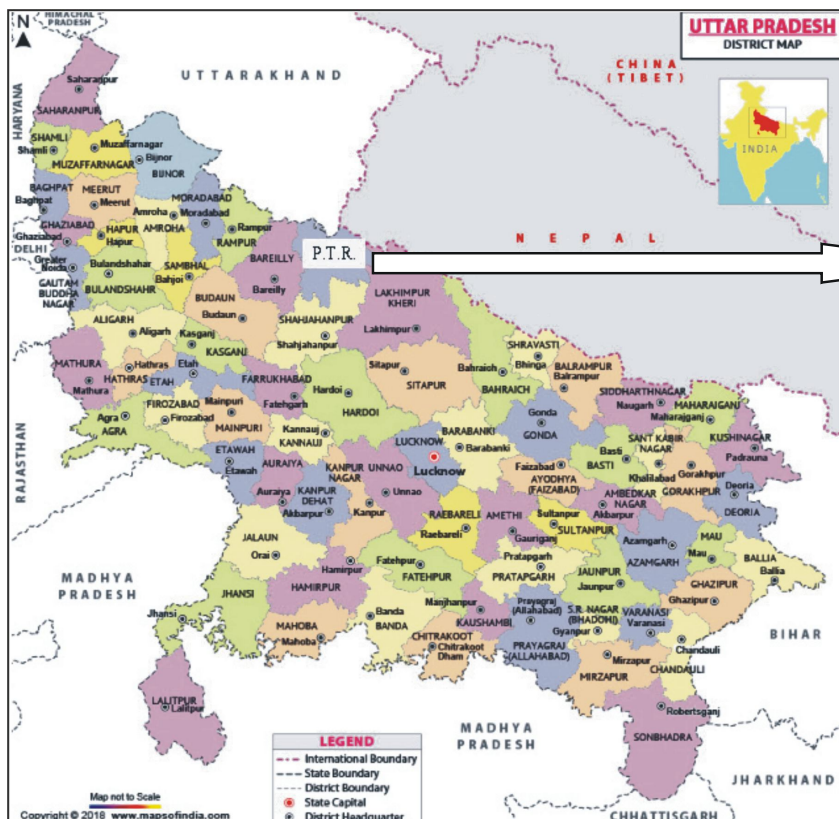
**Results and Discussion**

The present study is an effort to list invasive alien plant species of Pilibhit Tiger Reserve. Total 64 species belonging to 29 families are listed in table 1.

Dicotyledons represented by 57 species under 45 genera and monocotyledons by 7 species under 6 genera. Maximum number of species (13) were from the family Asteraceae, followed by Amaranthaceae (5) and then Euphorbiaceae (4), Papilionaceae (4), Caesalpiniaceae (3), Convolvulaceae (3), Poaceae (3). Herbs accounted for 45 species, undershrubs 6 species, shrubs 5, Grasses and sedges represented 3 and 2 species respectively, trees 2 and climber represented 1 species. It has been noted that few species such as *Lantana camara*, *Ageratum conyzoides*, *Ipomoea carnea*, *Parthenium hysterophorus* and *Xanthium indicum* are highly invasive.

**Impact of Invasive Alien Plant Species**

Invasive alien plant species are introduced, accidentally or intentionally in to the country are subsequently escaping from their entry points and they are spreading at alamingrate. The spread of invasive alien species is neither easy to manage nor easy to reverse. They are threatening not only biodiversity but also economic development. Invasive alien plant species have capability of spreading fast, high competitiveness and ability to



Map (a) District Map of Uttar Pradesh



Map (b) Map of Pilibhit Tiger Reserve

**Table 1:** Occurrence and Distribution of Invasive Alien Angiosperms in Pilibhit Tiger Reserve (Uttar Pradesh), India.

Sl. No.	Scientific Name of IAPS	Family	Life form	Flo. & Fruiting	Native Range
1	<i>Acacia farnesiana (L.) wild</i>	Mimosaceae	T	Aug.-Mar.	Tropical South America
2	<i>Ageratum conyzoides (L.)</i>	Asteraceae	H	Jul.-Jan.	Tropical America
3	<i>Ageratum houstonianum mill.</i>	Asteraceae	H	Jul.-Feb.	Tropical America
4	<i>Alternanthera pungens kunth</i>	Amaranthaceae	H	Aug.-Dec.	Tropical America
5	<i>Alternanthera ficoidea(L.) sm.</i>	Amaranthaceae	H	Jul.-Jan.	Tropical America
6	<i>Anagalis arvensis L.</i>	Premulaceae	H	Dec.-Apl.	Europe
7	<i>Argemone mexicana (L.)</i>	Papaveraceae	H	Sep.-Jan.	Tropical Central & South America
8	<i>Bidens pilosa L.</i>	Asteraceae	H	Jul.-Dec.	Tropical America
9	<i>Blumea eriantha DC.</i>	Asteraceae	H	Aug.-Dec.	Tropical America
10	<i>Blumea lacera (Burm.f.) DC.</i>	Asteraceae	H	Aug.-Feb.	Tropical America
11	<i>Calotropis gigantea (L.) Dryand.</i>	Asclepiadaceae	S	Throughout the year	Tropical Africa
12	<i>Calotropis procera</i>	Asclepiadaceae	S	Mar.-Dec.	Tropical Africa
13	<i>Celosia argentea L.</i>	Amaranthaceae	H	Sep.-Dec.	Tropical Africa
14	<i>Chloris barbata</i>	Poaceae	G	Sep.-Jan.	Tropical America
15	<i>Chrozophora rotleri</i>	Euphorbiaceae	H	Sep.-Feb.	Tropical Africa
16	<i>Cleome gynandra L.</i>	Cleomaceae	H	Sep.-Dec.	Tropical America
17	<i>Cleome viscosa L.</i>	Cleomaceae	H	Aug.-Dec.	Tropical America
18	<i>Corchorus tridens L.</i>	Tiliaceae	H	Aug.-Dec.	Tropical Africa
19	<i>Crotalaria pallid Aiton</i>	Papilionaceae	US	Aug.-Mar.	Tropical America
20	<i>Crotalaria retusa L.</i>	Papilionaceae	US	Aug.- Feb.	Tropical America
21	<i>Cuscuta reflexa</i>	Cuscutaceae	Cl	Aug.-Dec.	Mediterranean region
22	<i>Cyperus difformis L.</i>	Cyperaceae	Sg.	Aug.-Dec.	Tropical America
23	<i>Cyperus iria L.</i>	Cyperaceae	Sg.	Aug.-Jan.	Tropical America
24	<i>Digera muricata (L.) Mart.</i>	Amaranthaceae	H	Aug.-Jan.	North America
25	<i>Echinochloa colona (L.)Link</i>	Poaceae	G	Aug.-Mar.	Tropical South America
26	<i>Echinops echinatus Roxb.</i>	Asteraceae	H	Aug.-Dec.	Afghanistan
27	<i>Eclipta prostrata L.</i>	Asteraceae	H	Jul.-Mar.	Tropical America
28	<i>Eichhornia crassipes</i>	Pontederiaceae	H	Aug.-Dec.	Tropical America
29	<i>Erigeron canadensis L.</i>	Asteraceae	H	Jun.-Dec.	South America
30	<i>Euphorbia cyathophora</i>	Euphorbiaceae	US	Jun.-Dec.	Tropical America
31	<i>Euphorbia hirta L.</i>	Euphorbiaceae	H	Aug.-Dec.	Tropical America
32	<i>Galinosoga parviflora</i>	Asteraceae	H	Aug.-Jan.	Tropical America
33	<i>Gamphrena serrata L.</i>	Amaranthaceae	H	Jun.-Dec.	Tropical America
34	<i>Grangea madiraspatana L.</i>	Asteraceae	H	Aug.-Dec.	Tropical South America
35	<i>Ipomoea carnea</i>	Convolvulaceae	S	Throughout the year	Tropical America
36	<i>Ipomoea eriocarpa R.Br.</i>	Convolvulaceae	H	Jul.-Dec.	Tropical Africa
37	<i>Ipomoea pestigridis L.</i>	Convolvulaceae	H	Jul.-Feb.	Tropical East Africa
38	<i>Lantana camara L.</i>	Verbenaceae	S	Throughout the year	Tropical America
39	<i>Melilotus albus</i>	Papilionaceae	H	Aug.-Dec.	Europe
40	<i>Mimosa pudica L.</i>	Mimosaceae	H	Jul.-Feb.	Brazil
41	<i>Mirabilis jalapa L.</i>	Nyctaginaceae	H	Aug.-Dec.	Peru
42	<i>Parthenium hysterophorus L.</i>	Asteraceae	H	Jul.-Feb.	Tropical North America
43	<i>Dicliptera paniculata</i>	Acanthaceae	H	Aug.-Jan.	Tropical America
44	<i>Phyllanthus tenellus</i>	Euphorbiaceae	H	Aug.-Dec.	Mascarene Island
45	<i>Portulaca oleracea L.</i>	Portulacaceae	H	Aug.-Dec.	Tropical Central America
46	<i>Portulaca quadrifida L.</i>	Portulacaceae	H	Aug.-Sep.	Tropical South America
47	<i>Prosopis juliflora</i>	Mimosaceae	T	Sep.-Mar.	Mexico
48	<i>Ruellia tuberosa L.</i>	Acanthaceae	H	Apr.-Oct.	Tropical America

Table 1 Continue ...

Table 1 Continue ...

49	<i>Saccharum spontaneum L.</i>	Poaceae	G	Sep.-Jan.	Tropical West Asia
50	<i>Senna obtusifolia</i>	Caesalpiniaceae	US	Aug.-Dec.	Tropical America
51	<i>Senna occidentalis L.</i>	Caesalpiniaceae	US	Jul.-Dec.	South America
52	<i>Senna tora L.</i>	Caesalpiniaceae	H	Aug.-Dec.	Tropical South America
53	<i>Sesbania bispinosa</i>	Papilionaceae	H	Jun.-Dec.	Tropical America
54	<i>Sida acuta</i>	Malvaceae	H	Jul.-Dec.	Tropical America
55	<i>Solanum americanum Mill.</i>	Solanaceae	H	Jun.-Dec.	Tropical America
56	<i>Solanum torvum</i>	Solanaceae	S	Oct.-Mar.	West Indies
57	<i>Sonchus asper L.</i>	Asteraceae	H	Aug.-Feb.	Mediterranean region
58	<i>Spermacoce hispida L.</i>	Rubiaceae	H	Jun.-Dec.	Tropical America
59	<i>Tribulus terrestris L.</i>	Zygophyllaceae	H	Throughout the year	Tropical America
60	<i>Tridax procumbens</i>	Asteraceae	H	Throughout the year	Tropical Central America
61	<i>Typha angustifolia L.</i>	Typhaceae	H	May.-Dec.	Tropical America
62	<i>Urena lobata L.</i>	Malvaceae	H	Jul.-Dec.	Tropical America
63	<i>Veronica anagallis-aquatica L.</i>	Scrophulariaceae	H	Feb.-Jun.	Africa
64	<i>Waltheria indica L.</i>	Sterculiaceae	US	Jul.-Dec.	Tropical America

Life Form: H=Herb, S=Shrub, Us=Undershrub, Cl=Climber, T=Tree, Sg.= Sedge, G=Grass

colonize in new areas within a short period. Invasive alien plant species are one of the major threats to native species and ecosystems. Encroachment of rangelands by invasive alien species, reduction of crop yield, disruption of water flow, formation of impenetrable thickets etc. are some of

the impacts of invasive species. These species are altering the ecosystem processes, reducing native plant species abundance and richness and decreasing genetic diversity of different ecosystem. The invasive nature of *Parthenium hysterophorus* is evidenced from its ability to form huge mono cultural group with no other plant in the neighborhood. It is known to cause many ecological and agricultural problems, such as the less of crop productivity, depletion of biodiversity and health problems for human beings. The seed production of *Lantana camara* is prolific and easy seed dispersal, escaped

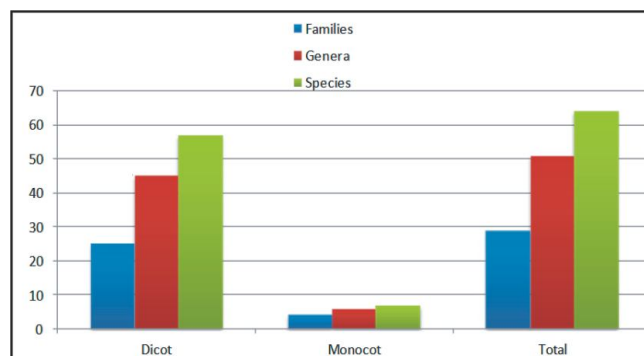


Fig. 1: Graphical Representation of Families, Genera and Species of IAPS in Pilibhit Tiger Reserve.

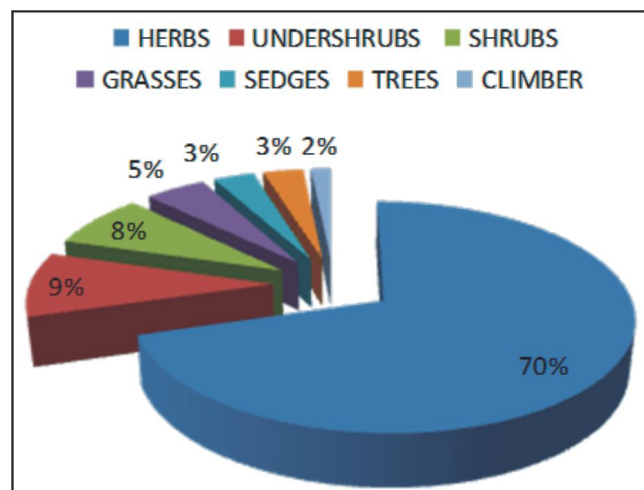


Fig. 2: Different Life Form of IAPS in Pilibhit Tiger Reserve.



Photo Plate: A-*Eichhornia crassipes*; B-*Parthenium hysterophorus L.*; C- *Calotropis procera*; D- *Lantana camara L.*

cultivation and become a pest in the social, ecological and economic concerns. *Prosopis juliflora* is an evergreen invasive woody plant that cause great destruction of other plant species. It show a great depressive effect on the number, density and frequency of native vegetations. *P. juliflora* has an effect on human health. It causes itching and tetanus in human being. Its thorns can even cause blindness.

It is, therefore, concluded that invasive alien plant species can affect the food sources of local population directly or indirectly and increase penetrability to hazards and risks. In areas where invasive alien plant species spread, they can destroy natural grasslands and reduce grazing potential of rangelands. Moreover, invasive alien plant species have adverse impact on many industries, such as fisheries, tourism.

### Acknowledgement

The authors are thankful to Dr. Rajesh Kumar, Taxonomy and Herbarium Discipline, Department of Botany, Bareilly, Uttar Pradesh for providing help in collection and identification of different plant species.

### References

- Babu, C.R. (1977). Herbaceous Flora of Dehradun. CSIR, New Delhi.
- Balakrishnan, N.P., T. Chakarbarty, M. Sanjappu, P. Lakshminarsimhan and P. Singh (2012). Flora of India, vol-23, Botanical Survey of India, Kolkata.
- Bhattacharya, U.C. and A.K. Goel (1982). Studies on the Vegetation of Tehri Dam and Some Rare Plants in Garhwal Himalayas. Botanical Survey of India. Howrah. 1-38.
- Biswas Sas. and S.S. Jain (2004). Invasive alien species of India and biodiversity conservation: National workshop on Invasive Alien Species organized by Banaras Hindu University, 18-20 August 2004.
- Cox, G.W. (2004). Alien Species and Evolution: The Evolutionary Ecology of Alien Plants, Animals, Microbes and Interacting Native Species. Island Press, Washington, D.C.
- Chandra Sekar, K., R. Manikandan and S.K. Srivastava (2012). Invasive Alien plants of Uttarakhand Himalaya. Proceeding of the National Academy of sciences, India section B: *Biological Sciences.*, **82(3)**: 375-383.
- Dixit, Gopal (2009). A survey of plants used in baskets, mats and cordage Industry by different ethnic group of Pilibhit District of Uttar Pradesh.
- Duthie, J.F. (1903-1929). Flora of the Upper Gangetic Plain and of the adjacent Siwalik and Sub-Himalayan tracts, Calcutta.
- Elton, C.S. (1958). The ecology of invasions by animals and plants, 2<sup>nd</sup> edn. Methuen, London.
- Gaur, T. and D.S. Rawat (2013). Diversity, nativity, flowering phenology and invasive alien species of Asteraceae in Pantnagar. *Pantnagar J. of Research.*, **11(3)**: 409-416.
- Gaur, R.D. (1999). Flora of the District Garhwal North West Himalaya, Transmedia: Srinagar Garhwal, india.
- Joshi, K. and D.S. Rawat (2011). A preliminary Investigation on Alien and Native Elements in the Flora of Pantnagar, U.K., India. *Journal of Indian Botanical Society.*, **90**: 66-74.
- Kumari, Beena (2009). Alien invasive plant species of district Moradabad (UP), India. *Plant Archives.*, **9(2)**: 723-724.
- Kanjilal, U.N. (1928). Forest Flora of the Chakrata, Dehradun and Saharanpur forest divisions, Uttar Pradesh. 3<sup>rd</sup>edn. Delhi: Manager of publications, Govt. of India Press.
- Khanna, K.K. (2009). Invasive Alien Angiosperms of Uttar Pradesh. *An International Journal.*, **1(2)**: 41-46.
- Kohli, R.K., K.S. Dogra, D.R. Batish and H.P. Singh (2004). Impact of invasive plants on the structure and composition of natural vegetation of North-western Indian Himalayas. *Weed Technology.*, **18**: 1296-1300.
- Kumar Rajesh (2011). Taxonomic and Ecological Studies in Angiospermic Diversity of Bareilly District Uttar Pradesh, India.
- Kumari, B., S.P. Singh, A.P. Singh, R. Kumar and S.A. Verma (2016). Preliminary survey of invasive alien angiosperms of Rohilkhan region (U.P.), India. *Plant Archive.*, **16(1)**: 45-50.
- Mack, M.C. and D. Antonio (1998). C.M. Impacts of biological invasions on disturbance regimes. *Trends in Ecology and Evolution.*, **13**: 195-198.
- Maheshwari, J.K. (1963). The flora of Delhi. CSIR, New Delhi.
- Maheshwari, J.K. and S.R. Paul (1975). The Alien flora of Ranchi. *J. Bombay Nat. Hist. Soc.*, **72(1)**: 158-188.
- Mishra, R. (1968). Ecology Work Book. Oxford and IBS Publishing Company, Calcutta.
- Nair, K.K.N. and H.B.K. Mikaniamirantha (1988). Anxious weed in the forests of Kerala. *Evergreen.*, **20**: 13-14.
- Negi, P.S. and P.K. Hajra (2007). Alien flora of Doon valley, North West Himalaya. *Current Science.*, **92(7)**: 968-978.
- Pandey, R.P. and P.J. Parmar (1994). The Alien flora of Rajasthan. *J. Econ. Tax. Bot.*, **18(1)**: 105-121.
- Raizada, P. (2007). Invasive species: The concept, invasion process and impact & management of invaders. *EnviroNews.*, **13(3)**: 07-09.
- Raghuvanshi, A.S., L.C. Rai, J.P. Gaur and J.S. Singh (2005). Invasive Alien species and biodiversity in India. *Current Science.*, **88(4)**.
- Rastogi J., D.S. Rawat and S. Chandra (2015). Diversity of invasive alien species in Pantnagar flora. *Tropical Plant Research.*, **2(3)**: 282-287.
- Reddy C.S. (2008). Catalogue of Invasive Alien Flora of India. *Life Science Journal.*, **5(2)**: 84-89.
- Sax, D.F., S.D. Gaines and J.H. Brown (2002). Species invasions exceed extinctions on islands worldwide : a comparative study of plants and birds. *American Naturalist.*, **160**: 766-783.
- Sharma, G.P., J.S. Singh and A.S. Raghuvanshi (2005). Plant invasions: Emerging trends and future implications. *Current Science.*, **88(5)**: 726-734.
- Uniyal, B.P., S. Singh and D.K. Singh (1995). Plant Diversity in the Tehri Dam Submersible Area. Botanical Survey of India, Govt. India.
- Vermeij, G. (1996). An agenda for invasion biology. *Biological Conservation.*, **78**: 3-9.