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A STUDY ON INVASIVE / INTRODUCED SPECIES OF VINOBA BHAVE UNIVERSITY CAMPUS (JHARKHAND)

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ABSTRAACT

Invasive and introduced species are crucial to any ecosystem. On one hand, they are sometimes important for various types of uses made by human being while on other hand they sometimes inflict adverse effect on local biodiversity. Some small constructed ecosystem like Vinoba Bhave University got many indigenous species as well as a number of introduced and invasive species. It is very-very important to document all those invasive and introduced species and to have an ecological study of those plants. Investigation was carried out with this intention and a detailed survey of introduced species was taken up to prepare a document for further studies.

Key words: Invasive species, Introduced species, Ecosystem, Vinoba Bhave University campus

INTRODUCTION

Invasive species, also known as alien species are those plant which are not native to the location in question and are introduced, accidentally or deliberately by human intervention. Such species are very important and crucial for native ecosystem because their response to local ecosystem is not known in the beginning. They often compete with local vegetation for nutrition and often cost them heavily. Several examples are their where invasive plants over dominated and almost completely wiped out local species. A classical example is of *Lantana camera* which was introduced as garden plant and was introduced from North America, later it spread in almost all part of India and almost eroded an important local herb *Dichanthium annulatum.* Hence, it is always advisable to be serious about invasive species. Vinoba Bhave University, apart from being an important educational institution is a unique mix up of natural and man made ecosystem.

The campus of Vinoba Bhave University, Hazaribag is situated about 6 km away from district head quarter on NH -33. Vinoba Bhave University lies between 24^0 1′ 11″ to 24^0 1′ 17″ North Latitude and 85^0 22′ 10″ to 85^0 22′ 35″ East Longitude. The total area of this campus is about 67.17 acre (271827.35 Sq.m) and a well constructed boundary is around the campus .The total constructed area is 19.34 acre (78279.55Sq.m). Open area of land runs in 47.83 acre (193547.79 Sq. m.). Nearly 72.21% of the total area is under green cover with 2654 trees belong to different species. Apart from that Diverse group of plants like, Bryophytes, Pteridophytes

and Gymnosperm are also being maintained in the campus. Most of the plant in this campus are planted. Apart from that some endangered species are also being maintained in the campus Botanical garden, two artificial water bodies are also present in the campus. The water bodies which are rather new in age and contain some algae and Hydrophytes as well as Keeping above facts in the mind, the present study was under taken to eneumerate invasive species of Vinoba Bhave University Campus, Hazaribag.

Site of study

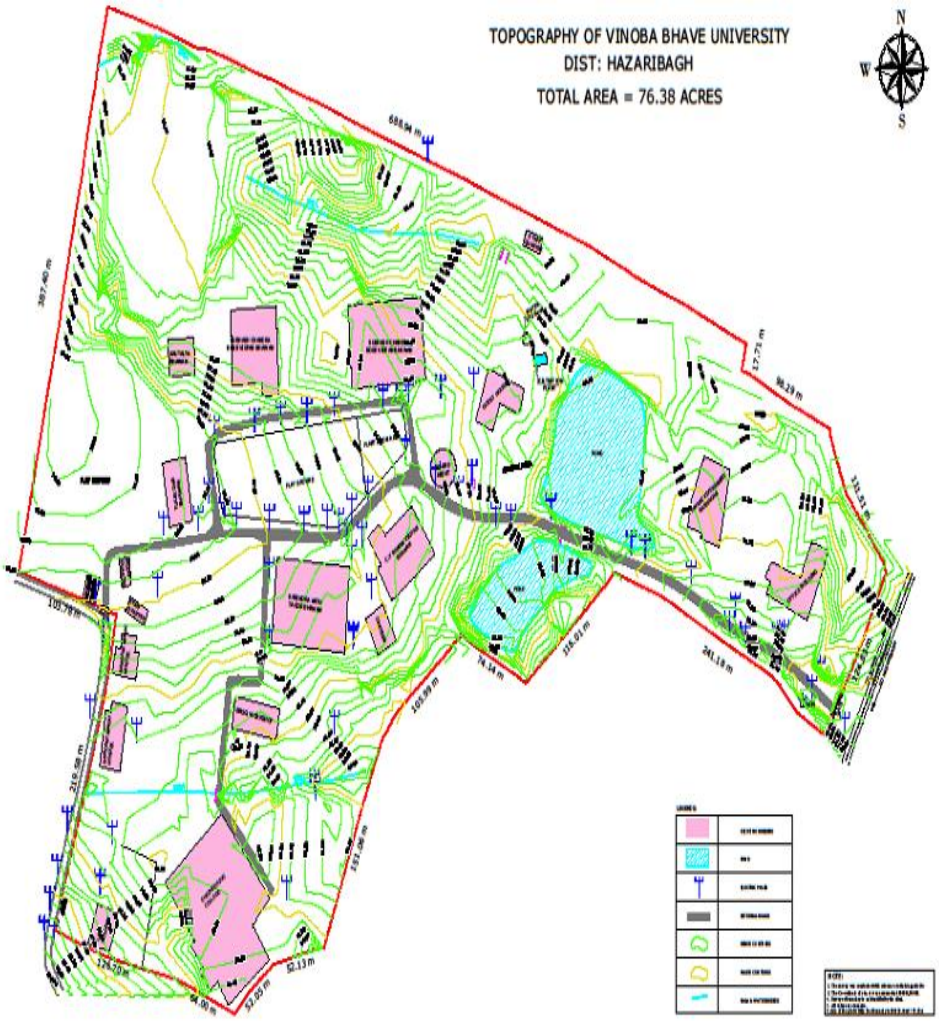


Fig of map of University campus

Methodology: - The present study was carried out in Vinoba Bhave University campus, Hazaribag Jharkhand state of India. An extensive field survey was conducted from February 2018 to September 2021 to record and collect the various planted and naturalized plant species growing in the main campus of Vinoba Bhave University. During the survey, visits were made to every nook and corner of the big University campus to search the plants species. Field trips were arranged in such a way as to collect the plant in flowering and fruiting stage. Nativity of collected plants were studied with the help of various extensive review of literature on global invasive species. (Cox 1999,Heywood 1989,Moony and Drake 1987 , Drake et al 1989, Randall et al 1997,Huxel 1999, Jenkins 1999,Londsdle 1999, Elton 2000, Mcneely et al 2001,)and of India and their spread based on history, species origin, species behavior and field observation. The nativity of the species is provided based on earlier worker (Mathew 1969) Maheshwari and Paul 1975, Sharma and Pandey 1984, Hajra and Das 1982 , Saxena 1991, Pandey and Parmar 1994, Reddy et al -2000, Reddy and Raju 2002, Negi and Hajra 2007,. The

identity and origin of the plant species was established by the floristic key of Hooker (1875-1887) Cooke (1901-1908) Good (1947) Baily (1968) and Raizada (1976)

RESULT AND DISCUSSION

Altogether 129 invasive/introduced plant species were recorded from Vinoba Bhave University campus. These species represented Fabaceae, Euphorbiaceae, Malvaceae, Asparagaceae, Asteraceae, Asphodelaceae, Apocynaceae, Amaranthaceae, Annonaceae, Araucariaceae, Papaveraceae, Nyctaginaceae, Crassulaceae, Marantaceae, Myrtaceae, Cannaceae, Caricaceae, Lauraceae, Cucurbitaceae, Commelinaceae, Cycadaceae, Poaceae, Solanaceae, Araceae, Verbenaceae, Pontideriaceae, Convolvulaceae, Heliconiaceae, Lamiaceae, Bignoniaceae, Cupressaceae, Cyperaceae, Onagraceae, Nymphaeaceae, Cactaceae, Oxalidaceae, Phyllanthaceae, Lamiaceae, Plumbaginaceae, Polygonaceae, Porellaceae, Potamogetonaceae, Ranunculaceae, Commelinaceae, Rosaceae, Plantaginaceae, Pedaliaceae, Malvaceae, Aizoaceae, Typhaceae, Violaceae, Zamiaceae, families. Detail enumeration of species with their family, local name, Origin e.t.c. are presented in table 1.

Table 1: Exotic Flora of Vinoba Bhave University campus, Hazaribag

Sl. No.	Botanical name	Family	Habit	Local name	Remarks	Native region
1.	*Acacia auriculiformis*	Fabaceae	Tree	Sabuni		Australia
2.	*Acalypha indica*	Euphorbiaceae	Herb	Copperleaf		North America
3.	*Adansonia digitata*	Malvaceae	Tree	Kalpataru	Medicinal	Africa
4.	*Agave americana*	Asparagaceae	Shrub	Murabba		Mexico
5.	*Agave sisalana*	Asparagaceae	Shrub	Sisal		Southern Mexico
6.	*Ageratum conyzoides*	Asteraceae	Herb	Uchanti		Tropical America especially Brazil
7.	*Aloe vera Linn.*	Asphodelaceae	Herb	Gritkumari		Oman
8.	*Allamanda* sp.	Apocynaceae	Shrub	Alamanda	Medicinal and Ornamental	Americas
9.	*Alternanthera philoxeroides*	Amaranthaceae	Herb	Silhanti		Temperate region of South America
10.	*Amaranthus viridis (Hook)*	Amaranthaceae	Herb	Chaulai bhaji		Southern United State & Mexico

Sl. No.	Botanical name	Family	Habit	Local name	Remarks	Native region
11.	*Amarenthes spinosus*	Amaranthaceae	Herb	Cholai		Tropical America
12.	*Anacyclus pyrethrum*	Asteraceae	Herb	Akarkara	Medicinal	Mediterranean Europe
13.	*Annona squamosa*	Annonaceae	Tree	Sarifa		Tropical Americas & West Indies
14.	*Araucaria columnaris*	Araucariaceae	Tree	X mas	Gymnosperm	New Caledonia
15.	*Argemone mexicana*L.	Papaveraceae	Herb	Shailkanta		America
16.	*Asparagus retrofractus*	Asparagaceae	Climber			South Africa
17.	*Bidens pilosa*	Asteraceae	Herb	Myana		Americas
18.	*Boerhavia diffusa*	Nyctaginaceae	Creeper	Punarwa		Old World Tropics
19.	*Bougainvillea spectabilis*	Nyctaginaceae	Shrub	Paper flower	Medicinal and Ornamental	Brazil
20.	*Bryophyllum pinnatum*	Crassulaceae	Herb	Jakhm Haijat	Medicinal	Madagascar
21.	*Caesalpinia pulcherrima*	Fabaceae	Tree	Peocock tree		Americas & West Indies
22.	*Cajanus scarabaeoides*	Fabaceae	Climber	Vankulthi		Madagascar
23.	*Calathea lancifolia*	Marantaceae	Herb	Rattlesnake		Rio de Janeiro state in Brazil
24.	*Calendula officinalis*	Asteraceae	Herb	Genda		Southern Europe
25.	*Callistemon citrina*	Myrtaceae	Tree	Bottle brush		Australia
26.	*Canna indica*	Cannaceae	Shrub	Cana		South America
27.	*Carica papaya*	Caricaceae	Tree	Papita		Tropics of the Americas

Sl. No.	Botanical name	Family	Habit	Local name	Remarks	Native region
28.	*Cassia alata*	Fabaceae	Shrub	Lollipop		New Tropics
29.	*Cassia sophera*	Fabaceae	Shrub	Coffi		Bangladesh
30.	*Cassia tora*	Fabaceae	Herb	Chakod		Central America
31.	*Catharanthus alba*	Apocynaceae	Herb	Sadabahar	Medicinal	Madagascar
32.	*Catharanthus roseus*	Apocynaceae	Herb	Sadabahar		Madagascar
33.	*Chenopodium album*	Amaranthaceae	Herb	Bhatua		North America
34.	*Chlorophytum comosum*	Asparagaceae	Herb	Musli		South Africa
35.	*Cineraria longipes*	Asteraceae	Herb			Southern Africa
36.	*Cinnamomum zeylanicum*	Lauraceae	Tree	Dalchini	Medicinal and Spices	Sri Lanka
37.	*Coccinia grandis*	Cucurbitaceae	Climber	Kundri		Tropical Africa
38.	*Commelina erecta*	Commelinaceae	Creeper	Kankawa		North America
39.	*Crotalaria pallida*	Fabaceae	Shrub	san		Central and Tropical America
40.	*Cycas circinalis*	Cycadaceae	Tree	Cycas	Gymnosperm	Sri Lanka
41.	*Cycas revoluta*	Cycadaceae	Tree	Cycas	Gymnosperm	Southern Japan
42.	*Cynodon dactylon* (L.) Pers.	Poaceae	Herb	Dubra		Eastern Africa
43.	*Dactyloctenium aegyptium*	Poaceae	Herb	Cowfoot		Africa
44.	*Dahlia pinnata*	Asteraceae	Shrub	Dahlia		Mexico and Central America
45.	*Datura stramonium*	Solanaceae	Shrub	Datura	Medicinal	North America

Sl. No.	Botanical name	Family	Habit	Local name	Remarks	Native region
46.	*Delonix regia*	Fabaceae	Tree	Radhachur		Madagascar
47.	*Dieffenbachia* sp	Araceae	Herb		Medicinal and Ornamental	New World Tropics (Mexico)
48.	*Dracaena reflexa*	Asparagaceae	Shrub			Madagascar
49.	*Duranta repens*	Verbenaceae	Shrub	Nilkanta		Mexico, South America
50.	*Eichhornia crassipes*	Pontideriaceae	Aquatic	Jalkumbhi	Hydrophyte	South America
51.	*Eupatorium odoratum*	Asteraceae	Shrub	Rutush		Americas
52.	*Euphorbia heterophylla*	Euphorbiaceae	Herb			Tropical and Subtropical America
53.	*Euphorbia hirta*	Euphorbiaceae	Herb	Dudhi		Tropical region of Americas
54.	*Euphorbia milii*	Euphorbiaceae	Herb	Milli	Medicinal and Ornamental	Madagascar
55.	*Euphorbia tirucalli*	Euphorbiaceae	Herb	Peteroplant	Ornamental	Tropical and Southern Africa
56.	*Evolvulus alsinoides Linn.*	Convolvulaceae	Herb	Shankhpushpi		South America
57.	*Gomphrena globosa*	Amaranthaceae	Herb	Gul-makhmal		Central America
58.	*Helianthus annuus*	Asteraceae	Shrub	Surjmukhi		Western US
59.	*Heliconia bracteata*	Heliconiaceae	Shrub	Van kela		Tropical America
60.	*Wrightia antidysenterica*	Apocynaceae	Shrub	Kurchi		Sri Lanka
61.	*Hyptis suaveolens*(L.)	Lamiaceae	Herb	Bantulsi		Tropical

Sl. No.	Botanical name	Family	Habit	Local name	Remarks	Native region
	Poit.					region of Mexico
62.	*Ipomoea fistulosa*	Convolvulaceae	Shrub	Theter		Tropical America
63.	*Jacaranda mimosifolia*	Bignoniaceae	Tree	Neeli gulmohur		Central and South America
64.	*Jatropha curcas*	Euphorbiaceae	Shrub	Bagrandi		Central America, Mexico
65.	*Jatropha podagrica*	Euphorbiaceae	Shrub	Barbados	Medicinal	Tropical Americas
66.	*Juniperus* sp.	Cupressaceae	Shrub	Juniperus	Gymnosperm	Mountainous area in Africa
67.	*Kyllinga brevifolia*	Cyperaceae	Grass	Nirvish		Tropical area in Americas
68.	*Lantana camara* L. var. *aculeata* (L.) Mold.	Verbenaceae	Shrub	Putush		American Tropics
69.	*Leucaena leucocephala*	Fabaceae	Tree	Subabul		Southern Mexico
70.	*Lippia alba*	Verbenaceae	Shrub	Mat grass		United State, Mexico
71.	*Livistona chinensis*	Arecaceae	Palm	Chinese Fan		Southern Japan, Taiwan
72.	*Ludwigia octovalvis*	Onagraceae	Herb	Ban lavanga		North America
73.	*Maranta leuconeura*	Marantaceae	Herb	Tikkor	Medicinal and Spices	Brazilian Tropical Forest
74.	*Medicago minima*	Fabaceae	Herb	Vilaiti gawuth.		Mediterranean Basin

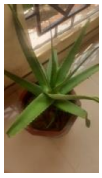
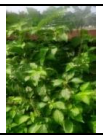
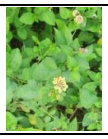
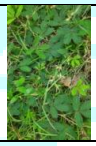
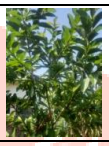
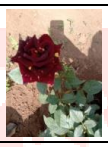
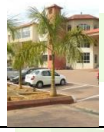
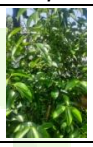
Sl. No.	Botanical name	Family	Habit	Local name	Remarks	Native region
75.	*Mimosa pudica*	Fabaceae	Herb	Lajwanti	Medicinal	South and Central America
76.	*Monstera deliciosa*	Araceae	Herb	Fruit salad tree	Medicinal and Ornamental	Southern Mexico, Panama
77.	*Nymphaea pubescens*	Nymphaeaceae	Aquatic	Saluk	Hydrophyte	Eastern North America
78.	*Oenothera drummondii*	Onagraceae	Shrub			Contiguous United States
79.	*Oplismenus undulatifolius*	Poaceae	Grass	Basket grass		Eurasia
80.	*Opuntia dillenii*	Cactaceae	Herb	Nagfani		Tropical and Subtropical Americas
81.	*Oxalis corniculata* L.	Oxalidaceae	Herb	Amruii		Southern Africa
82.	*Oxalis latifolia*	Oxalidaceae	Herb	Tin pati		Mexico
83.	*Parthenium hysterophorus*	Asteraceae	Herb	Gajarghas		American Tropics
84.	*Pedilanthus tithymaloides*	Euphorbiaceae	Shrub	Petroplant	Medicinal/ Ornamental	Southern Florida
85.	*Pennisetum purpureum*	Poaceae	Grass	Dinanath		Tropical Africa
86.	*Philodendron xanadu*	Araceae	Herb			Brazil
87.	*Phyla nodiflora*	Verbenaceae	Herb			North-South America to Southern United States
88.	*phyllanthus amarus*	Phyllanthaceae	Herb	Bhumi		Tropical

Sl. No.	Botanical name	Family	Habit	Local name	Remarks	Native region
				awla		America
89.	*Physalis minima*	Solanaceae	Herb			Tropical America
90.	*Pimenta dioica*	Myrtaceae	Tree	All – spice tree	Medicinal and Spices	West Indies
91.	*Plectranthus amboinicus*	Lamiaceae	Herb	Van Ajwain		Kenya to South Africa
92.	*Plumbago zeylanica*	Plumbaginaceae	Shrub	Chitrak	Medicinal	Hawaiian Islands
93.	*Polygonum glabrum*	Polygonaceae	Shrub	Pukur Mul		North America and Eurasia
94.	*Polypodium* sp.	Polypodiaceae	Fern		Pteridophyte	Western North America
95.	Porella sp.	Porellaceae	Bryo-phyta			Eurasia and Northern America
96.	*Potamogeton nodosus*	Potamogetonaceae	Aquatic	Kalay Pata	Hydrophyte	North America
97.	*Psidium guajava*	Myrtaceae	Tree	Amrud	Fruit	Mexico and America
98.	*Ranunculus sceleratus*	Ranunculaceae	Herb	Jal dhania		North America
99.	*Rauvolfia tetraphylla*	Apocynaceae	Shrub	Sarpgandha		Mexico and Central America
100.	*Rhoeo discolour*	Commelinaceae	Herb	Moses in the cradle	Medicinal and Ornamental	Belize
101.	*Rosa* sp.(pink, yellow, red, white, hybrid)	Rosaceae	Shrub	Gulab		Europe, North America
102.	*Roystonea regia*	Arecaceae	Palm	Royal palm	Palm	South

Sl. No.	Botanical name	Family	Habit	Local name	Remarks	Native region
			Tree			Florida & Cuba
103.	*Sasa palmate*	Poaceae	Grass	Japani bans	Medicinal and Ornamental	Japan
104.	*Scirpus rubrotinctus*	Cyperaceae	Grass	Motha		North America
105.	*Scoparia dulcis*	Plantaginaceae	Herb	Bandhaniya	Medicinal	New Tropics
106.	*Sesamum indicum*	Pedaliaceae	Shrub	Til		Sub-Saharan Africa
107.	*Sida acuta*	Malvaceae	Shrub	Bala		Central America
108.	*Sida rhombifolia*	Malvaceae	Herb	Bariyar		North America
109.	*Solanum nigrum*	Solanaceae	Herb	Makoi		Eurasia
110.	*Sonchus oleraceus*	Asteraceae	Herb			Europe
111.	*Spilanthes indica*	Asteraceae	Herb	Brajdanti	Medicinal	Africa
112.	*Stachytarpheta indica*	Verbenaceae	Shrub	Hathisud		Tropical Americas
113.	*Stevia rebaudiana*	Asteraceae	Herb	Madhu Tulsi	Medicinal	Paraguay
114.	*Swietenia mahagoni*	Meliaceae	Tree	Mahagoni	Medicinal and Timber	Florida
115.	*Synedrella nodiflora*	Asteraceae	Herb			South America, Mexico
116.	*Syngonium podophyllum*	Araceae	Herb	House plant	Ornamental	Mexico to Ecuador
117.	*Syzygium aromaticum*	Myrtaceae	Tree	Laung	Medicinal and Spices	Manuka Island
118.	*Tagetes patula*	Asteraceae	Herb	Genda		Mexico
119.	*Tecoma stans*	Bignoniaceae	Shrub			West Indies
120.	*Thevetia neriifolia*	Apocynaceae	Tree	Pila kaner	Medicinal and Ornamental	Mexico

Sl. No.	Botanical name	Family	Habit	Local name	Remarks	Native region
121.	*Thuja* orientalis	Cupressaceae	Tree	Mayuri		Canada
122.	*Tradescantia virginiana*	Commelinaceae	Herb		Medicinal and Ornamental	Southern Canada to Northern Argentina
123.	*Trianthema portulacastrum*	Aizoaceae	Herb			Africa
124.	*Tridax procumbens*	Asteraceae	Herb	Jharmakhna		Tropical Americas
125.	*Typha* sp.	Typhaceae	Aquatic	Hoogla, Kam	Hydrophyte	America
126.	*Viola* sp.	Violaceae	Herb			Eastern North America
127.	*Zamia* sp.	Zamiaceae	Shrub		Gymnosperm	Georgia
128.	*Zinnia acerosa*	Asteraceae	Grass			South West United States
129.	*Zinnia palustris*	Asteraceae	Grass	Wild rice		South West United States

Some important and dominant exotic plant species of the Vinoba Bhave University Campus are *Zamia sp., Tridax procumbens, Thuja orientalis, Thevetia neriifolia, Tagetes patula, Syzygium aromaticum, Sasa palmate, Roystonea regia, Rosa sp., Ranuncalus sceleratus, Psidium guajava, Pimenta dioica, Mimosa pudica, Lantana camara, Juniperus sp., Jacaranda mimosifolia, Hyptis suaveolens, Eichhornia crassipes, Duranta repens. Datura stamonium, Cycas circinslis , C ycas revoluta, Commelina erecta, Cinnamomum zeylanicum, Carica papaya, Calendula officinalis, Biden pilosa, Araucaria columnaris, Annona squamosa, Aloe vera and Parthenium hysterophorus.*

				
Agave americana	*Aloe vera*	*Annona squamosa*	*Bidens pilosa*	*Cajanus scarabaeoides*
				
Catharanthus alba	*Catharanthus roseus*	*Crotalaria pallida*	*Cycas circinalis*	*Cycas revoluta*
				
Duranta repens	*Eichhornia crassipes*	*Calotropis gigantea*	*Hyptis suaveolens*	*Lantana camra*
				
Mimosa pudica	*Opuntia dillenii*	*Parthenium hysterophorus*	*Psidium guajava*	*Ranunculus sceleratus*
				
Rosa sp.	*Roystonea regia*	*Syzygium aromaticum*	*Thevetia neriifolia*	*Thuja orientalis*
				
Tridax procumbens	*Zamia sp*			

As mentioned earlier, invasive and introduced species are often, highly competitive so far local vegetation is concerned. Local vegetation develop a system of co-existance duse several years. Introduced species on the other hand are highly demanding so far nutrition and water is concerned .Several previous workers like Mooney and Hobbs (2020), Mudgal and Hazra (1999), Hazra et al (1982), Elton (2000), Lal et. al. (2012), Tomar et. al. (2008), and Mukherjee (2015), Mukherjee and Kumar (2017) have studied in detail, the impact of invasive species. It is there for important to study in detail, the ecology of Vinoba Bhave University campus with special reference to invasive /introduced species. Any undesirable impact of such alien species will have effect on whole of Hazaribag ecology.

CONCLUSION

The study reveals that the Vinoba Bhave University campus is rich in exotic flora, represented mostly by ornamental plants, edible fruits trees, vegetable crop plants and weed plants. The flora of American origin dominates the exotic floristic composition of Vinoba Bhave University campus. The Fabaceae, Asteraceae and Poaceae are the dominant families of invasive floristic composition of V B U campus Hazaribag.

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