

Present status of the Angiospermic flora of Bhopal with special emphasis on the occurrence of invasive (alien) species

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Abstract

Bhopal, the capital city of M.P. has a rich angiospermic flora which comprises of more than 700 species belonging to diverse families. Majority of the plants are dicotyledones. The number of invasive species in India as reported by BSI is 173, out of which about 100 species are found in Bhopal. The invasive species have long been associated with the native plants and many of them have naturalized and are abundantly found in several areas of Bhopal and its suburbs. Some of these species comprise of *Parthenium hysterophorus*, *Eichhornia crassipes*, *Hyptis suaveolens*, *Lantana camara* & *Prosopis juliflora* etc. on the other hand species such as *Monochoria vaginalis*, *Solanum seafortianum*, and *Catharanthus pusillus* were encountered only once in the year 2000, and since then have not been witnessed. The present paper deals with the invasive (alien) species of Bhopal, their nativity and the present scenario.

There is an assemblage of various species at a given time in a geographical area. These may belong to the following categories.

Invasive species: An invasive species is a species that is not native to a specific location (an introduced species) and that has a tendency to spread to a degree believed to cause damage to the environment, human economy or human health (Wikipedia)
https://en.wikipedia.org/wiki/invasive_species

An invasive species is defined as a species that is non-native (or alien) to the ecosystem under consideration and whose introduction causes or likely to cause economic or environmental harm or harm to human health (USDA forest service Executive order 13112).
<http://www.fs.fed.us/wildflowers/invasive/index.shtml>

In my opinion, an invasive species is the one which is non native, has prolific

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flowering & fruiting with efficient dispersal mechanism, high reproductive capacity, adaptability to varying climatic and edaphic conditions and exercises allelopathic or teleotoxic effects on the neighbouring native plants. For the preparation of this manuscript relevant literature¹⁻⁹ has been consulted.

Non native plants : A plant introduced with human help (intentionally or accidentally) to a new place or new type of habitat where it was not previously found. Not all non-native plants are invasive. In fact when, many non-native plants are introduced to new places, they can not reproduce or spread readily without continued human help (for instance, many ornamental plants).

Native plants : A plant that is a part of the balance of nature that has developed over hundreds or thousand of years in a particular region or ecosystem.

The word native should always be used with a geographic qualifier (that is native to Europe, India, N. America).

Naturalized plant : A non native plant that doesn't need human help to reproduce and maintain itself over time in an area where it is not native.

https://www.nics.usda.gov/wps/porta/nrcs/ct/technical/ecoscience/invasive/?ed=nrcs142p2_011124

Exotic : A plant not native to the continent on which it is now found. Plants from India are exotic in S. America, Plants of S. America are exotic in India.

Translocated plant : A plant not

native to the portion of the continent where it is now found.

Opportunistic Native plant : A native plant that is able to take advantage of disturbance to the soil or existing vegetation to spread quickly and out compete the other plants on the disturbed site (*Meremmia emarginata*).

Weed : A weed is a plant (native or non native) that is not valued in the place where it is growing or any plant that poses a major threat to agriculture and/or natural ecosystems within a country. (*Sonchus arvensis*, *Convolvulus arvensis*).

Noxious weed : A plant that is particularly troublesome. Any plant or plant product that can directly or indirectly injure or cause damage to crops for instance *Eichhornia crassipes* and *Alternanthera philoxeroides*.

India, has been bestowed by nature with a rich floristic heritage, especially angiosperms. As per BSI's recent floral statistics (angiosperms) published in 2017 and updated on 19/07/2018, India has 18386 species, which account for 6.84% of the total number of angiosperms (2,68,600) present in the world.

There are 4303 endemic and about 1700 threatened species in the country. The same finding reports 173 invasive species of angiosperms which are not native to India but owe their origin from other far flung geographical areas of the world.

Bhopal, the capital city of Madhya

Pradesh is strategically situated in the heart of the country, is quite rich from floristic point of view and can boast as one of the green capitals of India. It is evident that the city and its suburbs harbour about 720 species of angiosperms, which encompass, wild, ornamental, and alien or invasive species.

The invasive plants of Bhopal comprise of 100 species of angiosperms belonging to different families and nativities. Out of these, 58 species are from Tropical America, followed by Tropical Africa and Tropical South America with 10 species each. In table-1 the number of invasive species and their nativity is given. The invasive species of Bhopal belong to 41 families.

The family Asteraceae dominates with 18 species followed by Caesalpiniaceae (6), Solanaceae, Convolvulaceae and Papilionaceae 5 each, Amaranthaceae, Asclepiadaceae, Tiliaceae Poaceae and Mimosaceae with 4 species each, Euphorbiaceae and Scrophulariaceae with 3 species each, Cleomaceae, Pontederiaceae, Lamiaceae, Verbenaceae & Malvaceae with 2 species each. The rest of the families are represented by 1 species each. Invasive species encountered in Bhopal and its suburbs are given in table-1.

Some of the species are found abundantly and have almost naturalized in their new home. These comprise of *Parthenium hysterophorus*, *Cassia obtusifolia*, *C. tora*, *Eichhornia crassipes*, *Lantana camara*, *Alternanthera philoxeroides*, *Hyptis suaveolems*, *Prosopis juliflora*, *Calotropis procera*, *Celosia argentea*, *Ageratum conyzoides*, *Ipomoea carnea*, *Leucaena*

leucocephala & *Xanthium strumarium*.

Species like *Alternanthera pungens*, *Blumea lacera*, *Corchorus aestuans*, *Cyperus iria*, *Datura metel*, *Euphorbia heterophylla*, *Malvastrum coromandelianum*, *Pistia stratiotes*, *Ruellia tuberosa*, *Sida acuta*, *Typha angustata*, *Tridax procumbens*, *Portulaca oleracea*, *Argemone mexicana*, *Acanthospermum hispidum*, *Sonchus asper*, *Sonchus oleraceus* & *Celosia argentea*, are frequently encountered but are not abundant in their area of occurrence, however, *Pistia stratiotes* becomes gregarious in some water bodies and *Typha angustata* forms thickets wherever it grows.

Species such as *Antigonon leptopus*, *Martynia annua*, *Nicotiana plumbaginifolia*, *Ocimum americanum*, *Physalis pruinosa*, *Lagascia mollis*, *Flaveria trinervis*, *Grangea maderaspatensis*, *Melilotus alba*, *Chrozophora rotleri.*, *Leonotis nepetifolia*, *Urena lobata* and *Saccharum spontaneum* are confined to selected localities.

Species of plants which are very rare but often encountered are *Aerva javanica*, *Asclepias curassavica*, *Blumea obliqua*, *Cleome gynandra*, *Datura innoxia*, *Emilia sonchifolia*, *Eclipta prostrata*, *Impatiens balsamina*, *Indigofera astragalina*, *Scoparia dulcis*, *Indigofera linifolia*, *Echinops echinatus* and *Cassia pumila*.

Some invasive species of Bhopal are regularly used as herbal medicines by the practitioners of indigenous medicine. Some of these are - *Alternanthera pungens*, *Glossocardia basvallea*, *Calotropis gigantea*, *Calotropis procera*, *Cassia tora*,

Table-1. Invasive angiospermic species of Bhopal from Tropical America

S. No.	Name of the species	Family
1.	<i>Aerva javanica</i> (Burm.f.) Juss.ex Schult.	Amaranthaceae
2.	<i>Ageratum conyzoides</i> L.	Asteraceae
3.	<i>Alternanthera philoxeroides</i> (Mart.) Griseb Arn.	Amaranthaceae
4.	<i>Alternanthera pungens</i> Kunth.	Amaranthaceae
5.	<i>Antigonon leptopus</i> Hook. & Arn.	Polygonaceae
6.	<i>Asclepias curassavica</i> L.	Asclepiadaceae
7.	<i>Asphodelus tenuifolius</i> Cav.	Liliaceae
8.	<i>Bidens pilosa</i> L.	Asteraceae
9.	<i>Blainvillea acmella</i> (L.) Philipson	Asteraceae
10.	<i>Blumea lacera</i> (Burm.f.) DC	Asteraceae
11.	<i>Blumea obliqua</i> (L.) Druce	Asteraceae
12.	<i>Cassia absus</i> L.	Caesalpiniaceae
13.	<i>Cassia obtusifolia</i> L.	Caesalpiniaceae
14.	<i>Cassia pumila</i> Lam.	Caesalpiniaceae
15.	<i>Catharanthus pusillus</i> (Murray) Don.	Apocynaceae
16.	<i>Chloris barbata</i> Sw.	Poaceae
17.	<i>Cleome gynandra</i> L.	Cleomaceae
18.	<i>Cleome viscosa</i> L.	Cleomaceae
19.	<i>Corchorus aestuans</i> L.	Tiliaceae
20.	<i>Corchorus fascicularis</i> Lam.	Tiliaceae
21.	<i>Cyperus iria</i> L.	Cyperaceae
22.	<i>Datura innoxia</i> Mill	Solanaceae
23.	<i>Datura metel</i> L.	Solanaceae
24.	<i>Eclipta prostrata</i> (L.) Mant.	Asteraceae
25.	<i>Eichhornia crassipes</i> (C.Martius) Solms.Loub	Pontederiaceae
26.	<i>Emilia sonchifolia</i> (L.) DC.	Asteraceae
27.	<i>Euphorbia heterophylla</i> L.	Euphorbiaceae
28.	<i>Ecolvulus nummularius</i> L.	Convolvulaceae
29.	<i>Hyptis suaveolens</i> (L.) Poit	Lamiaceae
30.	<i>Impatiens balsamina</i> L.	Balsaminaceae
31.	<i>Imperata cylindrica</i> (L.) Raensch	Poaceae
32.	<i>Indigofera astragalina</i> DC	Papilionaceae

33.	<i>Indigofera glandulosa</i> Roxb. ex Willd.	Papilionaceae
34.	<i>Ipomoea carnea</i> Jacq.	Convolvulaceae
35.	<i>Ipomoea hederifolia</i> L.	Convolvulaceae
36.	<i>Ipomoea quamoclit</i> L.	Convolvulaceae
37.	<i>Lantana camara</i> L.	Verbenaceae
38.	<i>Ludwigia adscendens</i> (L.) H. Hara	Onagraceae
39.	<i>Lycuaena leucocephala</i> (Lam) de Wit	Mimosaceae
40.	<i>Malvastrum coromandelianum</i> (L.) Gracke	Malvaceae
41.	<i>Martynia armua</i> (Houston & Martyn) L.	Pedaliaceae
42.	<i>Melochia corchorifolia</i> L.	Sterculiaceae
43.	<i>Monochoria vaginalis</i> Viv.	Pontederiaceae
44.	<i>Nicotiana plumbaginifolia</i> Viv.	Solanaceae
45.	<i>Ocimum americanum</i> L.	Lamiaceae
46.	<i>Opuntia stricta</i> (Haw.) Haw	Cactaceae
47.	<i>Pistia stratiotes</i> L.	Araceae
48.	<i>Ruellia tuberosa</i> L.	Acanthaceae
49.	<i>Scoparia dulcis</i> L.	Scrophulariaceae
50.	<i>Sida acuta</i> Burm.f	Malvaceae
51.	<i>Spermacoce hispida</i> L.	Rubiaceae
52.	<i>Stachytarpheta jamaicensis</i> (L.)Vahl	Verbenaceae
53.	<i>Synadenium grantii</i> Hook.f	Euphorbiaceae
54.	<i>Triumfetta rhomboidea</i> Jacq.	Tiliaceae
55.	<i>Turnera ulmifolia</i> L.	Turneraceae
56.	<i>Typha angustata</i> Bory & Chaub.	Typhaceae
57.	<i>Xanthium strumarium</i> L.	Asteraceae
58.	<i>Physalis pruinosa</i> L.	Solanaceae
From Tropical North America		
1.	<i>Macrodonia procumbens</i> (Mill.) Small	Scrophulariaceae
2.	<i>Parthenium hysterophorus</i> L.	Asteraceae
From Tropical Central America		
1.	<i>Flaveria trinervis</i> (Spreng.) C. Mohr.	Asteraceae
2.	<i>Lagascea mollis</i> Cav.	Asteraceae
3.	<i>Tridax procumbens</i> L.	Asteraceae

	From Tropical South America	
1.	<i>Acacia farnesiana</i> (L.) Willd.	Mimosaceae
2.	<i>Cassia occidentalis</i> L.	Caesalpiniaceae
3.	<i>Cassia tora</i> L.	Caesalpiniaceae
4.	<i>Indigofera linifolia</i> (L.f.) Retz	Papilionaceae
5.	<i>Passiflora foetida</i> L.	Passifloraceae
6.	<i>Peperomia pellucida</i> (L.) Kunth.	Piperaceae
7.	<i>Pilea microphylla</i> (L.) Liebm	Urticaceae
8.	<i>Portulaca oleracea</i> L.	Portulacaceae
9.	<i>Echinochloa colona</i> (L.) Link	Poaceae
10.	<i>Grangea maderaspatana</i> (L.) Poir	Asteraceae
	From Tropical Central & South America	
1.	<i>Argemone mexicana</i> (L.)	Papaveraceae
	From Brazil	
1.	<i>Acanthospermum hispidum</i> DC	Asteraceae
2.	<i>Mimosa pudica</i> L.	Mimosaceae
3.	<i>Solanum seafortianum</i> Andrews	Solanaceae
	From Europe	
1.	<i>Melilotus alba</i> Desv.	Papilionaceae
	From Australia	
1.	<i>Torenia fournieri</i> Linden ex E. Fournier	Scrophulariaceae
	From Peru	
1.	<i>Mirabilis jalapa</i> L.	Nyctaginaceae
	From Mexico	
1.	<i>Prosopis juliflora</i> (Sw.) DC	Mimosaceae
	From Afghanistan	
1.	<i>Echinops echinatus</i> Roxb.	Asteraceae

	From Madagascar	
1.	<i>Cryptostegia grandiflora</i> R.Br.	Asclepiadaceae
	From Mediterranean	
1.	<i>Cuscuta chinensis</i> Lam.	Cuscutaceae
2.	<i>Sonchus asper</i> Hill	Asteraceae
3.	<i>Sonchus oleracea</i> L.	Asteraceae
	From Tropical Africa	
1.	<i>Borassus flabellifer</i> L.	Arecaceae
2.	<i>Calotropis gigantea</i> (L.) R.Br.	Asclepiadaceae
3.	<i>Calotropis procera</i> (Ait.) R.Br.	Asclepiadaceae
4.	<i>Celosia argentea</i> L.	Amaranthaceae
5.	<i>Chrozophora rottleri</i> (Geis.) Spreng	Euphorbiaceae
6.	<i>Corchorus tridens</i> L.	Tiliaceae
7.	<i>Indigofera trita</i> L.f.	Papilionaceae
8.	<i>Leonatis nepetiifolia</i> (L.) R.Br.	Lamiaceae
9.	<i>Ludwigia perennis</i> L.	Onagraceae
10.	<i>Urena lobata</i> L.	Malvaceae
	From Tropical West Asia	
1.	<i>Saccharum spontaneum</i> L.	Poaceae
	From West Indies	
1.	<i>Cassia alata</i> L.	Caesalpinaceae
	From West Indies	
1.	<i>Glossocardia bosvallea</i> (L.f.) DC	Asteraceae
	From Tropical East Africa	
1.	<i>Ipomoea pes-tigridis</i> L.	Convolvulaceae

Eclipta prostrata, *Xanthium strumarium*, *Tridax procumbens*, *Cassia tora*, *Indigofera linifolia*, *Melilotus alba*, *Mirabilis jalapa*, *Cuscuta chinensis*, *Urena lobata* and *Acacia farnesiana*.

A number of invasive species are grown locally as ornamentals. These include : *Antigonon leptopus*, *Asclepias curassavica*, *Impatiens balsamina*, *Ipomoea quamoclit*, *Opuntia stricta*, *Stachytarpheta jamaicensis*, *Turnera ulmifolia*, *Pilea microphylla*, *Mimosa pudica*, *Torenia fournieri*, *Mirabilis jalapa*, *Cryptostegia grandiflora*, *Borassus flabellifer*, *Cassia alata* & *Synadenium grantii*.

Some species which used to be seen very often are occasionally witnessed and wherever they occur their number is not significant. These comprise of *Asphodelus tenuifolius*, *Cassia pumila*, *Catharanthus pusillus* (not seen for the last 30 years), *Evolvulus nummularius*, *Monochoria vaginalis*, *Scoparia dulcis*, *Macrodonia procumbens*, *Passiflora foetida*, *Peperomia pellucida*, *Solanum seafortianum* & *Leonotis nepetiifolia*.

*Monochoria vaginalis**, *Passiflora foetida***, *Peperomia pellucida**, *Scoparia dulcis***, *Solanum seafortianum**, *Stachytarpheta jamaicensis***, *Synadenium grantii*, *Turnera ulmifolia*** and *Tribulus terrestris***.

Mereover, I would like to highlight the fact that out of the 173 species listed under BSI's list of invasive species of India, 172 are flowering plants and one species (*Salvinia molesta* D.S. Mitch.) is an aquatic pteridophyte,

which has wrongly been associated with the angiosperms.

Some of the species which have been included in the list of invasive species of India do not fit well to be called invasive, they may simply be called as exotic which have landed in the country incidentally or have been brought to this country for varying reasons.

At least with reference to Bhopal and a number of other areas of the country, which the present worker has come across, the following species can not be included in the list of invasive species. These species are not abundantly found and have a low frequency distribution some of these are. *Acacia farnesiana*, *Aerva javanica*, *Asphodelus tenuifolius*, *Borassus flabellifer*, *Cassia pumila*, *Catharanthus pusillus**, *Cleome gynandra***, *Cryptostegia grandiflora*, *Cuscuta chinensis*, *Evolvulus nummularius**, *Grangea maderaspatana*, *Indigofera linifolia* and *Macrodonia procumbens**.

The species with an asterisk (*) mark were witnessed about two decades ago and to my knowledge have vanished from the floristic scene of this area, due to many and specific reasons. The species marked with two asterisk signs (**) are very rarely encountered at least in this area. During the last few years some plants of *Turnera ulmifolia* and *Stachytarpheta jamaicensis* have been raised and planted by local nurseries.

The species which used to occur few years back but not encountered now, may be due to their narrow range of adaptability lower reproductive capacity and biotic interferences at the sites of their occurrence.

References :

- 1 https://en.wikipedia.org/wiki/invasive_species
- 2 <http://www.fs.fed.us/wildflowers/invasive/index.shtml>
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