

INVASIVE ALIEN ANGIOSPERMS DIVERSITY FROM BHIWAPUR TAHSIL, NAGPUR DISTRICT OF VIDHARBHA REGION (M.S.), INDIA

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Abstract: Present study provides the comprehensive list of invasive alien angiosperms diversity from Bhiwapur Tahsil of Nagpur district with detailed information on Family, Nativity, Life form, Habit, Habitat and mode of introduction. A total of 72 species distributed in 57 genera and 33 families recorded from study area. Dicotyledons represent by 25 families, 49 genera and 64 species; monocotyledons represent by 8 families, 8 genera and 8 species. Asteraceae is the most dominant family with 10 species. The American continents contributed majority (51%) of invasive plants and an Africa contribute 17% species. While analyzing the plant habit 41 species (57%) are annuals and 31 species (43%) are perennials. Out of 72 invasive alien species reported in this area only 8 species introduced intentionally and 64 species unintentionally.

Key Words: Invasive alien angiosperms, diversity, Bhiwapur Tahsil, Nagpur District.

1. INTRODUCTION:

Alien species are those species which introduced outside their natural distribution range. These alien species are known as introduced species, exotic species, non-indigenous species, non-native species and invasive species. All alien species are not invasive but some of them have been established as invasive, start competing with native species causing a negative impact on ecosystems, local species, and habitats. Biological invasions by exotic species are widely recognized as a significant component of human-caused global environmental change, often resulting in a significant loss in biological diversity, economic value, and function of invaded ecosystems (Humble, 2003).

“An alien species which becomes established in habitat, natural or semi-natural ecosystems, is an agent of change and threatens native biological diversity are known as invasive species”. (Clare et al. 2000).

Alien species introduced accidentally or intentionally outside of their natural range and are regarded as the most detrimental to original ecosystems and their dependent biodiversity (MacNeely, 2001). Biological invasion worldwide threatens biodiversity, resource availability, ecosystem dynamics, national economy and human health (Ricciardi et al., 2000). Invasive plant species affect ecosystem process and alter native community composition, deplete species diversity, and thus cause huge economic and ecological imbalance (Dogra et al., 2009).

Invasive Species have been introduced over the last few decades in India from their native areas either accidentally or deliberately as fodder crops or ornamentals. It is fueled rapidly during the last half-century as the globalization of trade and industry has resulted in increased mobility of people and goods, and the associated transport of plants, animals and micro-organisms around the world. (Das and Duarah, 2013).

2. MATERIAL AND METHODS:

Location of study area: Bhiwapur taluka is situated between the 20°35' and 21°44' N latitudes and between 75°53, and 80° East longitudes and is spread over the area of 61323.62 hectares of land. Bhiwapur is a Taluka in Nagpur District of Maharashtra State, India. Bhiwapur Taluka Head Quarters is Bhivi town. It belongs to Vidarbha region. It belongs to Nagpur Division. It is located 65 KM towards South from District head quarters Nagpur. 837 KM from State capital Mumbai towards west. Bhiwapur Taluka is bounded by Pauni Taluka towards East, Kuhi Taluka towards North, Umred Taluka towards west, Chimur Taluka towards South. Umred City, Pauni City, Bhandara City, Pulgaon City are the nearby Cities to Bhiwapur. Bhiwapur consist of 115 Villages and 56 Panchayats. Keslapar is the smallest Village and Bhiwapur is the biggest Village. It is in the 262 m elevation (altitude). This Place is in the border of the Nagpur District and Bhandara District. Bhandara District Pauni is East towards this place. It is too Hot in summer. Bhiwapur summer highest day temperature is in between 33 °C to 49 °C. Average temperatures of January is 21 °C, February is 26 °C, March is 31 °C, April is 35 °C, May is 39 °C (Fig.No.01). (www.onefivenine.com/india/villag/Nagpur/Bhivapur).

Method: Intensive floristic surveys were undertaken during the Dec. 2014 – Nove.2016 in different villages Bhiwapur Tahsil of Nagpur District in such way that each locality, habitat could be studied in every season of the year. Periodic collection of invasive alien plants was made from each locality. Invasive alien plants collected, processed and indentified from the available floras and deposited at the PG. Dept. of Botany, Janata Mahavidyalaya, Chandrapur (Ugemuge, 1986; Yadao and Sardesai, 2002; Naik, 1979, 1998; Cook, 1967; Sharma et al. 1996; Singh and Kartikeyan, 2000; Singh et al. 2001).

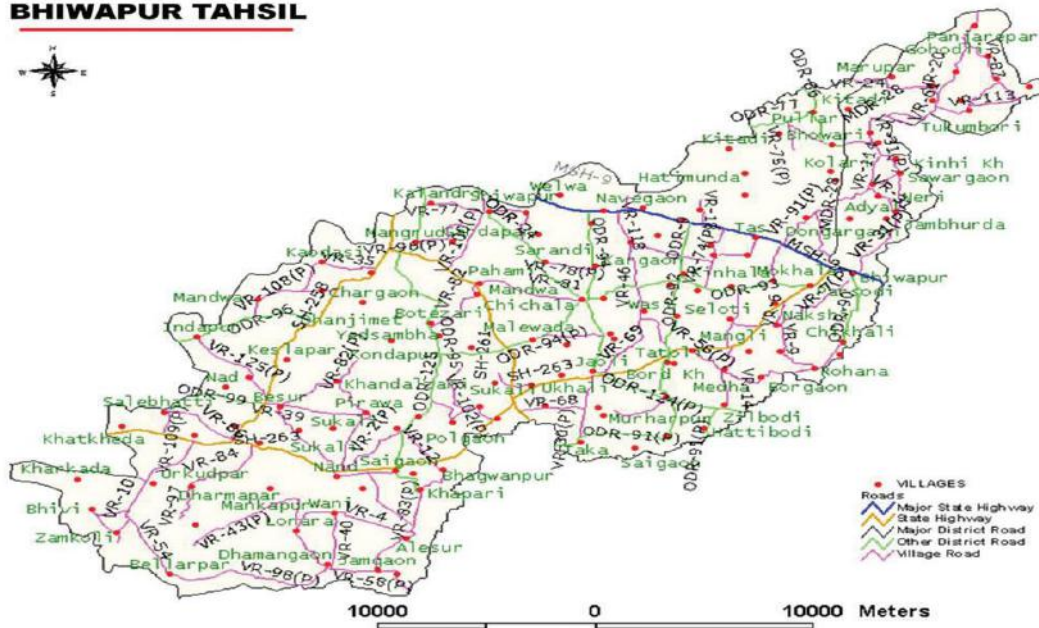
BHIWAPUR TAHSIL

Fig.No.01. Bhiwapur Tahsil of Nagpur District of Maharashtra (Map taken from Google Map).

The identification of invasive alien plant species and mode of introduction of these species in Bhiwapur Tahsil of Nagpur District were carried out again on the basis of available information and literature (Maheshwari, 1960; Maheshwari and Nayar ,1977; Hajra and Das ,1982; Sharma ,1984; Saxena ,1991; Pandey and Parmar, 1994; Mooney and Hobbs, 2000 ;Pandey, 2000; McNeely and Mooney ,2001; Negi and Hajra ,2007; Reddy, 2008; Singh et.al. 2010; Chandrshekar, 2012;Deshmukh et al,2012,2015), Eanguwar, 2015 and 2016).

A concise list of invasive alien plant species is prepared, which is our main work of this project. All invasive alien plants were categorized as food, fodder, ornamental, etc. and they also categorized by life form (herb, under shrub, shrub, climber and tree) and habit (annual and perennial). Habitat (wasteland, cultivated field, river banks, forest, road-side, aquatic, etc.) where a given species was most abundant also noted and parasitic plants were also recorded. The invasive species are enumerated alphabetically in tabular form, followed by author's abbreviations, name of the Family, Nativity, Life form, Habit, Habitat and mode of introduction (Table.No.1).

Results and Discussion: A total of 72 species distributed in 57 genera and 33 families recorded as invasive alien in the flora of in Bhiwapur Tahsil of Nagpur District (Table No.01). Among these, the dicotyledons represent by 25 families, 49 genera and 64 species; monocotyledons represent by 08 families,08 genera and 08species.

Table No.01. List of Invasive Alien Angiospermic plants

S.N	Name of plant	Family	Origin	Life form	Habit	Habitat	Mode of introduction
01	<i>Acanthospermum hispidum</i> DC.	Asteraceae	Brazil	H	A	W	Ui
02	<i>Ageratum conyzoides</i> L.	Asteraceae	Trop.America	H	A	W	O
03	<i>Alternanthera sessilis</i> (L.) DC.	Amaranthaceae	Trop. America	H	P	RB	Ui
04	<i>Alternanthera philoxeroides</i> (Mart.) Griseb	Amaranthaceae	Trop. America	H	P	RB	Ui
05	<i>Amaranthus spinosus</i> L.	Amaranthaceae	Trop. America	H	A	Cf	Ui
06	<i>Anagallis arvensis</i> L.	Primulaceae	Europe	H	A	Cf	Ui
07	<i>Antigonon leptopus</i> Hook. & Am.	Polygonaceae	Trop. America	C	P	AR	Ui
08	<i>Argemone mexicana</i> L.	Papaveraceae	S. America	H	A	W	Ui
09	<i>Asphodelus tenuifolius</i> Cav. *	Liliaceae	Trop. America	H	A	Cf	Ui
10	<i>Bidens pilosa</i> L.	Asteraceae	Trop.America	H	A	Cf	Ui
11	<i>Blumea eriantha</i> DC.	Asteraceae	Trop. America	H	P	W	Ui
12	<i>Blumea obliqua</i> (L.) Druce	Asteraceae	Trop. America	H	A	W	Ui

13	<i>Borassus flabellifer</i> L.*	Arecaceae	Trop. Africa	T	P	W	Ui
14	<i>Calotropis gigantea</i> (L.) R. Br.	Asclepiadaceae	Trop. Africa	S	P	W	Ui
15	<i>Calotropis procera</i> (Ait.) R. Br	Asclepiadaceae	Trop. Africa	S	P	W	Ui
16	<i>Cassia occidentalis</i> L.	Caesalpiniaceae	S. America	H	P	W	Ui
17	<i>Cassia pumila</i> Lam.	Caesalpiniaceae	Trop. America	H	A	W	Ui
18	<i>Cassia tora</i> L.	Caesalpiniaceae	S. America	H	A	W	Ui
19	<i>Cassia uniflora</i> Mill.	Caesalpiniaceae	S. America	H	A	W	Ui
20	<i>Celosia argentea</i> L.	Amaranthaceae	Trop. Africa	H	A	Cf	Fd
21	<i>Cleome viscosa</i> L.	Cleomaceae	Trop. America	H	A	W	Ui
22	<i>Corchorus tridens</i> L.	Tiliaceae	Trop. Africa	H	A	W	Ui
23	<i>Corchorus trilocularis</i> L.	Tiliaceae	Trop. Africa	H	A	W	Ui
24	<i>Croton bonplandianum</i> Baill.	Euphorbiaceae	S. America	H	P	W	Ui
25	<i>Cuscuta chinensis</i> Lam	Cuscutaceae	Mediterranean	H	P	P	Ui
26	<i>Cuscuta reflexa</i> Roxb	Cuscutaceae	Mediterranean	H	A	P	Ui
27	<i>Datura metel</i> L.	Solanaceae	Trop. America	S	P	W	Ui
28	<i>Datura stramonium</i> L.	Solanaceae	Trop. America	S	P	W	Ui
29	<i>Digera muricata</i> (L.) Mart.	Amaranthaceae	S. W. Asia	H	A	Cf	Ui
30	<i>Echinochloa colona</i> (L.) Link. *	Poaceae	S. America	G	A	RB	Ui
31	<i>Echinops echinatus</i> Roxb.	Asteraceae	Afghanistan	H	A	W	Ui
32	<i>Eclipta prostrata</i> (L.) Mant.	Asteraceae	Trop. America	H	A	AR	Ui
33	<i>Eichhornia crassipes</i> (C. Martius) Solms. *	Pontederiaceae	Trop. America	H	P	A	O
34	<i>Euphorbia hirta</i> L.	Euphorbiaceae	Trop. America	H	A	Cf	Ui
35	<i>Evolvulus nummularius</i> (L.) L.	Convolvulaceae	Trop. America	H	P	W	Ui
36	<i>Hyptis suaveolens</i> (L.) Poit.	Lamiaceae	Trop. America	H	A	AR	Ui
37	<i>Impatiens balsamina</i> L.	Balsaminaceae	Trop. America	H	A	AR	O
38	<i>Indigofera linnaei</i> Ali.	Fabaceae	Trop. Africa	H	A	F	Ui
39	<i>Ipomoea carnea</i> Jacq.subsp.fistulosa(Mart.ex Choisy)Austin.	Convolvulaceae	Trop. America	S	P	W	Ui
40	<i>Ipomoea hederifolia</i> L.	Convolvulaceae	Trop. America	H	A	F	Ui
41	<i>Ipomoea nil</i> (L.) Roth	Convolvulaceae	N. America	H	A	W	Ui
42	<i>Ipomoea obscura</i> (L.) Ker.- Gawal	Convolvulaceae	Trop. Africa	H	P	W	Ui
43	<i>Lantana camara</i> L.	Verbenaceae	Trop. America	H	P	F	O
44	<i>Leonotis nepetiifolia</i> (L.)R. Br.	Lamiaceae	Trop. Africa	H	A	W	Ui
45	<i>Ludwigia adscendens</i> (L.) Hara	Onagraceae	Trop. America	H	A	A	Ui
46	<i>Ludwigia octovalvis</i> (Jacq.) Raven.	Onagraceae	Trop. Africa	H	A	RB	Ui
47	<i>Ludwigia perennis</i> L.	Onagraceae	Trop. Africa	H	A	RB	Ui
48	<i>Malachra capitata</i> (L.) L.	Malvaceae	Trop. America	H	P	W	Ui
49	<i>Malvastrum coromandelianum</i> (L.) Garcke	Malvaceae	Trop. America	H	A	W	Ui
50	<i>Martynia ctinua</i> L.	Pedaliaceae	Trop. America	H	P	W	Ui
51	<i>Mimosa pudica</i> L.	Mimosaceae	Brazil	H	P	F	Ui
52	<i>Mirabilis jalapa</i> L.	Nyctaginaceae	Peru	H	A	W	O
53	<i>Monochoria vaginalis</i> (Burm.f.) C. Presl. *	Pontederiaceae	Trop. America	H	P	RB	Ui
54	<i>Ocimum americanum</i> L.	Lamiaceae	Trop. America	H	A	W	Ui

55	<i>Opuntia elatior</i> Miller	Cactaceae	S. America	S	P	W	Ui
56	<i>Oxalis corniculata</i> L.	Oxalidaceae	Europe	H	P	Cf	Ui
57	<i>Parthemium hysterophorus</i> L.	Asteraceae	N. America	H	A	W	Ui
58	<i>Physalis minima</i> L.	Solanaceae	Trop. America	H	A	W	Ui
59	<i>Pistia stratiotes</i> L. *	Araceae	Trop. America	H	P	A	Ui
60	<i>Portulaca oleracea</i> L.	Portulacaceae	S. America	H	A	W	Fd
61	<i>Prosopis juliflora</i> (Sw.) DC.	Mimosaceae	Mexico	S	P	W	Af
62	<i>Ruellia tuberosa</i> L.	Acanthaceae	Trop. America	H	A	RB	Ui
63	<i>Saccharum spontaneum</i> L. *	Poaceae	Trop. West Asia	G	P	RB	Ui
64	<i>Scoparia dulcis</i> L.	Scrophulariaceae	Trop. America	H	P	W	Ui
65	<i>Sida acuta</i> Burm.f.	Malvaceae	Trop. America	H	A	W	Ui
66	<i>Solanum nigrum</i> L.	Solanaceae	Trop. America	H	A	Cf	Ui
67	<i>Solanum torvum</i> Sw.	Solanaceae	West Indies	S	P	F	Ui
68	<i>Tridax procumbens</i> L.	Asteraceae	Central America	H	P	Cf	Ui
69	<i>Triumfetta rhomboidea</i> Jacq.	Tiliaceae	Trop. America	H	A	W	Ui
70	<i>Typha angustifolia</i> L.*	Typhaceae	Trop. America	H	P	RB	Ui
71	<i>Urena lobata</i> L.	Malvaceae	Trop. Africa	S	P	W	Ui
72	<i>Xanthium strumarium</i> L. P. P.	Asteraceae	Trop. America	H	A	AR	Ui

* =Monocot .**Origin: Trop.** = Tropical, **S** = South, **N** = North, **C** = Central, **S.W.** = Southwest .**Habitat: W**—Wastelands; **CF**—Cultivated fields; **F**—Forests; **AR**—Along roadside; **A**—Aquatic ;**P**—Parasites; **CF**—Crop fields; **RB**—River beds.

Life form: H—Herb, **S**—Shrub, **T**—Tree ,**C**—Climber.

Asteraceae is the most dominant family with 10 species; followed by Solanaceae, Convolvulaceae, and Amaranthaceae (05 sp. each) Malvaceae and Caesalpiniaceae (04 sp.); Lamiaceae, Tiliaceae, Onagraceae (03 sp. each); Asclepiadaceae, Cuscutaceae, Euphorbiaceae, Mimosaceae , Poaceae and Pontederiaceae (02 sp. each). These 15 dominant families contributed 75% (54 sp) of the alien invasive flora of Bhiwapur tahsil. Remaining 25% (18species) contributed from 18 families.

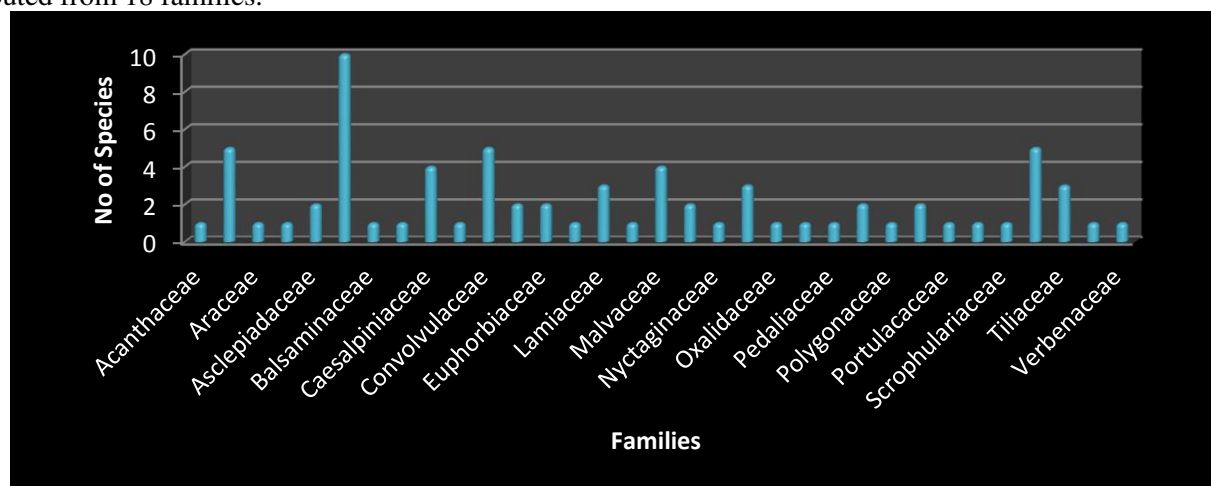


Fig. No.02. Families of invasive alien plant species showing species number in Bhiwapur Tahsil.

A total of 14 different country regions in terms of nativity are recorded in the present study. Among these, about 68% are contributed by two major geographical regions, viz., continent of Trop. America (37sp.) and Trop. Africa (12 sp.). The American continents contributed majority (51%) of invasive plants in Bhiwapur tahsil. (Fig.No.03).

Herbs constitute 82% (59 plants), whereas trees were represented by only one species viz *Borassus flabellifer*; one climbers namely, *Antigonon leptopus* have been recorded apart from 9 Shrubs. Apart from these, *Echinochloa colona* (L.) Link. Single species of grasses are also recorded as an invasive alien from Bhiwapur tahsil. While analyzing the plant habit 41 species (57%) are annuals and 31 species (43%) are perennials.(Fig.No.04).

The genera with the highest number of alien invasive species in Bhiwapur Tahsil are *Ipomoea* (04 species); *Cassia* (04 sp.); *Ludwigia* (03, spe) *Alternanthera*, *Cuscuta*, *Calotropis*, *Datura*, *Blumea Corchorus* and *Solanum* (02 sp. each). These top 10 genera contributed 35% (25sp.) taxa of alien flora of Bhiwapur tahsil.

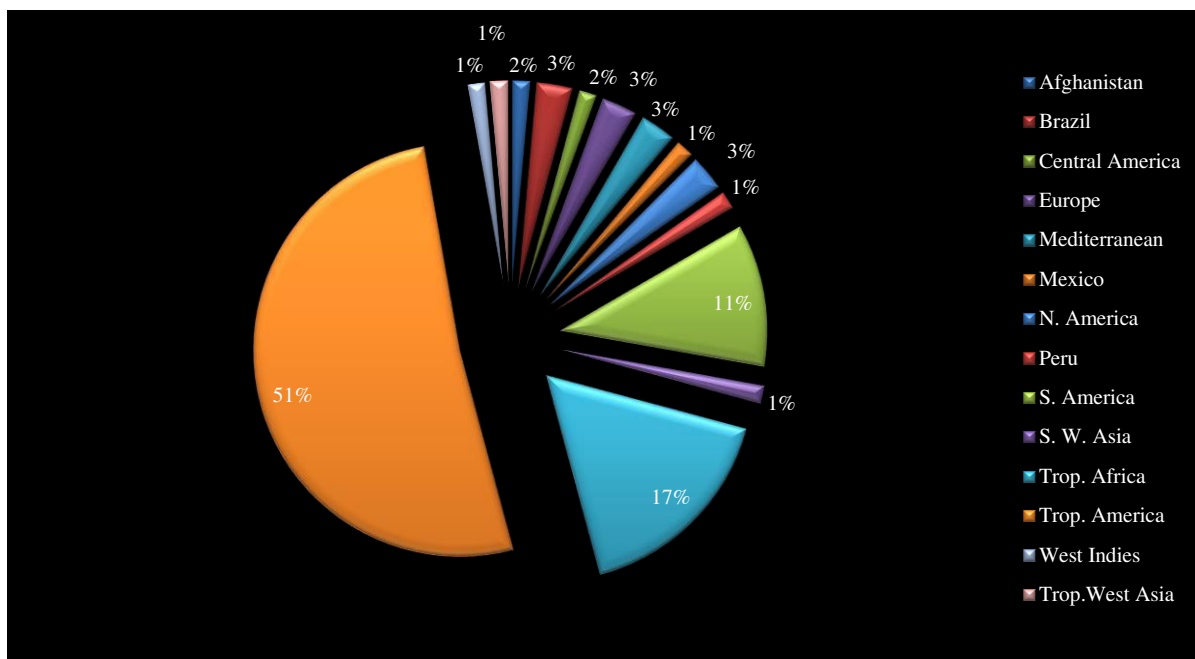


Fig. No.03. Countries showing percentage of invasive alien plant species in Bhiwapur Tahsil.

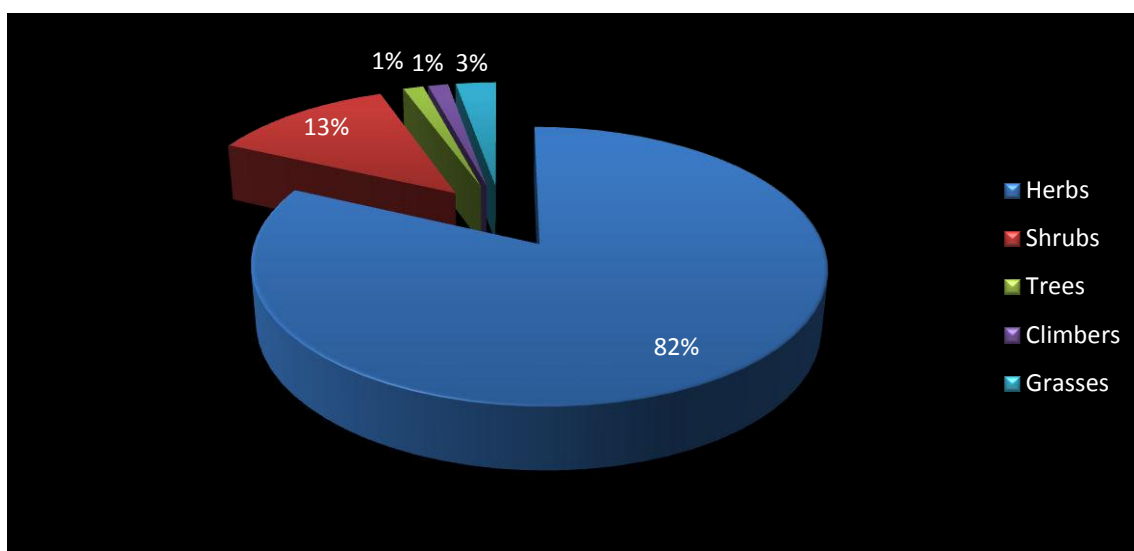


Fig No.04. Life form percentage of invasive alien plant species in Bhiwapur Tahsil.

Out of 72 invasive alien plant species 38 species (53%) reported from wasteland and 10 species found in cultivated fields and in river beds. 09 species were collected from forest area and along the road side area. 03 species namely *Eichhornia crassipes* (C.Martius) Solms, *Ludwigia adscendens* (L.) Hara, *Pistia stratiotes* L. are aquatic species reported as invasive in studied area. Two species namely *Cuscuta chinensis* Lam, *Cuscuta reflexa* Roxb are parasitic plants also reported as invasive alien plants. (Fig No.05).

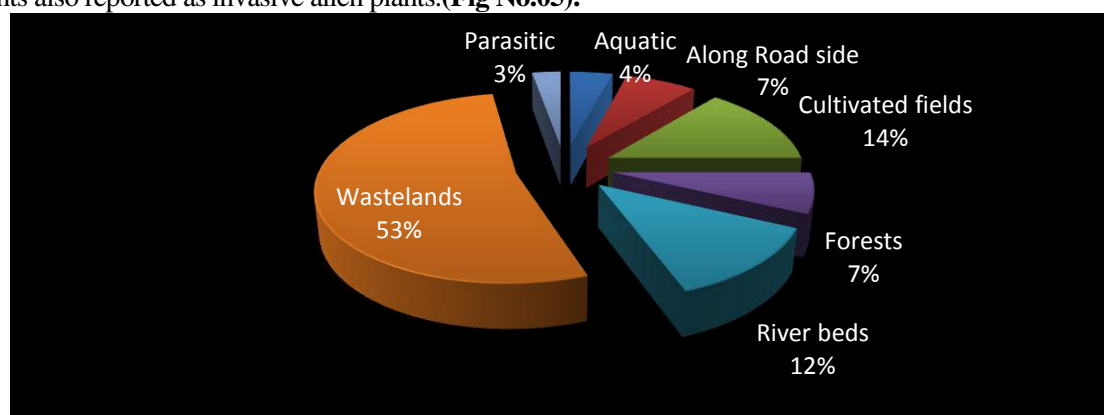


Fig No.05. Habitat percentage of invasive alien plant species in Bhiwapur Tahsil.

Out of 72 invasive alien species reported in this area only 8 species introduced intentionally. *Prosopis juliflora* (Sw.) DC. Introduced in India for Agroforestry purpose. *Celosia argentea* L., *Portulaca oleracea* L. These two plants introduced in India for food purpose *Ageratum conyzoides* L., *Eichhornia crassipes* (C. Martius) Solms, *Impatiens balsamina* L., *Lantana camara* L., *Mirabilis jalapa* L. these five species introduced in India for ornamental purpose and rest of them (64 spe.) unintentionally through trade exchange including grain import. (Fig.No.06)

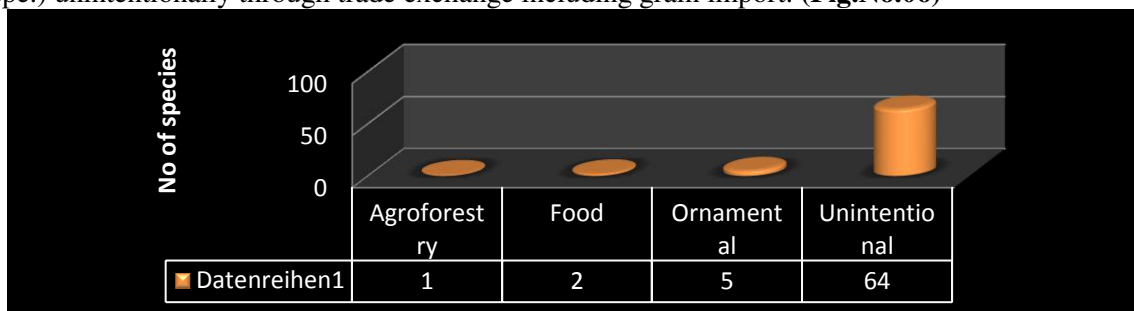


Fig.No.06. Mode of introduction of invasive alien plant species in Bhiwapur Tahsil

In the present study, however, only the wild invasive plant species were considered. Many species, recorded as invader of Bhiwapur Tahsil, are common to whole India (Reddy, 2008) and also with whole of the Uttar Pradesh (Singh et al., 2010), Indian Himalayan Region (Chandrasekar, 2012), Johrat (Das and Duarah, 2013) and North Eastern Uttar Pradesh (Srivastava et al., 2014).

Among the invasive species of Bhiwapur tahsil, 67% are native to American continent. Other such studies vary slightly in percent share of tropical American nativity. While Das and Duarah (2013) reported 88% invaders from American nativity. Singh et al. (2010) reported 73% of invasive plant species of Uttar Pradesh, for Indian Himalayan region, Chandrasekar (2012) also noticed 73% invaders, for North Eastern Uttar Pradesh (Srivastava et al., 2014) noticed 66% invasive alien species and Reddy (2008) noticed 58% of the invasive flora of India to be natives of American continent.

Alien species have been classified into naturalized and noxious species by various workers (Richardson et al., 2000; Wu et al., 2004). Some species such as *Ageratum conyzoides*, *L. camara* and *P. hysterophorus* are harmful to native species (Singh et al., 2010; Tripathi and Shukla, 2007; Dogra et al., 2009). Further, some of these species are known to be highly allergic, causing diseases in human beings (Saxena, 1991; Tripathi, 1999).

Since invasive plant species are rarely palatable, their dominance drastically reduces the number of grazers by way of reducing the carrying capacity of the pasture and wasteland (Sawarker, 1984). *Datura. innoxia* and *Datura stramonium* are serious threat to the native species of the region and are known to cause delay in seedling growth of neighboring plants (Sood et al., 2011).

In present survey Asteraceae family showing the dominance in Bhiwapur Tahsil and various other workers have also reported the dominance of Asteraceae among invasive alien species. Rao and Murugan (2006) found that the Asteraceae is dominating family in alien flora of India, in Uttar Pradesh (Singh et al., 2010), in Indian Himalayan region (Chandrasekar, 2012), in Johrat, Assam Das and Duarah (2013) and in North eastern Uttar Pradesh (Srivastava et al., 2014).

Convolvulaceae, Amaranthaceae and Solanaceae are the second largest families in the Bhiwapur Tahsil because the area contains most of the open and thickets types of forest and this is the congenial habitat for the growth of climbers including the members of the family Convolvulaceae. Monocots are present in the wetland or marshy type of habitat but the present area is under semi-arid zones of India therefore, their representation is least in the study area.

It is important to note the invasive alien plants for raising awareness to stop the invasion or eradication of invaded invasive plant species among rural, tribal and schools, college student levels in presence of Agriculturist or Botanist or Environmentalist or Officer from forest department at all levels, both at governmental and non-governmental level to face the serious problem of invasive alien species in any ecosystem or non-protected and protected areas.

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