

*Full Length Research Paper*

# Invasive alien flora of Jhabua district, Madhya Pradesh, India

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**The present study deals with comprehensive list and status of invasive plant species in Jhabua district of Madhya Pradesh along with their life form, nativity, uses, habitat, categories and mode of introduction. A total of 102 invasive alien plant species belonging to 80 genera under 39 families were recorded from the study area. The analysis of invasive species reveals that 16 species have been introduced intentionally, while the remaining species established were unintentionally through trade. Sixty four aliens have their origin in Tropical America as compared to 14 species in African continent. About 23 species of alien plants reached the study area from such far off places. A better planning is needed for early detection to control and report infestation of spread of new and naturalised weed to be monitored.**

**Key words:** Invasive alien, Jhabua district, Madhya Pradesh.

## INTRODUCTION

The International Union for Conservation of Nature and Natural Resources (IUCN) defines “alien invasive species” as an alien species which becomes established in natural or seminatural ecosystems or habitat as agent of change and threatens native biological diversity. Biological invasions of alien plants present one of the most serious threats to long-term maintenance of ecosystem health and biodiversity (Westman, 1990; Tyser and Key, 1988) and pose a major threat to indigenous biological diversity. Invasive alien plants have caused extensive economic and ecological damage throughout the world. Therefore, the effects of biological invasions are increasingly being

recognized for their role in degradation of biological diversity worldwide (Usher et al., 1988; D’Antonio and Vitousek, 1992). Biological invasion may be considered as a form of biological pollution and the significant component of anthropogenic changes leading to extinction of native species (IUCN). The ecological approach to plant invasion has been mostly based on biological and ecological features promoting the invasion success of particular species (Newsome and Noble, 1986; Rejmánek, 1995), the character and invisibility of invaded communities (Rejmánek, 1989). Recently, both approaches are treated as complementary (Lodge, 1993;

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Hobbs and Huenneke, 1992). The phytogeographical and floristic approaches are important for research on alien plants (McNeely et al., 2001). A number of workers have studied and provided catalogues of the invasive alien plant species in different parts of the world (Drake et al., 1989; Williamson, 1996; Carey et al., 1996; Pyšek et al., 2012). Alien plants have various effects on the environment and economy of non-native areas, many of the exotic plants are of economic benefit and some have severe negative impacts. Some alien species, often cultivated, may provide food, medicine, fuel or fodder to local communities (Kull et al., 2007; Roder et al., 2007) and some of them are responsible for endangerment and extinction of native species and has negative impact on crop production, forest regeneration, livestock grazing and on human health (Sharma et al., 2005; Kohli et al., 2006). It is estimated that as many as 50% of invasive species in general can be classified as ecologically harmful, based on their actual impacts (Richardson et al., 2000).

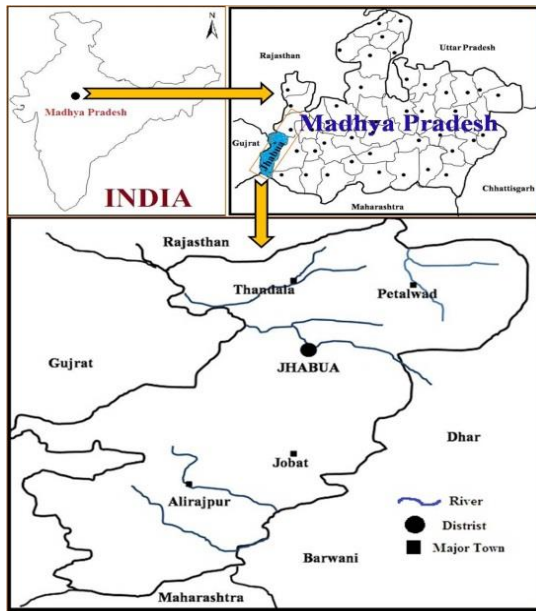
Over the last many decades, a number of invasive species have been introduced in India from their native areas either accidentally or deliberately as fodder crops or ornamentals. It is fueled rapidly during the last half-century as the globalisation of trade and industry has resulted in increased mobility of people and goods, and the associated transport of plants, animals and micro-organisms around the world. Due to increasing trade and transcontinental transport, the floras of Indian subcontinent have a number of alien species from various parts of the world as evident from the studies made at different parts in India, namely, Upper Gangetic Plain (Raizada, 1935, 1936), Kodaikanal and Palani Hills (Matthew, 1969), Kashmir Himalaya (Singh and Misri, 1974; Singh and Kachroo, 1983), Ranchi (Maheswari and Paul, 1975), Gangtok (Hajra and Das, 1982), Allahabad (Sharma, 1984), Melghat Tiger Reserve (Sawarker, 1984), Rajasthan (Pandey and Parmar, 1994), South Gujarat (Kshirsagar, 2005), Doon Valley (Negi and Hajra, 2007), Indian Himalayan Region (Sekar, 2012), Jhohrat, Assam (Das and Duarah, 2013) and North Eastern Uttar Pradesh (Srivastava et al., 2014). Likewise, the western Madhya Pradesh of India is also invaded by a variety of Invasive alien plants. Without realizing the consequences, they have been introduced into the study area knowingly or unknowingly. In Western Madhya Pradesh of Jhabua district, comprehensive studies on invasive species and plant invasions are still missing. Studies on sacred grove and ethnobotany in Jhabua district were done (Jain et al., 2011; Wagh and Jain, 2010, 2013, 2014). In view of this, the present study attempted to focus on document of the invasive alien species in the flora of Jhabua district. This listed invasive exotic species will serve as basic information for future research towards the conservation of endemic and natural forest vegetation of Madhya Pradesh.

## Study site

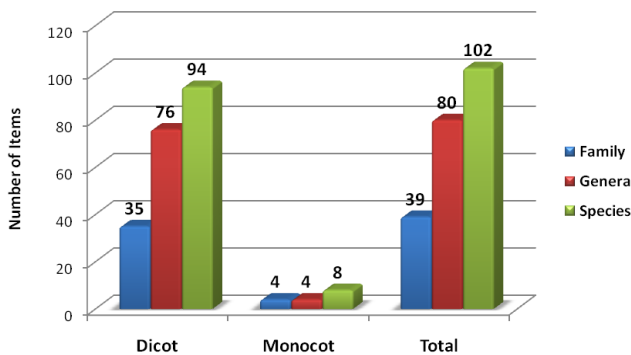
Jhabua is the district head-quarter, situated in western part of Madhya Pradesh and situated at 22° 47' N latitude and 71° 35' E longitude at an average altitude of 428 m above mean sea level (Figure 1). Total area of the district is 6,792 sq. km. The Total population of the district as per 2001 census is 13, 94,345. Most of the village habitants of Jhabua belong to tribal communities like *Bheel*, *Bhilala* and *Pataya*. Out of these tribes *Bheel* and *Bhilala* stand high in strength, scattered in most of the villages of the district. The *Bhil* tribe is one of the most important and the third largest tribe of India. In district, about 28% of the area is covered with forest whose total area is 1900 sq. km.

## MATERIALS AND METHODS

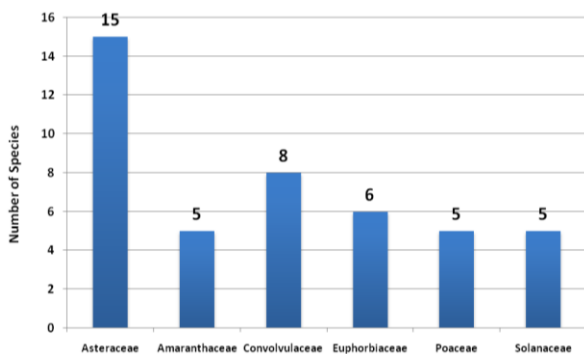
Intensive floristic surveys were undertaken during 2008 - 2013 in Jhabua district in the manner that each locality could be studied in each season of the year. Periodic collection of plants was made from each locality to collect the invasive plant species. The specimens were dried and pressed in the field and taken to the laboratory and herbarium was prepared according to the customary methods (Lawrence, 1951). These plant specimens were critically studied and identified with the help of various floras and published literature (Hooker, 1822, 1883; Cooke, 1901, 1908; Duthie, 1903, 1929; Gamble and Fisher, 1957; Kaushik, 1973; Oommachan, 1977; Kaushik, 1983; Maheshwari, 1963; Randhava, 1983; Deshpande and Singh, 1986; Verma et al., 1993; Kumar and Lal, 1995, 1998; Khanna and Kumar, 2000, 2006; Khanna et al., 2001). The identification was also made by referring some authentic publications and deposited in the herbarium of S.K. Jain Institute of Ethnobiology, Jiwaji University, Gwalior. Several extensive reviews were studied on invasive plant species that are available (Mooney and Drake, 1987; D'Antonio and Vitousek, 1992; Jenkins, 1999; Mooney and Hobbs, 2000; Elton, 2000; Cowie, 2001; Wasson, 2003). The website <http://www.isws.in/invasive-plants-of-india.php> (Reddy et al., 2008) was also searched for information on the origin and nativity of these invaders. Some information pertaining to the nativity of the species in India has been extracted from: Raghubanshi et al. (2005), Sujay et al. (2010), Singh (1976) and Sinha (1976). Invasive alien species occurring in this region were compiled based on the field observation, literature survey and discussion with local people. They were divided into three categories: naturalized, interfering and noxious. Self replacing plant populations by recruitment through seeds/ramets and capable of independent growth were categorized as naturalized. Alien and native plants which impacted agriculture adversely especially on the disturbed sites were taken as noxious. The adverse impact of noxious species was in the form of competition for space with tillage or forage crops and harbouring of pests or disease vectors, harmful to crops/native species. In addition to efficient vegetative mode of propagation, the seeds of these species are mostly wind distributed and may remain viable for several years. The species which were neither injurious nor noxious but caused profuse interference and hindrance to the growth of crop/native species over a large area by virtue of their vast numbers were taken as interfering. The invasive species are enumerated alphabetically with voucher specimen number and family in parenthesis followed by local name, life form, nativity, uses, habitat, categories and mode of introduction.



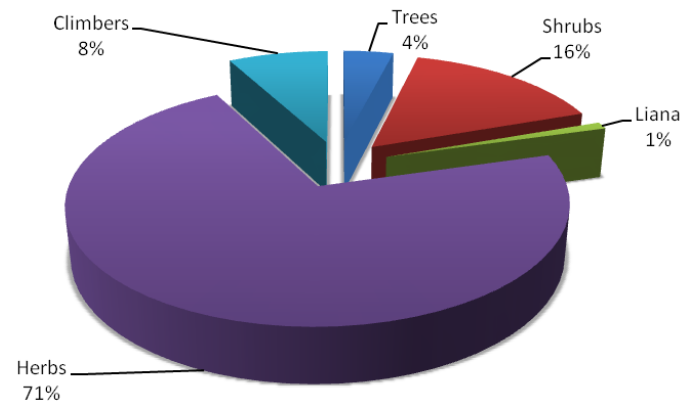
**Figure 1.** Map of Jhabua District of Madhya Pradesh, India.



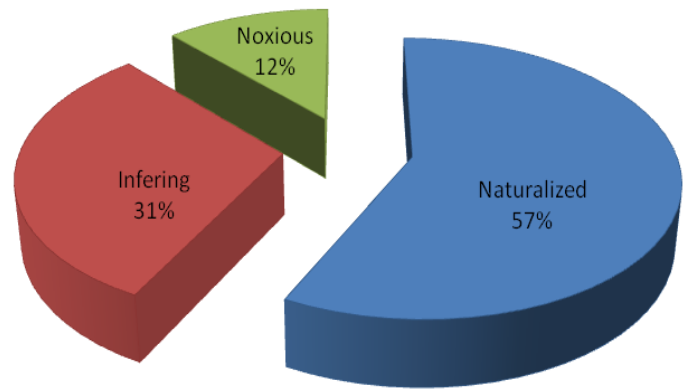
**Figure 2.** Status of genera, species and family of Invasive alien plant species in Jhabua district.



**Figure 3.** Dominant families of invasive alien plant species in Jhabua district.



**Figure 4.** Life form of invasive alien plant species in Jhabua ditrict.



**Figure 5.** Status of invasive alien plant species in Jhabua ditrict.

## RESULTS AND DISCUSSION

A total of 102 species of invasive aliens plants species from Jhabua district of Madhya Pradesh have been documented. These 102 alien species belonged to 80 genera under 39 families. The number of dicot alien species was 94, under 76 genera and 35 families. On the other hand, there were only 8 species of monocot aliens distributed among 4 genera under 4 families (Arecaceae, Liliaceae, Pontederiaceae and Poaceae) (Figure 2). Of 39 families having alien species, Asteraceae was the most dominant (15 species) followed by Convolvulaceae (8), Amaranthaceae and Euphorbiaceae (5 species each), Poaceae (5) and Solanaceae (5) (Figure 3). Of these aliens, 12 species were judged as noxious, 32 species as interfering, and 58 as naturalized species (Figure 4). Habit wise analysis shows that 71% of species are herbs, 16% are shrubs, 8% climbers, 4% are trees and 1% liana (Figure 5). The six dominant families contributed 45% of the invasive alien flora of wild vegetation of Jhabua district of western Madhya Pradesh.

The alien species amounted to 4.60% of the total 2214 wild plant species of the Madhya Pradesh state. 64 aliens have their origin in Tropical America as compared to 14 species in African continent. About 23 species of alien plants reached the study area from such far off places as Afghanistan, Brazil, Europe, Madagascar, Mediterranean, Mexico, Peru, South-West Asia Temperate South America, Tropical West Asia and West Indies. The herbaceous elements predominated the regional alien flora.

In the present study, however, only the wild invasive plant species were considered. Many species, recorded as invader of Jhabua district, are common to whole India (Reddy, 2008) and also with whole of the Uttar Pradesh (Singh et al., 2010), Indian Himalayan Region (Sekar, 2012), Johrat (Das and Duarah, 2013) and North Eastern Uttar Pradesh (Srivastava et al., 2014). Among the invasive species of Jhabua district, 63.36% 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, Sekar (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; Huang et al., 2009). Of the total alien plant species in Jhabua district, 12% species were judged as noxious, 31% are intergering and 57% as naturalised. Our field observation and discussion with local people indicate that there are 12 most noxious invasive plant species in this region, namely, *Ageratum conyzoides*, *Antigonon leptopus*, *Argemone mexicana*, *Cassia tora*, *Datura innoxia*, *Echinochloa crus-galli*, *Lantana camara*, *Lagascea mollis*, *Leucaena leucocephala*, *Parthenium hysterophorus*, *Opuntia elatior* and *Xanthium strumarium*. 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 they 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). *D. innoxia* and *Datura stramonium* are serious threat to the native species of the region and are known to cause delay in seedling growth of neighbouring plants (Sood et al., 2011). *L. leucocephala* alters the natural growth of native plants because not only it obstructs plenty of sunlight to reach surface layer but also its allelopathic exudates cause retardation in seedling growth of neighbouring plants (Chou, 1980).

Many invasive species tend to respond to temporarily nutrient enriched soil substrata and grow quickly cover the gaps in disturbed forests. They can destroy arable soil, negatively affect the growth of orchard, and could also supplant grasses in pasture, excreting a toxic volatile that prevents grazing (Saxena, 1991). The noxious plants are present in agricultural field as well as in the disturbed sites, their overgrowth results into the yield of the crop and so as economy of the farmers. The interfering invasive plants create a disturbance and hinderance in agriculture field and in the forest undergrowth. Their number is increasing very fastly by replacing the native flora. This is the alarming condition for the conservation of local floristic diversity.

The herbaceous invasive plant species were recorded as the dominant invasive flora (71%) of Jhabua district. The greater viability and tolerance to harsh conditions could result in the preponderance of herbs across the region. Invasive species of Asteraceae exhibited a much higher reproductive capacity than those of other families. This high reproductive potential is achieved by partitioning of reproductive capital into a large number of propagules that are minute, light and wind dispersed (Saxena and Ramakrishnan, 1982). 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 (Sekar, 2012), in Johrat, Assam Das and Duarah (2013) and in North eastern Uttar Pradesh (Srivastava et al., 2014). Convolvaceae is the second largest family in the study area because the area contains most of the open and thickets types of forest and this is the congeal 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.

Only 16 species namely, *Ageratum conyzoides*, *Catharanthus pusillus*, *Celosia argentea*, *Chenopodium album*, *Duranta repens*, *Eichhornia crassipes*, *Impatiens balsamina*, *Ipomoea eriocarpa*, *Ipomoea quamoclit*, *Lantana camera*, *Leucena leucocephala*, *Mirabilis jalapa*, *Passiflora foetida*, *Portulaca oleracea*, *Prosopis julliflora* and *Synadenium grantii* are seem to have been introduced deliberately; the rest of them unintentionally through trade exchange including grain import. A total of 15 different geographic regions in terms of nativity are recorded in the present study. About 54.45% of invasive species were most abundant in wastelands, while cultivated fields, road sides, river beds, forest/forest edges, aquatic, parasites were favored by 19, 18, 5, 7, 2 and 2% respectively. Many of the invasive species are of economic benefit also about 62 species listed in Table 1 are reported to be used by locals for medicinal purposes.

**Table 1.** List of Invasive plant species found in Jhabua district of Madhya Pradesh, India.

Botanical name and family	Local name	Life form	Nativity	Uses	Habitat	Categories	Mode of introduction
<i>Acanthospermum hispidum</i> DC. (JBA-483) Asteraceae	Chota Gokhru	Herb	Brazil	M	W	Naturalized	Ui
<i>Ageratum conyzoides</i> L. (JBA-71) Asteraceae	Jangali Gobi	Herb	Tropical America	M	W	Noxious	O
<i>Alternanthera sessilis</i> (L.) R.Br. ex DC. (JBA-42) Amaranthaceae	Guroo sag	Herb	Tropical America	M	RB	Naturalized	Ui
<i>Alternanthera pungens</i> Kunth (JBA-635) Amaranthaceae	Guroo sag	Herb	Tropical America	M, V	W	Naturalized	Ui
<i>Amaranthus spinosus</i> L. (JBA-319) Amaranthaceae	Chaulai	Herb	Tropical America	M, V	CF	Naturalized	Ui
<i>Anagallis arvensis</i> L. (JBA-41) Primulaceae	Phooli	Herb	Europe	M	CF	Naturalized	Ui
<i>Antigonon leptopus</i> Hook. & Arnott (JBA - 610) Polygonaceae		Climber	Tropical America	O	AR	Noxious	Ui
<i>Argemone mexicana</i> L. (JBA - 210). Papaveraceae	Pili kateli	Herb	Tropical South America	M	W	Noxious	Ui
<i>Asphodelus tenuifolius</i> Cav. Liliaceae	Khod	Herb	Trop. America	M	A	Interfering	Ui
<i>Blainvillea acmella</i> (L.) Philipson (JBA-438) Asteraceae	Kanghi	Herb	Tropical America	Ch	W	Interfering	Ui
<i>Blumea lacera</i> (Burm.) f. DC. (JBA-335) Asteraceae	Burando	Herb	Tropical America	M	W	Interfering	Ui
<i>Blumea obliqua</i> (L.) Druc (JBA-336) Asteraceae	Burandi	Herb	Tropical America	Ch	W	Interfering	Ui
<i>Borassus flabellifer</i> L. (JBA - 555) Areaceae	Tad	Tree	Tropical Africa	Hu, Br	W	Naturalized	Ui
<i>Calotropis gigantea</i> (L.) R.Br. (JBA-159) Apocynaceae	Aak	Shrub	Tropical Africa	M	W	Interfering	Ui
<i>Calotropis procera</i> (Aiton) R. Br. (JBA-157) Apocynaceae	Madar	Shrub	Tropical Africa	M	W	Interfering	Ui
<i>Cassia absus</i> L. (JBA - 16) Caesalpiniaceae	Chaksu	Herb	Tropical America	M	W	Naturalized	Ui
<i>Cassia occidentalis</i> L. (JBA - 257) Caesalpiniaceae	Kasundi	Shrub	Tropical South America	M	W	Naturalized	Ui
<i>Cassia tora</i> L. (JBA - 129) Caesalpiniaceae	Puadiya	Herb	Tropical South America	M	W	Noxious	Ui
<i>Catharanthus pusillus</i> (Murr.) G. Don (JBA-128) Apocynaceae	Ban sadabahar	Herb	Tropical America	Po	CF	Interfering	O
<i>Celosia argentea</i> L. (JBA-207) Amaranthaceae	Jangli murga	Herb	Tropical Africa	M, V	CF	Naturalized	Fd
<i>Chenopodium album</i> L. (JBA-340) Chenopodiaceae	Bathua	Herb	Europe	V	CF	Interfering	Fd
<i>Chenopodium murale</i> L. (JBA-388) Chenopodiaceae	Jangali bathua	Herb	Tropical America	V	CF, W	Naturalized	Ui
<i>Chloris barbata</i> Sw. (JBA - 378) Poaceae	Phuleri ghas	Herb	Tropical America	Fo	W	Naturalized	Ui
<i>Cleome gynandra</i> L. (JBA - 15) Capparidaceae	Safed hulhul	Herb	Tropical America	M, V	W	Naturalized	Ui
<i>Cleome viscosa</i> L. (JBA - 402) Capparidaceae	Pili hulhul	Herb	Tropical America	M	W	Naturalized	Ui

Uses: B- Basket making; Bf- Biomass fuel in rural area; Br- Broom; Ch- Presence of bioactive chemicals; Fi- Fibre; Fo- Fodder; Ft- Fruits edible; Hu- Hut; In- Insecticide; M- Medicinal; Nk- Not known; O- Ornamental; Po- Poisonous plant; Sa- Sacred Plant; Sm- Smoking; So- Social forestry; St- Secondary waste water treatment; T- Thatching; V- Vegetable; Habitat: W- Wastelands; CF-Cultivated fields; F- Forests; AR- Along roadside; A- Aquatic; P- Parasites; RB- River beds. Mode of introduction: Af- Agroforestry; Fd- Food; Fo- Fodder; O- Ornamental; Ui- Unintentional.

Table 1. Contd.

Botanical name and family	Local name	Life form	Nativity	Uses	Habitat	Categories	Mode of introduction
<i>Convolvulus arvensis</i> L. (JBA-516) Convolvulaceae	Shankpushpi	Herb	Europe	M	F, W	Naturalized	Ui
<i>Corchorus tridens</i> L. (JBA - 577) Tiliaceae	Rajan	Herb	Tropical Africa	V	AR, W	Naturalized	Ui
<i>Corchorus trilocularis</i> L. (JBA - 22) Tiliaceae	Rajanbhaji	Herb	Tropical Africa	V	W	Naturalized	Ui
<i>Croton bonpalandianus</i> Baill. (JBA-632) Euphorbiaceae	Bhangro	Herb	Temperate South America	Ch	W	Naturalized	Ui
<i>Cryptostegia grandiflora</i> R.Br. (JBA-452) Asclepiadaceae		Liana	Madagascar	O	CF	Interfering	Ui
<i>Cuscuta chinensis</i> Lam. (JBA-655) Cuscutaceae	Amarbel	Climber	Mediterranean	M	P	Interfering	Ui
<i>Cuscuta reflexa</i> Roxb. (JBA-21) Cuscutaceae	Amarvelo	Climber	Mediterranean	M	P	Interfering	Ui
<i>Cynodon dactylon</i> (L.) Pers. (JBA - 75) Poaceae	Dub	Herb	Africa	M, Fo	W	Naturalized	Ui
<i>Datura innoxia</i> Mill. (JBA-446) Solanaceae	Datura	Shrub	Tropical America	M	W	Noxious	Ui
<i>Datura metel</i> L. (JBA-515) Solanaceae	Kala Datura	Shrub	Tropical America	M	W	Interfering	Ui
<i>Digera muricata</i> (L.) Mart. (JBA-14) Amaranthaceae	Gol bhaji	Herb	South-West Asia	M	CF	Interfering	Ui
<i>Duranta repens</i> L. (JBA - 609) Verbenaceae	Pili heg	Shrub	America	O	CF	Naturalized	Af
<i>Echinochloa crusgalli</i> (L.) P. Beauv. (JBA - 267) Poaceae	Khas	Herb	Tropical South America	Fo	RB	Noxious	Ui
<i>Echinops echinatus</i> Roxb. (JBA-286) Asteraceae	Oontakato	Herb	Afghanistan	M	W	Naturalized	Ui
<i>Eclipta prostrata</i> (L.) L. (JBA-60) Asteraceae	Bhrigraj	Herb	Tropical America	M	AR	Naturalized	Ui
<i>Eichhornia crassipes</i> (Mart.) Solms (JBA - 538) Pontederiaceae	Jalkumbhi	Herb	Tropical America	St	A	Naturalized	O
<i>Euphorbia heterophylla</i> L. (JBA - 622) Euphorbiaceae	Dudhli	Herb	Tropical America	O	CF	Naturalized	Ui
<i>Euphorbia hirta</i> L. (JBA - 90) Euphorbiaceae	Kali dudhi	Herb	Tropical America	M	CF	Naturalized	Ui
<i>Evolvulus nummularius</i> (L.) L. (JBA-495) Convolvulaceae	Shankpushpi	Herb	Tropical America	Ch	W	Naturalized	Ui
<i>Glossocardia bosvallea</i> (L.f.) DC. (JBA-487) Asteraceae	Nakchikni	Herb	West Indies	Nk	W	Naturalized	Ui
<i>Gomphrena celosioides</i> Mart. (JBA-634) Amaranthaceae	Chota murga	Herb	Tropical America	Fo	CF	Naturalized	Ui
<i>Hyptis suaveolens</i> (L.) Poit. (JBA-104) Lamiaceae	Ban talsa	Herb	Tropical America	M	AR	Interfering	Ui
<i>Impatiens balsamina</i> L. (JBA - 10) Balsaminaceae	Tiwadi	Herb	Tropical America	O	AR	Naturalized	O
<i>Imperata cylindrica</i> (L.) P. Beauv. var. major (Nees) Hubb. ex Hubb. & Vaughan (JBA - 394) Poaceae	Dabh	Herb	Tropical America	R	W	Naturalized	Ui
<i>Indigofera linifolia</i> (L. f.) Retz. (JBA - 144) Fabaceae	Torki	Herb	Tropical South America	M	AR	Naturalized	Ui

Table 1. Contd.

Botanical name and family	Local name	Life form	Nativity	Uses	Habitat	Categories	Mode of introduction
<i>Indigofera linnaei</i> Ali (JBA - 201) Fabaceae	Leel	Herb	Tropical South America	M	F	Naturalized	Ui
<i>Indigofera trita</i> L. f. (JBA - 08) Fabaceae		Shrub	Tropical Africa	Ch	F	Naturalized	Ui
<i>Ipomoea carnea</i> Jacq. (JBA-34) Convolvulaceae	Umarichata	Shrub	Tropical America	M	W	Interfering	Ui
<i>Ipomoea eriocarpa</i> R.Br. (JBA-167) Convolvulaceae		Herb	Tropical Africa	M	W	Interfering	O
<i>Ipomoea hederifolia</i> L. (JBA-598) Convolvulaceae	Lal bel	Climber	Tropical America	M	F	Interfering	Ui
<i>Ipomoea nil</i> (L.) Roth (JBA-420) Convolvulaceae	Nilari	Climber	North America	M	FE, W	Interfering	Ui
<i>Ipomoea pestigridis</i> L. (JBA-496) Convolvulaceae	Nali	Climber	Tropical East Africa	M	W	Interfering	Ui
<i>Ipomoea quamoclit</i> L. (JBA - 686) Convolvulaceae	Kamlata	Climber	Tropical America	M	W	Interfering	O
<i>Jatropha curcas</i> L. (JBA - 33) Euphorbiaceae	Ratanjot	Shrub	Tropical America	M, Fe, Sa	AR, CF	Naturalized	Ui
<i>Jatropha gossypifolia</i> L. (JBA - 52) Euphorbiaceae	Lal Ratanjyot	Shrub	Brazil	M	AR	Naturalized	Ui
<i>Lagascea mollis</i> Cav. (JBA-89) Asteraceae	Jangali jeera	Herb	Tropical Cent. America	M	AR, CF	Noxious	Ui
<i>Lantana camara</i> L. (JBA-105) Verbenaceae	Jhai	Shrub	Tropical America	Bf	F	Noxious	O
<i>Leonotis nepetifolia</i> (L.) R. Br. (JBA-677) Lamiaceae	Lal gumda	Herb	Tropical Africa	M	W	Interfering	Ui
<i>Leucaena leucocephala</i> (Lamk.) de Wit (JBA - 119) Mimosaceae	Subabul	Tree	Tropical America	So, Fo	W	Noxious	Fo
<i>Ludwigia octovalvis</i> (Jacq.) Raven (JBA-147) Onagraceae	Jangali lawang	Herb	Tropical America	M	RB	Naturalized	Ui
<i>Malachra capitata</i> (L.) L. (JBA- 750) Malvaceae	Pili phulani	Herb	Trop. America	Fi, B	W	Interfering	Ui
<i>Malvastrum coromandelianum</i> (L.) Gar. Malvaceae	Kharenti	Herb	Tropical America	M, Fi	W	Naturalized	Ui
<i>Martynia annua</i> L. (JBA-77) Martyniaceae	Bicchua	Herb	Tropical America	M	W	Naturalized	Ui
<i>Mimosa pudica</i> L. (JBA-475) Mimosaceae	Chuimui	Herb	Brazil	M	F	Naturalized	Ui
<i>Mirabilis jalapa</i> L. (JBA - 59) Nyctaginaceae	Gulbas	Herb	Peru	O, Sa	W	Naturalized	O
<i>Nicotiana plumbaginifolia</i> Viv. (JBA-685) Solanaceae	Jangali tamakhu	Herb	Tropical America	Sm	W	Naturalized	Ui
<i>Ocimum americanum</i> L. (JBA-173) Lamiaceae	Jangali tulsi	Herb	Tropical America	Sa, In	W	Naturalized	Ui
<i>Opuntia elatior</i> Mill. Cactaceae	Nagphani	Shrub	Tropical America	M, Ft	AR, W	Noxious	Ui
<i>Opuntia vulgaris</i> Miller Cactaceae	Nagphani	Shrub	S. America	M, Ft	AR, W	Naturalized	Ui
<i>Oxalis corniculata</i> L. (JBA - 107) Oxalidaceae	Khatibuti	Herb	Europe	V	CF	Naturalized	Ui
<i>Oxalis corymbosa</i> DC.(JBA - 429) Oxalidaceae		Herb	South America	O, V	CF	Naturalized	Ui
<i>Parthenium hysterophorus</i> L. (JBA-383) Asteraceae	Gajarghas	Herb	Tropical North America	Nk	W	Noxious	Ui

Table 1. Contd.

Botanical name and family	Local name	Life form	Nativity	Uses	Habitat	Categories	Mode of introduction
<i>Passiflora foetida</i> L. (JBA-296) Passifloraceae	Rakhibel	Climber	Tropical South America	M	W	Interfering	O
<i>Peperomia pellucida</i> (L.) Kunth (JBA-633) Piperaceae		Herb	Tropical South America	V	AR	Naturalized	Ui
<i>Peristrophe paniculata</i> (Forssk.) Brummitt (JBA-25) Acanthaceae	Lal jeera	Herb	Tropical America	M	W	Interfering	Ui
<i>Physalis minima</i> L. (JBA-116) Solanaceae	Kanphuti	Herb	Tropical America	M, Ft	W	Naturalized	Ui
<i>Portulaca oleracea</i> L. (JBA - 428) Portulacaceae	Golbhaji	Herb	Tropical S. America	M, V	W	Naturalized	Fd
<i>Prosopis juliflora</i> (Swartz) DC. (JBA-26) Mimosaceae	Reuja	Tree	Mexico	Bf	W	Naturalized	Af
<i>Ricinus communis</i> L. (JBA - 57) Euphorbiaceae	Arandi	Tree	Africa	M, In	W, CF	Interfering	Ui
<i>Ruellia tuberosa</i> L. (JBA-638) Acanthaceae		Herb	Tropical America	Ch	AR	Naturalized	Ui
<i>Saccharum spontaneum</i> L. (JBA - 78) Poaceae	Kaans	Herb	Tropical West Asia	M, B	RB	Interfering	Ui
<i>Sesbania bispinosa</i> (Jacq.) W. F. Wight Fabaceae	Daden	S	Trop. America	Fi	AR	Naturalized	Ui
<i>Sida acuta</i> Burm. f. (JBA - 490) Malvaceae	Atibala	Herb	Tropical America	M, Fi, Fo	W	Naturalized	Ui
<i>Solanum nigrum</i> L. Solanaceae	Makoi	H	Trop. America	M, Ft, Po	CF	Naturalized	Ui
<i>Sonchus asper</i> (L.) Hill. (JBA-155) Asteraceae	Jangali surajmukhi	Herb	Mediterranean	M	AR	Interfering	Ui
<i>Sonchus oleraceus</i> L. Asteraceae	Jangali surajmukhi	Herb	Mediterranean	M, V	RB	Interfering	Ui
<i>Spermacoce hispida</i> L. (JBA-458) Rubiaceae	Vasuka	Herb	Tropical America	M	AR	Interfering	Ui
<i>Synadenium grantii</i> Hook. f. (JBA - 506) Euphorbiaceae	Videshi ealaichi	Shrub	Tropical America	M	CF	Naturalized	O
<i>Synedrella nodiflora</i> (L.) Gaertn. (JBA-363) Asteraceae		Herb	West Indies	Nk	W, AR	Naturalized	Ui
<i>Trema orientalis</i> (L.) Blume (JBA - 498) Ulmaceae	Jivani	Shrub	Africa	M	W, AR	Naturalized	Ui
<i>Tribulus terrestris</i> L. (JBA - 27) Zygophyllaceae	Bhui Gokhru	Herb	Tropical America	M	W	Naturalized	Ui
<i>Tridax procumbens</i> L. (JBA-68) Asteraceae	Ghamra	Herb	Tropical Cent. America	M, V	CF	Naturalized	Ui
<i>Triumfetta rhomboidea</i> Jacq. (JBA - 342) Tiliaceae	Liptiya	Herb	Tropical America	M	W	Naturalized	Ui
<i>Typha angustifolia</i> Bory & Chaub. (JBA - 115) Typhaceae	Lav	Herb	Tropical America	T, Hu	RB	Naturalized	Ui
<i>Urena lobata</i> L. (JBA -564) Malvaceae	Bachita	Shrub	Tropical Africa	Fi	W	Interfering	Ui
<i>Waltheria indica</i> L. (JBA - 468) Sterculiaceae		Herb	Tropical America	M	F	Interfering	Ui
<i>Xanthium strumarium</i> L. (JBA-54) Asteraceae	Gokhru	Herb	Tropical America	M	AR	Noxious	Ui

Uses: B- Basket making; Bf- Biomass fuel in rural area; Br- Broom; Ch- Presence of bioactive chemicals; Fi- Fibre; Fo- Fodder; Ft- Fruits edible; Hu- Hut; In- Insecticide; M- Medicinal; Nk- Not known; O- Ornamental; Po- Poisonous plant; Sa- Sacred Plant; Sm- Smoking; So- Social forestry, St- Secondary waste water treatment; T- Thatching; V- Vegetable; Habitat: W- Wastelands; CF- Cultivated fields; F- Forests; AR- Along roadside; A- Aquatic; P- Parasites; RB- River beds. Mode of introduction: Af- Agroforestry; Fd- Food; Fo- Fodder; O- Ornamental; Ui- Unintentional.



The species namely, *L. leucocephala* is being effectively used for social forestry. The uses of three species are not known or even not used by locals. Many of the plant species such as *Amaranthus spinosus*, *Celosia argentea*, *Chenopodium album*, *Chenopodium murale*, *Cleome gynandra* etc are used as vegetable due to its nutritional potential. Many of the species are cultivated for various purposes such as food, medicine, fuel, fodder, religious, fodder by the local communities. But some of the species like *Echinochloa crus-galli*, *Lagascea mollis*, *L. camara* and *P. hysterothorus* are having high allelopathic potential and harmful to natural plant population (Singh et al., 2010).

## Conclusion

Alien species are non-native or exotic organisms that occur outside their natural adapted ranges and have dispersal potential (McGeoch et al., 2010). These invasive species are widely distributed in all kinds of ecosystems throughout the world and include all categories of living organisms. Nevertheless, plants, mammals and insects comprise the most common types of invasive alien species in terrestrial environments (Raghubanshi et al., 2005). Many alien plant species support our farming and forestry systems in a big way. However, some of these aliens become invasive when they are introduced deliberately or unintentionally outside their natural habitats into new areas where they express the capability to establish, invade and out compete native species (Sujay et al., 2010). An important requirement for successful colonization of invaders is open habitat with reduced competition. Generally, the microsites created by grazing may be occupied by invader species (Singh, 1976; Sinha, 1976; Sawarker, 1984). The invaders usually dominate the highly disturbed and man-made landscapes. So far, no ready hand catalogue of invasive species is available for this region. The present catalogue of invasive exotic species is likely to serve as basic information for future research towards conservation of native plant species of the region.

The invasive species cause loss of biodiversity including species extinctions, and changes in hydrology and ecosystem function. Differences between native and exotic plant species in their requirements and modes of resource acquisition and consumption may cause a change in soil structure, its profile, decomposition, nutrient content of soil, moisture availability, etc. Invasive species are thus a serious hindrance to conservation and sustainable use of biodiversity, with significant undesirable impacts on the goods and services provided by ecosystems. Biological invasions now operate on a global scale and will undergo rapid increase in this century due to interaction with other changes such as increasing globalization of markets, rise in global trade, travel and

tourism. For effective management of invasive species, knowledge about their ecology, morphology, phenology, reproductive biology, physiology and phytochemistry is essential (Raghubanshi et al., 2005). Monitoring of invasion can be done through qualitative approach like species inventory (seasonally) and quantitative approach using phytosociological methods and mapping using ground based methods (*via* map overlays or GPS), remotely-sensed images (aerial photos, high resolution multi-spectral digital data). 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. A better planning is needed for early detection and reporting of infestations of spread of new and naturalized weeds by creation of plant detection network in Jhabua district of Madhya Pradesh by establishing communication links between taxonomists, ecologists and land managers to monitor and control.

## Conflict of interests

The authors did not declare any conflict of interest.

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