RESEARCH ARTICLE

INVASIVE ALIEN SPECIES IN URBAN ECOSYSTEM OF SARGUJA

Harsha Keshri, D.K. Yadav and M.K Jhariya*

Department of Farm Forestry, Sarguja University, Ambikapur-497001 (C.G.), INDIA
Email: manu9589@gmail.com

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Abstract: Biological diversity faces many threats throughout the world. One of the major threats to the native diversity is biological invasions, caused by the invasive alien species (IAS). These are the non-native species that are introduced in areas outside their natural habitat where they grow, survive, reproduce and produce self sustaining populations causing direct and indirect health effects. The effects are exacerbated by global climate change and chemical and physical disturbance to species and ecosystems. Change in climate may also produce more conducive conditions for the establishment and spread of invasive species as well as change the suitability of local climate for native species and nature of interactions among native species. The present study was undertaken to record the invasive alien species of Sarguja district of Chhattisgarh. The dominant invasive species mainly comprised of *Lantana camara*, *Parthenium hysterophorus*, *Cassia tora*, *Cyperus spp.*, *Ipomoea carnea* etc. *Parthenium* and *Lantana* were found to be most frequent species ouuuring in the region. The ecological diversity of invasive plants suggests wide ranging impacts which needs to be assessed.

Keywords: Biological diversity, Ecosystems, Habitat, IAS, Native species

INTRODUCTION

Plants are the basis of life on earth and are central to people's livelihoods. They provide natural conservation, ecological balance and benefits, as well as contribute towards the aesthetic values of the environment. People are closely allied to their ecosystem and live in harmony with nature (Tiger, 2008). Plants are assets in the urban and rural landscape.

Invasive species are recognized as one of the major threats to native species and ecosystems around the world (Kathiresan *et al.,* 2005). Invasive Alien Species (IAS) refer to plants, animals or micro organisms that are not native to specific ecosystem and whose introduction threatens biodiversity, food security and health or economic development (McNeely *et al.,* 2001). Invasive species are of concern because of their capability of spreading fast, their high competitiveness and ability to colonize new areas within short periods. Some of the species have luxuriant growth and suppress the growth of other native species. This results in a loss of native floral diversity of the country. These IAS are becoming a major concern, during past two decades, among conservationists, ecologists, foresters, policy makers and scientists for their severe biological, ecological and socio-economic impacts worldwide. The undisturbed natural forests are resistant to alien invasions while the degraded and secondary forest areas and wastelands are susceptible to aggressively invading IAS (Das, 1982).

Invasion by the species cause extensive effects on the habitats they invade, like impact on indigenous species diversity, soil nutrients, altering forest fire cycles and loss of productivity of invading ecosystems. It also becomes a threat to endangered or threatened plant species around the world (Pimentel *et al.,* 2005). The frequency of the alien herbal plants increased in the areas of human interference such as forest fragmentation (Higgins *et al.,* 1996). Alien species that can rapidly achieve high densities may have greater establishment success (Kolar and Lodge, 2001) and dominate invaded communities to the exclusion of indigenous species (Ortega and Pearson, 2005). The species capable of rapid colonization are, in general, more likely to have negative impacts on biodiversity (Callaway and Ridenour, 2004). There is a need of understanding the distribution patterns and effect of IAS on various types of habitats. The overarching goal and objective of the study is to assess invasion of IAS in urban ecosystem.

MATERIAL AND METHOD

The study was conducted in Sarguja district (Fig. 1). District Sarguja in the state of Chhattisgarh is very rich in natural vegetation and biological wealth (Sinha *et al*., 2014 & 2015; Yadav *et al*., 2015). It lies between 22^0 58'-23^0 49' N latitude and 81^0 33'-82^0 45' E longitude. The average elevation of the area

*Corresponding Author

varies from 600 meter and above. Geologically, the area is dominated by upper Gondwana rocks which are rich in coal deposits. The highest mountain ranges of the region occupies the northern part of the district. The climate of the study area is dry tropical. The mean monthly temperature ranges between 15.34^0 C (January) and 31.54^0 C (May) and the mean annual temperature averages 23.31^0 C. The average annual rainfall is 1161.42 mm (Sinha *et al*., 2015).

The study was conducted in urban environment of Sarguja district. Total 5 sites were selected, *viz.*, Site-1(Drain line and surrounding area), Site-2 (Private land), Site-3 (Public property/ open access), Site 4 (Near by water bodies) and Site 5 (institutional area). The study was carried out to compile a comprehensive list of IAS. Intensive field studies were conducted in a planned manner repeatedly in order to document maximum representation of invasive plant species. During the repeated field visits, the observations on field characters such as habit, habitat, spread, etc., were made. In each of these sites all the IAS encountered were identified. The species found in the study sites were identified and confirmed with the help of regional floras and published literature (Gamble and Fischer, 1957; Matthew, 1983; Nair and Henry, 1983; Henry *et al*., 1987; Chandrabose and Nair, 1988).

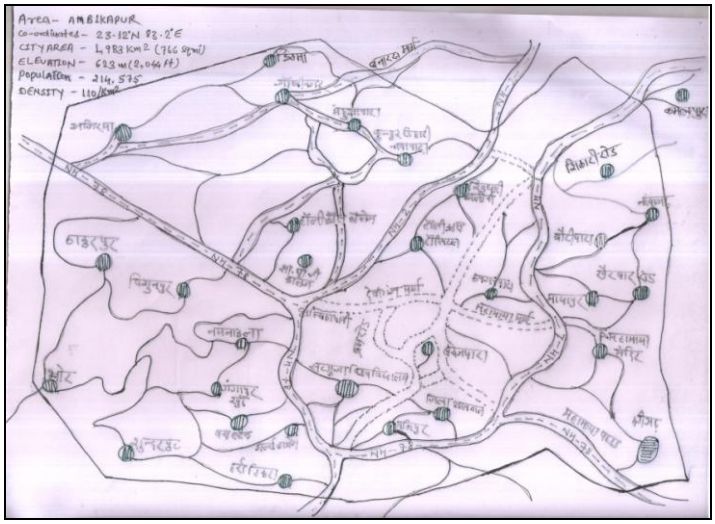

Fig 1. Location map of the study sites

RESULT AND DISCUSSION

A sum of 12 species distributed in 11 families were encountered in the study area. Euphorbiaceae was the single family comprising of 2 species (Table 1). In site 1 (Drain line and surrounding area) maximum infestation of *Lantana camara* and *Parthenium hysterophorus* was found which belong to family Verbenaceae and Asteraceae, respectively. Whereas, in Site-2 (Private land) maximum infestation was found of *Argemone Mexicana* and *Calotropis gigantea* of family Papaveraceae and Apocynaceae, respectively. In Site-3 (Public property/ Open access) maximum infestation was found of *Ricinus communis* and *Cassia alata* which belong to family Euphorbiaceae and Caesalpiniaceae. Site 4 (Near by water bodies) was found to be infested with *Pistea stratiotes* which belong to family Araceae. *Ipomoea carnea* species which belong to family Convolvulaceae was found to be infested in the site 5 (Institutional area).

Species namely, *Cassia alata*, *Eichhornia crassipes* and *Lantana camara* are seem to have been introduced deliberately; the rest of them unintentionally through trade exchange including grain import. A total of 5 different geographic regions in terms of nativity are recorded in the present study. Among these, about 50% are contributed by Tropical America (6 sp.) followed by South America 25% (3 sp.) and rest are equally contributed 8.33% (1 sp.) by Tropical Africa, North America and Mediterranean Basin and Eastern Africa, respectively. (Table 2). Perennials comprise about 66.67% (8 sp.) and the remaining are annuals. Herbs and shrubs constituted about 91.67% (11 sp.) and a single species of sedges was recorded as an IAS.

IAS significantally affect the distribution pattern, frequency, abundance, reproduction, population and diversity of indegenous flora of a region. Because of these ecological effects, alien species can also influence the evolution of natives exposed to novel interactions with invaders (Parker *et al*., 1999). Evolutionary changes in natives in response to selection from aliens are usually overlooked, yet common responses include altered anti-predator defenses, changes in the spectrum of resources and habitats used, and other adaptations that allow native populations to persist in invaded areas (Mooney and Cleland, 2001). So, introduction of such invasive species leads to change in the structure and composition of native communities (Rice and Emery, 2003).

Wagh and Jain (2015) reported a total of 102 invasive alien plant species belonging to 80 genera under 39 families in Madhya Pradesh, India in which 16 species have been introduced intentionally, while the remaining species established were unintentionally through trade. Similarily, Aravindhan and Rajendran (2014) reported a total number of 90 invasive alien species under 74 genera belonging to 37 families in Western Ghats, India. Among these, 53 species are being used by local inhabitants who residing in this forest range for medicinal purposes; 13 species have been introduced intentionally, while the remaining species established unintentionally through trade. Kour *et al*. (2014) enlisted 55 invasive alien plant species belonging to 24 families of 15 different geographic regions, among these more than 90% are contributed by continent of America, Africa, Europe and Mediterranean. The American continents contributed majority of noxious invasive plants. Mandal and Joshi (2014) found that 29 out of 72 species were exotic and invasive and comprised 21 genera and eight families. Indigenous species accounted for 59% of the total species and comprised 26 genera and 11 families. Perennials outnumbered the annuals in all study sites. Reddy (2008) reported 173 invasive alien species belonging to 117 genera under 44 families. Almost 80% of the species were introduced from neotropics. Tropical America (74%) and Tropical Africa (11%) contribute maximum proportion to the invasive alien flora of India.

CONCLUSION

Many of the exotic plants have severe negative impacts on the native biodiversity including that of break of local food-web and food-chain, thus contributing towards the breakdown of the local ecosystem. Plant invasions in the new areas alter indigenous community composition, deplete species diversity, affect ecosystem process and thus cause huge economic and ecological imbalance. There are scores of gaps in the current management approach against invasive species in the country. Undeniably there are innumerable areas that need to be strengthened to effectively administer the problem. To prevail over further detrimental effects on agricultural and natural ecosystems, the policy makers must put management of these IAS lofty on their list of national resource management priorities. Besides, of the many alien species in the country, their impact on local ecosystems have yet to be identified should be studied. The ecological diversity of invasive plants suggest wide ranging impacts which needs to be assessed. IAS causes severe threats to the conservation of native species, communities and ecosystems. Therefore, requires major attention to check the spread of these species or its introduction with proper planning and through creating public awareness.

Table 1. Invasive species occurred in study sites

Species	Family	Site 1	Site 2	Site 3	Site 4	Site 5
Argemone mexicana L.	Papaveraceae	√	√	√	x	√
Cassia tora L.	Fabaceae	√	√	√	x	x
Cassia alata L.	Caesalpiniaceae	√	√	√	x	x
Calotropis gigantea (L.) R. Br.	Apocynaceae	√	√	√	x	x
Cyperus compressus L.	Cyperaceae	√	x	√	x	x
Eichhornia crassipes (C. Martius) Solms.	Pontederiaceae	√	x	x	x	x
Ipomoea carnea Jacq. subsp. *Fistulosa* (Mart. *ex* Choisy) Austin	Convolvulaceae	x	x	√	x	√
Jatropha curcas L.	Euphorbiaceae	√	√	x	x	x
Lantana camara L.	Verbeneaceae	√	√	√	√	√
Parthenium hysterophorus L.	Asteraceae	√	√	√	√	√
Pistia stratiotes L.	Araceae	x	x	x	√	x
Ricinus communis L.	Euphorbiaceae	√	√	√	x	x

Table 2. Invasive species and their characterstics

Name of the Species	Nativity	Life Form	Habit	Uses	Habitat	Mode of Introduction
Argemone mexicana L.	South America	Herb	Annual	Medicinal	Wastelands	Unintentional
Cassia tora L.	South America	Herb	Annual	Medicinal	Wastelands	Unintentional

Cassia alata L.	South America	Shrub	Perennial	Medicinal	Cultivated fields	Ornamental
Calotropis gigantea (L.) R. Br.	Tropical Africa	Shrub	Perennial	Medicinal, Sacred Plant	Wastelands	Unintentional
Cyperus compressus L.	Tropical America	Sedges	Annual	Presence of bioactive chemicals	Cultivated fields	Unintentional
Eichhornia crassipes (C. Martius) Solms.	Tropical America	Herb	Perennial	Compos, Secondary waste water treatment	Aquatic	Ornamental
Ipomoea carnea Jacq. subsp. *Fistulosa* (Mart. *ex* Choisy) Austin	Tropical America	Shrub	Perennial	Medicinal	Wastelands	Unintentional
Jatropha curcas L.	Tropical America	Shrub/Small tree	Perennial	Biomass fuel in rural area	Wastelands	----------
Lantana camara L.	Tropical America	Herb	Perennial	Soil binder	Forests	Ornamental
Parthenium hysterophorus L.	North America	Herb	Annual	--------	Wastelands	Unintentional
Pistia stratiotes L.	Tropical America	Herb	Perennial	Medicinal	Aquatic	Unintentional
Ricinus communis L.	Mediterranean Basin and Eastern Africa	Shrub	Perennial	Oil, Medicinal	Wastelands	----------

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