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Diversity of Invasive Alien Species from Katepurna Sanctuary, District Akola (MS) India

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ABSTRACT

Along with anthropogenic activities, invasive alien species have done a major damage to native plant diversity. The present study is a comprehensive report on invasive alien species from Katepurna Wildlife Sanctuary (Maharashtra) India. A total of 93 invasive plant species belonging to 36 angiosperm families and 76 Genera are identified from the study area. More than 80%of alien species recorded are native to tropical America. The study also reported that most of the plants were unintentionally introduced in this region and then naturalized during the course of evolution. Of the recorded species, 72 % species were herbs, 15% species were shrubs, 4% species were trees and 9% species were climbers. The present study showed 26% of species from the study area were noxious, 11% of species were interfering and 63% of species were naturalized. These introduced alien species are found to gradually replacing the original local flora and hence this issue must be addressed on a priority basis.

Key words: *Katepurna Wildlife Sanctuary, Invasive alien species, Noxious, Interfering, Naturalized.*

Introduction

Biological invasion is the introduction and spread of any species in a new area to which the species is new. These biological invasions are operating at the global level. These threats are still increasing due to globalization, the rise in global trade, travel, and tourism. The increasing rapid invasions of different species in non-native areas are acclimatizing and homogenizing and considered as primary cause of native biodiversity loss (Mooney and Hobbs, 2000).

The invasive alien species have been getting more attention from world scientists for the past three decades. These invasive species potentially alter the native ecosystems as they are non-native and differ from other native species in their physiological requirements and growth patterns (Liao *et al.,* 2008). According to few studies, invasive species are a major cause of species extinction and change in hydrology and ecosystem function (Raghubansi *et al.,* 2005). These invasive species disturb trophic structure, create resource scarcity and damage ecosystem health (Rai and Singh, 2020). Further, these species also have a significant impact on the soil properties which are related to ecosystem diversity.

These invasive species are widely distributed in all categories of natural diversity. A recent study has reported the occurrence of 1,599 alien plant species belonging to 841 genera in 161 families in India, and the alien flora thus represents 8.5 % of the total Indian vascular flora (Reshi and Khuroo, 2012). D'Antonio and Meyerson (2018) have stated that the

increasing appearance of invasive alien species in community parks, and protected areas like Sanctuaries, National parks, and Biosphere reserves has become a major task for the respective restoration work. Therefore, it is necessary to identify the introduced exotic, invasive species from the natural habitat for their proper management.

Considering the overall scenario of invasive alien species across the globe, the present study was planned to prepare an inventory of invasive alien species from Katepurna wildlife sanctuary (Maharashtra) India, so that proper management steps could be taken by authority.

Materials and Methods

Katepurna is a small wildlife Sanctuary of the Akola District (Maharashtra) India. It covers an area of about 73.69 sq. km. It covers a significant area of the catchment of Katepurna reservoir. The sanctuary spread is in between 28o27'48.492'' North and 77o14'13.092'' East. Based on average annual rainfall, temperature and humidity conditions, the climate of the Sanctuary can broadly be termed as seasonal. The normal annual rainfall of the area is about 1000 mm. About 90% of the annual rainfall is received during the southwest monsoon period, i.e. June to September. The annual average temperature is about 30 °C and the highest temperature goes up to 48 °C during the month of May.

The current study was carried out from November 2020 to May 2023 by surveying each locality of the study area at regular intervals in all seasons of the year. These specimens were dried and pressed in the field and transported to the laboratory and the herbarium was prepared and deposited in the Herbarium, Department of Botany, Shri Shivaji College of Arts, Commerce, and Science, Akola (MS). The identification of collected plant specimens was done using floras (Naik, 1998 and Singh and Karthikeyan, 2000 and 2001). An extensive review of the literature on global invasive species was done for the nativity of these plants (Wagh and Jain 2015, Reshi *et al.*, 2017, Suman *et al.*, 2017 and Patil, 2017). The invasive alien species identified from the study area are presented in tabular form, family-wise, with botanical names accompanied by the author's abbreviations, habit/ life form, habitat, and nativity (Table 1).

Results and Discussion

During the present study, 93 plant species were identified as invasive alien species from Katepurna Wildlife Sanctuary, District- Akola (MS) India. The invasive species identified during this study belong to 36 flowering plant families and 76 genera. The

Fig. 1. Presentation of study site Katepurna Wildlife Sanctuary (MS) India

Table 1. Invasive alien species from Katepurna Wildlife Sanctuary.

Sr. No.	Family	Plant Name	Habit	Life form	Native country	Category
1	Acanthaceae	*Peristrophe bicalyculata* (Reitz) Nees.	Annual Herb	H	Tropical America	Interfering
2		*Ruellia britoniana* Leonard.	Annual Herb	H	Tropical America	Naturalized
3		*Ruellia tuberosa* L.	Annual Herb	H	Tropical America	Interfering
4	Amranthaceae	*Alternanthera pungens* (Humb.) Bonpl & Kunth.	Perennial Herb	H	Tropical America	Naturalized
5		*Alternanthera sessalis* (L) DC	Perennial Herb	H	Tropical America	Naturalized
6		*Amaranthus spinosus* L.	Annual Herb	H	Tropical America	Naturalized
7		*Amaranthus tenella* L.	AnnualHerb	H	Tropical America	Naturalized
8		*Celosia argentea* L.	Annual Herb	H	Tropical Africa	Interfering
9		*Digera muricata* (L.) Mart.	Annual Herb	H	South-west Asia	Naturalized
10		*Gomphrena serrata* L.	Annual Herb	H	Tropical America	Naturalized
11	Asclepiadaceae	*Calotropis gigantea* (L.) R. Br.	Shrub	S	Tropical Africa	Interfering
12		*Calotropis procera* (Ait.) R. Br	Shrub	S	Tropical Africa	Interfering
13		*Cryptostegia grandiflora* R. Br.	Perennial Herb	H	Madagascar	Naturalized
14	Asteraceae	*Acanthospermum hispidum* L.	AnnualHerb	H	Tropical America	Naturalized
15		*Ageratum conyzoides* L	AnnualHerb	H	Tropical America	Noxious
16		*Blainvillea acmella* (L.f.) Philipson	Annual Herb	H	Tropical America	Interfering
17		*Blumea eriantha* DC.	Annual Herb	H	Tropical America	Interfering
18		*Blumea lacera* (Burm. f.) DC.	Annual Herb	H	Tropical America	Interfering
19		*Echinops echinatus* Roxb.	Annual Herb	H	Afghanistan	Interfering
20		*Eclipta prostrata* (L.) Mant.	Annual Herb	H	Tropical America	Naturalized
21		*Glossocardia bosvallea* (L.f.) DC	Annual Herb	H	East Indies	Naturalized
22		*Lagascea mollis* Cav.	Annual Herb	H	Central America	Naturalized
23		*Parthenium hysterophorus* L.	Annual Herb	H	North America	Noxious
24		*Sonchus arvensis* L.	Annual Herb	H	Mediterranean	Interfering
25		*Tridax procumbens* L.	Annual Herb	H	Central America	Interfering
26		*Xanthium indicum* Koenig	Annual Herb	H	Tropical America	Interfering
27	Balsaminaceae	*Impatiens balsamina* L.	Annual Herb	H	Tropical America	Naturalized
28	Bignoniaceae	*Tecoma stans* (L.) Juss. ex. Kunth	Tree	T	Tropical America	Naturalized
29	Boraginaceae	*Heliotropium indicum* L.	Annual Herb	H	Tropical America	Naturalized
30	Cactaceae	*Opuntia stricta* Haw. var.dillenii (Ker.- Gawl.) Benson.	Shrub	S	Tropical America	Noxious
31	Capparaceae	*Capparis decidua* Edgew (Forssk.)	Small tree	T	North Africa	Naturalized
32		*Cleome gynandra* L.	Perennial Herb	H	Tropical America	Noxious
33		*Cleome viscosa* L.	Annual Herb	H	Tropical America	Interfering
34	Ceasalpiniaceae	*Cassia absus* L.	Annual Herb	H	Tropical America	Naturalized
35		*Cassia obtusifolia* L.	Perennial Herb	H	Tropical America	Naturalized
36		*Cassia occidentalis*	Shrub	S	South America	Naturalized
37		*Cassia tora* L.	Annual Herb	H	South America	Noxious
38		*Cassia uniflora* Mill.	Annual Herb	H	South America	Noxious
39		*Parkinsonia aculiata* L.	Small tree	T	Tropical America	Naturalized
40	Chenopodiaceae	*Chenopodium album* L.	Annual Herb	H	Tropical America	Interfering
41	Ceratophyllaceae	*Ceratophyllum demersum* L.	Annual Herb	H	Tropical America	Naturalized
42	Convolvulaceae	*Convolvulus arvensis* L.	Annual Climber	C	Europe	Naturalized
43		*Evolvulus alsenoids* L.	Annual Herb	H	Tropical America	Naturalized
44		*Ipomoea eriocarpa* R.Br.	Annual Climber	C	Tropical Africa	Interfering
45		*Ipomoea nil* (L.) Roth	Annual Climber	C	North America	Interfering
46		*Ipomoea obscura* (L.) Ker.Gawl.	Annual Climber	C	Tropical Africa	Interfering
47	Cusutaceae	*Cuscuta reflexa*Roxb.	Perennial parasite	C	Mediterranean	Noxious
48	Euphorbiaceae	Chrozophora rottleri (Geis.) Juss. Ex. Spreng.	Annual Herb	H	Tropical Africa	Interfering
49		*Croton bonplandianum* Baill.	Perennial Herb	H	South America	Naturalized
50		*Euphorbia hirta* L	Annual Herb	H	Tropical America	Naturalized
51		Jatropha curcus L.	Shrub	S	Tropical America	Naturalized
52		*Jatropha gossypofolia* L.	Shrub	S	Brazil	Naturalized

Table 1. *Continued...*

Sr. No.	Family	Plant Name	Habit	Life form	Native country	Category
53		*Phyllanthus amarus* Schumach and Thonn.	Annual Herb	H	Tropical America	Naturalized
54	Fabaceae	*Indigofera hirsuta* L.	Annual Herb	H	Tropical America	Naturalized
55		Indigofera linifolia (L.f.) Retz.	Annual Herb	H	South America	Naturalized
56		*Indigofera linnaei* Ali	Annual Herb	H	Tropical Africa	Naturalized
57		*Melilotus alba* Medik. ex Desr.	Annual Herb	H	Europe	Naturalized
58		*Pithecellobium dulce* (Roxb.) Benth	Tree	T	Mexico	Naturalized
59		*Sesbania bispinosa* (Jacq.) W. F. Wight	Shrub	S	Tropical America	Naturalized
60		*Stylosanthes fruiticosa* (Reit) Alston.	Shrub	S	Tropical America	Naturalized
61	Lamiaceae	Hyptis *suaveolens* (L.) Poit.	Annual Herb	H	Tropical America	Interfering
62		*Leonotis nepetifolia* (L.)R. Br.	Annual Shrub	S	Tropical Africa	Interfering
63		*Ocimum americanum* L.	Perennial Herb	H	Tropical America	Naturalized
64	Malvaceae	*Malachra capitata* L.	Annual Herb	H	Tropical America	Naturalized
65		*Malvastrum coromandelianum* (L.) Garcke.	Perennial Herb	H	Tropical America	Naturalized
66		*Sida acuta* Burm. f	Annual Herb	H	Tropical America	Naturalized
67		*Triumfetta rhomboidea* Jacq.	Shrub	S	Tropical America	Naturalized
68		*Urena lobata* L.	Shrub	S	Tropical Africa	Interfering
69	Martyniaceae	*Martynia annua* L.	Shrub	S	Tropical America	Naturalized
70	Mimosaceae	*Mimosa pudica* L.	Perennial Herb	H	Brazil	Interfering
71		*Prosopis juliflora* (Sw.) DC.	Shrub	S	Mexico	Naturalized
72	Nyctaginaceae	*Mirabilis jalapa* L.	Annual Herb	H	Peru	Naturalized
73	Onagraceae	*Ludwigia perennis* L.	Annual Herb	H	Tropical Africa	Naturalized
74	Oxalidaceae	*Oxalis corniculata* L.	Annual Herb	H	Europe	Naturalized
75	Papaveraceae	*Argemone Mexicana* L.	Annual Herb	H	South America	Noxious
76	Passifloraceae	*Passiflora foetida* L.	Perennial Climber	C	South America	Naturalized
77	Pediliaceae	*Martynia annua* L.	Perennial Herb	H	Tropical America	Naturalized
78	Pontederiaceae	*Eichhornia crassipes* (C.Martius) Solms.	Perennial Herb	H	Tropical America	Noxious
79	Portulacaceae	*Portulaca oleracea* L.	Annual Herb	H	South America	Naturalized
80	Polygonaceae	*Antigonon leptopus* Hook& Arn.	Perennial Climber	C	Tropical America	Noxious
81	Primulaceae	*Anagalis arvensis* L.	AnnualHerb	H	Europe	Naturalized
82	Sapindaceae	*Cardiospermum helicacabum L.*	Perennial Climber	C	Tropical America	Naturalized
83	Solanaceae	*Datura ferox* L.	Shrub	S	South America	Naturalized
84		*Datura innoxia* Mill.	Shrub	S	Tropical America	Naturalized
85		*Datura metel* L.	Shrub	S	Tropical America	Interfering
86		*Physalis minima* L.	Annual Herb	H	Tropical America	Naturalized
87		*Solanum nigrum* L	Annual Herb	H	Tropical America	Interfering
88	Tiliaceae	*Corchorus tridens* L.	Annual Herb	H	Tropical Africa	Naturalized
89		*Corchorus trilocularis* L.	Annual Herb	H	Tropocal Africa	Naturalized
90		*Triumfetta rhomboidea* Jacq.	Annual Herb	H	Tropical America	Naturalized
91	Typhaceae	*Typha angustifolia* L.	Perennial Herb	H	Tropical America	Interfering
92	Verbenaceae	*Lantana camara* L.	Shrub	S	Tropical America	Noxious
93	Zygophyllaceae	*Tribulus terrestris* L.	Perennial Herb	H	Tropical America	Naturalized

Note: T: Tree, S: Shrub, H: Herb and C: Climber

details of the invasive species identified are given in Table 1. It includes the family of the plant, the botanical name of the plant, life form, habit, and the origin of the plants in consideration. The family-wise distribution of invasive plant species is presented in Figure 1. It shows that most numbers of invasive plants were identified from the family Asteraceae (13) followed by Amaranthaceae (7), Fabaceae (7), Euphorbiaceae (6), and Ceasalpiniaceae (6). Other families were represented by two to five invasive members while 20 families are represented by only one member as an invasive species (Fig. 2). All these invasive species were introduced in this area mostly unintentionally and by travel and tourism. Of the identified invasive species over 80% species are native of tropical America

and the rest 20% nativity was distributed among Tropical Africa, Southeast Asia, Brazil, the Mediterranean, Central America, North Africa, Europe, and Afghanistan (Table 1). From these species, about 63% of invasive species were found to be naturalized in the study area.

Of the recorded 93 invasive plant species, 72 % species were herbs, 15% species were shrubs, 4% species were trees and 9% species were climbers (Fig. 3) including 9 aquatic species. Considering the category of invasiveness; the identified taxa were grouped into 3 categories *viz.* noxious, interfering and naturalized. The present study showed 26% of species from the study area are noxious, 11% of species were interfering and 63% of species were naturalized (Table 1 and Fig. 4).

Shukla *et al.* (2009) studied the invasive species from the Achanakmar-Amarkantak biosphere reserve and suggested that such invasion is harmful for local flora and fauna. Suman *et al.*, (2017) reported the invasive angiospermic plant species from the Panna tiger reserve and they concluded that some invading species have a noxious impact on local biodiversity. Kumar *et al.*, (2020) investigated invasive alien species from Nauradehi Wildlife Sanctuary Madhya Pradesh, India, and reported 108 alien species from this protected area and showed the damaging effect of these alien species on local biodiversity and soil. Das *et al.* (2021) have given a broad spectrum review of alien species in terrestrial and swampland habitats of India. They suggested that such alien species have detrimental effects on habitat occupancy, widespread dispersal, and secretion of toxic chemicals, thus ultimately damaging the growth of local plants. Chavre and Patil (2023) reviewed the alien flora of Maharashtra state. According to them, many foreign species are introduced intentionally in different states of India for ornamentation, agriculture, or unintentionally by travel and tourism and later these get acclimatized in those regions causing damage to local plant diversity and even affecting the agricultural production negatively, so their management is essential. From this, it could be stated that the enlisting of invasive alien species from different protected areas is

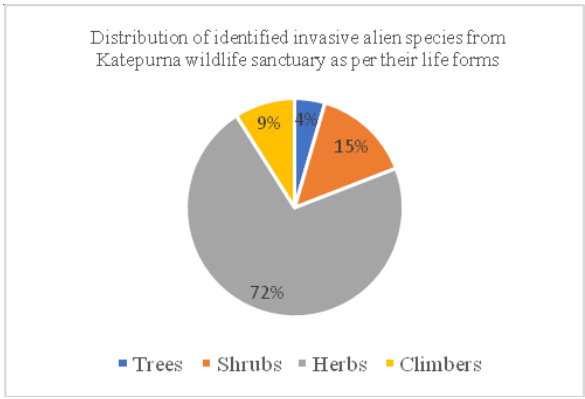

Fig. 3. Distribution of invasive alien species from Katepurna Wildlife Sanctuary.

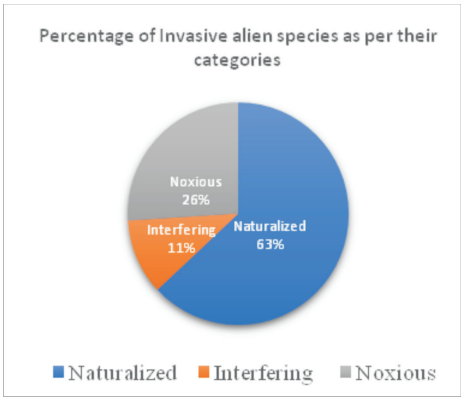

Fig. 4. Percentage of invasive species as per their categories from Katepurna Wildlife Sanctuary

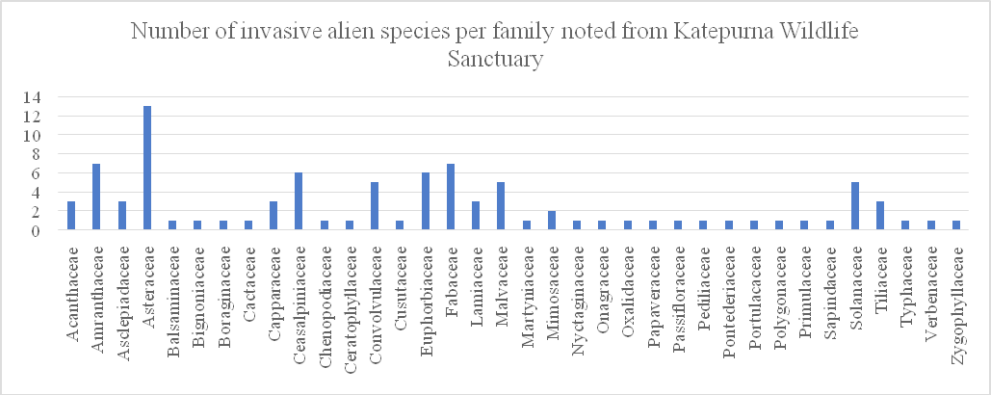

Fig. 2. Number of invasive alien species per family from Katepurna Wildlife Sanctuary.

essential to counter the problem of plant invasion.

Conclusion

The present study indicates that Katepurna Wildlife Sanctuary is facing a threat of invasive alien species. Therefore, it is essential to take some justified steps to counter this problem of invasion. Early warning is important to manage this issue before severe damage to local natural plant diversity. The taxonomic inventory of alien species represents the first important step, but more detailed studies on the characterization of alien species based on their stage of invasion, identification of potentially invasible areas/ ecosystems, detection of introduction pathways and vectors of alien species, assessment, mapping and monitoring of invasive species using modern geospatial technology such as hyper spectral remote sensing, impact assessment, and restoration could be more effective in the management of plant invasions. The present study is an attempt in this direction to prepare an inventory of invasive alien plants from Katepurna Wildlife Sanctuary so that the problem of invasion can be addressed properly at an early stage.

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Conflict of Interest: None

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