

## Documentation of Invasive Angiosperm Species of Thattekkad Bird Sanctuary

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**ABSTRACT:** Thattekkad bird sanctuary, known as the premier bird sanctuary of Kerala, is located in Central Kerala, North East to Kothamangalam in Ernakulam district. Though the sanctuary covers an area of 25.16 km<sup>2</sup>, almost 9 km<sup>2</sup> is under human inhabitation, thereby increasing the risk of invasion. Invasive plant species arose serious threats to the biodiversity of Kerala, even then such biological invasions are not well studied, especially in the protected areas of the state. In the present study, hundred observation points were laid across the sanctuary. Each such point was selected on the basis of visual invasive behaviour. The plant species thus observed were checked against the checklist of invasive plants of Kerala. 24 such plant species obtained were categorised into four group viz., high risk, medium risk, low risk and insignificant based on the probable impact risk. Among them 10 species are of high risk, 5 pose medium risk, 7 with low risk and 2 are insignificant with respect to the risk impact. Out of the 24 plants, 1 is tree, 8 are shrubs, 9 are herbs and 6 are climbers. Most introductions were intentional. Immediate measures are to be taken to restore habitats from alien invasive plants and eradicate the plants that are in the early phase of establishment. Their further spread, in terms of new introductions and already established are to be strictly checked.

**Keywords:** Thattekkad bird sanctuary, invasion, high risk, alien invasive plants, establishment.

### INTRODUCTION

A species that is not indigenous, or native, to a particular area, can be considered as an invasive organism. They can cause great economic and environmental harm to the new area. There are several characteristics that help a species to be invasive. Most important among them is the large quantity of seeds they produce which are very small so as to be carried away to long distances by wind and water (Khare, 1980). The gestation period of these seeds would be long and their large number increases the propagule pressure on the new habitat (Carlton, 1996). The propagules of the native species will have to compete with a large number of seeds of the invasive species. Many alien invasive species are early colonizers which help them to thrive on resource poor habitats (Funk and Vitousek 2007). They have very fast establishment and growth rates (Burns, 2004, 2006) and can make use of tree fall gaps (David *et al.*, 2005), degraded forests and forest fringes better than the native species (Rojas *et al.*, 2011). The allelochemicals produced by many of the invasive plants prevent the establishment of native plants in their vicinity (Callaway and Aschehoug 2000). Majority of the invasive plants can reproduce both sexually and vegetatively that help them to spread all through the year (Silvertown, 2008). They exhibit phenotypic plasticity that help these plants to adapt to a variety of habitats as evidenced by *Mimosa diplotricha* Arathy *et al.*,

var. *diplotricha* which remains a shrub in open lands but turns into a climber when trees are close by Hulme, (2008) and Niklas (2008).

Invasive plants exert several impacts on the ecosystem by direct displacement of native plant species. This happens through several mechanisms like change of soil chemical profile, rewarding pollinators better than the native species thereby reducing the reproductive success of native species, changing hydrological regimes, making the new habitats fire prone, limiting the photosynthetic efficiency of the native species by reducing light availability, and by inviting the necessity of herbicide application thereby impacting both the flora and fauna of the area (Nilsson and Grelsson 1996; Levine *et al.*, 2003). The results would be reduced availability of forest resources like medicinal plants and timber from forest plantations. One of the classical examples of the impact of invasive plants is, Kaziranga National park where the movement of the one horned rhinoceros was limited by thickets of *Mimosa diplotricha* var. *diplotricha*. In many other national parks *Lantana camara* causes negative impacts on the native fauna (Vattakkavan *et al.*, 2002; Singh, 1976). A comprehensive inventory of the invasive alien flora of India's fifth largest and most populous state, Uttar Pradesh, revealed 152 species from 109 genera and 44 families. Dicots represented 137 species and monocots 15 species (Singh *et al.*, 2010).

A survey of invasive alien plant species of Rohilkhand region (U.P.) recorded a total richness of 79 species belonging to 29 families (Beena *et al.*, 2016).

The book, Handbook on invasive plants of Kerala, for the first time, brought out a concise list of invasive alien plant species recorded from the State of Kerala. Eighty four species of terrestrial plants were included, all of which call for urgent attention in terms of control and management (Suresh *et al.*, 2013). Another study brought into light 38 invasive plants in the forests of Kerala (Sajeev *et al.*, 2012). Praveen (2018) reported that about 46% of the floral components of Kuttadankole wetland of Thrissur district, Kerala, fall under invasive category. In another study on invasive plants of Mukkam municipality of Kozhikode district, Kerala revealed that, there are about 28 invasive species belonging to 18 families. The documentation was mainly based on the field observation, discussions with local peoples as well as scrutinizing the literature review. Many invasive plants are threat to the native flora, out of these some of them are utilized by people for curing and controlling various ailments (Abhijith and Binu 2017). Sudhakar (2008) in his study gave the list of a total of 173 invasive alien species in India belonging to 117 genera under 44 families. In another study done across Indian Himalayan region, 297 naturalized alien plant species belonging to 65 families were reported. Of the total 297 naturalized alien plant species in IHR, maximum species occur in Himachal Pradesh (232; 78.1%) followed by Jammu & Kashmir (192; 64.6%) and Uttarakhand (181; 60.90%) (Ravi *et al.*, 2019). Prabhat and Singh (2020) had well explained the impact of invasive alien plant species in ecosystem services and human health. About 81 invasive plants are reported in a book named Invasive plants of Kerala,

(Hrideek *et al.*, 2020). In one of the studies at Anaikatty hills of Coimbatore forest division, about 98 invasive plant species were recorded (Prakash *et al.*, 2022). A research study entitled “Invasive alien plant species at Hassan District, Karnataka” reported a total of 312 alien species belonging to 236 genera in 79 families (Prasanth, 2022).

A total of 25 invasive alien plants were recorded from the survey conducted in Shendurney Wildlife Sanctuary (Sajeev *et al.*, 2021).

Thattakkad bird sanctuary, known as the premier bird sanctuary of Kerala, is located in Central Kerala, North East to Kothamangalam in Ernakulam district. Though the Sanctuary covers an area of 25.16 km<sup>2</sup>, almost 9 km<sup>2</sup> out of this is under human inhabitation, thereby increasing the risk of invasion. The present study aims to document the invasive plants of Thattakkad bird sanctuary and to review the probable impact risk by invasive plants to the ecosystem of Thattakkad bird sanctuary. No authentic reports are available regarding the invasive plants of the Sanctuary.

## MATERIALS AND METHODS

Around 100 observation points were laid across the Sanctuary covering tropical evergreen forests, tropical semi evergreen forests, moist deciduous forests, riparian forests and plantations. Each such point was selected on the basis of visual invasive behavior of plants. The plant species thus observed were checked against the checklist of invasive plants of Kerala and grouped into four categories viz., high risk, medium risk, low risk and insignificant based on the Invasive Species Assessment Protocol (Morse *et al.*, 2004).

**Table 1: Description of Invasive Rank used in the study.**

Rank	Description
High	Species represents a severe threat to native species and ecological communities
Medium	Species represents moderate threat to native species and ecological communities
Low	Species represents a significant but relatively low threat to native species and ecological communities
Insignificant	Species represents an insignificant threat to native species and ecological communities

## RESULTS AND DISCUSSION

24 invasive plant species were obtained and they were categorised into 4 group viz., high risk, medium risk, low risk and insignificant, based on the probable impact risk. Among them 10 species are of high risk, 5 pose medium risk, 7 pose low risk and 2 are insignificant with respect to the risk impact. Out of the 24 plants, 1 is tree, 8 are shrubs, 9 are herbs, 6 are climbers and one is an aquatic plant. Most introductions were intentional. In one of the studies 25 alien invasive plants were recorded from another protected areas of Kerala, the Shendurney Wildlife Sanctuary (Sajeev *et al.*, 2021). The present study identified 24 invasive plant species in Thattakkad bird sanctuary of which 10 are in high risk category. They need special attention in terms of control measures. Numbers of plants in medium risk and low risk are 5 and 7 respectively. Constant monitoring is needed to prevent further spread and new

intrusions. The study of Sajeev *et al.* (2012) identified 38 alien invasive species in the forests of Kerala. Of them, 10 were of high risk, 12 posed medium risk, 10 posed low risk and 6 insignificant as per the risk assessment. There were 5 trees, 11 shrubs, 4 subshrubs, 12 herbs and 6 climbers among the alien invasives found in the forests of Kerala. The invasive plants exert both direct and indirect effects on the forest ecosystem. Immediate measures are to be taken to restore habitats from alien invasive plants and eradicate the plants that are in the early phase of establishment. Also their further spread, in terms of new introductions and already established are to be strictly checked. Such a documentation study of invasive angiosperm species will definitely help a protected area like Thattakkad bird sanctuary to develop conservation strategies of native forest flora.

**Table 2: Invasive plants, their families, habit and risk category.**

Sr. No.	Species	Family	Habit	Rank
1.	<i>Ageratum conyzoides</i> L.	Asteraceae	Herb	Low
2.	<i>Alteranthera bettzickiana</i> (Regel) G. Nichols.	Amaranthaceae	Herb	Insignificant
3.	<i>Alteranthera philoxeroides</i> (Mart.) Griseb.	Amaranthaceae	Herb	Insignificant
4.	<i>Amaranthus spinosus</i> L.	Amaranthaceae	Herb	Low
5.	<i>Centrosema molle</i> Benth	Fabaceae	Climber	Low
6.	<i>Chromolena odorata</i> (L.) King & H. Rob.	Asteraceae	Shrub	High
7.	<i>Clidemia hirta</i> (L.) D. Don	Melastomataceae	Shrub	Low
8.	<i>Hyptis suaveolens</i> (L.) Poit.	Lamiaceae	Shrub	Medium
9.	<i>Ipomoea purpurea</i> (L.) Roth.	Convolvulaceae	Climber	Medium
10.	<i>Lantana camara</i> L.	Verbenaceae	Shrub	High
11.	<i>Leucaena leucocephala</i> (Lam.) de Wit	Fabaceae	Tree	Low
12.	<i>Merremia vitifolia</i> (Burm. f.) Hallier f.	Convolvulaceae	Climber	High
13.	<i>Mikania micrantha</i> Kunth.	Asteraceae	Climber	High
14.	<i>Mimosa diplotricha</i> C. White ex Sauvalle var. <i>diplotricha</i> C. White ex Sauvalle	Fabaceae	Shrub	High
15.	<i>Mimosa pudica</i> L.	Fabaceae	Herb	Low
16.	<i>Mucuna bracteata</i> DC ex. Kurz	Fabaceae	Climber	High
17.	<i>Pennisetum polystachyon</i> (L.) Schult.	Poaceae	Herb	Medium
18.	<i>Pontederia crassipes</i> Mart.	Commelinaceae	Herb	High
19.	<i>Pueraria phaseoloides</i> (Roxb.) Benth.	Fabaceae	Climber	High
20.	<i>Senna alata</i> (L.) Roxb.	Fabaceae	Shrub	High
21.	<i>Senna hirsute</i> (L.) Irwin & Barneby	Fabaceae	Shrub	Medium
22.	<i>Senna occidentalis</i> (L.) Link	Fabaceae	Shrub	Low
23.	<i>Sphagneticola trilobata</i> (L.) Pruski	Asteraceae	Herb	High
24.	<i>Synedrella nodiflora</i> (L.) Gaertn.	Asteraceae	Herb	Medium

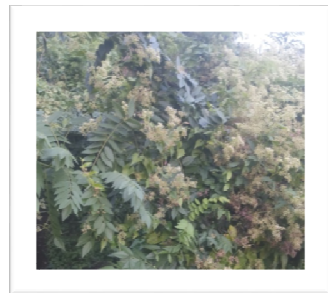
**Major High risk invasive angiosperm species of Thattekkad Bird Sanctuary**



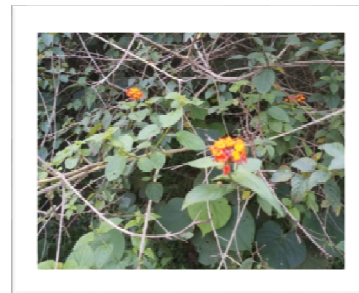
*Sphagneticola trilobata* (L.) Pruski



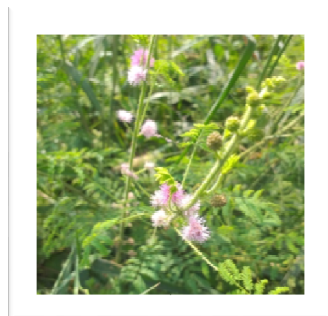
*Chromolena odorata* (L.) King



*Lantana camara* L.



*Mikania micrantha* Kunth



*Mimosa diplotricha* C. White ex Sauvalle var. *diplotricha* C. White ex Sauvalle



*Senna alata* (L.) Roxb

## CONCLUSIONS

This study provides a primary data towards the invasive plants of Thattekad sanctuary. Action plans are to be developed for the eradication of high risk species. Being a tourist destination, thorough checking of the belongings of tourists is needed to prevent spread and further introduction.

## FUTURE SCOPE

Quantitative study is needed to assess the actual state of invasion. Continuous monitoring is to be ensured to prevent further spread. Programmes that raise awareness among tourists about biological invasions are to be designed, like placing boards etc.

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**Conflict of Interest.** None.

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