

## Study on bee diversity in selected invasive plants of Manakody kole wetland, Thrissur district, Kerala

Vishnu A V<sup>1</sup>, Bijoy C<sup>1\*</sup>, R Soumya<sup>2</sup>

<sup>1</sup> Department of Zoology, Shadpada Entomology Research Lab, Christ College (Autonomous), Irinjalakuda, Thrissur, Kerala, India

<sup>2</sup> Assistant Professor (Ad-hoc), Department of Botany, Christ College (Autonomous), Irinjalakuda, Thrissur, Kerala, India

### Abstract

The present study which was conducted from June 2023 to October 2023 at Manakody Kole wetlands, Thrissur made a preliminary investigation on the bee diversity and its association to the selected invasive plants of the study area. A total of 10 morphospecies of bees belonging to 5 genera and 3 families were collected from 3 invasive plants (*Sphagneticola trilobata*, *Mimosa pudica* and *Alternanthera sessilis*). The dominant bee association is seen in the *Mimosa pudica*.

**Keywords:** Kole wetland, Invasive Alien Plant species (IAPs), bees, diversity

### Introduction

Kole wetlands, is a source of clean water and a good pollinating and nesting habitat of bees. Thrissur kole wetlands are a part of the Vembanad-kole, one of the Ramsar sites of India. As the name 'Kole' indicates, it gives profuse yield to the farmers even with one cultivation a year. [4]

The exotic plants which when cause an ecological and economic damage in the introduced habitat become an Invasive Alien Plant species (IAPs) and the process is known as Biological Invasion. [11] These is considered as the major direct driving force for biodiversity loss across the globe [10] having the capacity to disturb qualitative and quantitative aspects of biodiversity, negative health impacts on local population and livestock. [6] A number of facets are exhibited by IAPs, aided their widespread occurrence like multiple mode of reproduction, fast growth, superior competition etc. [12]

Bees are the beneficial pollinators belonging to the order Hymenoptera, superfamily Apoidea and seven families - Apidae, Halictidae, Megachilidae, Andrenidae, Colletidae, Melittidae and Stenotritidae. [7] About 20,273 bees have been reported from different parts of the world. [1] From India, 796 species belonging to 71 genera has been reported. [8] From Kerala, 86 species of bees are reported. [9] A study conducted on the rice ecosystem in Kerala documented 19 species of solitary non-*Apis* bees belonging to 7 genera and 3 families. [3]

The present study proposes to make preliminary investigation on bee diversity of selected IAPs from Manakody kole wetland and to understand the role of bees in the spread of IAPs in kole wetlands.

### Methodology

Observational or monitoring strategy was used to study and document native bee diversity. Parameters like temperature, humidity and wind speed were noted at regular intervals. The study was carried out from June to October 2023.

### Study area

Study was conducted in Manakody kole wetland (10.5136°N, 76.1774°E), Thrissur, Kerala, India (Figure 3)

### Collection of bees

Bees were collected between 09.00 am and 03.00 pm, in the 150m transect and observations made regularly every month. Habitat association and correlation between flowering invasive plants and bees were specifically looked upon and noted. Associated bees were collected using sweep nets (10 sweeps/5m) with sweeping done 3 times (morning, noon and afternoon). Collected specimens were killed using ethyl acetate and stored in 70% alcohol, which was later pinned and dried. Identification up to morphospecies level was done using published taxonomic keys and referring to experts. Specimens are identified using Labomed Luxeo 6z stereomicroscope.

### Results

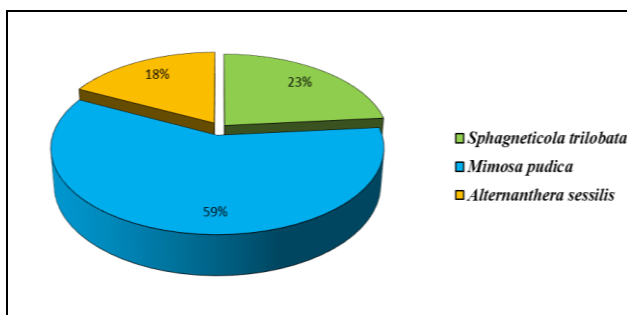
A total of 10 morphospecies of bees belonging to 5 genera and 3 families were collected from 3 IAPs - *Sphagneticola trilobata*, *Mimosa pudica*, *Alternanthera sessilis* from the study area.

**Table 1:** Morphospecies of bees identified from the study site

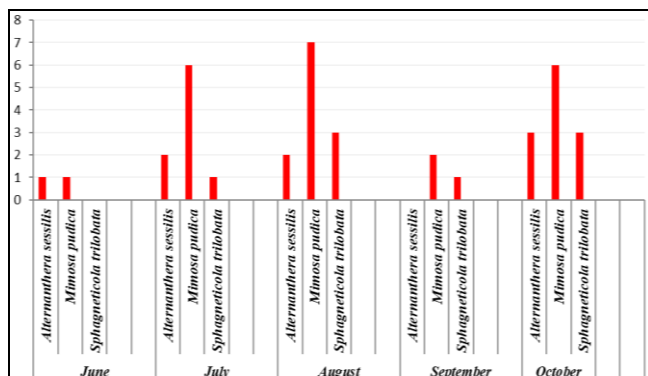
Sl. No.	Species	Subfamily	Family
1	<i>Apis cerana</i> Fabricius, 1793		
2	<i>Amegilla zonata</i> (Linnaeus, 1758)	Apinae	
3	<i>Amegilla niveocincta</i> (Smith, 1854)		Apidae
4	<i>Ceratina binghami</i> Cockerell, 1908		
5	<i>Ceratina smaragdula</i> (Fabricius, 1787)	Xylocopinae	
6	<i>Ceratina unimaculata</i> Smith, 1879		
7	<i>Nomia crassipes</i> (Fabricius, 1798)		
8	<i>Nomia westwoodi</i> Gribodo, 1894	Nomiinae	Halictidae
9	<i>Nomia</i> sp.1		
10	<i>Megachile disjuncta</i> (Fabricius, 1781)	Megachilinae	Megachilidae

**Table 2:** Plant-wise species richness of bees

Sl. No.	Plant species	Bee species
		<i>Apis cerana</i>
1	<i>Sphagneticola trilobata</i>	<i>Ceratina binghami</i>
		<i>Ceratina smaragdula</i>
		<i>Ceratina unimaculata</i>
		<i>Apis cerana</i>
		<i>Ceratina binghami</i>
		<i>Ceratina unimaculata</i>
		<i>Ceratina smaragdula</i>
		<i>Amegilla zonata</i>
2	<i>Mimosa pudica</i>	<i>Amegilla niveocincta</i>
		<i>Nomia crassipes</i>
		<i>Nomia westwoodi</i>
		<i>Nomia</i> sp.1
		<i>Megachile disjuncta</i>
		<i>Ceratina binghami</i>
3	<i>Alternanthera sessilis</i>	<i>Ceratina unimaculata</i>
		<i>Ceratina smaragdula</i>



**Fig 1:** Plant-wise species richness of bees



**Fig 2:** Month-wise species richness of bees in 3 invasive plants



**Fig 3:** Manakody kole wetland

**Discussion**

From the nine IAPs recorded from the Manakody kole wetland, bee associations were recorded from only three IAPs with 10 morphospecies of bees. Highest species association was recorded from *M. pudica* with 10 bee species. Four bee species were recorded from *S. trilobata*, and *Alternanthera sessilis* was having association only with *Ceratina* genus. *S. trilobata* is the riskiest IAP in the kole habitat as it comes under high-risk category [11] and is widespread throughout the state. It is most abundant in vacant lands, vacant paddy fields, forest fringes, etc. The species smothers the infested area and completely hinders the growth of other species by competing with them for light, water and food sources. *M. pudica* and *A. sessilis* belong to the insignificant category. [11]

The direct interactions between invasive plants and pollinators are poorly understood. The interaction between most plants and bees is based on mutualism, yet many invasive species also exhibit commensalism. Due to the differences in the availability, distribution, quality, and quantity of floral resources of non-native plants, visitors to the plants interact with them differently or do not react to them in the same manner. Attraction of bees to IAPs aid in its pollination and eventually reproduction. [13] IAPs show different strategies for spreading. *S. trilobata* and *A. sessilis* usually spread through vegetative propagation using stem fragments (seed is rare) and *M. pudica* spread through seeds. *Apis mellifera* play an important role in assisting pollination in *M. pudica* thus in turn helping in its seed formation and eventually its spread. [5] In *S. trilobata*, bees are attracted to collect its rewarding nectar. [2]

**Conclusion**

Unfortunately, not all of the factors that determine how effective bees are as pollinators have been investigated by those who study pollination. From our observations, the study could conclude that bees are showing association with IAPs with highest association documented from *M. pudica*. *S. trilobata* and *A. sessilis* which are acting as a nectar provider to bees. This indicates the interference of IAPs in the food web of the alien habitat and thereby causing its alteration.

**Acknowledgement**

The authors are thankful to the Principal of Christ College (Autonomous), Irinjalakuda, Kerala, for providing the facilities for undertaking this study. The first and second author is thankful to the the Kerala State Council for Science, Technology and Environment (KSCSTE) for the financial support in the form of project and project fellow.

**References**

1. Ascher JS, Pickering J. Discover Life bee species guide and world checklist (Hymenoptera: Apoidea: Anthophilia). Available from: [http://www.discoverlife.org/mp/20q?guide=Apoidea\\_species](http://www.discoverlife.org/mp/20q?guide=Apoidea_species) (accessed on December 13, 2020).
2. Baboo SK. Native insect pollinators visiting flowers of selected invasive plant species in three districts of Kerala [dissertation]. University of Calicut, 2020.
3. Bijoy C, Rajmohana K, Jobiraj T, Gnanakumar M. Diversity of non-*Apis* bees in rice ecosystems-a case study from Kerala. *Envis Newsletter*, ZSI,2019:25(1-4):19-21.

4. Fathibi K, Sudhikumar AV, Aneesh EM. Species composition and abundance of rotifers (Rotifera: Eurotatoria) in Thrissur Kole wetland, Kerala, India. *Egypt J Aquat Biol Fish*,2020;24(6):439–451.
5. Fohouo T, Tchuenguem FN. Pollination efficiency of *Apis mellifera* Linnaeus 1758 (Hymenoptera, Apidae) on *Mimosa pudica* Linnaeus 1753 (Fabaceae) inflorescences at Yassa (Douala-Cameroon). *J Entomol Zool Stud*,2018;6:2027-2033.
6. Hrideek TK, Suby, Amruth M, Muralikrishnan K. Major invasive plants of Kerala. Kerala Forest Research Institute, 2020.
7. Michener CD. *The Bees of the World*. Baltimore, Maryland, U.S.A: The Johns Hopkins University Press, 2007, 1-913.
8. Pannure A, Belavadi VV. Status and diversity of pollinators in India- A case for conserving non-*Apis* bees. *Envis Newsletter, ZSI*,2019;25(1-4):3-8.
9. Prakash AS, Jobiraj T, Bijoy C. A checklist of bees (Insecta: Hymenoptera: Apoidea) of Kerala. *Entomon*,2020;45(3):189-200.
10. Premakumari, *et al.* Invasive exotic plant species and their influence on the environment, ecosystem services, economy and health: a search. *Journal of Advanced Scientific Research*,2022;13(01):64-74.
11. Sankaran KV, Suresh TA, Sajeev TV. Handbook on invasive species of Kerala. Kerala state biodiversity board, KSBB Hand Book,2012;6:84.
12. Silvertown J. The evolutionary maintenance of sexual reproduction: evidence from the ecological distribution of asexual reproduction in clonal plants. *Int J Plant Sci*,2008;169:157-168.
13. Stout JC, Tiedeken EJ. Direct interactions between invasive plants and native pollinators: evidence, impacts and approaches. *Funct Ecol*,2017;31(1):38-46.