International Journal of Advanced Biochemistry Research 2025; SP-9(2): 331-335

International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2025; SP-9(2): 331-335
www.biochemjournal.com
Received: 01-12-2024
Accepted: 05-01-2025

Mahendra Devanda
Research Scholar, Department of Zoology, University of Rajasthan, Jaipur, Rajasthan, India

Dr. Santosh K Charan
Associate Professor, Department of Zoology, University of Rajasthan, Jaipur, Rajasthan, India

Corresponding Author:
Dr. Santosh K Charan
Associate Professor, Department of Zoology, University of Rajasthan, Jaipur, Rajasthan, India

Bee diversity and pollination dynamics on Ankol (*Alangium salvifolium*) in the foothills of Mount Abu, Rajasthan

Mahendra Devanda and Santosh K Charan

DOI: https://doi.org/10.33545/26174693.2025.v9.i2Se.3762

Abstract
The study investigates the diversity and abundance of bees visiting the Ankol (*Alangium salvifolium*) plant in the foothills of Mount Abu, Rajasthan, a semi-arid region with significant ecological diversity. The present study was based on surveys conducted during the flowering seasons of Ankol from March to May in both 2021 and 2022 in the foothills of Mount Abu. Observations were conducted during the flowering season to document bee activity, species diversity, and their influence on the reproductive success of Ankol. *Alangium salvifolium* is a significant medicinal plant known for its diverse bioactive compounds. These compounds exhibit a wide range of pharmacological properties, including antidiabetic, anticancer, anti-inflammatory, analgesic, antiarthritic, antiprotozoal, antihypertensive, and cardioprotective effects. These attributes make *A. salvifolium* a valuable resource for traditional medicine and modern pharmaceutical research.
A total of 19 bee species were recorded visiting Ankol (Alangium salvifolium) during the flowering seasons of 2021 and 2022, including *Apis cerana*, *Apis dorsata*, *Apis florea*, *Amegilla cingulata*, *A. dizona*, *A. violacea*, *A. zonata*, *Ceratina bighami*, *C. smaragdula*, *Tetragonula iridipennis*, *Thryeus remosus*, *Xylocopa fenestrata*, *X. latipes*, *Nomia crassipes*, *N. elliotii*, *Pseudapis oxybeloides*, *Megachile cephalotes*, *M. bicolor*, and *M. gathela*. The identified bee species belong to three families: Apidae, Halictidae, and Megachilidae. Among them, *Apis florea* was the most abundant, constituting about 16.12% of the total bee population, while *Nomia elliotii* was the least abundant, representing only about 0.64% of the total population in the study areas. The study highlights the crucial ecological role of bees in the pollination of Ankol, emphasizing the importance of conserving these pollinators to ensure the sustainability of plant reproduction and biodiversity.

Keywords: Bee, Ankol, Apoidae, Rajasthan

Introduction
Pollination is a crucial environmental process that has evolved over millions of years, benefiting both flowering plants and their pollinators. Pollinators visit flowers for various reasons, including for food, pollen gathering, and warmth. During these visits, pollen rubs off or falls onto their bodies, facilitating the transfer of genetic material between flowers. This process is essential for the life cycle of all flowering plants, as it triggers seed and fruit formation. The superfamily Apoidea, which includes bees, is a vast group with over 20,000 species worldwide, playing a vital role in pollination across ecosystems.
Bees are among the most diversified taxa, largely due to their apicultural importance and effectiveness as pollinators (Michener, 2007) [6]. They play a critical ecological role by pollinating both natural and managed ecosystems (Gallai *et al*., 2009) [3]. In India, the distribution of bee families includes Stenotritidae (0 species), Melittidae (4 species), Colletidae (31 species), Andrenidae (20 species), Halictidae (214 species), Megachilidae (237 species), and Apidae (218 species). In total, 724 bee species have been recorded in India, compared to 20,077 species globally (Makkar and Chhuneja, 2015) [5].
Chaudhary *et al*. (2018) [2] evaluated the pollination of mustard crops (*Brassica campestris*) in Jhunjhunu district, Rajasthan, and found that a total of 80 insect species were involved in pollination, 19 of which belonged to the order Hymenoptera. Saini *et al*. (2016) [10] recorded 8 bee species for the first time in Rajasthan, including *Amegilla cingulata*, A. confusa, *A. dizona*, *A. fallax*, *A. mucorea*, *A. niveocincta*, *A. violacea*, and *A. zonata*. Pollination is crucial for biodiversity conservation, ecosystem stability, cultural practices, food security,

and agricultural productivity. However, factors such as urbanization, climate change, pesticide use, genetically engineered plants, and invasive species pose significant threats to pollinators, as reported by Potts *et al*. (2016) [9].

Imran *et al*. (2018) [4] observed that 16 bee species from three families (Halictidae, Apidae, and Megachilidae) contributed to the pollination of onion crops in Western Rajasthan, enhancing both the quality and quantity of production. Pollinators play a crucial role in biodiversity, ecosystem services, crop production, and human health. However, their decline is attributed to factors such as habitat loss, habitat degradation, pesticide use, pathogens, climate change, and the presence of exotic species (Potts *et al.*, 2010) [8]. Bhardwaj *et al.* (2012) [1] documented 13 hymenopteran species involved in the pollination of various cultivated crops in an agro-ecosystem in Bikaner, Rajasthan.

The diversity of plant species in and around agricultural landscapes plays a crucial role in sustaining pollinator populations by providing essential food resources and habitats for both domestic and solitary bee species, along with other beneficial insects. This increased biodiversity directly enhances pollination efficiency and overall ecosystem services within agro-ecosystems (Nicholls and Altieri, 2012) [7]. *Alangium salvifolium*, a plant of significant ecological and medicinal value, has long been utilized in traditional healing systems such as Ayurveda and Siddha. Its various parts—including the roots, leaves, stems, and bark—are employed in treating a wide range of ailments. Recent scientific research has increasingly affirmed its therapeutic potential, demonstrating efficacy in managing conditions such as diabetes, peptic ulcers, arthritis, inflammation, and anthelmintic activity, highlighting its promising role in modern pharmacological applications.

The Ankol plant (*Alangium salvifolium*) is a highly underutilized shrub with significant potential in the food industry for its bioactive compounds, including anthocyanins, flavonoids, and phenols. Found widely across Asia and Africa, this plant offers functional food applications due to its therapeutic properties such as anti-diabetic, anti-cancer, and cardio-protective effects. Molecular research suggests the presence of novel phytochemicals, positioning *A. salvifolium* as a valuable resource for both functional foods and pharmaceutical advancements *Alangium salvifolium* is known to contain a range of physiologically active phytochemicals, including alangine, ankorine, tubulosine, alangicine, and salsoline, among others. This plant is widely distributed across Southeast Asia, including regions such as India, China, Thailand, the Philippines, Indonesia, and Papua New Guinea, as well as Africa, Madagascar, southern and eastern Asia, tropical Australia, the western Pacific Ocean islands, and New Caledonia (Shravya *et al*., 2017) [11]. Pollinators are not only critical for sustaining natural ecosystems, but they also play an essential role in maintaining healthy and productive agricultural systems by ensuring the development of high-quality fruits and viable seed sets in many crops.

The present study focuses on examining the diversity of bees and their association *with A. salvifolium*. It aims to explore the importance of bee conservation in relation to human health and ecosystem services, such as maintaining plant diversity in forest ecosystems, enhancing agricultural productivity, ensuring food quality, and supporting economically beneficial bee species. The study will contribute valuable insights into the vital role of bees in promoting biodiversity and sustaining the health of both natural and agricultural environments.

Materials and Methods

Study Area: The survey areas are located on one side in agricultural regions and on the other side in forest regions, near Abu Road in the Sirohi District of Rajasthan, India. The study site was visited weekly for bee collection and observation during the flowering seasons, which spanned from March to May in both 2021 and 2022. The bees were collected during the daytime, typically between 8:00 AM and 2:00 PM. The bees were collected twice from the area using a simple hand net with a sweeping method, ensuring collection occurred only when the wind speed did not exceed 2.5 m/s.

Bees were captured using an aerial insect net. The following collection; the insects were immediately transferred into a killing bottle, constructed from a cylindrical glass jar. After being transferred to the killing bottle, the bees were carefully spread and pinned on a spreading board to facilitate detailed morphological studies and precise species identification. The specimens were subsequently pinned using entomological steel pins and allowed to undergo proper desiccation. Some Collected specimens were kept in vials with 70% alcohols. The deceased specimens were then placed in storage boxes for preservation. To prevent fungal and other pest contamination, naphthalene balls were placed within the storage boxes. Photographs of Bees are taken in lab with a Camera Nikon D5600 and AF-S Micro NIKKOR 60 mm 1.2.8.G ED lens.

Initial identification to the genus level was conducted in field. Identifications were further approved and identified to species level by experts Dr. Jagdish Saini, Assistant Professor, Department Zoology, University of Allahabad, Prayagraj, Uttar Pradesh, India-211002.

Flowering plant with *Apis dorsata*

Immature fruits Setting on *Alangium salvifolium*

Result

A total of 155 individuals representing 19 bee species were collected and examined, belonging to the families Apidae, Halictidae, and Megachilidae. These families fall under the superfamily Apoidea, suborder Apocrita, within the order Hymenoptera. Among the identified species, 13 belonged to the family Apidae, 3 to the family Halictidae, and 3 to the family Megachilidae. The detailed list of identified species has been organized in a tabular format (Table 1).

The total number of bees collected was 155, with various species showing different levels of abundance. The most dominant species was *A. florea*, making up 16.12% of the total population. The second most abundant species was *A. dorsata* at 10.32%, followed by *Tetragonula iridipennis* (8.38%), *C. smaragdula* (7.74%), and *Apis cerana* (7.09%). Other species in the sample include *Amegilla cingulata* (5.80%), *A. dizona* (5.16%), *A. violacea* (5.16%), *A. zonata* (4.51%), *Xylocopa fenestrata* (4.51%), *X. latipes* (3.87%), *M. bicolor* (3.22%), *Thryeus remosus* (1.29%), *Nomia crassipes* (1.29%), *Pseudapis oxybeloides* (1.29%), *Megachile cephalotes* (1.29%), *M. gathela* (1.29%), and the least abundant species, *N. elliotii* (0.64%).

The limited number of species reported in the present study may be attributed to the relatively short sampling period. A longer sampling duration could have resulted in the identification of additional species.

The diversity revealed the abundance, and distribution of bee taxa in study area, emphasizing the role of these spaces as viable ecological habitats for diverse bee fauna. However, information on the ecological significance of bee, with most research concentrated on their pollination efficiency in ecosystems.

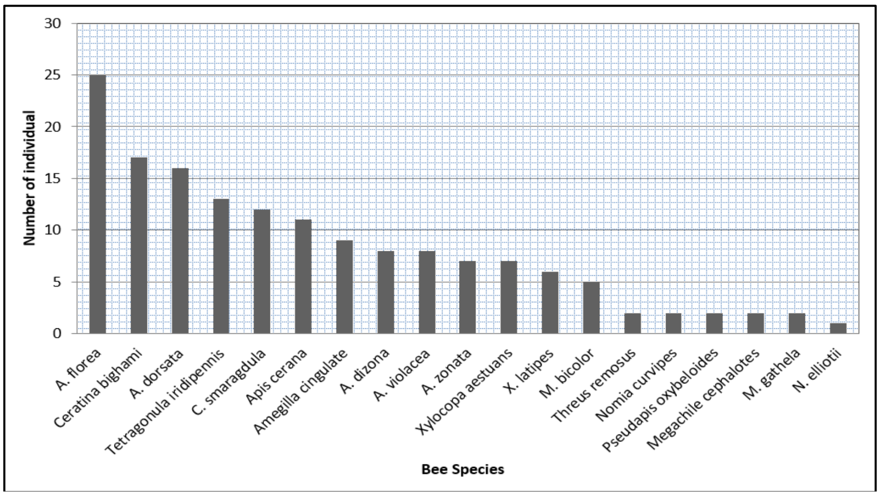


Fig 1: x-Axis indicates name of species and y-axis indicates number of individual

Relative Abundance:

Bee abundance was calculated as the total number of bees collected at site, summed across all sampling events. Bee diversity was calculated by summing the number of unique species across all sampling periods and then applying Shannon's Diversity Index. Total 155 individuals are captured and 19 species were recorded. The Average population size is 8.158 recorded.

1. Simpson Index: ($\sum_i n_i (n_i\text{-}1)/N (N\text{-}1)$): 0.07734
2. Margalef Richness Index: S-1/ln N: 3.569

Note: Alpha indices are for a single sample of a single region. These indices are calculated with all data provided to the calculator as a single sample. A total ten sweeps of the hand insect net were made on the study plant.

Table 1: Bee species and their relative abundance

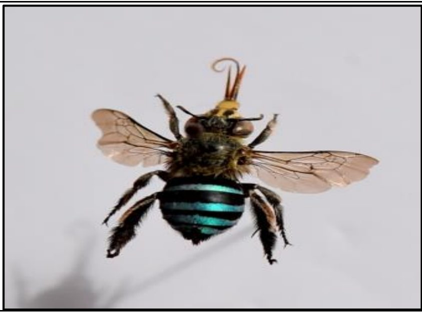
S. No.	Name of Species	Number of Individuals	Relative Abundance %	Family
1	*Apis cerana* (Fabricius, 1793)	11	07.09	Apidae
2	*A. dorsata* (Fabricius, 1793)	16	10.32	Apidae
3	*A. florea* (Fabricius, 1787)	25	16.12	Apidae
4	*Amegilla cingulata* (Fabricius, 1775)	9	05.80	Apidae
5	*A. dizona* (Engel, 2009)	8	05.16	Apidae
6	*A. violacea* (Lepeletier, 1841)	8	05.16	Apidae
7	*A. zonata* (Linnaeus, 1758)	7	04.51	Apidae
8	*Ceratina bighami* (Cockerell, 1908)	17	10.96	Apidae
9	*C. smaragdula* (Fabricius, 1787)	12	07.74	Apidae
10	*Tetragonula iridipennis* (Smith, 1854)	13	08.38	Apidae
11	*Thyreus ramosus* (Lepeletier, 1841)	2	01.29	Apidae
12	*Xylocopa fenestrata* (Fabricius, 1798)	7	04.51	Apidae
13	*X. latipes* (Drury, 1773)	6	03.87	Apidae
14	*Nomia crassipes* (Fabricius, 1798)	2	01.29	Halictidae
15	*N. elliotii* (Latreille, 1804)	1	00.64	Halictidae
16	*Pseudapis oxybeloides* (Smith, 1875)	2	01.29	Halictidae
17	*Megachile cephalotes* (Smith, 1853)	2	01.29	Megachilidae
18	*M. bicolor* (Fabricius, 1781)	5	03.22	Megachilidae
19	*M. gathela* (Cameron, 1908)	2	01.29	Megachilidae

Photographs of bee species from study area

1. *Apis cerana* (Fabricius, 1793)

2. *A. dorsata* (Fabricius, 1793)

3. *A. florea* (Fabricius, 1787)



4. *Amegilla cingulata* (Fabricius, 1775)

5. *A. dizona* (Engel, 2009)

6. *A. violacea* (Lepeletier, 1841)

7. *A. zonata* (Linnaeus, 1758)

8. *Ceratina bighami* (Cockerell, 1908)

9. *C. smaragdula* (Fabricius, 1787)

10. *Tetragonula iridipennis* (Smith, 1854)

11. *Thyreus ramosus* (Lepeletier, 1841)

12. *Xylocopa fenestrata* (Fabricius, 1798)

13. *X. latipes* (Drury, 1773)

14. *Nomia crassipes* (Fabricius, 1798)

15. *N. elliotii* (Latreille, 1804)

		
16. *Pseudapis oxybeloides* (Smith, 1875)	17. *Megachile cephalotes* (Smith, 1853)	18. *M. bicolor* (Fabricius, 1781)

19. *M. gathela* (Cameron, 1908)

Conclusion

This study highlights the diversity and abundance of bee species visiting Ankol (*Alangium salvifolium*), a medicinally important plant, in the semi-arid foothills of Mount Abu, Rajasthan. The findings underscore the crucial ecological role of bees in the pollination and reproductive success of *A. salvifolium*, which is vital for its sustainability and the broader biodiversity of the region. The medicinal significance of *A. salvifolium*, due to its diverse pharmacological properties, further emphasizes the importance of conserving bee populations to support its propagation and the associated benefits for traditional medicine and pharmaceutical research. Protecting these pollinators is essential for maintaining ecological balance and ensuring the continuation of valuable plant-pollinator interactions.

References

1. Bhardwaj H, Thaker P, Srivastava M. Hymenopteran floral visitors as recorded from an agro-ecosystem near Bikaner, Rajasthan. Glob J Sci Front Res Agric Biol. 2012;12(3).
2. Chaudhary S, Jangir BP, Srivastava M. Insects associated with mustard crop as observed in an agro-ecosystem in Rajasthan, India. Int J Allied Pract Res Rev. 2018;5(9):1-12.
3. Gallai N, Salles JM, Settele J, Vaissiere BE. Economic valuation of the vulnerability of world agriculture confronted with pollinator decline. Ecol Econ. 2009;68:810-821.
4. Imran, Rajpurohit A, Damayantipatel, Pathan H, Gupta RK. Bee visitors (Apoidea) on *Allium cepa* L. in western Rajasthan. J Environ Bio-Sci. 2018;32(1):77-80.
5. Makkar GS, Chhuneja PK. Diversity assessment of regional crop pollinating bee fauna in ecological perspective. Eco Env Cons. 2015;21(4):1811-1816.
6. Michener CD. The bees of the world. 2nd ed. Baltimore: Johns Hopkins University Press; 2007. 972 p.
7. Nicholls CI, Altieri MA. Plant biodiversity enhances bees and other insect pollinators in agro-ecosystems. Agron Sustain Dev. 2012; DOI 10.1007/s13593-012-0092-y.
8. Potts SG, Biesmeijer JC, Kremen C, Neumann P, Schweiger O, Kunin WE. Global pollinator declines: trends, impacts and drivers. Trends Ecol Evol. 2010;25(6):345-353.
9. Potts SG, Fonseca VI, Ngo HT, Aizen MA, Biesmeijer JC, Breeze TD, *et al*. Safeguarding pollinators and their values to human well-being. Nature. 2016;540:220-229.
10. Saini J, Sharma SL, Gupta RK. Taxonomy of the bee genus *Amegilla* Friese (Apoidea, Apidae: Anthophorini) with eight species first ever recorded from Rajasthan, India, with a dichotomous key and a complete distribution record. J Environ Bio-Sci. 2016;30(2):567-572.
11. Suresh S, Nair VB, Sunil C. Bulletin of Faculty of Pharmacy, Cairo University. 2017;55(2):217-222.