Int.J.Curr.Microbiol.App.Sci (2026) *15*(3): 272-280

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 15 Number 3 (2026)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2026.1503.028

Seasonal dynamics of *Apis* bees and its floral interaction in Agricultural and Horticultural ecosystem at PAJANCOA and RI campus, Karaikal, India

T. Yuvasri* and M. Kandibane

Department of Agricultural Entomology, Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal, Puducherry, India

**Corresponding author*

Keywords

Honey bee, Pollinator, Floral resources, Conservation, Honey flow

Article Info

Received: 22 January 2026
Accepted: 28 February 2026
Available Online: 10 March 2026

ABSTRACT

The study was conducted during October 2024 – June 2025 in Agricultural and Horticultural ecosystem at PAJANCOA and RI, Karaikal. The main of the study was to evaluate the diversity of seasonal and temporal dynamics of *Apis* bees namely *Apis dorsata, Apis cerana indica* and *Apis florea*. To record their floral interactions, and construct floral calendar about nectar and pollen sources in different months, which are vital for effective beekeeping, crop pollination and conservation of bees. Major honey flow period recorded during February to May. *A. dorsata* activity was more followed by *A. cerana indica* and *A. florea*. During study, Recorded a total of 22 flowering plants in Agricultural and 21 plants in Horticultural ecosystem. Plant pollinator interaction was stronger in Horticultural ecosystem when compared to Agricultural ecosystem.

Introduction

Pollination is the most essential mechanism in fertilization, seed production, and plant reproduction by transfer of pollen to the stigma (Kevan, 1999). Pollination was completed by different biotic (Insects, Birds and Animals) and Abiotic factors (Wind, Water) (Day and Hannah, 2015). Among them insect pollinators like bees, butterflies, beetles and flies that drive global food security and ecosystem health by facilitating the reproduction of over 80 per cent of flowering plants (Maggi *et al.,* 2024). Bee-pollinated flowers represent the most widespread pollination syndrome, termed melittophily. With over 25,000 bee species documented worldwide, they collectively provide pollination services to nearly 88 per cent of all flowering plants (Ollerton, 2017). Honeybees provide many useful products like honey, pollen, royal jelly. In addition to that it plays invaluable role in cross pollinating the economic crops like Apples, Sunflowers, Cucurbits etc., China contributed an estimated 30–50 per cent of the global economic value generated through pollination, making it the leading beneficiary among pollination-dependent nations such as India, the United States, Brazil, Japan, and Turkey (Lautenbach *et al.,* 2012). Globally, *Apis mellifera* Linnaeus is considered the primary pollinator, offering critical services to a wide range of crops of economic importance (Hung *et al.,* 2018). In addition, native Indian honey bees such as *Apis cerana indica*, *Apis dorsata*, and *Apis florea* serve as vital pollinators, supporting the reproductive success of wild flora and enhancing crop yields. Across Pakistan and much of South and Southeast Asia, the giant honey bee (*A. dorsata*) plays a vital role in crop pollination (Crane *et al.,* 2023). *A. cerana*, commonly known as the Indian honey bee, is native to Asia and has been valued for honey and pollination services for thousands of years (Patel *et al.,* 2025). The dwarf honey bee (*A. florea*) holds fundamental importance as a pollinator, sustaining the reproduction of numerous tropical plants and flowers (Soman and Chawda, 1996). Pollinator–plant relationships play a pivotal role in the reproductive processes of flowering plants, supporting terrestrial biodiversity and agricultural productivity (Byers, 2017). Pollinators are significantly impacted by various anthropogenic and environmental stressors, such as habitat degradation, extensive monoculture cultivation, pesticide exposure, environmental pollution, the spread of pathogens, and the extensive effects of climate change. Conservation of pollinators need to study the diversity of species, foraging pattern, habitat preferences, and interaction with other plants in floral communities (Kisvarga *et al.,* 2025)

Materials and Methods

The present investigation on the foraging patterns of *Apis* bees in Agricultural and Horticultural ecosystem was carried out during October 2024 to June 2025 at Pandit Jawaharlal Nehru College of Agriculture and Research Institute (PAJANCOA and RI), Karaikal, U. T. of Puducherry, India. The study area situated at 10°52′ North latitude and 79°52′ East longitude, with an elevation of 4 meters above mean sea level. The bees were collected from different flowering plants at weekly intervals by using different methods *viz.,* visual observation and net sweeping. Aerial net was most commonly used to collect bee pollinators flying over the inflorescences. Visual observation was used to document the number of bee pollinators on the inflorescences per m^2 was recorded for 5 minutes in the case of field crops, vegetable crops, tree crops and weeds during foraging hours (6.00 am to 5.00 pm). The details were used to prepare crop calendar and plant – pollinator interaction using bipartite graph. Correlation analyses were carried out to find out the relationship between *Apis* bees and meteorological parameters *viz*., maximum and minimum temperature, relative humidity (RH), rainfall (RF), wind speed and sunshine.

Result and Discussion

Apis bees and associated flower crops

A total of three *Apis* bees recorded namely *Apis dorsata, Apis cerana indica* and *Apis florea* (Fig.1) at PANJCOA and RI campus, Karaikal. It belongs to the order Hymenopteran order and Apidae family. During study the bee were recorded to forage for nectar and pollen sources in 22 flowering plants in Agricultural ecosystem and 21 in Horticultural ecosystem. *A. dorsata* activity was more in agricultural ecosystem whereas *A. cerana indica and A. florea* foraging activity was higher in horticultural ecosystem. Hemalatha *et al.,* (2018) recorded a total of 183 plants belonging to 76 families which acted as both nectar and pollen sources for *A. cerana indica* at Madurai, Tamil Nadu. In Karnataka, Raghunandan and Basavarajappa, (2014) registered a total of 252 flowering plants belong to 74 families which acted as a food resource for *A. dorsata*.

Bee activity was low during *Rabi* season (October – January) due to rainfall and low availability of nectar and pollen sources. After monsoon, the honey flow period started from end of February. Floral sources such as Pungam (*Pongamia pinnata*), Copper pod tree (*Peltophorum pterocarpum*), Asian spiderflower (*Cleome viscosa*), Bittergourd *(Momordica charantia*), and sesame (*Sesamum indicum*) provided nutrient rich nectar and pollen (Table 1 and 2). This resource availability supported bee population and foraging activity increased. Similar to the findings Vidhya *et al.,* (2019) reported that *A. florea* preferred majorly weed plants like *Trianthema portulacastrum* and *Alternenthera sessilis.*

Temporal Dynamics of *Apis* bee activity

During the study period, weekly surveys were carried out to record the population of bees in both ecosystems. *Apis dorsata* activity started to increase from March and peak acitivity was noticed during April month (14th standard week) which coincides with the honey flow period (Fig. 2). *A. cerana indica* and *A. florea* activity was notably increase after March, provided a constant foraging activity and ensured stability in the ecosystem.

Table.1 Bees and Their Associated Floral Resources in Agricultural Ecosystems

SL No.	Crop Name	Scientific Name	Family	Present Month(s)	Pollinator Scientific Name(s)	Nectar/Pollen/ Nectar +Pollen
1	**Maize**	*Zea mays*	Poaceae	March	*A. dorsata*	Pollen
2	**Sesame**	*Sesamum indicum*	Pedaliaceae	March–May	*A. dorsata*, *A. cerana indica*	Nectar +Pollen
3	**Sunflower**	*Helianthus annuus*	Asteraceae	March	*A. dorsata*	Nectar +Pollen
4	**Finger millet**	*Eleusine coracana*	Poaceae	April	*A. dorsata*	Pollen
5	**Daincha**	*Sesbania aculeata*	Fabaceae	Nov–Dec	*A. dorsata*	Nectar +Pollen
6	**Sunhemp**	*Crotalaria juncea*	Fabaceae	April	*A. dorsata*	Nectar +Pollen
7	**Copper pod tree**	*Peltophorum pterocarpum*	Fabaceae	March	*A. dorsata*, *A. cerana indica*, *A. florea*	Nectar +Pollen
8	**Pungam**	*Pongamia pinnata*	Fabaceae	March–April	*A. dorsata*, *A. cerana indica*, *A. florea*	Nectar +Pollen
9	**Coconut**	*Cocos nucifera*	Arecaceae	Dec–Feb, May	*A. dorsata*, *A. cerana indica*	Nectar +Pollen
10	**Rain tree**	*Samanea saman*	Fabaceae	April	*A. dorsata*	Nectar +Pollen
11	**Flame of forest**	*Butea monosperma*	Fabaceae	March	*A. dorsata*	Nectar +Pollen
12	**Jamun tree**	*Syzygium cumini*	Myrtaceae	April	*A. florea*	Nectar +Pollen
13	**Blue Rats Tail**	*Stachytarpheta jamaicensis*	Verbenaceae	Dec	*A. dorsata*	Nectar +Pollen
14	**Sessile Joyweed**	*Alternanthera sessilis*	Amaranthaceae	Dec–Jan, May	*A. dorsata*	Nectar +Pollen
15	**Water Primrose**	*Ludwigia perennis*	Onagraceae	Nov–Dec	*A. dorsata*	Nectar +Pollen
16	**Indian Hydrolea**	*Hydrolea zeylanica*	Hydroleaceae	Dec	*A. dorsata*, *A. cerana indica*	Nectar +Pollen
17	**Maderaspatanus Cucumber**	*Mukia maderaspatana*	Cucurbitaceae	Dec	*A. dorsata*	Nectar +Pollen
18	**Indian Catmint**	*Anisomeles indica*	Lamiaceae	Dec–Jan	*A. dorsata*	Nectar +Pollen
19	**Coatbuttons**	*Tridax procumbens*	Asteraceae	Oct, Dec–Mar, May	*A. dorsata*	Nectar +Pollen
20	**Flat-Stemmed Buttonweed**	*Borreria latifolia*	Rubiaceae	Oct–Dec	*A. dorsata*	Nectar +Pollen
21	**Giant Pigweed**	*Trianthema portulacastrum*	Aizoaceae	April	*A. dorsata*, *A. cerana indica*, *A. florea*	Nectar +Pollen
22	**Asian Spiderflower**	*Cleome viscosa*	Cleomaceae	Dec, Mar–Apr	*A. dorsata*, *A. cerana indica*	Nectar +Pollen

Table.2 Bees and Their Associated Floral Resources in Horticultural Ecosystem

SL NO.	Crop Name	Scientific Name	Family	Present Month(s)	Pollinator Scientific Name(s)	Nectar/Pollen /Nectar +Pollen
1	**Cucumber**	*Cucumis sativus*	Cucurbitaceae	Feb–Apr	*A. dorsata*, *A. cerana indica*	Nectar +Pollen
2	**Pumpkin**	*Cucurbita moschata*	Cucurbitaceae	Mar	*A. dorsata*, *A. cerana indica*	Nectar +Pollen
3	**Bittergourd**	*Momordica charantia*	Cucurbitaceae	Jan–Mar	*A. dorsata*, *A. cerana indica*	Nectar +Pollen
4	**Chilly**	*Capsicum annuum*	Solanaceae	Feb–Mar	*A. dorsata*, *A. cerana indica*	Nectar +Pollen
5	**Brinjal**	*Solanum melongena*	Solanaceae	Feb–Mar	*A. dorsata*	Pollen
6	**Sponge gourd**	*Luffa cylindrica*	Cucurbitaceae	Apr	*A. dorsata*, *A. cerana indica*, *A. florea*	Nectar +Pollen
7	**Guava**	*Psidium guajava*	Myrtaceae	Mar	*A. dorsata*	Nectar +Pollen
8	**Mango**	*Mangifera indica*	Anacardiaceae	Nov–Dec	*A. florea*	Nectar +Pollen
9	**Sandalwood tree**	*Santalum album*	Santalaceae	Oct–Nov, Mar	*A. dorsata*, *A. cerana indica*, *A. florea*	Nectar +Pollen
10	**Copper pod tree**	*Peltophorum pterocarpum*	Fabaceae	Mar–May	*A. dorsata*, *A. cerana indica*, *A. florea*	Nectar +Pollen
11	**Pungam**	*Pongamia pinnata*	Fabaceae	Mar–Apr	*A. dorsata*, *A. cerana indica*, *A. florea*	Nectar +Pollen
12	**Coconut**	*Cocos nucifera*	Arecaceae	Nov	*A. cerana indica*	Nectar +Pollen
13	**Banana**	*Musa paradisiaca*	Musaceae	Feb	*A. cerana indica*	Nectar +Pollen
14	**Yellow bell**	*Tecoma stans*	Bignoniaceae	Oct–Nov	*A. dorsata*, *A. cerana indica*	Nectar +Pollen
15	**Sessile Joyweed**	*Alternanthera sessilis*	Amaranthaceae	Nov	*A. florea*	Nectar +Pollen
16	**Water Primrose**	*Ludwigia perennis*	Onagraceae	Nov	*A. cerana indica*, *A. florea*	Nectar +Pollen
17	**Flat-Stemmed Buttonweed**	*Borreria latifolia*	Rubiaceae	Oct	*A. florea*	Nectar +Pollen
18	**Axillary Cyanotis**	*Cyanotis axillaris*	Commelinaceae	Nov–Jan	*A. dorsata*, *A. cerana indica*, *A. florea*	Nectar +Pollen
19	**Giant Pigweed**	*Trianthema portulacastrum*	Aizoaceae	Apr	*A. dorsata*, *A. cerana indica*, *A. florea*	Nectar +Pollen
20	**Erect Spiderling**	*Boerhavia erecta*	Nyctaginaceae	Feb–Mar	*A. cerana indica*	Nectar +Pollen
21	**Asian Spiderflower**	*Cleome viscosa*	Cleomaceae	Jan–Apr	*A. dorsata*, *A. cerana indica*	Nectar +Pollen

Table.3 Network and Group level plant pollinator interaction

Parameter	Agricultural	Horticultural	Finding
Network-Level			
Connectance	0.485	0.635	Horti more densely connected.
Modularity Q	0.307	0.229	Agri slightly more modular.
Nestedness (NODF)	9.36	60.17	Stronger nestedness in horti.
Shannon diversity	3.466	3.689	Higher diversity in horti.
Robustness HL	0.838	0.906	Pollinators more resilient in horti.
Group- Level			
Number of species HL	22	21	Similar pollinator richness.
Mean number of links HL	1.81	2.25	Pollinators more linked in horti.
Cluster coefficient HL	0.604	0.750	Stronger clustering in horti pollinators.
Robustness LL	0.324	0.383	Plants more robust in horti.
Partner diversity HL	0.48	0.74	Pollinators more diverse in horti.

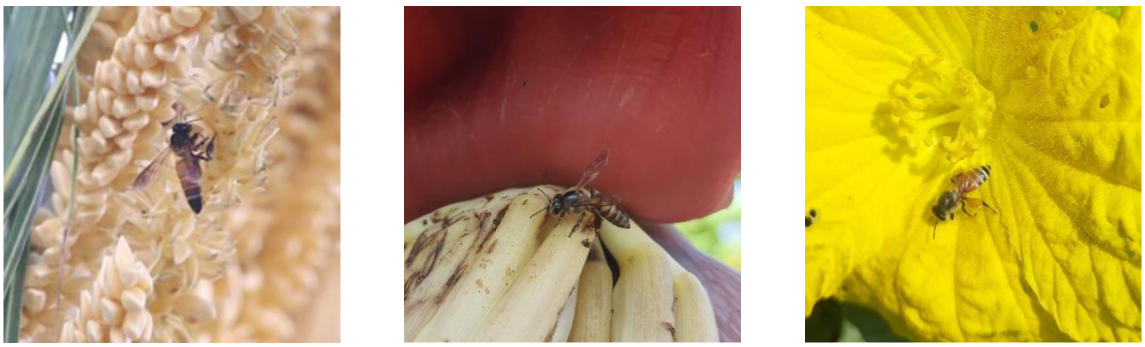
Table.4 Network and Group level plant pollinator interaction

Species	Degree	Strength	Nested Rank	Betweenness	Partner Diversity
Higher level Species (Agri)					
Copper pod tree	3	0.440	0.00	0.33	1.099
Pungam	3	0.440	0.05	0.33	1.099
Giant pigweed	3	0.440	0.10	0.33	1.099
Sesame / Coconut / Hydrolea / Asian spiderflower	2	0.190	0.14 - 0.29	0.00	0.693
Most crops and weeds (Maize, Sunflower, Finger millet, *etc.*)	1	0.048–0.25	0.33 - 1.00	0.00	0.000
Lower-level Species (Agri)					
Apis dorsata	21	17.0	0.00	0.00	3.045
Apis cerana indica	7	3.0	0.50	0.00	1.946
Apis florea	4	2.0	1.00	0.00	1.386
Higher level Species (Horti)					
Sponge gourd / Sandalwood / Copper pod / Pungam / Cyanotis / Giant pigweed	3	0.234	0.00 - 0.25	0.135	1.099
Cucumber / Pumpkin / Bittergourd / Chilly / Waterprimrose	2	0.134–0.163	0.30 - 0.55	0.016 - 0.094	0.693
Brinjal / Guava / Mango / Coconut / Banana / Sessile Joyweed / Buttonweed / Erect spiderling	1	0.06–0.10	0.65 - 1.00	0.00	0.000
Lower-level Species (Horti)					
Apis cerana indica	16	8.5	0.00	0.00	2.773
Apis dorsata	14	7.0	0.50	0.00	2.639
Apis florea	10	5.5	1.00	0.00	2.303

Table.5 Correlation between *Apis* bees and weather parameters

Species / Weather	Maximum Temperature	Minimum Temperature	Morning RH	Evening RH	Rainfall	Wind	Sunshine
A. dorsata	0.18	0.08	-0.02	-0.19	-0.22	-0.04	0.23
A. cerana indica	0.58**	0.31	-0.30	-0.49**	-0.51**	0.22	0.47**
A. florea	0.22	0.19	-0.20	-0.27	-0.20	0.12	0.24
**** = significant at 1%**							

Fig.1 *Apis* bee pollinators in PAJANCOA and RI, Karaikal



1. Apis dorsata ***2. Apis cerana indica*** ***3. Apis florea***

Figure.2 Temporal Dynamics of *Apis* Bee Activity

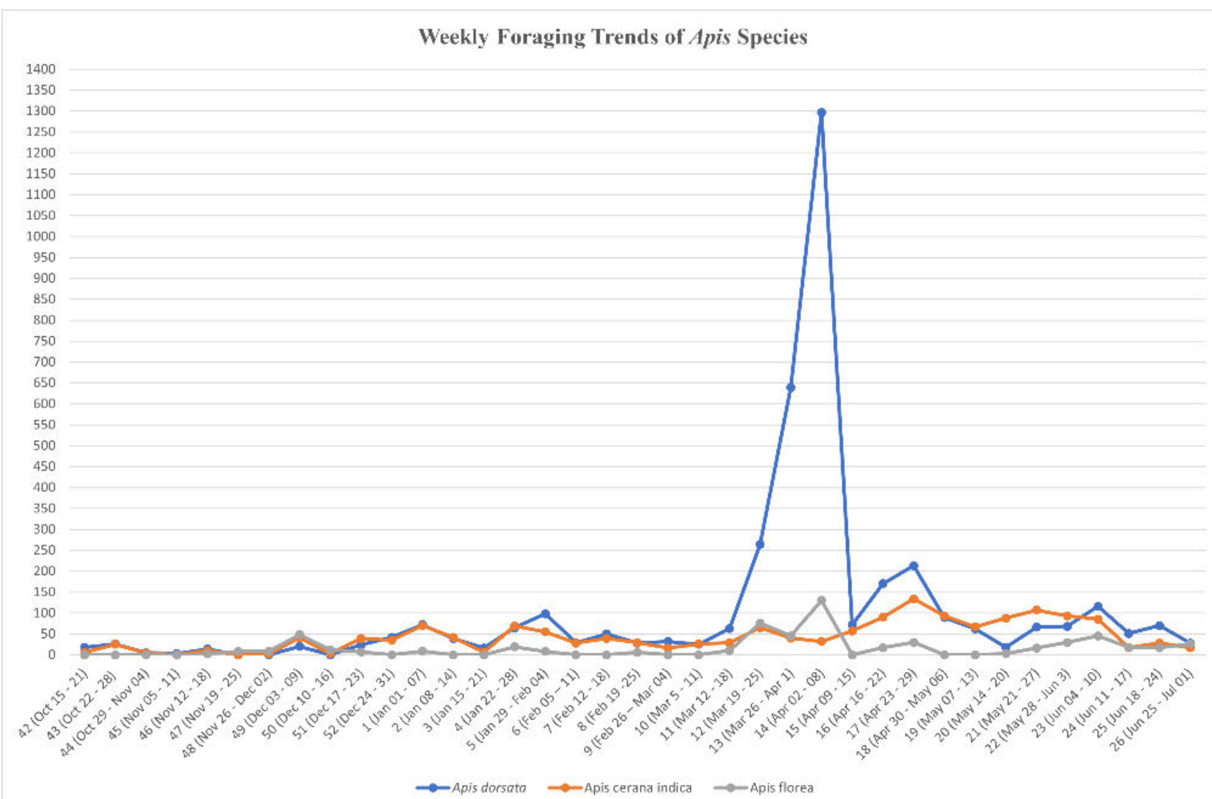
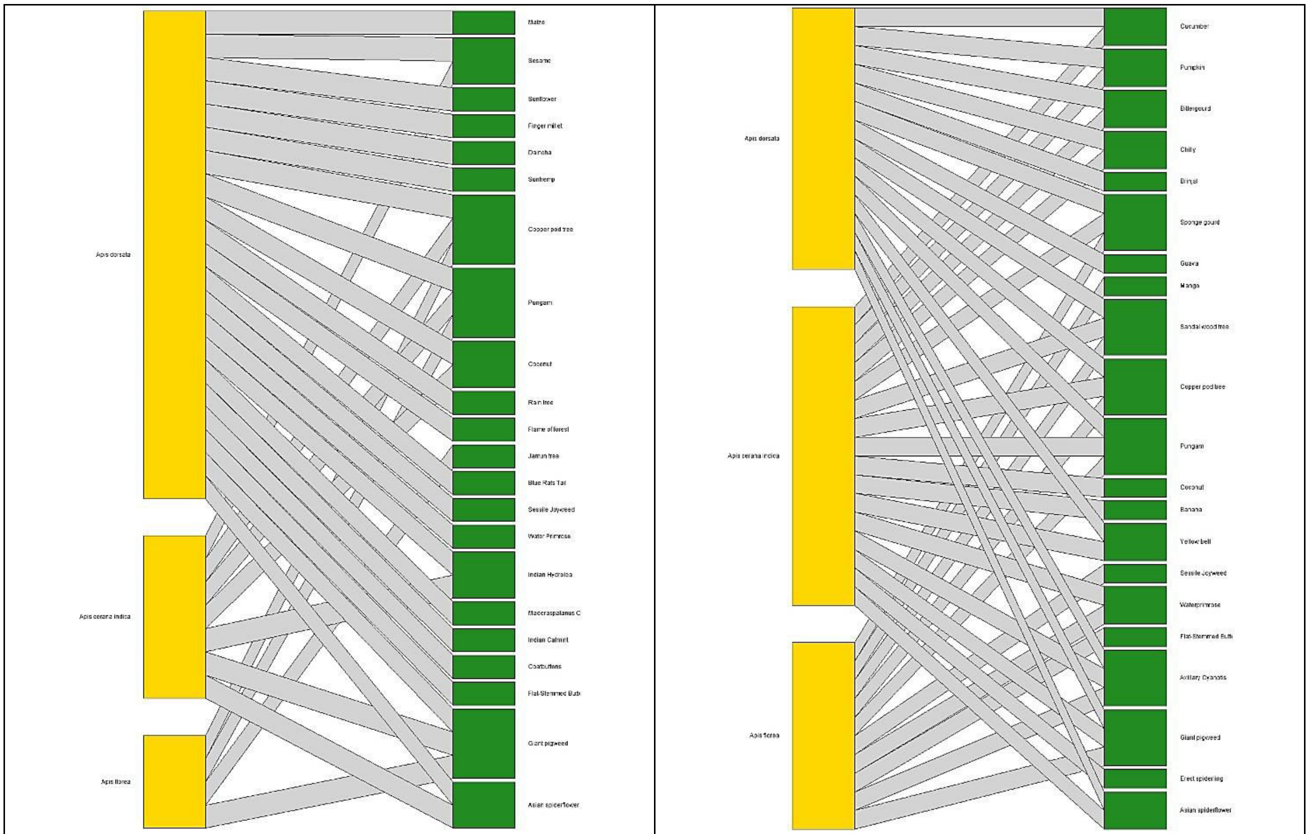


Fig.3 Plant- pollinator network



Agricultural Ecosystem	Horticultural ecosystem

[Lazar *et al.,* (2023)](#) reported that bee activity increased from February -May during honey flow season and reduced activity was noticed during dearth period (June – July) in Puducherry which corroborates with the current findings.

Network, group and species level analysis

The comparison of network and group level parameters revealed that notable structural differences in insect interaction between Agricultural and Horticultural ecosystem were observed (Table 3) (Fig 2). At the network level, horticultural ecosystems show higher connectance (0.635), stronger nestedness (60.17), greater Shannon diversity (3.689), and more resilient pollinators (Robustness High Level (HL) = 0.906), when compared to agricultural ecosystem. The present finding is in support with the fact of Deeksha *et al.,* (2022) who found that cultivated land site has higher connectance (0.23) when compared to un cultivated area. At the group level, both systems have equal pollinator richness, but horticultural pollinators were more linked (2.25), show stronger clustering (0.75), and greater partner diversity (0.74). Plants were also more robust in horticulture (Robustness Low Level (LL) = 0.383). Vinotha (2024) reported that the integrated farming system exhibited higher mean numbers of partner HL (Phase I: 3.59; Phase II: 2.73) compared to the conventional farm (2.08). This aligns with findings from similar studies, where horticultural ecosystems enriched by a diverse array of flowering crops which tend to support more interconnected ecological networks.

Species level analysis showed that agricultural ecosystem comprised fewer hub plants while horticultural ecosystems comprise more hub plants. In agriculture ecosystem, major hub plants were Copper pod tree, Pungam, and Giant pigweed (Degree = 3, Strength = 0.44, Partner diversity = 1.099), while most crops and weeds remain specialists with only one pollinator link (Degree = 1, Strength = 0.048- 0.25) (Table. 4). The pollinator network is dominated by *Apis* *dorsata* (Degree = 21, Strength = 17, Diversity = 3.045), followed by *A. cerana indica* as an intermediate and *A. florea* as a specialist. In horticulture ecosystem, hub plants were more numerous (Sponge gourd, Sandalwood, Copper pod, Pungam, Cyanotis, Giant pigweed), with intermediates like cucumber and pumpkin (Degree = 2, Strength = 0.134 - 0.163, Diversity = 0.693), and many fruit trees and weeds as specialists (Degree = 1, Strength = 0.06 - 0.10). The pollinator network is balanced, with *A. cerana indica* as the main hub (Degree = 16, Strength = 8.5, Diversity = 2.773), *A. dorsata* still strong (Degree = 14, Strength = 7, Diversity = 2.639), and *A. florea* acted as a specialist (Degree = 10, Strength = 5.5, Diversity = 2.303). Horticulture ecosystem comprised more hubs when compared to Agriculture, making it structurally more resilient.

Apis bees and its relationship with weather parameters

During study period, October 2024 and June 2025, weather parameters were monitored and correlated with bee activity (Table 5). The analysis revealed that *A. cerana indica* showed a significant positive correlation with Maximum temperature (0.58) and Sunshine (0.47).

According to Paikara and Painkra (2020), Indian bees have a substantial negative link with wind speed (-0.09), evening relative humidity (-0.16), and minimum temperature (-0.75), all of which agree with the current study. *Apis* bees showed positive correlation with Maximum temperature, Minimum temperature and Sunshine. Similar to the above finding, Mohanty *et al.,* (2023) reported a positive correlation between foraging activity of *A. cerana indica* and temperature (Maximum: 0.56; Minimum temperature: 0.63). Thakur *et al.,* (2022) reported that *A. dorsata* recorded positive correlation with temperature (0.76) which correlate with the present study.

Acknowledgements

This study was supported by the Department of Agricultural Entomology, PAJANCOA and RI, Karaikal, Puducherry which is gratefully acknowledged.

Author Contributions

T. Yuvasri: Investigation, formal analysis, writing—original draft. M. Kandibane: Validation, methodology, writing—reviewing.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

References

Byers, D. L. 2017. Studying plant–pollinator interactions in a changing climate: A review of approaches. *Applications in Plant Sciences* 5(6): apps.1700012.

Crane, E., Luyen, V. V., Mulder, V., and Ta, T. C. 1993. Traditional management system for *Apis dorsata* in submerged forests in southern Vietnam and central Kalimantan. *Bee World* 74: 27–40.

Day, H. G. 2015. Biotic and abiotic factors contribute to cranberry pollination. *Journal of Pollination Ecology* 15: 15–22.

Deeksha, M. G., Khan, M. S., and Kumaranag, K. M. 2022. Plant–pollinator interaction network among the scrubland weed flora from foothills of north–western Indian Himalaya. *International Journal of Tropical Insect Science* 42(2): 1593–1603.

Hemalatha, D., Jayaraj, J., Murugan, M., Balamohan, T. N., Senthil, N., Chinniah, C., and Suresh, K. 2018. Floral diversity for foraging of the Asiatic honey bee, *Apis cerana indica* (Hymenoptera: Apidae) in Madurai District of Tamil Nadu, India. *International Journal of Current Microbiology and Applied Sciences* 7(10): 3452–3456.

Hung, K. L. J., Kingston, J. M., Albrecht, M., Holway, D. A., and Kohn, J. R. 2018. The worldwide importance of honey bees as pollinators in natural habitats. *Proceedings of the Royal Society B: Biological Sciences* 285(1870): 20172140.

Kevan, P. G. 1999. Pollinators as bioindicators of the state of the environment: Species, activity and diversity. In *Invertebrate Biodiversity as Bioindicators of Sustainable Landscapes*, pp. 373–393. Elsevier.

Kisvarga, S., Horotán, K., Neményi, A., Táborská, J., Istvánfi, Z., and Orlóci, L. 2025. A systematic review of native–invasive pollinator competition in urban green space. *Environmental Challenges* 20: 101219.

Lautenbach, S., Seppelt, R., Liebscher, J., and Dormann, C. F. 2012. Spatial and temporal trends of global pollination benefit. *PLoS ONE* 7(4): e35954.

Lazar, J., Prasad, S., Das, L., Anupama, K., and Kumaresan, V. 2023. Nectar and pollen resources of the honey bee (*Apis cerana*) in Merveille: An ecorestoration site near Puducherry, Southern India. *Journal of Economic and Taxonomic Botany* 47(3): 136–150.

Maggi, T., Pardo, L., and Chreil, R. 2024. Insect pollinators: A key to ecosystem resilience and food security. *Pollinators* 1: 35–50.

Mohanty, P., Khuntia, A., and Behera, P. 2023. Foraging activity of Indian honey bee (*Apis cerana indica* F.) in winter season in Odisha condition. *The Pharma Innovation Journal* 12(2): 203–210.

Ollerton, J. 2017. Pollinator diversity: Distribution, ecological function, and conservation. *Annual Review of Ecology, Evolution, and Systematics* 48: 353–376. https://doi.org/10.1146/annurev-ecolsys-110316-022919.

Paikara, S. P., and Painkra, G. P. 2020. Effects of independent variables on various dependent factors on coriander flowers. *Journal of Plant Development Sciences* 12(11): 657–664.

Patel, R., Islam, S., Patel, M., *et al.,* 2025. Foraging resource partitioning between Indian native *Apis florea* and *Apis cerana*: Unveiling entomological signatures in honey through honey DNA metabarcoding. *Scientific Reports* 15: 11546.

Raghunandan, K. S., and Basavarajappa, S. 2014. Floral hosts and pollen calendar of Asian giant honeybee, *Apis dorsata* Fabricius at Southern Karnataka, India. *Indian Bee Journal* 76(1): 12–18.

Soman, A. G., and Chawda, S. S. 1996. A contribution to the biology and behaviour of the dwarf honey bee, *Apis florea* F., and its economic importance in Kutch, Gujarat, India. *Indian Bee Journal* 58: 81–88.

Thakur, M. V., Munj, S. S., Humbare, M. D., Tudu, L., Patel, Y. K., Verma, R. D., and Ramya, R. 2022. Effect of weather parameters on population abundance of *Apis* species on coriander. *The Pharma Innovation Journal* 11(11): 2575–2577.

Vidhya, A., Suresh, K., Chinniah, C., Krishnamoorthy, V., and Shanthi, M. 2019. Weed flora, a rich foraging source for little/dwarf bee *Apis florea* Fabricius (Hymenoptera: Apidae) in Madurai District, Tamil Nadu. *International Journal of Current Microbiology and Applied Sciences* 8(6): 955–959.

Vinotha, S. 2024. Pollinator diversity studies in integrated farming system. M.Sc. (Agri.) thesis, Division of Entomology, Indian Agricultural Research Institute, New Delhi. pp. 43–52.

How to cite this article:

Yuvasri T. and Kandibane M. 2026. Seasonal dynamics of *Apis* bees and its floral interaction in Agricultural and Horticultural ecosystem at PAJANCOA and RI campus, Karaikal, India. *Int.J.Curr.Microbiol.App.Sci.* 15(3): 272-280. **doi:** https://doi.org/10.20546/ijcmas.2026.1503.028