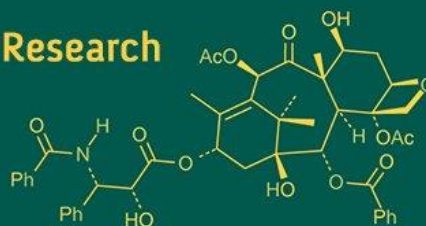
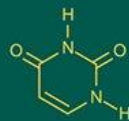


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Parise Teena
Department of Entomology,
College of Agriculture,
Rajendranagar, Professor
Jayashankar Telangana
Agricultural University
(PJTAU), Hyderabad,
Telangana, India

Dr. V Sunitha
Senior Scientist, All India
Network Project on Vertebrate
Pest Management (AINP-
VPM), Professor Jayashankar
Telangana Agricultural
University (PJTAU),
Rajendranagar, Hyderabad,
Telangana, India

Dr. D Anitha Kumari
Principal Scientist, Vegetable
Research Station, Sri Konda
Laxman Telangana
Horticultural University
(SKLTHU), Rajendranagar,
Hyderabad, Telangana, India

Dr. D Srinivasa Chary
Department of Statistics and
Mathematics, College of
Agriculture, Professor
Jayashankar Telangana
Agricultural University
(PJTAU), Rajendranagar,
Hyderabad, Telangana, India

Dr. Krishna Kumar Bonkuri
Department of Entomology,
N.M. College of Agriculture,
Navsari Agricultural
University, Navsari, Gujarat,
India

Corresponding Author:
Parise Teena
Department of Entomology,
College of Agriculture,
Rajendranagar, Professor
Jayashankar Telangana
Agricultural University
(PJTAU), Hyderabad,
Telangana, India

Diversity and abundance of pollinators visiting bottle gourd (*Lagenaria siceraria* (Molina) Standley) agroecosystems

Parise Teena, V Sunitha, D Anitha Kumari, D Srinivasa Chary and Krishna Kumar Bonkuri

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Abstract

Insect pollinators are essential for the reproductive success and productivity of cucurbit crops such as bottle gourd (*Lagenaria siceraria*), which largely depends on insect-mediated cross-pollination. This present study (2023-24) at the Vegetable Research Station, Agricultural Research Institute, Rajendranagar, Hyderabad, India, documented the diversity and abundance of insect visitors to bottle gourd. Pollinators were observed from 10 per cent to 90 per cent flowering using water pan traps, sweep nets, and aspirators. A total of 211 insect pollinators representing 16 species, 8 families, and 4 orders were recorded. Hymenoptera was the dominant order with 118 individuals and 55.9% relative abundance, followed by Diptera (25.1%), while Lepidoptera and Coleoptera each contributed 9.48% of the total pollinator population. At the family level, Apidae was most abundant (44.1%), followed by Syrphidae (19.0%) and Halictidae (11.9%). *Amegilla* sp. was reported as the most abundant species (23.7%), while *Xylocopa* sp. and *Sarcophaga* sp. were the least frequent (1.4% each). Diversity indices indicated a moderately diverse and evenly distributed community (Shannon-Wiener $H' = 2.42$; Simpson 1-D = 0.88). The dominance of hymenopteran pollinators, particularly Apidae, highlights their vital role in bottle gourd pollination. The findings provide valuable baseline information on pollinator diversity in bottle gourd agroecosystems and highlight the need for pollinator-conservation strategies to sustain pollination services and enhance crop productivity.

Keywords: Abundance, Apidae, *Amegilla* sp., bottle gourd, diversity, hymenoptera, insect pollinators

Introduction

The family Cucurbitaceae is one of the most important groups of vegetable crops cultivated worldwide, particularly in tropical and subtropical regions. It consists of approximately 118 genera and over 800 species, many of which are economically important and widely cultivated for their edible fruits (Minocha, 2015) [4]. Major cucurbit crops include cucumber, bottle gourd, ridge gourd, bitter gourd, muskmelon, and other gourds that contribute significantly to vegetable production and nutritional security. Among cucurbits, bottle gourd is an important vegetable crop grown during both rainy and summer seasons. The crop exhibits considerable variation in fruit shape, ranging from bottle-shaped and cylindrical to flask-shaped and globose forms. Bottle gourd is a monoecious vine bearing separate male and female flowers on the same plant (Morimoto *et al.*, 2004) [5]. The flowers are white, open during the evening, and remain receptive for a relatively short period. Like other cucurbit crops, bottle gourd primarily relies on insect-mediated pollination because its pollen grains are relatively large, sticky, and unsuitable for effective wind dispersal. Successful pollination is a prerequisite for fruit set and seed development in cucurbits. Male flowers generally appear earlier and provide both nectar and pollen, while female flowers often produce higher quantities of nectar, thereby attracting a greater number of pollinators. Since flower longevity and pollen viability are limited, timely pollen transfer by insect visitors is essential for effective fertilization. Consequently, insect pollinators, particularly bees, play a crucial role in enhancing fruit set, yield, and quality in cucurbit crops.

Pollination by insects is one of the most cost-effective and environmentally sustainable approaches for improving the productivity of cross-pollinated crops. However, pollinator populations have experienced substantial declines in recent decades due to habitat loss,

changes in land-use patterns, indiscriminate pesticide application, environmental pollution, climate change, and the spread of pests and diseases. The decline of pollinator communities poses a significant threat to agricultural productivity and ecosystem stability. Understanding the diversity, abundance, and composition of pollinator communities is fundamental to the development of effective pollinator-conservation and crop-management strategies (Kevan *et al.*, 2001)^[6]. Considering the indispensable role of insect pollinators in cucurbit production and growing concerns over insect pollinator declines, this study was undertaken to document the diversity and abundance of insect pollinators associated with bottle gourd ecosystems. The results aim to improve knowledge of pollinator diversity and to inform practical measures for pollinator conservation and sustainable crop production.

Material and methods

The study was conducted during 2023-24 at the Vegetable Research Station, Agricultural Research Institute, Rajendranagar, Hyderabad, Telangana, India (17°20' N, 78°30' E; 573 meters above mean sea level) in a bottle gourd. The experiment was conducted in a 500 m² plot laid out in a Randomized Block Design (RBD). The crop was maintained following the recommended agronomic practices, with a plant-to-plant spacing of 0.5 metres. Pollinator diversity and abundance were assessed using various trapping methods like water pan traps, sweep netting, and aspirators. Observations were recorded at weekly intervals from 10 per cent to 90 per cent flowering to capture temporal variation in visitation. Collected specimens were preserved as both dry and wet collections following standard entomological procedures. Identification to the lowest practicable taxonomic level was performed with assistance from taxonomic experts at the National Centre for Biological Sciences (NCBS), Gandhi Krishi Vignana Kendra (GKVK), Bengaluru, and the Indian Institute of Rice Research (IIRR), Rajendranagar, Hyderabad.

The relative abundance of species was calculated using the formula given below.

$$\text{Relative abundance (\%)} = N_i \div N_A \times 100 \text{ (MacArthur, 1960)}^{[1]}$$

Where,

- N_i = Total number of individual pollinator species
- N_A = Total number of pollinator species

Shannon-Wiener Diversity Index

It was used to quantify community diversity, incorporating both the number of individuals and the number of taxa (Shannon, 1948)^[2]

The formula used for calculation-

$$H = - \sum P_i \ln P_i$$

Where,

- $P_i = S / N$
- S = number of species
- N = total number of individuals
- $\ln$ = logarithm to base e

Simpson index

The Simpson index, which accounts for both species richness and the relative abundance of each species, was calculated as $1 - D$ (Simpson, 1949)^[3]

The formula used for calculation -

$$D = \sum n_i (n_i - 1) / N(N-1)$$

Where,

- n_i = Total number of individuals of a particular species
- N = Total number of individuals of all species

Statistical analysis: The abundance and diversity of insect pollinators collected from four cucurbitaceous vegetables at ARI were computed by the following indices using the software PAST (Paleontological Statistics Tool) version 3.25.

Result and discussion

Insect pollinator composition in bottle gourd flowers

Bottle gourd is a monoecious creeping vine with white flowers that open at dusk and close the next morning. Pollinator species play an important role in cross-pollinating the crop. In the present study, a total of 211 insect pollinators comprising 16 species, 8 families, and 4 orders were documented on bottle gourd flowers (Table.1). Among the recorded orders, Hymenoptera were the major pollinators, accounting for 118 individuals representing seven species from two families, Apidae and Halictidae. The hymenopteran species recorded included *Apis cerana indica* (10 individuals), *Apis dorsata* (15 individuals), *Ceratina binghami* (5 individuals), *Xylocopa* sp. (3 individuals), *Amegilla* sp. (50 individuals), *Amegilla violacea* (10 individuals), and *Nomia* sp. (25 individuals). Within this order, *Amegilla* sp. was found to be the most abundant species, contributing 50 individuals. Dipteran order was reported as the second most abundant order with 53 individuals belonging to four species and three families. The dipteran pollinators included *Sarcophaga* sp. (3 individuals) from Sarcophagidae, *Ischiodon scutellaris* (30 individuals) and *Eristalinus quinquestriatus* (10 individuals) from Syrphidae, and *Musca* sp. (10 individuals) from Muscidae. Among dipterans, *I. scutellaris* was identified as the predominant species. Lepidoptera was represented by 20 individuals belonging to four species from two families. The species recorded were *Danaus chrysippus* (5 individuals) from Nymphalidae and *Eurema hecabe* (6 individuals), *Colotis danae* (5 individuals), and *Belenois aurota* (4 individuals) from Pieridae. Coleoptera was represented by a single species, *Aulacophora foveicollis*, from the family Chrysomelidae, with 20 individuals. The family Apidae was observed as the most dominant, with 93 individuals, whereas Sarcophagidae was the least abundant, with only 3 individuals.

The current findings were on par with Subhakar and Sreedevi (2015)^[9], who reported 10 insect species belonging to nine families of five orders (Hymenoptera, Lepidoptera, Coleoptera, Orthoptera and Dictyoptera) and identified *A. foveicollis* as a pollinator. While Lepidopterans were found to be dominant pollinators in the Coimbatore region, comprising nine species from eight families of four orders

(Hymenoptera, Lepidoptera, Coleoptera, and Hemiptera) (Manju *et al.*, 2022) ^[8]. Additionally, *A. foveicollis* and *A. cerana* were identified as floral visitors on bottle gourd. Similarly, Padhiyar and Patel (2021) ^[10] also documented Lepidopterans as primary pollinators of nine species belonging to eight families and five orders (Lepidoptera,

Coleoptera, Hemiptera, Orthoptera and Odonata). In contrast to current findings, Morimoto *et al.* (2004) ^[5] documented 22 species across 10 families within four orders in Kenya, including *Belenois* sp. (Pieridae), Hawk moths and noctuid moths as primary foragers on bottle gourd flowers.

Table 1: List of insect pollinators from bottle gourd flowers (*Lagenaria siceraria*)

S.No.	Order	Family	Common name	Scientific name	No. of individuals
1.	Hymenoptera	Apidae	Indian honey bee	<i>Apis cerana indica</i>	10
			Rock bee	<i>Apis dorsata</i> Fabricius	15
			Small carpenter bee	<i>Ceratina binghami</i> Cockerell	5
			Carpenter bee	<i>Xylocopa</i> sp.	3
			Blue banded bee	<i>Amegilla</i> sp.	50
			Digger bees	<i>Amegilla violacea</i> (Lepeletier)	10
			Sub total		93
		Halictidae	Alkali bee	<i>Nomia</i> sp.	25
			Sub total		25
			Total of families		118
2.	Lepidoptera	Nymphalidae	Plain tiger	<i>Danaus chrysippus</i> Linn.	5
			Sub total		5
		Pieridae	Common grass yellow	<i>Eurema hecabe</i> Linn.	6
			Crimson tip	<i>Colotis danae</i> Fabricius	5
			Pioneer white	<i>Belenois aurota</i>	4
			Sub total		15
			Total of families		20
3.	Diptera	Sarcophagidae	Flesh fly	<i>Sarcophaga</i> sp.	3
			Sub total		3
		Syrphidae	Common hover fly	<i>Ischidon scutellaris</i> Fabricius	30
			Hover fly	<i>Eristalinus quinquestriatus</i> Fabricius	10
			Sub total		40
		Muscidae	Housefly	<i>Musca</i> sp.	10
			Sub total		10
			Total of families		53
4.	Coleoptera	Chrysomelidae	Red pumpkin beetle	<i>Aulacophora foveicollis</i> Lucas	20
			Sub total		20
			Total of family		20
			Overall Total		211

Relative Abundance of Insect pollinators on bottle gourd

The low species richness was attributed to the short flowering duration of bottle gourd flowers, which generally remain open for only a single night and complete anthesis in the early morning hours. The restricted blooming period may limit pollinator visitation, thereby reducing the diversity and abundance of floral visitors.

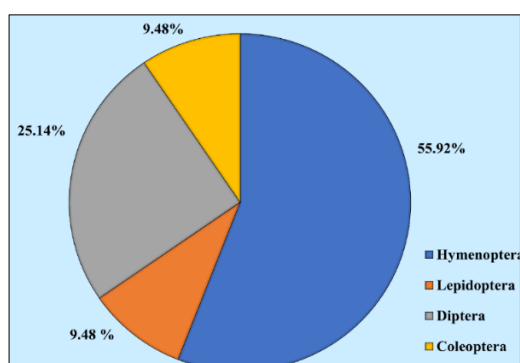
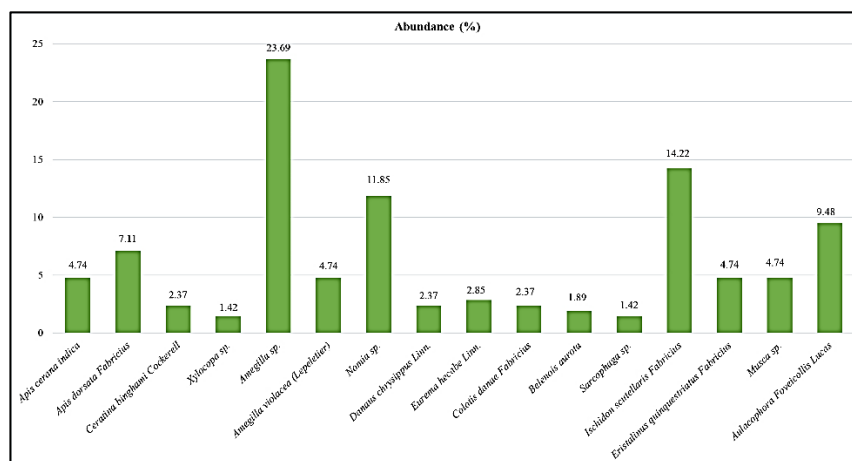
The relative abundance of the recorded pollinator groups is represented in Table 2. Among the four orders documented, Hymenoptera was the dominant pollinator group, accounting for 55.92% of all individuals recorded. This was followed by Diptera (25.14%), while Lepidoptera and Coleoptera each contributed 9.48% of the total pollinator abundance. Family-wise analysis revealed that Apidae was the most abundant family, representing 44.07% of the total pollinator population, followed by Syrphidae (18.96%), Halictidae (11.85%), Chrysomelidae (9.48%), Pieridae (7.11%), Muscidae (4.74%), Nymphalidae (2.37%), and Sarcophagidae (1.42%). Among the individual pollinator species, *Amegilla* sp. was the most abundant, accounting for 23.69% of the total pollinator population. In contrast, *Xylocopa* sp. and *Sarcophaga* sp. were the least abundant species, each contributing only 1.42% of the total individuals recorded. At the family level, Apidae exhibited the highest relative abundance (44.07%), whereas Sarcophagidae recorded the lowest (1.42%). The predominance of

hymenopteran pollinators, particularly members of the family Apidae, highlights their major contribution to the pollinator assemblage associated with bottle gourd flowers.

The present findings are in partial agreement with Bhardwaj and Srivastava, 2012 ^[12], who reported that Dipterans (85.71%) were the most abundant pollinators, followed by Lepidopterans (71.42%) and Hymenopterans (40%). Manju *et al.* (2022) ^[8] stated that among other pollinators, *A. foveicollis* (0.83%) also contributes to the pollination of bottle gourd flowers. They found that *A. cerana indica* constitutes a major abundance, which supports the findings of our present study. In contrast to the present findings, Subhakar and Sreedevi (2015) ^[9], observed a major share of pollinator abundance in Lepidopterans (70.07%), followed by Orthopterans (8.60%), Coleopterans (7.60%), Hymenopterans (7.33%) and Dictyopterans (6.40%). While orders Orthoptera and Dictyoptera were not reported in the current study. Similarly, Padhiyar and Patel (2021) ^[10] also recorded the highest abundance of pollinators from Lepidoptera (44.44%) followed by Coleoptera (22.22%), Hemiptera (11.11%), Orthoptera (11.11%) and Odonata (11.11%), but not from Hymenoptera. However, they identified *A. foveicollis* as a pollinator with significant abundance, showing partial consistency with the current study.

Table 2: Relative abundance of insect pollinators on bottle gourd flowers

S.No.	Order	Family	Species	Species Abundance within Order (%)	Species Abundance among the Order (%)	Total (%)
1.	Hymenoptera	Apidae	<i>Apis cerana indica</i>	8.47	4.74	55.92
			<i>Apis dorsata</i> Fabricius	12.71	7.11	
			<i>Ceratina binghami</i> Cockerell	4.24	2.37	
			<i>Xylocopa</i> sp.	2.54	1.42	
			<i>Amegilla</i> sp.	42.37	23.69	
			<i>Amegilla violacea</i> (Lepeletier)	8.48	4.74	
			Sub total	78.81	44.07	
		Halictidae	<i>Nomia</i> sp.	21.19	11.85	
			Sub total	21.19	11.85	
2.	Lepidoptera	Nymphalidae	<i>Danaus chrysippus</i> Linn.	25	2.37	9.48
			Sub total	25	2.37	
		Pieridae	<i>Eurema hecabe</i> Linn.	30	2.85	
			<i>Colotis danae</i> Fabricius	25	2.37	
			<i>Belenois aurota</i>	20	1.89	
			Sub total	75	7.11	
3.	Diptera	Sarcophagidae	<i>Sarcophaga</i> sp.	5.66	1.42	25.14
			Sub total	5.66	1.42	
		Syrphidae	<i>Ischidon scutellaris</i> Fabricius	56.6	14.22	
			<i>Eristalinus quinquestratus</i> Fabricius	18.87	4.74	
			Sub total	75.47	18.96	
		Muscidae	<i>Musca</i> sp.	18.87	4.74	
			Sub total	18.87	4.74	
4.	Coleoptera	Chrysomelidae	<i>Aulacophora Foveicollis</i> Lucas	100	9.48	9.48
			Sub total	100	9.48	
			Total	100		

**Fig 1:** Relative Abundance of Insect Pollinator Orders on Bottle Gourd Flowers

*Ischiodon scutellaris* Fabricius*Aulacophora foveicollis* Lucas*Apis cerana indica* Fab.*Sarcophaga* sp.*Musca* sp.

Shannon-Wiener Diversity Index and Simpson Index (D)

The insect pollinator community in bottle gourd exhibited a Shannon Wiener diversity index (H') of 2.42, suggesting considerable species diversity and a relatively even distribution of individuals among species. Simpson's diversity index (1-D) was 0.88, indicating a highly diverse pollinator community with a low probability of dominance by any single species. The present findings are in accordance with Yogapriya *et al.* (2022)^[7], who reported a maximum Shannon diversity index of 2.52 for insect pollinators in bitter gourd, which is nearly similar to the current study.

Conclusion

This study documents the diversity and abundance of insect pollinators in bottle gourd agroecosystems and demonstrates the crucial role of insect visitors in the pollination ecology of this cross-pollinated crop. A total of 16 pollinator species belonging to eight families and four orders were recorded, with Hymenoptera as the dominant order. Apidae members, especially *Amegilla* sp., represented the dominant pollinators, highlighting their pivotal role in bottle gourd pollination. Species richness was lower than that reported for some other cucurbits, due to bottle gourd's short flowering window and restricted early-morning floral availability. These results provide baseline data for Hyderabad agro-climatic conditions and highlight the importance of conserving key pollinator groups through pollinator-friendly management, habitat enhancement, and prudent pesticide use.

Disclaimer (artificial intelligence)

Authors hereby declare that NO generative AI technologies such as Large Language Models (ChatGpt, COPILOT, etc.) and text-to-image generators have been used during writing or editing of this manuscript.

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References

1. MacArthur R. On the relative abundance of species. *Am Nat.* 1960;94(874):25-36.
2. Shannon CE. A mathematical theory of communication. *Bell Syst Tech J.* 1948;27(3):379-423.
3. Simpson EH. Measurement of diversity. *Nature.* 1949;163:688.
4. Minocha S. An overview on *Lagenaria siceraria* (bottle gourd). *J Biomed Pharm Res.* 2015;4(3):4-10.
5. Morimoto Y, Gikungu M, Maundu P. Pollinators of the bottle gourd (*Lagenaria siceraria*) observed in Kenya. *Int J Trop Insect Sci.* 2004;24(1):79-86.
6. Kevan PG, Phillips TP. The economic impacts of pollinator declines: An approach to assessing the consequences. *Conserv Ecol.* 2001;5(1):8.
7. Yogapriya A, Usharani B, Suresh K. Diversity and foraging activity of flower visitors/pollinators of *Momordica charantia* L. in Tamil Nadu. *Entomon.* 2022;47(1):41-50.
8. Manju R, Srinivasan MR, Ganapathy N, Mohankumar S, Geethanjali S. Plant-pollinator interaction, pollinator diversity and relative abundance in bottle gourd

- (*Lagenaria siceraria*) in Coimbatore. Pharma Innov J. 2022;11(7):963-967.
9. Subhakar G, Sreedevi K. Nocturnal insect pollinator diversity in bottle gourd and ridge gourd in southern Andhra Pradesh. Curr Biotica. 2015;9(2):137-144.
 10. Padhiyar DH, Patel SR. Floral biology and diversity of pollinator fauna in bottle gourd in South Gujarat. J Entomol Zool Stud. 2021;9(2):435-438.
 11. Morimoto Y, Gikungu M, Maundu P. Pollinators of the bottle gourd (*Lagenaria siceraria*) observed in Kenya. Int J Trop Insect Sci. 2004;24(1):79-86.
 12. Bhardwaj H, Srivastava M. A study on insect visitors of certain cucurbit vegetable crops in an agro-ecosystem near Bikaner, Rajasthan, India. Academica J. 2012;2(3):99-126.
 13. Konyak WS, Devi HS, Sahu AK, Singh YS, Devi HM, Imtinaro L. Diversity and population dynamics of fruit fly in bottle gourd and its correlation with abiotic factors in Nagaland. Biol Forum Int J. 2023;15(3):379-385.
 14. Prajapati A, Patel J, Trivedi N, Kachhadiya N. Biodiversity of insects and mites in organic farming system of bottle gourd (*Lagenaria siceraria* (Molina) Standl.). Int J Stat Appl Math. 2024;9:43-47.
 15. Adaikkan Y, Thirunavukkarasu S. Pollinator activities in *Momordica cymbalaria* (Cucurbitaceae). Indian J Entomol. 2024;86(2):230-233.
 16. Ali M, Saeed S, Sajjad A, Bashir MA. Exploring the best native pollinators for pumpkin (*Cucurbita pepo*) production in Punjab, Pakistan. Pak J Zool. 2014;46(2):531-539.
 17. Amin MR, Nahid S, Suh SJ. Impact of pollinator insects associated with cucumber fruit set. Agric Sci Dig. 2021;41(4):615-619.
 18. Gautam PP, Kumar N, Nishad MK. Foraging behaviour of carpenter bee (*Xylocopa fenestrata*) on ridge gourd (*Luffa acutangula*) flowers. J Entomol Zool Stud. 2018;6(3):188-193.
 19. Gurung S, Koju NK, Koju NP. Diversity of pollinators in marigold (*Tagetes erecta* L.) in a core area of Kathmandu Valley, Nepal. Nepal J Environ Sci. 2020;8(1):29-38.
 20. Shrivastava U. Insect pollination in some cucurbits. In: Proceedings of the Sixth International Symposium on Pollination; 1990; Tilburg, Netherlands. p. 27-31.
 21. Shrivastava GP, Shrivastava U. Coevolution of stamens and carpels in cucurbits and of their insect pollinators. In: Proceedings of the Sixth International Symposium on Pollination; 1991; Tilburg, Netherlands. p. 347-353.
 22. Sihag RC. Behaviour and ecology of subtropical carpenter bee, *Xylocopa fenestrata* F. Host plant association. Indian Bee J. 1990;52(1-4):35-40.