



POLLINATOR DIVERSITY AND FORAGING BEHAVIOUR OF INSECT POLLINATORS IN CORIANDER

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ABSTRACT

This study on pollinator diversity and abundance of frequent floral visitors was conducted during on coriander during rabi 2019-20 in Lalapuram village of Kallikudi block, Madurai district. Coriander flowers were observed to be visited by 25 pollinators. Among the visitors, four species were hymenopterans belonging to *Apis* (16%) and six from Non-*Apis* spp. (24%) Four belonged to Lepidoptera and Diptera (16%), three from Hemiptera and Coleoptera (12%) and one from Araneae (4%). Among all these, *Apis florea* was the most dominant one among *Apis* spp. followed by *Apis cerana indica* and *Tetragonula iridipennis*. The foraging activity and Shannon-Weiner's diversity index (2.78) was observed to be maximum during 1000- 1200 hrs.

Key words: Coriander, pollinator diversity, abundance, *Apis florea*, *A. cerana indica*, *Tetragonula iridipennis*, Hymenoptera, Diptera, Lepidoptera, Shannon- Wiener index, foraging

The annual, aromatic herb coriander (*Coriandrum sativum* L.) belonging to the family Umbelliferae/Apiaceae is important crop among the 20 seed spices. It is used for flavouring various cuisine items and essential oil of this crop has medicinal properties (Mandal and Mandal, 2015; Pathak et al., 2011). It has protandrous, hermaphrodite flowers (Nemeth and Szekely, 2000), and these are small, pinkish white, arranged in compound umbels (Shivashankara et al., 2015), These have strong fragrance which abundantly attracts the pollinators, and a large number of pollinating agents have been recorded. Of these, the honey bee species contribute more for coriander pollination (Ranjitha et al., 2019; Khalid, 2008). In addition to this, dipterans, lepidopterans, coleopterans are also involved in increasing seed set. Being a cross pollinated crop, the important factor is pollinating agent for increasing seed yield. The knowledge on these are meagre and hence this study.

MATERIALS AND METHODS

The study was carried out at Lalapuram village (10°02'E, 78°22'N) of Kallikudi block, Madurai district. Local coriander variety was sown during November (rabi, 2019- 20). The field with an area of 25 cents was kept free from chemical sprays throughout the flowering period. To study the pollinator fauna, visual counting of insects visiting flowers was done by randomly selecting sampling spots of 1m². The relative abundance of

pollinators was calculated by visual counting of insect pollinators for five minutes in each sampling spots with five replications and counting was repeated at 0600 - 0800, 0800 - 1000, 1000 - 1200, 1200 - 1400, 1400 - 1600 and 1600 - 1800 hr of the day. The same observations were repeated at four days interval for four times at different floral densities. During observations, pollinators visiting the crop were collected, preserved in 70% ethanol and identified with available taxonomic keys. Calculation of diversity indices, species richness was done with Shannon-Weiner diversity 'H' index (Ghanshyam Kachhawa et al., 2020).

RESULTS AND DISCUSSION

A total of 25 flower visitors were found on coriander crop. Among the 25 pollinators visited, the order Hymenoptera with 10 species contributed maximum share followed by Diptera and Lepidoptera. While considering abundance, Hymenoptera shared a maximum of 40% (*Apis* spp.- 16% and non-*Apis* spp.- 24%), Diptera and Lepidoptera with 16% share, Coleoptera and Hemiptera with 12% share and Araneae with least share of 4% (Table 1). In order Hymenoptera, Apidae was the dominant family with four species. The study on foraging activity of major pollinators revealed that three species of *Apis* hymenopterans and two species of non *Apis* hymenopterans frequently visited the flowers. These were followed by the dipterans with

Table 1. Pollinator fauna recorded on coriander during 2019- 20

S.No.	Pollinators	Family	Order	Abundance %
1.	<i>Apis cerana indica</i> F.	Apidae	<i>Apis</i> -	
2.	<i>Apis florea</i> F.	Apidae	Hymenoptera	16
3.	<i>Andrena</i> sp.	Apidae		
4.	<i>Tetragonula iridipennis</i> Smith	Apidae		
5.	<i>Halictus</i> sp.	Halictidae	Non- <i>Apis</i> Hymenoptera	
6.	<i>Nomia</i> sp.	Halictidae		
7.	<i>Chrysis</i> sp.	Chrysididae		24
8.	<i>Paranicistocerus fulvipes</i> De Saussure	Vespidae		
9.	<i>Monomorium pharaonis</i> L.	Formicidae		
10.	<i>Camponotus</i> sp.	Formicidae		
11.	<i>Agonoscelis nubilis</i> F.	Pentatomidae		
12.	<i>Rhynocoris fuscipes</i> F.	Reduviidae	Hemiptera	12
13.	<i>Geocoris</i> sp.	Geocoridae		
14.	<i>Cylindromyia</i> sp.	Tachinidae		
15.	<i>Musca domestica</i> L.	Muscidae	Diptera	16
16.	<i>Syrphus ribesii</i> L.	Syrphidae		
17.	<i>Episyrphus balteatus</i> De Geer	Syrphidae		
18.	<i>Menochilus sexmaculatus</i> F.	Coccinellidae		
19.	<i>Coccinella septempunctata</i> L.	Coccinellidae	Coleoptera	12
20.	<i>Aulacophora foveicollis</i> Lucas	Chrysomelidae		
21.	<i>Pieris brassicae</i> L.	Pieridae		
22.	<i>Acraea terpiscore</i> L.	Nymphalidae	Lepidoptera	16
23.	<i>Danaus chrysippus</i> L.	Nymphalidae		
24.	<i>Eretmocera</i> sp.	Scythrididae		
25.	<i>Argiope aemula</i> Walckenaer	Araneidae	Araneae	4

three species. Chaudhary and Singh (2006) reported 34 species of flower visiting species on coriander with 18 families and 8 orders; these observed that the dipterans were more active than hymenopterans. Bhowmik et al. (2017) reported that *Apis* spp. (66%) as the more abundant followed by dipterans (29%) and coleopterans (5%). The most abundant species among Hymenoptera was *A. florea* (2.60- 19.20/ m²/ 5min.) followed by *A. cerana indica* (2.80- 17.80/ m²/ 5min). The abundance of *A. florea* and *A. cerana indica* was maximum during 25% flowering (Table 2).

The study conducted by Ranjitha et al. (2019) also proves that the pollinator abundance was more during 25% flowering. *Apis florea* was the abundant pollinator among all the recorded frequent floral visitors. Sharma and Meena (2019) observed that *A. florea* was the most dominating species (34.1%) in semi arid region of Rajasthan. The peak abundance was observed during 10.00- 12.00 hr. The next abundant species were *A. cerana indica*, *T. iridipennis*, *Halictus* sp., *Nomia* sp., *Syrphus ribesii*, *Cylindromyia* sp., *Pieris brassicae*,

Episyrphus balteatus and *Rhynocoris fuscipes*. According to Painkra (2018), *A. cerana indica* was the dominant one. Considering all the pollinators maximum activity was found during 1000- 1200 hrs and least during 0600- 0800 hrs. Shannon-Weiner diversity 'H' index during 0600- 0800, 0800- 1000, 1000- 1200, 1200- 1400, 1400- 1600 and 1600- 1800hrs was found to be 2.12, 2.32, 2.78, 2.54, 2.49 and 1.94, respectively. These results agree with those of Yogapriya et al. (2019) where the Shannon's diversity index was maximum during 1000- 1200 hr.

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Table 2. Relative abundance of major pollinators in coriander

Time	Relative abundance (No. of insects/ 5 min/ m ²)										
	<i>Apis florea</i>	<i>Apis cerana indica</i>	<i>Tetragonula iridipennis</i>	<i>Nomia</i> sp.	<i>Halictus</i> sp.	<i>Episyrphus balteatus</i>	<i>Rhynocoris fuscipes</i>	<i>Syrphus ribesii</i>	<i>Cylindromyia</i> sp.	<i>Pieris brassicae</i>	
0600- 0800	2.60 ± 0.40	2.80 ± 0.37	0.60 ± 0.24	0.00 ± 0.00	0.20 ± 0.19	0.00 ± 0.00	0.20 ± 0.19	0.00 ± 0.00	0.00 ± 0.00	0.40 ± 0.20	
0800- 1000	10.00 ± 0.84	8.80 ± 1.46	2.40 ± 0.66	0.40 ± 0.24	1.40 ± 0.39	0.60 ± 0.22	0.00 ± 0.00	0.40 ± 0.20	0.40 ± 0.19	1.40 ± 0.22	
1000- 1200	19.20 ± 1.02	17.80 ± 1.02	7.40 ± 0.51	0.80 ± 0.20	3.60 ± 0.49	1.00 ± 0.20	0.60 ± 0.21	0.40 ± 0.20	0.40 ± 0.20	0.80 ± 0.23	
1200- 1400	14.40 ± 0.51	13.60 ± 0.81	4.80 ± 0.37	1.20 ± 0.37	4.20 ± 0.32	0.40 ± 0.19	0.20 ± 0.19	1.20 ± 0.58	1.50 ± 0.58	0.00 ± 0.00	
1400- 1600	11.20 ± 1.39	9.80 ± 0.58	3.00 ± 0.32	1.40 ± 0.51	2.40 ± 0.21	0.00 ± 0.00	1.40 ± 0.74	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	
1600- 1800	10.00 ± 0.32	9.60 ± 0.51	1.20 ± 0.20	0.80 ± 0.37	0.60 ± 0.12	0.00 ± 0.00	0.60 ± 0.39	0.80 ± 0.39	0.50 ± 0.37	0.60 ± 0.37	
0600- 0800	2.20 ± 0.37	1.80 ± 0.58	1.20 ± 0.20	0.40 ± 0.24	0.40 ± 0.20	0.00 ± 0.00	0.00 ± 0.00	0.40 ± 0.39	0.00 ± 0.00	0.00 ± 0.00	
0800- 1000	10.60 ± 0.68	7.20 ± 1.11	3.00 ± 0.45	0.00 ± 0.00	2.00 ± 0.24	0.80 ± 0.37	0.00 ± 0.00	0.00 ± 0.00	0.40 ± 0.20	1.20 ± 0.58	
1000- 1200	16.60 ± 0.93	14.60 ± 1.72	8.00 ± 1.00	1.20 ± 0.80	4.20 ± 0.32	0.60 ± 0.12	0.60 ± 0.21	0.60 ± 0.22	0.20 ± 0.19	0.00 ± 0.00	
1200- 1400	15.60 ± 1.44	12.80 ± 0.58	4.40 ± 0.24	1.60 ± 0.40	3.20 ± 0.37	0.80 ± 0.19	0.20 ± 0.19	1.20 ± 0.58	1.20 ± 0.58	0.00 ± 0.00	
1400- 1600	8.60 ± 1.33	8.00 ± 1.00	3.60 ± 0.40	0.20 ± 0.20	3.00 ± 0.97	1.00 ± 0.20	0.60 ± 0.22	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	
1600- 1800	9.80 ± 0.37	9.80 ± 0.37	1.60 ± 0.68	0.20 ± 0.20	0.80 ± 0.19	0.00 ± 0.00	0.40 ± 0.22	0.20 ± 0.19	0.20 ± 0.19	0.80 ± 0.37	
0600- 0800	2.60 ± 0.24	2.00 ± 0.55	2.20 ± 0.20	0.00 ± 0.00	0.60 ± 0.22	0.60 ± 0.37	0.40 ± 0.20	0.20 ± 0.19	0.00 ± 0.00	0.20 ± 0.19	
0800- 1000	9.00 ± 0.84	7.80 ± 0.86	4.00 ± 0.32	1.00 ± 0.32	1.60 ± 0.50	0.80 ± 0.16	0.00 ± 0.00	1.00 ± 0.32	0.80 ± 0.37	1.20 ± 0.92	
1000- 1200	18.20 ± 0.92	15.80 ± 0.37	9.40 ± 0.51	1.20 ± 0.73	3.20 ± 0.38	0.40 ± 0.20	0.40 ± 0.20	1.00 ± 0.40	1.00 ± 0.55	0.60 ± 0.22	
1200- 1400	15.00 ± 1.30	13.80 ± 0.97	4.60 ± 0.24	1.80 ± 0.37	4.60 ± 0.22	0.00 ± 0.00	0.00 ± 0.00	1.20 ± 0.58	1.20 ± 0.58	0.00 ± 0.00	
1400- 1600	9.40 ± 0.51	9.00 ± 0.71	3.60 ± 0.40	0.20 ± 0.20	3.60 ± 0.39	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	
1600- 1800	12.60 ± 1.29	11.00 ± 1.30	1.20 ± 0.49	1.40 ± 0.24	0.80 ± 0.19	0.00 ± 0.00	0.60 ± 0.22	0.80 ± 0.37	0.60 ± 0.37	1.20 ± 0.19	
0600- 0800	3.00 ± 0.32	2.40 ± 0.18	1.80 ± 0.92	0.00 ± 0.00	0.00 ± 0.00	0.40 ± 0.39	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.20 ± 0.19	
0800- 1000	10.40 ± 0.93	8.60 ± 0.23	3.80 ± 1.11	0.80 ± 0.49	1.60 ± 0.20	0.60 ± 0.22	0.20 ± 0.19	0.60 ± 0.22	0.60 ± 0.22	0.60 ± 0.12	
1000- 1200	16.20 ± 0.49	17.00 ± 0.40	9.60 ± 0.98	2.00 ± 0.32	3.80 ± 1.65	0.00 ± 0.00	0.80 ± 0.23	0.80 ± 0.19	0.80 ± 0.19	0.00 ± 0.00	
1200- 1400	17.20 ± 1.07	15.20 ± 0.68	5.20 ± 0.80	1.40 ± 0.51	2.00 ± 0.32	0.60 ± 0.58	0.60 ± 0.20	1.40 ± 0.50	1.20 ± 0.58	0.00 ± 0.00	
1400- 1600	10.60 ± 1.21	10.60 ± 0.54	4.00 ± 0.80	1.60 ± 0.73	4.00 ± 1.48	0.80 ± 0.19	0.00 ± 0.00	0.80 ± 0.37	0.60 ± 0.39	0.80 ± 0.37	
1600- 1800	10.00 ± 0.71	9.60 ± 0.18	1.60 ± 0.45	0.20 ± 0.20	1.00 ± 0.77	0.00 ± 0.00	1.20 ± 0.39	0.60 ± 0.37	0.00 ± 0.00	0.00 ± 0.00	

Each value is mean of five observations; Mean ± S.E.

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(Manuscript Received: December, 2020; Revised: January, 2021;
Accepted: January, 2021; Online Published: May, 2021)
Online published (Preview) in www.entosocindia.org Ref. No. e20410