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# Foraging behaviour of insect pollinators on coriander

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**Abstract**

The major insect pollinators included Hymenoptera, Diptera, a few Lepidoptera, Hemiptera and Coleoptera. Among these, the mean of total hymenopterans visiting the umbels of coriander during the entire flowering period happened to be 18.89/plant/minute-observation/day; within hymenopterans, *A. florea* and *A. dorsata* were the most dominant forming 91.54 per cent. The foraging activity of *A. florea* was more pronounced during 12-2 p.m. (1.312 bees/ day/ plant/ minute observation), whereas the foraging activity of *A. dorsata* was maximum during 8-10 a.m. (0.032 bees/ day/ plant/ minute observation). *A. florea* formed 38.86 (8-10 a.m.), 86.36 (12-2 p.m.) and 27.43 (4-6 p.m.) per cent of the total insect pollinators, the corresponding figures for *A. dorsata* were 9.35 (8-10 a.m.), 1.18 (12-2 p.m.), and 2.26 (4-6 p.m.) per cent. The total dipterans that visited the umbels of coriander during the entire flowering period happened to be 0.36-flies/plant/minute/day. The family Muscidae was most dominant with 0.26-flies/plant/minute/day. The foraging activity of muscid flies was the maximum during 4-6 p.m. (0.094-flies/ plant/minute/day) forming 26.70 per cent. Otherwise too, Dipterans happened to be the maximum during 4-6 p.m. (0.061-flies/plant/minute/day) followed by that at 8-10 a.m. (0.035-flies/plant/minutes/day). The other insect pollinators included insects of Lepidoptera, Hemiptera and Coleoptera and their numerical abundance formed 0.107-insects/plant/minute/day. Of these, hemipteran visitors dominated with 0.091-bugs/plant/minute/day. The foraging activity of Hemiptera was the maximum during 4-6 p.m. (10.01%) and minimum during 12-2 p.m. (1.98%). On the basis of the seven class-interval categories that could be identified, most insect pollinators happened to fall under the category of 1-5 insects per unit of observation.

**Key words**: Coriander, insect pollinators, diversity, foraging behaviour

## Introduction

Coriander (*Coriandrum sativum* L.) is a classic example having xygomorphic flowers, the flower having reduced five sepals, petals, stamens and inferior ovaries consisting of two chambers, each containing one ovule. Stylopadium surrounds the ovaries around which nectar is secreted and two short styles emerge from the centre of the disc. Although the flowers are self-fertile the protandrous condition prevents self-pollination (McGregor 1976). Nearly 300000 plant species and over 200000 insect species and vertebrates are involved in interdependent plant-pollinator interactions worldwide (NRC, 2007). Diverse pollinator assemblages can lead to improved ecosystem function through enhanced pollination services, plant reproduction (Fontaine *et al*., 2006). Insect pollination results in significant crop yield and also improves the fruit quality. Honey bees and some other closely related social Hymenoptera, having nectar and pollen as the only source of their food, while foraging fortuitously reciprocate by performing valuable pollination services. The important insect pollinator genera include: honey bees, solitary bees, bumble bees, stingless bees and many kinds of flies, beetles, black ants, thrips and moths. Among insects, the members of the super-family Apoidea (Hymenoptera) are the most important pollinators. Of the 95 per cent cross pollinated flowers, 85 per cent depend on insect pollination (Carruth, 1950); and bees are responsible for almost 80 per cent of the pollination services. Another benefit of coriander derives from the reproductive biology of this plant, as coriander produces a considerable quantity of nectar and thereby attracts many different insects for pollination, an external effect which is of both ecological and economic value; hence, is also a good melliferous plant (Luk'janov and Reznikov, 1976) with the ability of obtaining 500 kg of honey from one hectare of coriander. Keeping these points in view, studies were carried out to study the diversity of insect pollinators visiting coriander.

## Materials and Methods

The study on diversity of insect pollinators on coriander was conducted at the Department of Entomology, Rajasthan College of Agriculture, Udaipur. The crop of

coriander was cultivated at the Instructional Farm of the College. The land was prepared by ploughing with the help of tractor mounted mould board plough 15 days before sowing the crop and just before sowing the land was again ploughed and leveled with the help of a heavy plank. Half of the recommended dose of nitrogenous fertilizers (60 kg/ha) and full dose of phosphatic (40 kg/ha) and potassic (25 kg/ha) fertilizers were applied at the time of last ploughing and the rest of the nitrogenous fertilizer was applied through top dressing at the time of flowering. Coriander variety "RCR-41" was cultivated; before sowing the seeds were crushed into halves by gently rubbing between palms and treated with Thiram and Bavistin in the portion of 1: 1 @ 2 g/kg seed. Sowing was done by manually operated hand driven plough maintaining the row to row distance of 30 cm with a seed rate of 10 kg/ha. During the crop period five irrigations were given at an interval of 20 – 25 days. The first irrigation was applied just after sowing. Thinning was done 30 days after sowing keeping the plant to plant distance at 10 cm. Weeding was done twice after first and second irrigation respectively. Other recommended agronomical practices were followed as and when needed.

A replicated trial was conducted to estimate the diversity of insect pollinators of coriander, for this 5 plants from one plot were selected at random, tagged for observing the pollinators at flowering and records were made from 7 such plots ($3 \times 2$ meter$^2$). Insect pollinators were recorded at three different periods of the day {morning (8-10 a.m.), afternoon (12-2 p.m.) and evening (4-6 p.m.)}. The duration of each observation to record the pollinators was one minute per tagged plant. While taking observations, the total number of insects that visited during each observational period was noted; besides, the hymenopterans and dipterans were categorized. The data on insect pollinators (total, order-wise and species-wise) were correlated with the abiotic factors of the environment (average atmospheric temperature, relative humidity and wind velocity). The species richness and abundance was estimated and expressed as a percentage. The diversity indices (Shanon-Weiner and Simpson) were calculated to establish the species' numerical abundance for each observational period separately.

$$Shannon - Weiner\ Diversity\ Index = -\Sigma \ln (pi) \times pi$$

$$Simpson\ Diversity\ Index = \Sigma (pi)^2 / N$$

**Results**

The insect pollinator diversity recorded during the flowering period on coriander included insects belonging to the orders Hymenoptera, Diptera, Hemiptera, Coleoptera and Lepidoptera; however, the dominant pollinators represented Hymenoptera and Diptera. Observations were taken from 5 plants, selected at random, and from 7 such replications totaling to 35 plants as the sample unit, and have been expressed accordingly. Careful observation was made to note the activity of the hemipteran pollinators so as to ascertain whether they caused any damage to the floral parts or manifested pollination by chance.

From Table (1) on relative intensity of hymenopteran pollinators visiting coriander during 2008-09, it can be observed that the total hymenopterans that visited the umbels of coriander during the entire flowering period summed up to a total of 3060 per 35 observed plants; wherein, each plant was observed for a one-minute duration. Among the hymenopterans, *A. florea* and *A. dorsata* were the most dominant forming 91.54 percent of the total hymenopterans. The foraging activity of *A. florea* was recorded to be the maximum during 12-2 p.m. with an average of 45.94 bees visiting per day on the 35 plants observed for 1 minute on each plant; whereas, the foraging activity of *A. dorsata* was the maximum during 8-10 a.m. (1.12 bees visiting per day on the 35 plants observed for 1 minute on each plant). However, *A. florea* was also noted to forage during 8-10 a.m. (4.64 bees per day on the 35 plants observed for 1 minute on each plant) and 4-6 p.m. (3.42 bees per day on the 35 plants observed for 1 minute on each plant). Similarly, *A. dorsata* also foraged during 12-2 p.m. (0.62 bees per day on the 35 plants observed for 1 minute on each plant) and also during 4-6 p.m. (0.28 bees per day on the observed 35 plants). The maximum numbers of total hymenopteran pollinators were recorded during 12-2 p.m. (2456 per 35 observed plants during the entire flowering period for 1 minute on each plant) and minimum during 4-6 p.m. (274 per 35 observed plants during the entire flowering period for 1 minute on each plant). The maximum seasonal mean of hymenopteran pollinators at bloom was observed for *A. florea* during 12-2 p.m. (45.94), while maximum seasonal mean for *A. dorsata* was observed during 8-10 a.m. (1.12). On the basis of proportion of hymenopterous species, *A. florea* was the most dominant foraging species during 12-2 p.m. (93.52%), followed by that at 8-10 a.m. (70.30%) and minimum at 4-6 p.m. (62.41%). The bee, *A. dorsata* was observed to be proportionally the maximum during 8-10 a.m. (16.76%), followed by that at 4-6 p.m. (5.11%); thereafter, 1.26 per cent during 12-2 p.m. The Shannon-Weiner Diversity Index for the hymenopteran pollinators was the maximum during 8-10 a.m. and 4-6 p.m. (being 0.811 at both times). The diversity index was the lowest during 12-2 p.m. (0.284). Similarly, the Simpson Index showed maximum diversity of hymenopteran pollinators during 4-6 p.m. (6.03) followed by that during 8-10 a.m. (5.56) and the lowest during 12-2 p.m. (3.42).

The frequency of hymenopteran pollinators visiting coriander umbels at different hours of the day has been presented in Table: 1 (A). The data obtained on frequency of visits by different hymenopteran species has been expressed on a number basis as well as in percentage. The frequency

of visit by the insect pollinators was analyzed within 7 different class-intervals, *i.e*., 1-5; 6-10; 11-15; 16-20; 21-25; 26-30 and more than 31 bees/ other hymenopterans per unit of observation (35 plants, each plant having been observed for 1 minute). Accordingly, it could be observed that in the morning during 8 to 10 a.m., irrespective of the species of hymenopteran visiting coriander, the class-interval with 1-5 insects/ unit of observation had the maximum frequency (*A. florea* – 50%; *A. dorsata* – 82% and other hymenopterans – 86.7%). During 12 to 2 p.m., the class-interval of 1-5 insects/ unit of observation showed the maximum frequency for *A. dorsata* (94.1%) and other hymenopterans (58.3%); however, the class-interval with more than 31 insects/ unit of observation had the maximum frequency only for *A. florea* (69.4%). In the evening hours of the day (4 to 6 p.m.), the class-interval with 1-5 insects/ unit of observation indicated the maximum frequency (*A. florea* – 47.8%; *A. dorsata* – 100% and other hymenopterans – 73.7%); nevertheless, the class-intervals with 6-10 insects and 11-15 insects per unit of observation evinced a moderately good frequency of hymenopteran pollinator visits (*A. florea* – 17.4 & 21.7% and the other hymenopterans 15.8 & 5.2%, respectively).

From Table (2) showing the relative intensity of dipteran pollinators visiting coriander, it could be observed that the total dipterans that visited the umbels of coriander during the entire flowering period accrued to 628.34 per 35 observed plants for 1 minute duration on each plant. Among the total dipterans, flies of Muscidae family were the most dominant (72.31%). The foraging activity of muscid flies was the maximum during 4-6 p.m. (3.304 flies per day per minute on the 35 observed plants). The population of syrphid flies was the maximum during 8-10 a.m. (0.08 flies per day per minute on the 35 plants observed). The other unidentified dipteran pollinators were more (Total - 168) in comparison to syrphid flies (Total - 6) and these dipterans were the maximum during 4-6 p.m. (2.14 per day per minute on the 35 plants) followed by that during 8-10 a.m. (1.22 per day per minute observation on the 35 plants). Similarly, the seasonal mean for the flies of Muscidae was the maximum during 4-6 p.m. (3.30). The maximum proportion of flies (Muscidae) was during 12-2 p.m. (99.66%). As observed from the Table 2, the Shannon-Weiner Diversity Index was the maximum during 4-6 p.m. (0.6135) and minimum during 12-2 p.m. (0.017), while the Simpson Diversity Index was the maximum during 4-6 p.m. (7.62), followed by that during 8-10 a.m.(3.96) and lowest during 12-2 p.m. (3.02). Based on the class-interval analysis [Table: 2 (A)] the frequency of dipterans including Muscids, Syrphids and others happened to be almost 100 per cent in the class-interval of 1-5 insects per unit of observation at the different periods of the day observed; however, during 4 to 6 p.m. the class-interval with 6-10 insects per unit of observation showed a frequency of 16 per cent.

The other insect pollinators that included Lepidoptera, Hemiptera and Coleoptera (Table: 3), that visited the umbels of coriander during the entire flowering period accrued to 188 per 35 observed plants. Careful observations indicated that none of these visitors caused any visible symptoms of damage to the floral parts of coriander or the crop as a whole. Among the pollinators other than hymenopterans and dipterans, the hemipterans dominated with 85.11 per cent during the day. The foraging activity of Hemiptera was the maximum during 4-6 p.m. (1.24 bugs per day per minute on the 35 observed plants totaling 62 bugs) and minimum during 8-10 a.m. (0.9 per day per minute on the 35 observed plants). Lepidoptera was also maximum at 4-6 p.m. (a total of 6 per 35 observed plants during the entire flowering period) and minimum at 8-10 a.m. (a total of 2 per 35 observed plants during the entire flowering period); whereas, Coleoptera was maximum during 12-2 p.m. (a total of 9 per 35 observed plants during the entire flowering period) and minimum during 8-10 a.m. (a total of 2 per 35 observed plants). The maximum mean pollinator population, other than hymenopterans and dipterans, was for Hemiptera during 4-6 p.m. (1.24 per 35 observed plants per minute) and minimum during 8-10 a.m. (0.9 per 35 observed plants per minute). Within the hemipterans, the maximum proportion was recorded during 8-10 a.m. (91.84%) and minimum during 12-2 p.m. (80.30%). The maximum diversity of insect pollinators other than hymenopterans and dipterans as indicated by Shannon-Weiner Index was during 12-2 p.m. (0.617) and minimum during 8-10 a.m. (0.339). Similarly, the maximum diversity as indicated by Simpson Diversity Index was during 12-2 p.m. (4.49).

From the Table 3 (A), the frequency of insects pollinators of other orders excluding Hymenoptera and Diptera, showed the dominance of the class-interval with 1-5 insects per unit of observation at all hours of the day thereby indicating the number of pollinators per unit did not exceed 5. However, the frequency of visit by hemipterans happened to fall in the class-interval of 6-10 insects per unit of observation during 8 to 10 a.m. and in the class-interval of 6-10 and more than 11 insects per unit of observation at 12-2 p.m.

**Discussion**

During the present investigation, the insect pollinators that were observed to visit coriander crop included hymenopterans, dipterans, a few Lepidoptera, Hemiptera and Coleoptera; and based on the significant numbers in which they were recorded, they could be considered as the major insect pollinators. Among these, the mean total hymenopterans visiting the umbels of coriander during the entire flowering period happened to be 18.89/plant/minute-observation/day. Among hymenopterans, *A. florea* and *A. dorsata* were the most dominant forming 91.54 per cent. The foraging activity of *A.*

*florea* was more pronounced during 12-2 p.m. (1.312 bees/ day/ plant/ minute observation), whereas the foraging activity of *A. dorsata* was maximum during 8-10 a.m. (0.032 bees/ day/ plant/ minute observation). While *A. florea* formed 38.86 (8-10 a.m.), 86.36 (12-2 p.m.) and 27.43 (4-6 p.m.) per cent of the total insect pollinators, the corresponding figures for *A. dorsata* were 9.35 (8-10 a.m.), 1.18 (12-2 p.m.), and 2.26 (4-6 p.m.) per cent. Similar studies on coriander could not become available from the literature; however, Mahy *et al.* (1998) recorded the dominance of insects of Hymenoptera, Diptera and Lepidoptera in the pollination system of *Calluna vulgaris*, among which honeybees and bumble bees were the most efficient pollinators while syrphid flies were important co-pollinators. Kapila *et al.* (2002) recorded bees (69.29%) as a dominant group of insect pollinators on radish, followed by Dipterans and other insects collectively. Kuberappa *et al.* (2007) recorded 10 species of insect pollinators on *Vishnu tulsi* (*O. sanctum*) belonging to order Hymenoptera and Diptera. The mean abundance of *A. florea* (8.82/plant/5mintues) was higher compared to *A. dorsata* (8.52/plant/5 minutes) and *A. cerana* (6.85/plant/5minutes).

In the present study, the total dipterans that visited the umbels of coriander during the entire flowering period happened to be 0.36-flies/plant/minute/day. Of all the dipterans, the family Muscidae was most dominant with 0.26-flies/plant/minutes/day. The foraging activity of Muscidae flies was the maximum during 4-6 p.m. (0.094-flies/ plant/minute/day) forming 26.70 per cent. Otherwise to Dipterans happened to be the maximum during 4-6 p.m. (0.061-flies/plant/minute/day) followed by that during 8-10 a.m. (0.035-flies/plant/minutes/day). Other insect pollinators included Lepidoptera, Hemiptera and Coleoptera and their numerical abundance formed 0.107-insects/plant/minute/day. Of these, hemipteran visitors dominated with 0.091-bugs/plant/minute/day. The foraging activity of Hemiptera happened to be the maximum during 4-6 p.m. (10.01%) and minimum during 12-2 p.m. (1.98%). The earlier work done clearly depicts the dominance of hymenopterans and dipterans as pollinators and more so of honeybees. The earlier work done clearly depicts the dominance of hymenopterans and dipterans as pollinators and more so of honeybees (Hafeez and Kotwal, 1996; Sachdeva *et al.,* 2003; Faria-Junior *et al.,* 2008).

The analysis of frequency of insect pollinators visiting coriander umbels at different hours of the day showed that the hymenopterans, dipterans and insects of other groups (Lepidoptera, Hemiptera and Coleoptera) happened to fall in the class-interval with 1-5 insects per unit of observation. This clearly indicated that per unit of observation there were not more than 5 insects visiting each minute observed. However, among hymenopterans, more than 31 insects per unit of observation were recorded for the dwarf honeybee, *A. florea* at 12 to 2 p.m. (Fig. 1). In a similar manner, among the insect pollinators of other orders, hemipterans were recorded to be in the class-intervals of 6-10 and more than 11 insects per unit of observation. It could be deduced that on coriander, at any given moment per unit of umbels, the number of insect visitors did not exceed more than 5, except in the case of *Apis florea* Fabricius and some other hymenopterans during mid-day (12-2 p.m.). Such an observation could be due to the more congenial atmospheric temperature for the bees/ hymenopterans during February-March season.

Table 1. Relative intensity of hymenopteran pollinators visiting coriander (*Coriandrum sativum* L.)

| Parameters | 8:00-10:00am | | | 12:00-2:00pm | | | 4:00-6:00pm | | |
|---|---|---|---|---|---|---|---|---|---|
| | Apis. florea | Apis dorsata | Others | Apis florea | Apis dorsata | Others | Apis florea | Apis dorsata | Others |
| Sub.-total | 232 | 56 | 42 | 2297 | 31 | 128 | 171 | 14 | 89 |
| Total | 330 | | | 2456 | | | 274 | | |
| Mean | 4.64 | 1.12 | 0.84 | 45.94 | 0.62 | 2.56 | 3.42 | 0.28 | 1.78 |
| Proportion (%) | 70.30 | 16.96 | 12.73 | 93.52 | 1.26 | 5.21 | 62.41 | 5.11 | 32.48 |
| Shanon-Weiner D.I. = $\sum$ ln pi *pi | 0.811 | | | 0.284 | | | 0.811 | | |
| Simpson D.I. $(pi)^2/N$ | 5.56 | | | 3.42 | | | 6.03 | | |

Note: Population intensity values are a total count from 35 plants (5-plants x 7-replications)

Table 1(A). Frequency of hymenopteran pollinators visiting coriander at different population densities during different hours of the day

| Class intervals for population density | Period of major insect pollinator visits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 8:00 to 10:00 | | | 12:00 to 2:00 | | | 4:00 to 6:00 | | |
| | *A. florea* | *A. dorsata* | Others | *A. florea* | *A. dorsata* | Others | *A. florea* | *A. dorsata* | Others |
| 1-5 | 16 (50.00) | 14 (82.00) | 13 (86.70) | 1 (2.00) | 16 (94.10) | 14 58.30) | 11 (47.80) | 9 (100.00) | 14 (73.70) |
| 6-10 | 8 (25.00) | 3 (9.40) | 2 (13.30) | 3 (6.12) | 1 (5.90) | 8 (33.30) | 4 (17.40) | - | 3 (15.80) |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 11-15 | 6 (18.75) | - | - | 2 (4.08) | - | 2 (8.30) | 5 (21.70) | - | 1 (5.20) |
| 16-20 | 2 (6.25) | - | - | 2 (4.08) | - | - | 2 (8.70) | - | 1 (5.20) |
| 21-25 | - | - | - | 4 (8.16) | - | - | 1 (4.30) | - | - |
| 26-30 | - | - | - | 3 (6.12) | - | - | - | - | - |
| > 31 | - | - | - | 34 (69.40) | - | - | - | - | - |
| Total | 32 | 17 | 15 | 49 | 17 | 24 | 23 | 9 | 19 |

Note: Figures in parentheses are corresponding per cent values

Table 2. Relative intensity of dipteran pollinators visiting coriander (*Coriandrum sativum* L.)

| Parameters | 8:00-10:00am | | | 12:00-2:00pm | | | 4:00-6:00 pm | | |
|---|---|---|---|---|---|---|---|---|---|
| | Muscidae | Syrphidae | Others | Muscidae | Syrphidae. | Others | Muscidae | Syrphidae | Others |
| Sub.-total | 153.20 | 4.0 | 61.0 | 135.94 | 1.0 | 0.0 | 165.20 | 1.0 | 107.0 |
| Total | 218.20 | | | 136.94 | | | 273.20 | | |
| Mean | 3.064 | 0.08 | 1.22 | 2.7188 | 0.02 | - | 3.304 | 0.02 | 2.14 |
| Proportion (%) | 70.21 | 0.66 | 10.07 | 99.66 | 0.23 | 0.00 | 60.47 | 0.16 | 16.72 |
| Shannon-Weiner D.I= - pi ln (pi) | 0.5126 | | | 0.017 | | | 0.6135 | | |
| Simpson D.I. = $\sum (pi)^2/N$ | 5.96 | | | 3.02 | | | 7.62 | | |

Note: Population intensity values are a total count from 35 plants (5-plants x 7-replications)

Table 2 (A). Frequency of dipteran pollinators visiting coriander at different class intervals

| Class intervals for population density | Period of major insect pollinator visits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 8:00-10:00a.m. | | | 12:00-2:00p.m. | | | 4:00-6:00p.m. | | |
| | Muscidae | Syrphidae | others | Muscidae | Syrphidae | Others | Muscidae | Syrphidae | Others |
| 1-5 | 50 (100.00) | 5 (100.00) | 25 (100.00) | 48 (96.00) | 2 (100.00) | - | 50 (100.00) | 2 (100.00) | 42 (84.00) |
| 6-10 | - | - | - | 2 (4.00) | - | - | - | - | 8 (16.00) |
| Total | 50 | 5 | 25 | 50 | 2 | - | 50 | 2 | 50 |

Table 3. Relative intensity of other insect pollinators visiting coriander (*Coriandrum sativum* L )

| Parameters | 8:00-10:00am | | | 12:00-2:00pm | | | 4:00-6:00 pm | | |
|---|---|---|---|---|---|---|---|---|---|
| | L | H | C | L | H | C | L | H | C |
| Sub.-total | 2.0 | 45.0 | 2.0 | 4.0 | 53.0 | 9.0 | 6.0 | 62.0 | 5.0 |
| Total | 49.0 | | | 66.0 | | | 73.0 | | |
| Mean | 0.04 | 0.9 | 0.04 | 0.08 | 1.06 | 0.18 | 0.12 | 1.24 | 0.1 |
| Proportion (%) | 4.08 | 91.84 | 4.08 | 6.06 | 80.30 | 13.64 | 8.22 | 84.93 | 6.85 |
| Shannon-Weiner D.I.= - $\sum$ ln pi *pi | 0.339 | | | 0.617 | | | 0.527 | | |
| Simpson D.I. = $\sum (pi)^2/N$ | 3.50 | | | 4.49 | | | 4.09 | | |

Note: L – Lepidoptera, H - Hemiptera, C – Coleoptera; Population intensity values are a total count from 35 plants (5-plants x 7-replications)

Table 3 (A). Frequency of other insect orders as pollinators visiting coriander at different class intervals

| Class intervals for population density | Period of major insect pollinator visits | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 8:00-10:00a.m. | | | 12:00-2:00p.m. | | | 4:00-6:00p.m. | | |
| | Lepidoptera | Hemiptera | Coleoptera | Lepidoptera | Hemiptera | Coleoptera | Lepidoptera | Hemiptera | Coleoptera |
| 1-5 | 2 (100.00) | 21 (95.50) | 2 (100.00) | 4 (100.00) | 18 (85.70) | 7 (100.00) | 6 (100.00) | 24 (88.90) | 5 (100.00) |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 6-10 | - | 1 (4.50) | - | - | 2 (9.50) | - | - | 3 (11.10) | - |
| More than 11 | - | - | - | - | 1 (4.80) | - | - | - | - |
| Total | 2 | 22 | 2 | 4 | 21 | 7 | 6 | 27 | 5 |

Note: Figures in parentheses are corresponding per cent values

Table 3 (B) Diversity of insect pollinators visiting coriander and their intensity at different hours of the day

| Period of observation | Mean abiotic factors of the environment Temperature: 18.12°C; Relative Humidity: 58.16 %; Sunshine: 7.11 Hrs.; Wind Velocity: 2.16 Kmph | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Major insect pollinators (Visits per plant/minute/day) | | | | | | | | |
| Insect groups | Hymenopterans | | | Dipterans | | | Other orders | | |
| Foraging Period | *Apis florea* | *Apis dorsata* | Others | Muscidae | Syrphidae | Others | Lepidoptera | Hemiptera | Coleoptera |
| 08:00 – 10:00 a.m. | 0.133 (38.86) | 0.032 (9.35) | 0.024 (7.01) | 0.088 (25.72) | 0.0023 (0.67) | 0.035 (10.23) | 0.0011 (0.32) | 0.0257 (7.51) | 0.0011 (0.32) |
| 12:00 – 02:00 p.m. | 1.312 (86.36) | 0.018 (1.18) | 0.073 (4.81) | 0.078 (5.13) | 0.00057 (0.0375) | 0.000 (Zero) | 0.0022 (0.14) | 0.0302 (1.98) | 0.0051 (0.34) |
| 04:00 – 06:00 p.m. | 0.097 (27.43) | 0.008 (2.26) | 0.051 (14.42) | 0.0944 (26.70) | 0.00057 (0.16) | 0.061 (17.25) | 0.0034 (0.96) | 0.0354 (10.01) | 0.0028 (0.79) |

Note: Figures in parentheses are corresponding per cent values

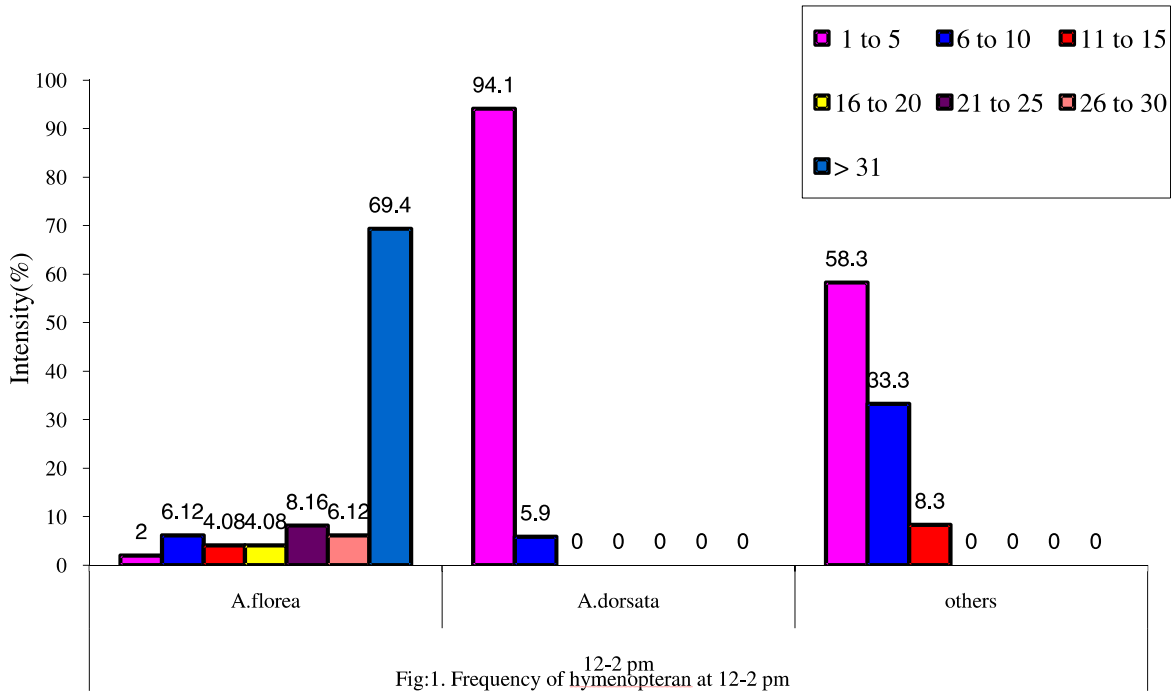


Fig:1. Frequency of hymenopteran at 12-2 pm

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