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Foraging behaviour of honey bees on sweet basil (*Ocimum basilicum* Linn.) under natural field conditions

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Abstract

Studies on diversity on insect pollinators sweet basil was carried out at Instructional Farm, Rajasthan College of Agriculture, MPUAT, Udaipur. In the present study, the insect pollinator diversity was recorded during the flowering period from 21/08/2017 to 29/10/2017 on sweet basil. The major insect pollinators belonged to 5 different orders: Hymenoptera, Lepidoptera, Coleoptera, Diptera and Hemiptera that were observed during different hours of the day. The foraging activity of most pollinators was recorded maximum during 12:00 to 14:00 hours of the day. The time spent by individual forager honeybee ranged from 25.00 to 76.67 seconds per flower during the flowering period. The maximum time spent per flower was 76.67 seconds per flower during 36th SMW during this week. The number of flowers visited per plant ranged from 2.45 to 6.60.

Keywords: Sweet basil, insect pollinators, insecta, honey bees, forager

Introduction

Among medicinal and aromatic plants, the genus *Ocimum* is widespread over Asia, Africa and Central and Southern America; it appears to have its center of diversity in Africa. The first ever cultivation of basil is believed to be in India and is an extremely versatile group consisting of about 160 species (Pullaiah, 2006) [2]. With a geographic distribution spread over the tropical, sub-tropical and warmer parts of the temperate regions. A systematic field investigation on the world distribution of the genus is still lacking. It is found throughout India, ascending up to 1800 m in the Himalayas and in the Andaman and Nicobar Islands (Pullaiah, 2006) [2]. Sweet basil (*Ocimum basilicum* Linn: Lamiaceae), perhaps the most popular and widely used culinary herb, is a tender annual, aromatic plant with a spicy odour and flavour. Majority of the wild plants are entomophilic (Ollerton *et al.* 2011) [1]. And thereby insect pollinators forms an essential component in the maintenance of biodiversific plant communities and ecosystem functioning.

Materials and Methods

To establish the diversity of insect pollinators visiting the standing crop of sweet basil grown at the Instructional farm, Rajasthan College of Agriculture, Udaipur, all the flower visiting insects were collected at different hours of the day (06:00-08:00, 08:00-10:00, 10:00-12:00, 12:00-14:00, 14:00-16:00 and 16:00-18:00 hours of the day) from ten randomly selected plants of sweet basil at different locations within the crop area. Individual foragers were followed to observe their foraging behavior on randomly selected 5 plants and the following observations were recorded:

- Time spent by individual foragers per flower
- Number of flowers visited per plant
- Time spent will be recorded using a stop watch.

Results

The foraging activity was recorded at the interval of every 2 hours from 06:00 hours until 18:00 hours on a weekly basis. The maximum activity of foraging honeybees was observed during 12:00 to 14:00 hours of the day. The time spent by individual forager honeybee was recorded with help of stopwatch. It ranged from 25.00 to 76.67 seconds per flower during the flowering period.

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The maximum time spent per flower was 76.67 seconds per flower during 36th SMW during this week. The mean atmospheric temperature was 25.37 °C, mean relative humidity was 85.71 percent, mean wind velocity was 5.84 kmph and mean sunshine hours was 2.24 hours; thereafter, no sudden change was observed on the time spent per flower in seconds. The number of flowers visited by foragers ranged from 0.78 to 2.36 flowers per minute during the flowering period. Each foraging honeybee visited 2.36 flowers per min that was maximum were during 35th SMW when flowering

period just started. The mean atmospheric temperature was 27.37 °C, mean relative humidity was 82.08 percent, mean wind velocity was 3.91 kmph and mean sunshine hours were 5.41 hours. The number of flowers visited per plant ranged from 2.45 to 6.60; however, the maximum number of flowers visited per plant was 6.60 as observed during 38th SMW; thereafter, it showed gradual changes in flowers visited per plant. The mean atmospheric temperature was 26.18 °C, mean relative humidity was 83.86 per cent, mean wind velocity was 2.49 kmph and mean sunshine hours were 3.84 hours.

Table 1: Seasonal mean of foraging behavior of observed honey bee during *Kharif*, 2017

SWM	Mean abiotic Factors				Time Spent Per Flower (Seconds)	Flower visited/ min.	Flower Visited (No./Plant)
	Atmospheric Temperature (°C)	Relative Humidity (%)	Wind Velocity (kmph)	Sunshine (Hours)			
35	27.37	82.08	03.91	05.41	25.38	02.36	02.60
36	25.37	85.71	05.84	02.24	76.67	00.78	03.60
37	26.06	73.93	03.27	05.33	60.00	01.04	04.80
38	26.18	83.86	02.49	03.84	63.64	00.94	06.60
39	26.62	62.65	03.26	05.79	65.71	00.91	04.20
40	26.99	54.29	03.11	08.37	54.00	01.11	04.00
41	26.57	46.79	03.69	07.79	33.33	01.80	02.60
42	26.79	46.50	02.77	06.31	44.00	01.00	03.00
43	26.96	39.21	03.21	09.01	43.33	00.96	02.85
44	23.81	65.86	02.67	08.97	25.00	00.80	02.45

Discussion

The foraging activity was recorded at the interval of every 2 hours from 06:00 hours until 18:00 hours on a weekly basis. The maximum activity of foraging honeybees was observed during 12:00 to 14:00 hours of the day. The time spent by individual forager honeybee ranged from 25.00 to 76.67 seconds per flower during the flowering period. The number of flowers visited by foragers ranged from 0.78 to 2.36 flowers per minute. The number of flowers visited per plant ranged from 2.45 to 6.60 during the flowering period.

Similarly, Singh and Choudhary (2006)^[3]. Observed that *Apis cerana* had higher foraging rate (15.2 /flower) than *Apis mellifera* (13.1) and *Apis dorsata* (10.6) and also visited more number of plants per minute (3.6, 2.7 and 2.1/min, respectively). Sharma and Abrol (2015) observed that the number of bees foraging at different times during day ranged from 4.7 - 11.30/ 5 plants/5 min; visited 12 - 25 flowers/5 plant and spent 2.3 - 7.9 s/flower. Rojeet *et al.* (2012) reported that *Apis dorsata* was found to be dominant forager (34.2%). The maximum number of *Apis dorsata* / m² /min. was found 6.67 ± 0.33 during 10:00-11:00 hrs and minimum was 1.33 ± 0.33 during 16:00-17:00 hrs. The maximum frequency of flower visit was found to be 14.67 ± 0.88 during 10:00-11:00 hrs and minimum was 2.67 ± 0.33 during 16:00-17:00 hrs. Likewise, maximum time spent / flower was recorded 3.97 ± 0.10 seconds during 09:00-10:00 hrs and minimum was 1.47 ± 0.27 seconds during 15:00-16:00 hrs of the day. Ramanuj and Phool Chand (2017)^[4]. Recorded that the foraging rate of the insect pollinators per meter square per hour was highest during forenoon, 11:00-12:00 hrs followed by that at 08:00-09:00 hrs and 15:00-16:00 hrs.

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