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RESEARCH ARTICLE

POLLINATORS/VISITORS DIVERSITY IN PEACH (*PRUNUS PERSICA*) AT BARIMA, MAINPAT BLOCK OF SURGUJA DISTRICT OF CHHATTISHGARH

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Abstract: Studies on the diversity of pollinators/visitors on peach (*Prunus persica*) flowers total 7 species of insects were observed visiting on peach (*Prunus persica*). The *Apis mellifera* was found dominant bee species among other main pollinators like *Apis dorsata, Tetragonula iridipennis* and *Apis cerana indica*. Some other pollinators/visitors were also recorded like *Musca domestica*, *Pantala flavescens* and *Eurema brigitta* visiting on peach flowers. Peach flowers were visited by seven species of insect pollinators, of which four species of insect pollinators belong to order Hymenoptera, one species to Diptera, Odonata and Lepidoptera respectively. Honeybee species *viz., Apis mellifera, Apis dorsata, Tetragonula iridipennis* and *Apis cerana indica* constituted about 76.76 percent of the total insect pollinators visiting peach compared to 23.24 percent of other insect pollinators.Timely fluctuations in the populations of major insect pollinators/visitors revealed that the peak activity was observed between 12.00 - 1.00 P.M. and 3.00 - 4.00 P.M.

Keywords: *Apis mellifera*, Diversity, Honey bee, Pollinator, Visitors, *Prunus persica*

INTRODUCTION

The peach tree (*Prunus persica*) has chromosomal number 2n = 16 and is a member of the Rosaceae family and subfamily Prunoidae, which also includes other species known to as "stone fruits." The peach is a smooth-skinned mutation is generally grown in temperate regions. The peach blossom bud can withstand temperatures as low as -23 to -26 °C, which restricts its ability to grow at higher latitudes. The majorities of peach cultivars are extremely vulnerable to early spring frosts and require 100 to 1000 hours of chilling below 7°C peach varieties differ greatly in their fruits both globally and regionally. Fruits can be clingstone or freestone, and their shapes can range from beaked to round to flat. Their colours can be yellow, white or red and their flesh can either melt or not. Peaches are delicious and a great source of fibres, vitamins and antioxidants whether they are eaten fresh, tinned or dried. Peaches of the greatest quality are grown in areas with warm to hot summers.

There are currently more than 15,000,000 tonnes of peaches produced worldwide, with Asia accounting for about half of that amount (mostly China). Peaches are second in tonnage only to apples among the deciduous fruits. With North America contributing 11%, South America 6% and Africa 5% of the harvest, Europe produces around 30% of the peach production. Italy, Greece and Spain are the top three producers in Europe, while the western and eastern seaboards as well as the Great Lakes in North America have the highest concentration of output. Over the past ten years the peach industry in Asia has expanded significantly whereas peach output elsewhere in the globe has changed just slightly or not at all. Although relatively small the peach sector in South America is expanding in Chile and Brazil.

Peach (*Prunus persica*) is one of the most important stone fruits grown in Punjab, Haryana and the adjacent areas of Western Uttar Pradesh, Uttarakhand and Himachal Pradesh. Because of the surge in dietary awareness and health concerns, stone fruits and their processed products are in higher demand. It is anticipated that in the near future there will be an increase in demand for these fruits.

The mountainous Mainpat (Surguja) tract, Samri and Jokapat in Balrampur and Pendrapat area in Jashpur district in Chhattisgarh provide the ideal agro-ecological conditions for peach fruit chilling development.

Any loss of biodiversity is a cause for public worry but the loss of pollinators particularly insects may be upsetting owing to possible effects on the reproduction of blooming plants and consequently on food. Hymenoptera (bees, ants and wasps), Diptera (flies, mosquitoes *etc*.), Lepidoptera (butterflies and moths), Coleoptera (beetles and weevils) and

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Thysanoptera (thrips) are some of the most significant and numerous insects involved in the pollination of horticultural and agricultural crops (Mattu and Bhagat, 2015). On several temperate fruit crops, honeybees make up a large share of the insect pollinators.

MATERIALS AND METHOD

Collection and identification of the various insect pollinators/ visitors

Use of cone-shaped insect collecting nets, a variety of insects that pollinate peach flowers had been captured. The whole flowering season saw sweeps. Thereafter, insects were put to death in a killing bottle and kept as dry specimens. After the first two days of flowering, insect collecting began, and it continued throughout the duration of flowering. The All India Coordinated Research Project on Honey Bees and Pollinators secton of Entomology, RMDCARS, Ajirma, Ambikapur (C.G.), sorted the collected insects in the lab and carried out the identification.

Abundance of different insect pollinators visiting peach bloom

21 trees were chosen at random from the orchards at the sites based on the amount of insect pollinators they contained. The experimental trees were designed with branches that were almost the same size in terms of spread, blooming stage, quantity of flowers, and height above the ground. The observations began two days after the start of blooming and were kept track of hourly intervals from the beginning to the end of flying activities throughout the day (8-00 A.M.-5.00 P.M.). At the start of each hour, numbers of insects were counted along 15cm branches for five minutes. Moreover hourly measurements of pollinators/visitors abundance between 8.00 A.M. and 5.00 P.M. were obtained.

RESULTS AND DISCUSSION

Diversity of pollinators/visitors on peach (*Prunus persica*) bloom

Italian bee (*Apis mellifera*) was observed from January, 1st 2023 (3.00 bees/5min/15cm twig), the peak period of Italian bee activity was recorded during January, 21th 2023 (5.33 bees/5min/15cm twig) and started decline during February, 4th 2023 (2.00 bees/5min/15cm twig) and also minimum activity recoded. The overall mean population of Italian bee was observed (3.70 bees/5min/15cm twig.

Rock bee (*Apis dorsata*) was recorded their activity was noticed from January, 1st 2023 (2.33 bees/5min/15cm twig) to continued at February, 18th 2023 (2.66 bees/5min/15cm twig). The highest activity of rock bee was recorded during February, 14th 2023 (with 4.33 bees/5min/15cm twig) on peach flower and minimum visitation was observed during january, 7 th 2023 with population of (1.66 bees/5min/15cm twig).The overall average population was found (2.93 bees/5min/15cm twig).

Stingless bee (*Tetragonula iridipennis*) was observed during January, 1st 2023 (2.00 *Tetragonula iridipennis*/5min./15cm twig) and the highest population of stingless bee was recorded in January, 28th 2023 (3.33 *Tetragonula iridipennis* /5min./15cm twig). The population of *Tetragonula iridipennis* started declining in January, 14th 2023 (2.33 *Tetragonula iridipennis*/5min./15cm twig) and reached its lowest level during February, 4th 2023 (1.66 *Tetragonula iridipennis*/5min./15cm twig). The overall mean population was found 2.28 *Tetragonula iridipennis* /5min./15cm twig).

Indian honey bee (*Apis cerana indica*) was first appeared from January, 1st 2023 with population (1.66 bees/5min/15cm twig) and continued at February, 18th 2023 with (1.00 bees/5min/15cm twig). The peak period of activity was recorded on January, 21th 2023 with average population of (2.66 bees/5min/15cm twig). After that the average activity of Indian honey bee started declining and least Indian honey bee activity was observed on February, 18th 2023 (1.00 bees/5min/15cm twig). The overall mean population of Indian bee was recorded as (1.58 bees/5min/15cm twig).

Housefly (*Musca domestica*) the first data recorded during January 1st 2023 (1.00 *Musca domestica*/5min/15cm twig). Further, again the *Musca domestica* population was observed highest during February 21st 2023 (2.66 *Musca domestica* /5min/15cm twig) and lowest population of *Musca domestica* was recorded on January, 14th 2023 (1.33 *Musca domestica*/5min/15cm twig). The overall average populations were noticed as (1.96 *Musca domestica* /5min/15cm twig).

Small grass yellow butterfly (*Eurema brigitta*) was first revealed from January, 1st 2023 (1.33 *Eurema brigitta* /5min/15 cm twig). The population reached its peak period during February, 4th 2023 (1.66 *Eurema brigitta* /5min/15 cm twig) and the minimum population of *Eurema brigitta* was recorded during January, 28th 2023 (0.00 *Eurema brigitta*. The overall average population was recorded (0.87 *Eurema brigitta*/5min/15 cm twig).

Globe skimmer (*Pantala flavescens*) was first recorded during January, 1st 2023 (1.66 *Pantala flavescens*/5min/15cm twig), thereafter the population of Globe skimmer increased and reached its peak period during January, 21st 2023 (1.33 *Pantala flavescens*/5min/15cm twig). Further, it started declining during February, 4th 2023 (0.66 *Pantala flavescens*/5min/15cm twig) and least *Pantala flavescens* activity was noticed during January, 14th 2023 (0.00 *Pantala flavescens*/5min/15cm twig). The overall mean population of *Pantala flavescens* was found as (1.04 *Pantala flavescens* /5min/15cm twig).

Results are in close agreement with Painkra and Shaw (2016) observed that the first week of November 2011 and the second week of December 2012 saw the maximum foraging activity of *Apis cerana indica* in niger flowers (33.83 bees/5min/m2). At 1100 hours, there were the most visitors (66.06 bees/5min/m^2). The foraging activity of *Apis dorsata* peaked at 1100 hours (11.7 bees/5min/m^2), whereas it peaked at 1700 hours (0.50 bees/5min/m^2). The *Apis florea* was seen foraging at its peak at 1300 hours (4.00 bees/5min/m^2) and at its lowest at 0900 hours (0.56 bees/5min/m2).Verma and Dulta (1986) studied the foraging activity of *Apis cerana* and *A. mellifera* on apple bloom and reported maximum activity from 09.00-11.30h and 11.00-13.30h.

Diversity of various insect pollinators/visitors/5min/15cm twig during different time interval of the day on peach (*Prunus persica*) bloom

Data pertaining to abundance of insects based on timely fluctuation (three time interval of the day) during 2023 at Potato and Temperate Fruits Crops Research Station Barima, Mainpat, Sarguja (C.G.).

The data on the diversity of pollinators/visitors natural conditions in peach orchards at different times of the day is presented in (Table 2)

The data revealed that the activity of pollinators/visitors under natural conditions varied at different hours of the day., *Apis mellifera* 3.12, 5.50, and 4.37, *Apis dorsata* 1.87, 4.37 and 23.50, *Tetragonula iridipennis* 2.0, 4.0 and 2.62,*Apis cerana indica* 1.12, 2.50 and 2.37, *Musca domestica* 1.62, 2.75 and 1.50, *Pantala flavescens* 1.12, 1.37, and 0.62 and *Eurema brigitta* 0.75, 1.00, and 0.87 at 8.00 - 9.00 A.M., 12.00 - 1.00 P.M. and 3.00 - 4.00 P.M. respectively. The activity showed increasing trend from 8.00 - 9.00 A.M. and then again decreased up to 5.00 - 6.00 P.M. The highest activity of pollinators/visitors was recorded at 12.00-1.00 P.M.

These findings are in confirmity with the findings of Neelima and Kumar (1997) who reported that insect visitors (*Apis mellifera* and *Apis cerana indica* F.) were more frequent in the morning hours (10-11am) than in the evening (4-5 pm). Verma and Dulta (1986) also reported peak foraging activity of *Apis mellifera* L. and *Apis cerana indica* F. between 9-12 am in Shimla Hills. The maximum activity of insect visitors during this period can be attributed to pollen dehiscence of *Malus* sp. (Red Delicious) which peaks between 10-12am. Anand (2003) the increase in activity of the insect pollinators from 10-11am could also be due to comparatively warm temperature and bright sun also reported who recorded the peak activity of honeybees at 10-12am However, frequency of Dipterans *Eristalis* sp. and *Syrphus* sp. were recorded maximum at 8-9 am, when the temperature was low and relative humidity high.

Verma and Chauhan (1985) reported the peak activity hours of *Eristalis tenax* and *E. angustimarginatus* were 0800-0900 hr. The present findings also receive support from the observations of Mishra *et al*. (1976) who recorded maximum number of *Eristalis* and *Syrphus* sp. in the fore noon. The difference in peak hours may be attributable to temperature patterns as also supported by Verma and Chauhan (1985). Furthermore, different timings in the peak activity of different bee species reflect the ecological adaptation of each bee species and this behaviour avoids the competition between the closely related species or ecotypes to utilize the available resources. Dar *et al*. (2016) studied in peach that 46 species from 5 orders, 31 families and 20 genera of insects were found in the maximum number. The most common genera of floral visitors were *Lassioglossum, Megachile, Syrphus* and *Musca,* which were all somewhat less common. Shannon diversity indices, Simpson's dominance, and Simpson's dominance all have minimal values in Srinager of 5.415, 6.056 and 0.8115 respectively. The dissimilarity coefficient of species richness ranges from 11.00 to 19.83. The dominance index of Berger-Parker can be used to describe the percentage of people that the three fruit crops' three species' abundances on an uneven scale.

CONCLUSION

The highest abundance recorded was that of the activity of pollinators/visitors at different hours of the day. *Apis mellifera* 3.12, 5.50 and 4.37, *Apis dorsata* 2.87, 4.37 and 3.50, *Tetragonula iridipennis* 2.0, 4.0 and 2.62, *Apis cerana indica* 1.12, 2.50 and 2.37, *Musca domestica* 1.62, 2.75 and 1.50, *Pantala flavescens* 1.12, 1.37 and 0.62 *Eurema brigitta* 0.75, 1.00 and 0.87, at 8.00 - 9.00 A.M., 12.00 - 1.00 P.M. and 3.00 - 4.00 P.M. respectively. The activity showed increasing trend from 8.00 - 9.00 A.M. and then again decreased up to 3.00 - 4.00 P.M. The highest activity of pollinators/visitors was recorded at 12.00 - 1.00 P.M.

Hourly fluctuations in the populations of various insect pollinators/visitors revealed that the peak activity was observed between 12.00 - 1.00 P.M. and 3.00 - 4.00 P.M.

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Table 1. Diversity of pollinators/visitors on peach (*Prunus persica*) bloom during 01/01/2023 to 18/02/2023

S.N.	Pollinators/ visitors	Scientific Name	Order	Family	(Pollinators/visitors/5min/ 15cm twig)			Mean	Contribution of insect pollinators/ visitors (%)	Total percentage (Insect order)
					8-9 A.M.	12-1 P.M.	3-4 P.M.			
1	Italian bee	*Apis mellifera*	Hymenoptera	Apidae	3.12	5.50	4.37	4.33	26.01	76.76
2	Rock bee	*Apis dorsata*	Hymenoptera	Apidae	2.87	4.37	3.50	3.58	21.50	
3	Stingless bee	*Tetragonula iridipennis*	Hymenoptera	Apidae	2.00	4.00	2.62	2.87	17.24	
4	Indian honey bee	*Apis cerana*	Hymenoptera	Apidae	1.12	2.50	2.37	2.00	12.01	
5	House fly	*Musca domestica*	Diptera	Muscidae	1.62	2.75	1.50	1.95	11.71	11.71
6	Globe skimmer	*Pantala flavescens*	Odonata	Libellulidae	1.12	1.37	0.62	1.04	6.25	6.25
7	Small grass yellow butterfly	*Eurema brigitta*	Lepidoptera	Pieradae	0.75	1.00	0.87	0.88	5.28	5.28
Total					**12.60**	**21.49**	**15.85**	**16.65**	**100.00**	**100.00**
Mean					**1.80**	**3.07**	**2.26**	**2.38**	**14.28**	**25.00**

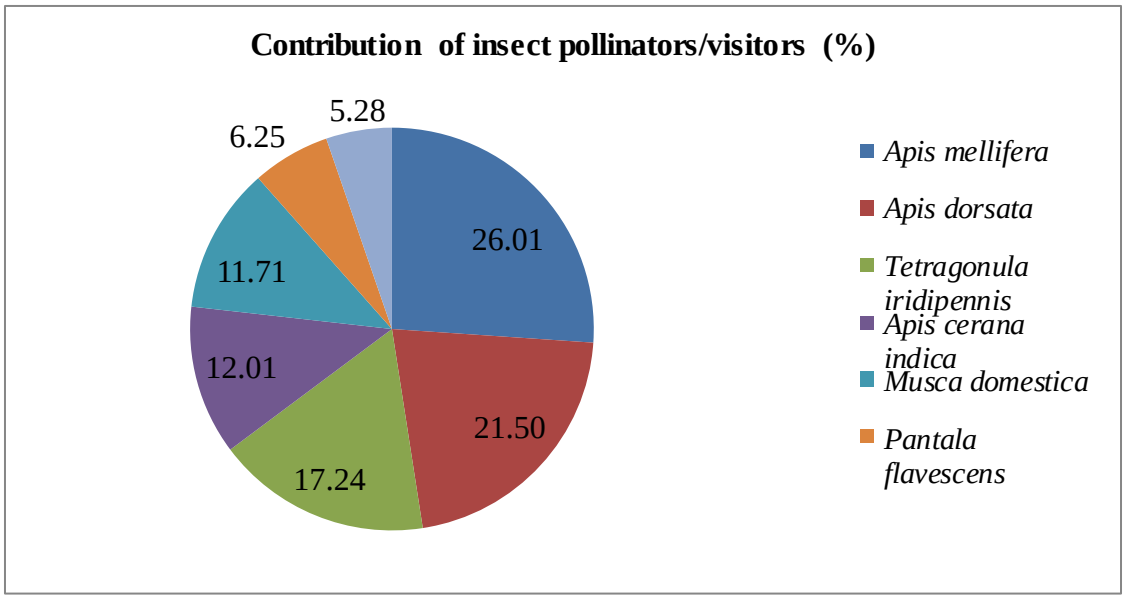

Fig. 1 Diversity of pollinators/visitors on peach (*Prunus persica*) bloom during 01/01/2023-18/02/2023

Table 2. Diversity of various insect pollinators/visitors/5min/15cm twig during different time interval of the day on peach (*Prunus persica*) bloom during 2023.

Date of observation	Mean number of pollinators/ visitors/5min/15cm twigs (flowers)							Mean
	Apis mellifera	*Apis dorsata*	*Tetragonula iridipennis*	*Apis cerana*	*Musca domestica*	*Pantala flavescens*	*Eurema brigitta*	
01/01/2023	3.00	2.33	2.00	1.66	1.00	1.66	1.33	1.85
07/01/2023	3.33	1.66	2.66	1.33	1.66	0.66	1.00	1.76
14/01/2023	5.00	4.33	2.33	2.00	1.33	0.00	0.33	2.19
21/01/2023	5.33	3.00	3.00	2.66	2.66	1.33	0.66	2.66

28/01/2023	4.66	4.00	3.33	1.00	1.66	1.00	0.00	2.24
04/02/2023	2.00	2.33	1.33	1.33	2.00	0.66	1.66	1.62
11/02/2023	2.66	3.66	2.00	1.66	2.33	1.33	1.33	2.14
18/02/2023	3.66	2.66	1.66	1.00	3.00	1.66	0.66	2.04
Overall Mean	**3.70**	**2.93**	**2.28**	**1.58**	**1.96**	**1.03**	**0.87**	**16.50**

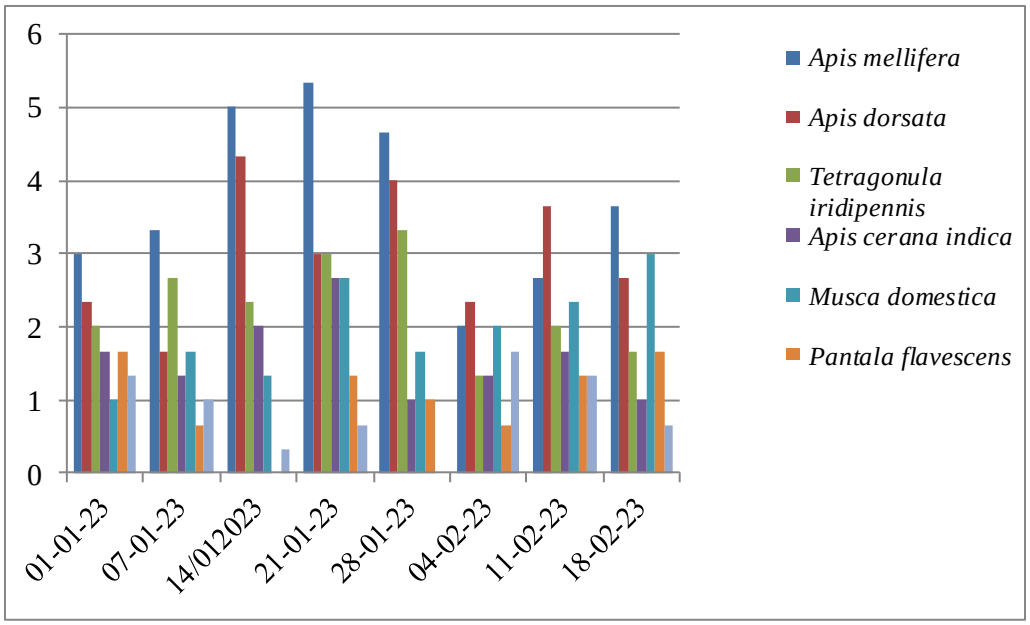

Fig 2 Diversity of various insect pollinators/visitors/5min/15cm twig during different time interval of the day on peach (*Prunus persica*) bloom 2023.

Tetragonula iridipennis

Apis mellifera

Apis dorsata

Musca domestica

Eurema brigitta

Pantala flavescens

Fig 3 Various pollinators/visitors were recorded on peach *Prunus persica* bloom at Barima during 2023.

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