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Insect pollinators of kiwifruit (*Actinidia deliciosa* Chev.) and flora of bumblebee (*Bombus haemorrhoidalis* Smith) in Solan region of Himachal Pradesh

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Abstract

Kiwifruit is a dioecious vine which requires a male vine to pollinate a female vine for the female vine to produce fruits. It is difficult to pollinate due to the flowers are not a good source of nectar and less attractive to insect pollinators. Various insect pollinators of three orders were reported that pollinate the Kiwifruit flowers in the Solan region of Himachal Pradesh. Six plant families were visited by *Bombus haemorrhoidalis* Smith for nectar and pollen grains at locations ranging from 1275 to 1555 meters above mean sea level. Our results highlight the important contribution of insect pollinators to the kiwifruit pollination and flora of bumblebee.

Keywords: Kiwifruit, *Bombus haemorrhoidalis*, insect pollinator, flora

Introduction

Pollination is one of the major factors responsible for production of qualitative and quantitative parameters of any agricultural and horticultural crop. Insect pollinators like bumble bees, honey bees, syrphid flies and solitary bees helps in the process of reproduction of many field and fruit crops by transferring pollens grains from male flower to female flower. They are in commercial use for successful crop production (McGregor, 1976) [10]. Bumblebees are important social insect pollinators belonging to insect order Hymenoptera. High speed of pollination, vibration to burst the pollen sacs and efficiency to forage at low temperature and light makes them the most reliable and efficient pollinators (Heinrich, 1979; Abrol, 2012) [1, 4]. Crops like kiwifruit and other fruit and vegetable crops need such pollinators to get low cost constituents (Kwon and Saeed, 2003) [8]. Fruit weight is highly dependent on seed number (Pyke and Alspach, 1986) [12] and, therefore, an adequate pollination is an important aspect in kiwifruit production. The flowers of kiwifruit mainly pollinated with hand pollination that depends on the environmental factors and is labour intensive (Naik, 2011) [11]. Kiwifruit also pollinated by different insect pollinators but bumblebees are efficient pollinator of this fruit crop. A number of medicinal, wild and ornamental plants visit by bumblebees. This study was carried out to find out the insect pollinators of kiwifruit and suitable food plants of bumblebee in the locality to conserve and manage the plant species.

Material and Methods

The study was carried out in Nauni campus of Dr. YS Parmar University of Horticulture & Forestry situated at 30.86° N latitude and 77.16° E longitude with at an altitude of 1275 meters above the mean sea level. Climate of the area is generally sub-temperate and semi-humid characterized by cold winters. Generally, December and January month are the coldest while, May and June are the hottest months. The average temperature range from 26.5-29 °C, relative humidity 55% and rainfall 20.6 mm during the course of investigation. The observation on insect pollinator of kiwifruit, the visual observation was carried out to find out the insect pollinators of different orders. The intensity of visitation by the insect pollinators was visually monitored by recording the number of times flowers of kiwifruit was visited by different insect pollinators. Bumble bee depends on large number of floral sources for their survival and sustenance in nature. The observation on food plants of *Bombus haemorrhoidalis* Smith were recorded from February to April month and identified the plant species and families.

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Result and Discussion

Data on insect pollinators of kiwifruit and food plants of bumblebee have been summarized as follows:

Totally five insect pollinators were reported on kiwifruit flowers at Kiwi Block of Nauni campus. They were grouped under four families viz., Apidae, Syrphidae, Muscidae and curculionidae (Plate 1). The identified insect pollinators were *Apis mellifera*, *Bombus haemorrhoidalis*, *Episyrphus balteatus*, *Masca domestica* and *Polydrusus formosus* (Table 1). These all insect pollinators helps to pollinate the kiwifruits. Among these pollinators, *Apis mellifera* and

Bombus haemorrhoidalis were good pollinators because they frequently visit the flowers of kiwifruit. The flowers of kiwifruit have less quantity of nectar so bumblebee can be considered efficient pollinators as compare to honeybees. The results are conformity with the MacFarlane (1981) ^[9], Donovan (1983) ^[4] and Hopping (1984) ^[6] they observed that a range of insects, especially bees and flies were known insect pollinators of kiwifruit. These insects have been observed on both pistillate and staminate flowers are known to carry pollen and deposit it on the stigma (Donovan 1983; Jay & Jay 1984) ^[4, 7].

Table 1: Insect pollinators of kiwifruit reported during flowering season 2017.

Common name	Scientific name	Family	Order
Honeybee	<i>Apis mellifera</i>	Apidae	Hymenoptera
Bumblebee	<i>Bombus haemorrhoidalis</i>	Apidae	Hymenoptera
Syrphid fly	<i>Episyrphus balteatus</i>	Syrphidae	Diptera
House fly	<i>Masca domestica</i>	Muscidae	Diptera
Little green weevil	<i>Polydrusus formosus</i>	Curculionidae	Coleoptera



a) *Bombus haemorrhoidalis*



b) *Episyrphus balteatus*



c) *Polydrusus formosus*



d) *Apis mellifera*



e) *Musca domestica*

Plate 1: Insect pollinators of kiwifruit.

Flora of bumblebee

Bumblebee depends on many types of medicinal, ornamentals and fruit plants for their survival in nature. The foragers of bumblebees visit almost all the blooming crops but are found in large number of crops belongs to families Acanthaceae, Brassicaceae, Fabaceae, Lamiaceae, Papaveraceae Ranunculaceae, Nyctaginaceae, Asteraceae, Plantaginaceae

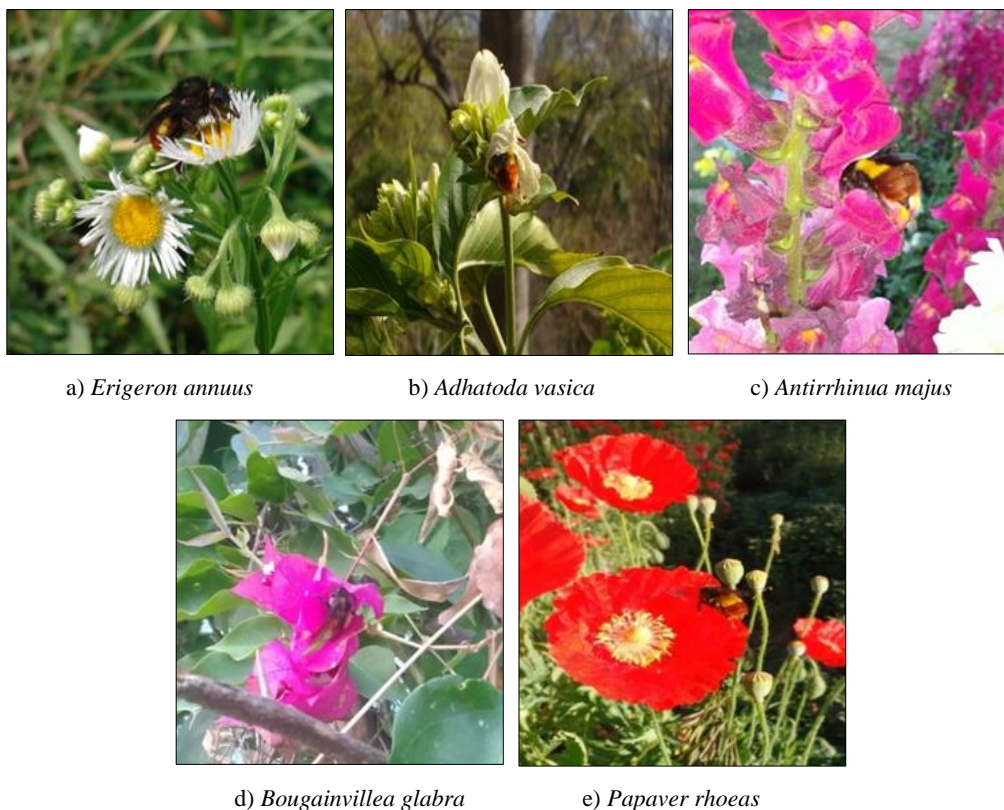
and Actinidiaceae. The queens and workers of bumble bee started foraging with the onset of spring in the early morning and evening. The mated queens of previous season were foraging for pollen and nectar from diverse bee flora. The list of important bee flora on which queens workers were foraged is presented in table 2.

Table 2: Important bee flora on which queens workers were foraged during 2017.

Month	Common name	Botanical name	Family	Foraging time
February	Basuti	<i>Adhatoda vasica</i> (L.)	Acanthaceae	Evening
	Mustard	<i>Brassica juncea</i> (L.)	Brassicaceae	Evening
	Lupin	<i>Lupinus mutabilis</i> (Sweet)	Fabaceae	Morning
	Caryopteris	<i>Caryopteris bicolor</i> (Mabb.)	Lamiaceae	Morning Evening
March	Basuti	<i>Adhatoda vasica</i> (L.)	Acanthaceae	Evening
	Golden poppy	<i>Papaver rhoeas</i> (L.)	Papaveraceae	Morning
	Rocket larkspur	<i>Delphinium ajacis</i> (L.)	Ranunculaceae	Morning Evening
	Snapdragon	<i>Antirrhinum majus</i> (L.)	Plantaginaceae	Morning
April	Basuti	<i>Adhatoda vasica</i> (L.)	Acanthaceae	Evening
	Rocket larkspur	<i>Delphinium ajacis</i> (L.)	Ranunculaceae	Morning
	Kiwifruit	<i>Actinidia deliciosa</i> (Chev.)	Actinidiaceae	Morning Evening
	Daisy fleabane	<i>Erigeron annuus</i> (L.)	Asteraceae.	Morning
	<i>Bougainvillea</i>	<i>Bougainvillea glabra</i> (Choisy)	Nyctaginaceae	Morning

The observations revealed that during February, March and April months of the year the major bee flora were found to be Basuti, Mustard, Lupin, Caryopteris, Golden poppy, Rocket larkspur, Snapdragon, Kiwifruit, Daisy fleabane and *Bougainvillea* respectively (Plate 2). It is clear from the present studies that during February-April, Basuti, Mustard, Lupin, Caryopteris, Golden poppy and Larkspur were the

flora available for queen sustenance. Similar bee flora for sustain the queen bumble bee population in nature during these months were reported earlier by Chauhan (2011) [3], Chauhan *et al.* (2013) [2] and Yankit (2016) [13] from Nauni area except Golden poppy and Rocket larkspur recorded in the month of March in present studies.

**Plate 2:** Flora of *Bombus haemorrhoidalis*.

Conclusion

The present studies on important insect pollinators of kiwifruit and flora of bumblebee in Solan region of Himachal reveals that bumblebees and honeybees are good pollinators under natural condition. *Bombus haemorrhoidalis* visited ten floral families including Acanthaceae, Brassicaceae, Fabaceae, Lamiaceae, Papaveraceae Ranunculaceae, Nyctaginaceae, Asteraceae, Plantaginaceae and Actinidiaceae for the collection of nectar and pollen. Out of these flora most

frequently visit was found on Basuti herb, *Adhatoda vasica* (L.).

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References

1. Abrol DP. Pollination biology: Biodiversity conservation and agricultural production. Springer. New York, 2012, 792-794.
2. Chauhan A, Katna S, Rana BS. Ethological studies on bumble bees under subtropical conditions in India. Journal of Medical Science and Clinical Research. 2013;1(3):125-129.
3. Chauhan A. Refinement of bumble bee rearing technology and its use in cucumber pollination. M.Sc. Thesis, Department of Entomology Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan, India, 2011, 152.
4. Donovan B. Kiwifruit pollination. Proceedings of Ministry of Agriculture and Fisheries beekeepers seminar, Nelson, 1983, 458-461.
5. Heinrich B. Majoring and minoring by foraging bumblebees *Bombus vagans*. Ecology. 1979;60:245-255.
6. Hopping ME. Effects of exogenous auxins, gibberellins and cytokinins on fruit development in Chinese gooseberry (*Actinidia chinensis* Planch.). New Zealand Journal of Botany. 1976;14:69-75.
7. Jay D, Jay C. Observations of honey bees on Chinese gooseberries ('kiwifruit') in New Zealand. Bee World. 1984;65:155-166.
8. Kwon YJ, Saeed S. Effect of temperature on the foraging activity of *Bombus terrestris* L. (Hymenoptera: Apidae) on greenhouse hot pepper (*Capsicum annuum* L.). Applied Entomology and Zoology. 2003;38:275-280.
9. MacFarlane RP. Kiwifruit pollination. Tree Crop Journal of New Zealand. 1981;6:44.
10. McGregor SE. Insect pollination of cultivated crops plant. Agriculture Handbook, Academic Press, London, 1976, 496.
11. Naik S. Effect of pollination methods on the fruit set, yield and quality of kiwifruit (*Actinidia deliciosa* Liang & Ferguson). M.Sc. Thesis submitted to Dr. YS Parmar University of Horticulture and Forestry, Solan, 108.
12. Pyke NB, Alspach PA. Inter-relationships of fruit weight, seed number and seed weight in kiwifruit. New Zealand Journal of Agricultural Science. 1986;20:153-156.
13. Yankit P. Studies on bumble bee pollination in tomato (*Solanum lycopersicum* Mill.) under protected condition. M.Sc. Thesis submitted to Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan, 2016, 96.