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Pollination efficiency of insect pollinators on *Aegle marmelos* Correa. At Kumarganj, Faizabad

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Abstract

In the present research the variety “Narendra Bael 9 (NB 9)” was taken to study the insect pollinator’s abundance and their pollination efficiency at Main Experiment Station (26.47°N latitude, 82.12° E longitude and 113 meters altitude), Horticulture and Apiculture laboratory, Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad (U.P.), India during 2014. The hymenopterans were the major floral visitors comprising of six species from four families viz., Xylocopidae, Apidae, Vespidae and Formicidae, followed by dipterans (One species from one family) viz., Syrphidae, Lepidoptera (three species from two families) viz., Pieridae and Arctiidae. The abundance of *Apis dorsata* was highest (7.90 bees/spike/5 minutes) followed by syrphid flies, *Eupeodes corolae* (3.45 visitors/spike/5 minutes) and *Apis mellifera* (1.20 bees/spike/5 minutes). Based on pollination index (Number of loose pollen grains sticking on the body of visitors × abundance), *A. dorsata* was found to be the most efficient pollinator of bael flowers followed by *Eupeodes corolae* and *A. mellifera* under agro-ecological conditions of Kumarganj, Faizabad (India).

Keywords: Abundance, pollinator, pollination efficiency, pollination index, pollen grain, bael

1. Introduction

Bael (*Aegle marmelos* C.) belongs to family rutaceae and it is known in India from pre-historic time [6]. In nature, only about 5 per cent of the flowers are self-pollinated and 95 per cent animal pollinated [5]. Bael is mostly cross pollinated fruit crop which has entomophilous flowers and pollination is carried out by various insect pollinators like honey bees (*Apis dorsata*, *A. mellifera*), hover flies, yellow wasp, carpenter bee, weevil, black ants, butterflies etc. [4]. Bees are the best among all pollinators. Butterflies are occasional pollinators, and do pollination of crops while feeding on nectar from one flower to another. Flies, hoverflies and wasps are effective pollinators because they visit flowers to feed upon nectar (or in some species pollen) for essential nutrients for egg maturation and extending their life-span [2]. Being a cross pollinated crop, its fruit set is expected to be affected by the insect visitors. The investigation was carried out on the pollination efficiency, which is defined as the proportion of pollinated flowers relative to those that experienced pollen removal. The present studies were conducted with the objectives to know pollinators abundance and pollination efficiency of pollinator species.

2. Materials and Methods

The pollination studies in bael variety, “NB 9” was carried out under sodic soil condition and experimental site is located at Main Experimental Station, Department of Horticulture, Narendra Deva University of Agriculture and Technology, Faizabad (U.P.) [26.47° N latitude, 82.12° E longitude and altitude of 113 metres from mean sea level] during 2014.

2.1 Abundance of insect visitors: Abundance (number of visitors/ spike/5 minutes) of major pollinators was recorded from six randomly selected bael plants. These observations were recorded from 6:00 am to 6:00 pm at an interval of 3:00 hours. Observations were recorded for 7 days each after the initiation of 10% flowering in crop, at peak flowering and before the cessation of flowering in the crop.

2.2 Loose pollen grains sticking on the body of insects visitors: For estimating the number of loose pollen grains sticking to the body of major insect pollinator species, the insect pollinators were captured gently by forceps from the flowers to avoid shaking of body and the

hind legs of the bee pollinators, which collect the pollen on their hind legs, were amputated. Insects were captured at the time of peak flowering and kept in 70% alcohol in vials and were shaken vigorously to wash out pollen grains from their bodies. The numbers of pollen grains were counted with the help of a haemocytometer under the microscope. Ten individuals of each insect species were captured for counting the number of loose pollen grains. Comparative pollination efficiency of different insect pollinators was worked out.

2.3 Pollination efficiency: Comparative pollination efficiency of different major pollinators were calculated based on their relative abundance and number of loose pollen grains sticking to their bodies by using the formula given below-
Pollination Efficiency = Number of loose pollen grain sticking on the body of insect × Abundance of insect pollinators on bael flowers

2.4 Statistical analysis: All the data pertaining to relative abundance, loose pollen grains and pollination efficiency, were statistically analyzed by using factorial RBD.

3. Result and Discussion

Abundance of major insect pollinators on blossoms of bael crop during, June 2014 is presented in Table 1. The mean population of different insect species ranged from 1.2 (*A. mellifera*) to 7.90 (*A. dorsata*) pollinators/spike/5 minutes. *A. dorsata* had highest population (7.90 pollinators / spike/5 minutes) followed by *Eupeodes corolae* (3.45 pollinators / spike/5 minutes) and *A. mellifera* (1.20 pollinators / spike/5 minutes) irrespective of day hours. The maximum abundance of pollinators was observed during 9 am-12 noon in case of *A. dorsata* (12.60 pollinators / spike / 5 minutes) and least abundance observed in case of *A. mellifera* during 3 pm- 6 pm

(0.40 pollinators / spike / 5 minutes). Present findings are in line with the previous findings [3] who studied on the population of bees (bees/m²/5 minutes) at different day hours, among the three bee species. *Halictus* sp. was the most abundant visitor with mean population of 1.44 bees/m²/5 minutes followed by *Megachile* sp. (1.05 bees/m²/5 minutes) and *A. dorsata* (0.78 bees/m²/5 minutes) in ber plant. The population of *Halictus* sp. (3.47 bees/m²/5 minutes), *Megachile* sp. (2.07 bees/m²/5 minutes) and *A. dorsata* (1.67 bees/m²/5 minutes) was observed maximum at 8 am-10 am of the day.

Data in Table 2 revealed that *A. dorsata* had maximum number of pollen grains (average 211950 pollen grains) followed by *A. mellifera* (average 195250 pollen grains) and syrphid flies, *Eupeodes corolae* (average 85000 pollen grains). The abundance of *A. dorsata* (7.90 pollinators / spike/5 minutes) was highest followed by *Eupeodes corolae* (3.45 pollinators / spike/5 minutes) and *A. mellifera* (1.20 pollinators / spike/5 minutes). The pollination index calculated for *A. dorsata* was highest (1674405) followed by *Eupeodes corolae* (293250) and *A. mellifera* (234300). Therefore, it is concluded that *A. dorsata* was efficient pollinator on Bael flowers under agro-ecological conditions of Faizabad (India). The aforesaid findings on pollination index are well supported by the observations on *A. mellifera* on apple crop [7]. This result is in line with the previous findings of [1] studied on the foragers (100%), *A. mellifera* and *A. dorsata* visiting parental lines of *Brassica napus* were top workers and touched the reproductive parts of flowers followed by *A. cerana indica* (88.14% and 97.35%) and *A. florum* (66.25% and 83.94%) respectively. It was concluded that *A. mellifera* and *A. dorsata* were the best pollinators with best pollination efficiency followed by *A. cerana indica* and *A. florum*.

Table 1: Abundance of major insect pollinators on blossoms of *Aegle marmelos* C.

Species	Number of pollinators/spike/5 minutes during different day hours				Mean
	6 am-9 am	9 am-12noon	12noon-3pm	3 pm-6 pm	
<i>Apis dorsata</i>	8.00 (2.92)	12.60 (3.62)	4.40 (2.21)	6.60 (2.66)	7.90 (2.85)
<i>Apis mellifera</i>	2.40 (1.70)	0.60 (1.05)	1.40 (1.38)	0.40 (0.95)	1.20 (1.27)
<i>Eupeodes corolae</i>	5.40 (2.43)	3.80 (2.07)	1.20 (1.30)	3.40 (1.97)	3.45 (1.95)
Factors	SE(m)			C.D.	
Insect Species	0.031			0.091	
Day hours	0.036			0.105	
Insect species × Day hours	0.062			0.182	

Figures in parentheses are the transferred (square root) means

Table 2: Pollination Efficiency of different insect species on Bael flowers

Species	No. of pollen grains sticking on the body of insect pollinators	Avg. Abundance (Number of pollinators /spike / 5 minutes)	Pollination efficiency/ index	Rank
<i>Apis dorsata</i>	211950 ± 8030.9	7.90	1674405	1 st
<i>Eupeodes corolae</i>	85000 ± 5102.1	3.45	293250	2 nd
<i>Apis mellifera</i>	195250 ± 7129.9	1.20	234300	3 rd

Each value represents mean of 10 observations

4. Conclusion

According to present results, honeybees like *Apis dorsata*, *Apis mellifera* and syrphid fly (*Eupeodes corolae*) are efficient pollinators and *Apis dorsata* is the most abundant pollinator among other pollinators of bael flowers. So by augmenting the honeybee colony in cropping area, we can increase the quality and quantity of the bael fruits.

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6. References

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