

Studies on foraging activity of major insect pollinators on cucumber, *Cucumis sativus* L.

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ABSTRACT

Cucumber, a member of gourd family, Cucurbitaceae, is a widely cultivated vegetable renowned for its refreshing flavor and crisp texture. Cucumbers typically tend to be monocious and need insects as pollinators for efficient and successful pollination. Field experiment was carried out to study foraging efficiency of major insect pollinators of cucumber. The lowest foraging speed (time spent on flower in seconds) was recorded in *Apis cerana* (5.60 seconds) and highest in *Eristalis arbustorum* (51.55 seconds). The highest foraging rate (number of flowers visited /minute) was recorded in *Apis cerana* (11.27) and lowest in *Eristalis arbustorum* (1.20). *Apis cerana* carried the highest number of loose pollen grains (4.0 lakh) and *Eristalis arbustorum* carried the lowest number of loose pollen grains (0.2 lakh).

Key words: Foraging activity, Insect pollinators, *Cucumis sativus*

Introduction

Cucumber (*Cucumis sativus* L.) is one of the oldest vegetables grown in tropical and subtropical regions of the world. It is one of the most prominent vegetables belonging to family Cucurbitaceae and a popular salad ingredient is commonly referred as "kheera" (Arunkumar *et al.*, 2011). It has enormous economic and nutritional significance. Cucumbers are cultivated throughout the world, for salad and pickling. Commonly, the fruit is picked when it is still green. They can be consumed either raw, cooked, or pickled and is rich source of iron, calcium, thiamine, vitamin C, niacin, phosphorus, and dietary fibre (Shah *et al.*, 2015). The cucumber blossoms are mostly pollinated by insects, as they are neither wind-pollinated nor self-pollinated (Hossain *et al.*, 2018). This draws a variety of pollinators due

to exposed nectar and prolific pollen production. Monitoring foraging behaviour of insect pollinators is a vital part of pollination ecology. As a result, the current study on the foraging behaviour of insect pollinators on cucumber is crucial because there hasn't been much research done on these subjects in India.

Methodology

The present study on foraging activity of major insect pollinators on cucumber, *Cucumis sativus* L., was conducted at experimental field of Division of Entomology in 2021, Faculty of Agriculture, SKUAST-K Wadura. Cucumber var Japanese green long (JGL) was cultivated in accordance with the practises advised by SKUAST-K in randomized Block Design with plot size 5 x 7 m² and spacing 1 x

1 m from row tow and plant to plant. Pollination efficiency of major insect pollinators viz., *Apis cerana*, *Apis mellifera*, *Xylocopa vulga*, *Lassioglossum marginatum* and *Eristalis arbustorum* was determined on the basis of foraging speed, foraging rate and loose pollen grain count.

Foraging speed: The foraging speed (Time spent on flowers in seconds) of major insect pollinators was observed with the help of stop watch. A stopwatch was used to record the amount of time spent on 10 randomly chosen flowers at alternate days for a week at 12.0 hours during peak flowering period.

Foraging rate: The foraging rate (number of flowers visited in a minute) of pollinators was recorded visually by counting the number of flowers that a particular species of pollinator visited in a minute.

Loose pollen grain count: The loose pollen grains adhering to the body of major insect pollinators viz., *Apis mellifera*, *A. cerana*, *Xylocopa vulga*, *Lassioglossum marginatum*, *Eristalis arbustorum* and were estimated. The insects were gently grasped using forceps to prevent shaking of its body from the flowers. The caught insects hind legs were delicately amputated. The insect pollinators were captured on their peak activity during peak flowering period and preserved in 70 per cent alcohol in glass vial. To remove the pollen grains from the insects body, they were shaken vigorously. A haemocytometer was used to count the pollen grains in the alcohol

Results and Discussion

The foraging speed (time spent on flower in seconds) of major insect pollinators viz., *Apis cerana*, *Apis mellifera*, *Xylocopa vulga*, *Lassioglossum marginatum* and *Eristalis arbustorum* differed significantly from each other at 12.00 hours during the peak flowering period on day 1, 3, 5 and 7 (Table 1). The mean foraging speed of *A. cerana*, *A. mellifera*, *X.*

vulga, *L. marginatum* and *E. arbustorum* was recorded as 5.60, 11.10, 13.67, 20.45 and 51.55 seconds, respectively at 12.0 hours during the peak flowering period which indicated that *A. cerana* and *E. arbustorum* spent minimum and maximum time, respectively, on bloom of cucumber during peak flowering period. Rani *et al.* (2017) found minimum foraging speed of *A. cerana* as 5.03 to 5.20 seconds on bloom of summer squash (*Cucurbita pepo* L.). Similar results were shown by Ahmad *et al.* (2017) who found that *Apis cerana* spending 6.24 ± 0.12 seconds per flower in apple orchard of Kashmir.

The foraging rate (number of flowers visited per minute) of major insect pollinators viz., *Apis cerana*, *Apis mellifera*, *Xylocopa vulga*, *Lassioglossum marginatum* and *Eristalis arbustorum* differed significantly from each other at 12.00 hours during the peak flowering period on day 1, 3, 5 and 7 (Table 1). The mean foraging rate of *A. cerana*, *A. mellifera*, *X. vulga*, *L. marginatum* and *E. arbustorum* was recorded as 11.27, 5.63, 4.51, 2.97 and 1.20 (number of flowers visited/minute) respectively at 12.0 hours during the peak flowering period which indicated that *A. cerana* and *E. arbustorum* visited maximum and minimum flowers, respectively, on cucumber during peak flowering period. Ahmad *et al.* (2017) who reported *A. cerana* visiting 10.50 ± 0.18 flowers per minute in apple orchards of Kashmir which is very close to our findings in present investigation. Sharma *et al.* (2016) further found *A. cerana* visiting 8.20 flowers per minute on bloom of radish which is somewhat in accordance with our findings. They discovered that a variety of factors, like proboscis length, instinctive foraging behaviour, floral structure, specifically corolla depth, and the kind and density of flowers on a particular cultivar of crop, have an impact on the number of flowers visited each minute by any pollinator species

The data on number of loose pollen grains stick-

Table 1. Foraging speed and foraging rate of major insect pollinators of cucumber (*Cucumis sativus* L.)

Name of Pollinator	Time spent on flower(Sec.)					Flowers visited/minute (No.)				
	*Day 1	*Day 3	*Day 5	*Day 7	Mean	*Day 1	*Day 3	*Day 5	*Day 7	Mean
<i>Apis cerana</i>	5.50	5.70	6.40	4.80	5.60	11.37	11.06	9.88	12.80	11.27
<i>Apis mellifera</i>	9.30	11.00	12.30	11.80	11.10	6.78	5.68	4.93	5.15	5.63
<i>Xylocopavalga</i>	12.30	14.90	13.30	14.20	13.67	4.86	4.31	4.55	4.33	4.51
<i>Lassioglossummarginatum</i>	19.80	19.60	20.10	22.30	20.45	3.05	3.11	3.02	2.71	2.97
<i>Eristalisarbustorum</i>	54.70	45.80	53.80	51.90	51.55	1.10	1.39	1.11	1.21	1.20
C.D.(p<0.05)	2.09	8.10	1.81	4.08		1.11	1.04	1.01	0.89	

*Mean of ten replications

ing to the body of major insect pollinators viz., *Apis cerana*, *Apis mellifera*, *Xylocopa vulga*, *Lassioglossum marginatum* and *Eristalis arbustorum* was computed (Table 2). *A. cerana* carried highest number of loose pollen grains (4.0 lac), followed by *A. mellifera* (3.0 lac), *X. vulga* (2.2 lac), *L. marginatum* (1.2 lac) and *E. arbustorum* (0.2 lac). Hanh *et al.* (2014) found that *Apis* sp. entrapped maximum number of pollen grains (113690) under ecological conditions of Hissar (Haryana). The variation in the number of loose pollen grains in our findings could be due to different pollen species, climatic conditions and different agro ecological zone. Bora *et al.* (2020) found average loose pollen grains adhered to the body to the body of *Eristalinus* as 1333.2 ± 50.48 on bloom of mustard. The variation in the value in the present study could be because of difference in floral resource and type of crop.

Table 2. Number of loose pollen grains of major insect pollinators of cucumber (*Cucumis sativus* L.)

Pollinator species	Number of loose pollen grains (lakh)
<i>Apis cerana</i>	4.0
<i>Apis mellifera</i>	3.0
<i>Xylocopa vulga</i>	2.2
<i>Lassioglossum marginatum</i>	1.2
<i>Eristalis arbustorum</i>	0.2

Conclusion

Cucumber being highly cross pollinated is capable of attracting diverse insect pollinators for its pollination. *Apis cerana* have highest foraging rate and less foraging speed on cucumber bloom which means it spends less time per visit on the flowers of cucumber but visits more number of flowers per unit time and adheres highest number of loose pollen grains on their body, making it an efficient pollinator of cucumber among all other major pollinators.

Conflict of Interest

None

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