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Foraging behaviour of pollinators of turnip (*Brassica rapa*) in Kashmir Himalayas

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Abstract

The turnip (*Brassica rapa*) Family: *Brassicaceae* (mustard family), is widely used in Kashmir as vegetable. In Kashmir, it is a popular vegetable both among rich and poor and grown in almost all kitchen gardens and also as a commercial crop around cities and towns. Farmers always need quality seed for sowing, hence it was felt to study the insect pollinators of turnip which are responsible for proper pollination of the crop. The experiment was carried out at Urban Technological Park, Habbak, Division of Vegetable Science, SKUAST-K and the study was made on crop raised during Rabi season of 2017-2018. It was found 14 species of insects pollinators/visitors were recorded from turnip bloom, The 5 species belonged to Hymenoptera, 7 to Diptera, 2 to Lepidoptera. Hymenoptera was the most abundant order constituting 87.57% of total pollinators. Among the total pollinators, *Lassioglossum marginatum* was the most predominant constituting 35.46% of the total pollinators followed by *A. cerana* constituting 26.03%, *A. mellifera* which constitutes 16.45% and other pollinators contributing only 22.06%. The abundance of insect pollinators was the maximum at 10:00 to 11:00 hr, followed by 12:00 to 13:00 hr and was least at 14:00 to 15:00 hr recording 115.5, 73.3 and 1.6 total population of pollinators at the respective timings.

Keywords: Foraging, pollinators, turnip, Kashmir and Himalayas

Introduction

More than 90 percent of approximately 25000 flowering plant species depend on animals for their sexual reproduction^[3] including 75% of major crop species of fruits, vegetables, oil seed, nuts etc.^[4]. Insects especially the bees are the crucial pollinators responsible for the sustainability of any ecosystem as they contribute 35% to overall food volume besides providing important nutrients for human survival^[4]. Brassica flowers are hermaphrodite and are borne in racemes. These flowers open during the early hours of daylight and few hours later, the anthers dehisce exposing their pollen but the stigma is receptive for about five days prior to anthesis and up to four days after anthesis and during this time period cross pollination is obligatory^[5]. It is a temperate season crop. Its small and tender varieties are grown for human consumption while large varieties are grown as feed for livestock. The area under turnip crop in Kashmir valley is nearly 1400 ha with an annual production of 35,146 metric tonnes and the productivity is 25.10 mt/ha^[1]. It is traditional vegetable is under cultivation since ancient times. In Kashmir, turnip is grown in almost all kitchen gardens and also as a commercial crop. Apart from valley, turnip crop is also grown in some parts of Jammu and Himachal Pradesh. The present study was planned to identify the most effective native pollinators of turnip on the basis of their foraging behaviors i.e. diurnal dynamic pattern, abundance, visitation frequencies, stay time on flowers, nectar robbing, stigma contact events, thrust for nectar and/or pollen and number of pollen grains deposited in a single floral visit.

Material and methods

The study was made on turnip crop raised during 2017-18. The crops were sown during the first week of September and were transplanted in the experimental fields during first week of November. The experimental fields were well prepared and all the recommended packages were adopted to raise a good crop. The experimental plot was kept free from any spray during flowering period. Five spots of 1 meter square area were selected randomly for observation. Observations were made for different groups of pollinators visiting the turnip field during peak flowering at 10:00 to 11:00 hr., 12:00 to 13:00 hr. and 14:00 to 15:00 hr. for two minutes in

each of the selected spots. Unidentified pollinators were collected by using standard insect collecting hand net and were identified. The collected data was later subjected to statistical analysis to infer the pollinator fauna as well as the dominance/relative abundance of particular group. Relative abundance of dominant species of pollinator was worked out by using the following formula given by ^[6] after pooling all the data.

$$\text{Relative abundance of particular species} = \frac{\text{Number of species particular visiting flower}}{\text{Total no. of pollinators visited}} \times 100$$

Results and Discussion

The total number of insect pollinators/visitors species recorded on Turnip bloom was 14, out of which 5 belonged to

Hymenoptera and constituted 87.57% of total pollinators, 7 to Diptera contributing 10.68% of total pollinators and 2 to Lepidoptera which contributed only 1.75% of total pollinators. Among all the pollinators, Hymenopterans were the most abundant (Table:1). *Lasioglossum marginatum* was the most dominant pollinator constituting 35.46% followed by *Apis cerana* which constituted 26.03%, *Apis mellifera* constituting 16.45%, *Andrena cineraria* having 7.66%, *Xylocopavalga* constituting 2.71%, *Eristalis tenax* recording 2.39%, *Eoseristalis cerealis* recording 2.55%, *Eristalo desparia* recording 1.05%, *Sphaerophoria bengalensis* recording 1.75%, *Metasyrphus bacculatus* recording 0.47%, *Scathophaga spp.* recording 1.75%, *Callophora spp.* recording 0.47%, *Vanessa cordui* constituting 0.79% and *Pieris brassicae* recording 0.47%.

Table 1: Insect pollinators/visitors identified on Turnip crop in Kashmir

S. No.	Name of Pollinator/visitor	Systematic position	Relative abundance of pollinators (%)	Relative abundance of insect orders (%)
1	<i>Lasioglossum marginatum</i>	Halictidae: Hymenoptera	35.46%	87.57%
2	<i>Apis cerana</i>	Apidae: Hymenoptera	26.03%	
3	<i>Apis mellifera</i>	Apidae: Hymenoptera	16.45%	
4	<i>Andrena cineraria</i>	Andrenidae: Hymenoptera	7.66%	
5	<i>Xylocopa valga</i>	Apidae: Hymenoptera	2.71%	
6	<i>Eristalis tenax</i>	Syrphidae: Diptera	2.39%	10.68%
7	<i>Eoseristalis cerealis</i>	Syrphidae: Diptera	2.55%	
8	<i>Eristalo desparia</i>	Syrphidae: Diptera	1.05%	
9	<i>Sphaerophoria bengalensis</i>	Syrphidae: Diptera	1.75%	
10	<i>Metasyrphus bacculatus.</i>	Syrphidae: Diptera	0.47%	
11	<i>Scathophaga spp.</i>	Scathophagidae: Diptera	1.75%	
12	<i>Callophora sp.</i>	Callophoridae: Diptera	0.47%	1.75%
13	<i>Vanessa cordui</i>	Nymphalidae: Lepidoptera	0.79%	
14	<i>Pieris brassicae</i>	Pieridae: Lepidoptera	0.47%	

The data on various insect visitors on Turnip flowers at different day hours revealed that a total of 14 insect pollinators belonging to 3 orders and 8 families were recorded during the period of study (Table 2). The study indicated that the population of insect visitors was highest in the morning time from 10:00 to 11:00 hr (115.1 pollinators/sq.mt/2 min.) followed by 12:00 to 13:00 hr (73.3 pollinators/sq.mt/2 min.) and lowest population was recorded from 14:00 to 15:00 hr (1.6 pollinators/sq.mt/2 min.). Also the table indicates that *Lasioglossum marginatum* was the most abundant visitor during the day with an average value of 22.2 pollinators/sq.mt/2 min. followed by *Apis cerana* and *Apis mellifera* with 16.3 and 10.3 pollinators/sq.mt/2 min respectively and *Andrena cineraria* recording an average

value of 4.8 pollinators/sq.mt/2 min . The least values were recorded in *Metasyrphus bacculatus*, *Callophora spp* and *Pieris brassicae* all recording an average value of 0.3pollinators/sq.mt/2 min. The mean insect pollinators (No.of bees/sq.mt/2 min) over different day hours on Turnip flowers varied from 0.11 (14:00 to 15:00hr) to 8.22 (10:00 to 11:00hr). Thakur *et al.* (2000) reported that the most frequent visitor of turnip was *Eristalis tenax*, followed by *Episyrphus balteatus* and *A. cerana* and *E. tenax* also spent less time per flower and was rated as the most efficient pollinator of the crop in Himachal Pradesh. The studies shows that Turnip bloom attracts various insect pollinators and the list has been documented first time in Kashmir valley.

Table 2: Abundance of Insect pollinators/visitors at different hours per day

Population of insect visitors/sq.mt/2 minutes					
S. No.	Insect visitor	10:00 to 11:00hr	12:00 to 13:00hr	14:00 to 15:00hr	Average
1.	<i>Lasioglossum marginatum</i>	38.0	28.5	0.2	22.2
2.	<i>Apis cerana</i>	29.0	20.0	0.0	16.3
3.	<i>Apis mellifera</i>	20.0	11.0	0.1	10.3
4.	<i>Andrena cineraria</i>	8.5	5.5	0.5	4.8
5.	<i>Xylocopa valga</i>	3.4	2.4	0.1	1.7
6.	<i>Eristalis tenax</i>	2.4	1.9	0.4	1.5
7.	<i>Eoseristalis cerealis</i>	2.5	2.0	0.3	1.6
8.	<i>Eristalo desparia</i>	1.8	0.0	0.0	0.6
9.	<i>Sphaerophoria bengalensis</i>	2.5	1.0	0.0	1.1
10.	<i>Metasyrphus bacculatus.</i>	1.0	0.0	0.0	0.3
11.	<i>Scathophaga spp.</i>	2.5	1.0	0.0	1.1
12.	<i>Callophora sp.</i>	1.0	0.0	0.0	0.3
13.	<i>Vanessa cordui</i>	1.5	0.0	0.0	0.5
14.	<i>Pieris brassicae</i>	1.0	0.0	0.0	0.3
	Total	115.1	73.3	1.6	62.6
	Mean	8.22	5.23	0.11	4.47



Fig 1: *Apis cerana* and *Eristalis tenax* on turnip bloom

Conclusion

It was found from the studies pollinators play very vital role in pollination of turnip crop as it is hermaphrodite and dependent on visitors for pollen transfer for good seed set. It was revealed that 14 insect pollinators were recorded from the bloom of turnip during 2017-18

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