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Diversity and abundance of insect pollinators of *Brassica juncea*

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ABSTRACT

Brassica juncea is an annual plant. The flowers have yellow petal. *Brassica is* an excellent research crop to study patterns of variation in pollinator behavior because it is mostly pollinated by insects and has a rapid life cycle, does not self-pollinate and require insects for cross pollination. Study was conducted in Bahona college campus located in Jorhat district of Assam from October 2018 to February 2019 during flowering period. Observations of pollinator insects were carried out using scan sampling. 21 species of pollinating insects belonging to 4 orders were found during the study period. Three species of hymenopteran insects showed a high abundance i.e. *A. cerana*, *A. dorsata* and *Trigona sp.* Additionally, ten species of Lepidoptera and three species of Diptera and one species of coleoptera visited mustard flowers. Species richness of pollinator insects increased from 8.00 h to 11.00 h.

Keywords: Diversity, pollinators, insects, flowering plants.

INTRODUCTION

Brassica juncea is an annual plant. The flowers have four yellow petals, which are twice as long as the sepals. Each stem has around four flowers at the top, forming a ring around the stem. Pollination is entmophilous. Pollination is a basic ecological process, essential for the maintenance of viability and diversity of the ecosystem (Potts *et al.,* 2006, Klein *et al.,* 2007). Among the various pollinating agents, insects played a major role. Insect pollinators are providers of vital ecosystem services in pollinating even wild plants also along with cultivated crops (Klein *et al.,* 2007). Bees are considered as the best pollinating agents due to their suitable body size, hairiness, thoroughness, steadfastness, floral constancy and manageable populations. The *Brassica* crops may be benefited from cross pollination and insects may play an important role in this process. *Brassica* is an excellent research crop to study patterns of variation in pollinator behaviour because it is mostly pollinated by insects and has a rapid life cycle, does not self-pollinate and require insects for cross pollination (Stewart, 2002).

MATERIAL AND METHODS

Study site:
Study was conducted in Bahona college campus located in Jorhat district of Assam from October 2018 to February 2019 during flowering period. Jorhat City is located at 26.75°N 94.22°E. It has an average elevation of 116 metres (381 feet).

Observation of flower visiting insects:
Around One hundred plants of mustard were planted in agricultural landscape for studied the pollinator diversity. Observations of pollinator insects were carried out using scan sampling (Martin and Bateson, 1993) for 20 min. per hour, starting from 7.00 h until 15.00 h on sunny days to measure abundance and species composition of floral visitors. Observations of flower-visiting insects were conducted from the start of flowering until the flower faded.

Collection:
Samples of insect visitors were caught by sweep net. Several types of nets are available with standard sizes being either 30.5cm (12in) or 38cm (15in) diameter. Aerial nets were used mainly to capture flying insects. Beating nets were used to sweep through vegetation. Direct searching can be used for hymenopteran insects like ants, wasps and bees etc.

Identification:
Species identification was done in the laboratory with the help of various books and literatures.

Pollinator effectiveness:
To measure the pollinator effectiveness some plants of mustard were caged by insect screen of which pollinators had no access to flowers, others were exposed to pollinators.

Data Analysis:
Relative abundance of insect pests was calculated using the following formula:

$$\text{Relative abundance (\%)} = \frac{\text{Total no. of each species}}{\text{Total no. of all species}} \times 100$$

Species diversity: (Shannon & Weiner 1963). The index is expressed as-

$$H = -\sum_{i=1}^{ST} Pi \ln Pi$$

Where, Pi = the proportion of individuals in the ith species and
ST= the total species

$$[\ Pi = \frac{ni}{N}\ ;$$

ni = the number of individuals observed for each species and

N = the total number of individuals in each study area].

RESULTS AND DISCUSSION

Diversity of Pollinating insects:
21 species of pollinating insects belonging to 4 orders were found during the study period. Three species of hymenopteran insects showed a high abundance i.e. *A. cerana*, *A. dorsata* and *Trigona sp.* Additionally, ten species of Lepidoptera and three species of Diptera and one species of coleopteran visited mustard flowers.

Species richness:
Species richness of pollinator insects increased from 8.00 h to 11.00 h. Flowering was lasted for about a month.

Seed set:
Diversity of pollinator insects affected to reproductive success of mustard. The number of pods, seeds per pod, and seed weight per plant was higher in non-netted plant than those in netted
Plants.

Bees are the primary pollen vector because the pollen is heavy and sticky and is not carried great distances by wind. Cross-pollination of nearby plants can also result from physical contact of the flowering racemes. Present study revealed the importance of pollinator insects to help plant pollination. The investigation showed that mustard flowers were highly attractive to a wide variety of insects. Among all the insect visitors Hymenopterans especially honey bees were the dominant flower visitors. Honeybees alone are considered as significant pollinators on *Brassica* crop, however a number of other insects also visit on this crop during flowering period as reported by various workers from different parts of the country.

Table 1: Number of individuals, Relative abundance and species diversity of insects visiting *Brassica juncea*.

Order	Species	Number of individuals	Relative abundance(%)	Species diversity
Hymenoptera	*Apis cerana*	600	19.43	.315
Hymenoptera	*Apis dorsata*	564	18.26	.307
Hymenoptera	*Trigona sp.*	507	16.41	.288
Hymenoptera	*Xylocopa confusa*	404	13.08	.265
Hymenoptera	*Xylocopa caerulea*	400	12.95	.254
Lepidoptera	*Eurema hecabe*	100	3.23	.105
Lepidoptera	*Pieris canidia*	50	1.61	.046
Lepidoptera	*Danaus plexippus*	55	1.78	.069
Lepidoptera	*Neptis hylas*	46	1.48	.059
Lepidoptera	*Moduza procris*	40	1.29	.053
Lepidoptera	*Papilio polytes*	51	1.65	.066
Lepidoptera	*Papilio helenus*	45	1.45	.059
Lepidoptera	*Zizina otis*	26	0.84	.038
Lepidoptera	*Danaus chryssipus*	24	0.77	.034
Lepidoptera	*Junonia almana*	43	1.39	.056
Lepidoptera	*Junonia lemonias*	24	0.77	.034
Diptera	*Eupeodes corollae*	13	0.42	.022
Diptera	*Syrphus sp*	11	0.35	.017
Diptera	*Musca domestica*	65	2.10	.081
Coleoptera	*Coccinella magnifica*	11	0.35	.017
Coleoptera	*Coccinella septempunctata*	9	0.29	.012

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