



doi: <https://doi.org/10.20546/ijcrar.2022.1008.006>

## Study on the Insect Pollinators Associated with Mustard Crop Cultivated in Chakberia Town of South 24 Parganas District, West Bengal, India

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### Abstract

In the present survey, the diversity and the abundance of insect pollinators associated with mustard crop from Chakberia town, conducted during November 2021- February 2022. Chakberia is an agriculture based town within the jurisdiction of the Sonarpur CD block in the Baruipur subdivision of the South 24 Parganas district in West Bengal. A total of 400 pollinators from 3 orders, 6 families were recorded. The study shows that Hymenoptera was most diverse insect pollinators on mustard followed by Diptera and Lepidoptera. *Apis cerena* (62.5%) was the most abundant insect species followed by *Eupeodes corollae*(14%), *Melanitis leda*(6.25%), *Tabanus maculicornis* (5.75%), *Apis dorsata* (4.5%), *Danaus* sp.(3.25%), *Eurema hecabe*(2.5%), *Tirumala limniace* (0.75%) and *Papilo polytes* (0.5%). The present survey also shows that the foraging activity of hoverflies and bees were maximum in the morning and afternoon, whereas butterflies showed maximum activity during the afternoon.

### Article Info

Received: 06 July 2022

Accepted: 28 July 2022

Available Online: 20 August 2022

### Keywords

Pollinator Insects, mustard crop, Diversity, Chakberia town, South 24-Parganas.

### Introduction

The process of transfer pollen from anther to stigma either of the same or different flower is pollination. Pollination is regarded as an imperative service to our ecosystem which supports the yielding of many edible crops (Schulp *et al.*, 2014). From previous studies, it has been reported that pollinators support the production of 35% food at global level comprising of highly, moderately and slightly pollinator dependent crops (Klein *et al.*, 2006). Approximately 75% of crops all over the world rely upon pollination by animals out of which majority is composed of insect pollinators (Choi *et al.*, 2015). Insect pollinators profit the worldwide crop, yielding. They facilitate the reproduction in 90% of the world's flowering plants. Insect perform 80% of total

pollination activity and bees contribute nearly 80% of the total insect pollination, thus are considered as the better pollinator (Robinson & Morse, 1989). The insects those contribute in pollination process falls under three orders i.e. Lepidoptera, Hymenoptera and Diptera (Jadhav *et al.*, 2011).

Among the Hymenopterans, Honey bees are the preeminent insect pollinators succeeded by wasps and flies (Bashir *et al.*, 2018). They are responsible for major crops, especially in the seeded species and it's not bees that are doing all the several others are pollinated by wasps, flies, beetles, moths and other insects.

Flowering plants and honey bees show mutual relationship, they obtain nectar and pollen from plants

and honey bees in turn carry out pollination and communication in the plant species. Honey bees help farmers by increasing crop yield both qualitatively and quantitatively through pollination (Sharmah *et al.*, 2015). Destruction and fragmentation of habitats adversely affect the diversity and abundances of solitary wild bees and bumble bees.

Many studies were conducted to managed and wild bees for their compelling pollination services but the consideration of non bee species for pollinating crops have been less explored. Earlier studies showed that Lepidopterans, Dipterans, Formicidae and Coleopterans provided invaluable service of pollination by pollinating 25-50% of the total visited flowers during their foraging activity (Rader *et al.*, 2016). Cluster of flowers entice more pollinators and supports pollen out-crossing by butterflies with minimal movements (Das *et al.*, 2018).

Diptera are one of the most diverse animal groups in the world. Insects from different familie various s of Diptera visit around 555 flowering plant species (Larson *et al.*, 2001) and act as pollinator of more than 100 cultivated plants including mango, cashew, tea, cacao, onions, strawberries (Larson & Kevan ; Heath, 1982), cauliflower, mustard, carrots, apples (Mitra and Banerjee, 2007), leek (Clement *et al.*, 2007) and cassava (Hansen, 1983).

Diptera are thus one of the most important groups of pollinating organisms, second only to the Hymenoptera. There are other important insect pollinators are also present which visit flowers regularly for pollen and nectar collection and in turn help in pollination of crop. Thus the current study has been undertaken to find out the diversity of insect pollinators visiting mustard crop (*Brassica rapa* L.).

*Brassica rapa* is an important crop in Asia (Rubatzkky and Yamaguchi 2000). Rape seed and mustard are the third most important edible oilseed crops of the world after soybean and oil palm, mostly pollinated by insects. Flowers of *B. rapa* are formed in the stem elongates after the leaf stop growing.

The stem has many branches, small leaves and bright yellow flower. Wind is not a good pollinator in *Brassica* spp. and bees play an important role in pollen vectors. Selfing in the absence of cross pollination generally reduces seed yield seed size and yield in subsequent generation (Delaplane & Mayer 2000). The present study reports for the first time on diversity and abundance of

the different pollinator insects associated with mustard plant cultivated in Chakberia town of South 24 Parganas, West Bengal for the first.

## Materials and Methods

### Study area and Site of collection

The present study was carried out at Chakberia census town located in South 24 Parganas district of West Bengal, India. The study area is situated between the North latitude 22°25'23" N and at the longitude 88°30'19" E. It has an average elevation of 9 meters (30ft). It is enriched with enormous agricultural fields where cultivation of different types of crops are grown here throughout the year. The major crops that are cultivated here include Paddy, Mustard, Sesame seeds, and different kinds of vegetables round the year.

### Survey method

The observations on diversity and abundance of different insect species were recorded on mustard crops. At least 1-2 hours of survey was done, 2 days in a week for a period of 4 months of almost 30.33 square meters of area. The study conducted during the November, 2021-February, 2022.

### Collection and Identification

Insect pollinators were searched intensively in the mustard crop fields. Insects were collected with a handpicked method and net using method for flying insects. Collected species were killed by killing jar and the species were also preserved in 70% alcohol and in dry envelopes. The insects were identified on the spot and the unidentified species were brought to the college laboratory for identification.

### Statistical Analysis of Data

Identified species of insects observed in the study area were analysed by using the relative abundance was calculated by using the following formula (Das and Jha 2019):

$$\text{Relative abundance (\%)} = \frac{\text{Population of a particular species visiting flowers}}{\text{Total population of all species visiting flowers}} \times 100$$

## Results and Discussion

Species of pollinators in the study area The insect pollinators observed in the study area is presented in Table 1. The results showed that a total of 400 individuals and 9 species of pollinators belong to 6 families of 3 orders recorded to act as insect pollinators in the study area.

The most diverse order of insect pollinators found to be Lepidoptera (5 species), followed by Hymenoptera (2 species) and Diptera (2 species) [Fig 1]. The detailed chart of insect pollinators according to family level [Fig 2] showed that among the Lepidopterans 3 species belongs to family Nymphalidae, and family Pieridae and Papilionidae got single insect species.

Among the Hymenopterans, 2 species are belongs to family Apidae and the order Dipterans, one species belongs to family Syrphidae and another one species belongs to family Tabanidae. Diversity of the species of pollinators in the study area. Relative abundance of insect pollinators on mustard. The perusal of data [Table 2] indicated the 9 identified species from 3 orders: Hymenoptera, Diptera and Lepidoptera including respectively, 2, 2 and 5 species has been recorded on mustard *Apis cerena* (62.5%) was the most abundant insect in mustard crop respectively *Eupeodes corolla* (14%), *Melanitis leda* (6.25%), *Tabanus maculicornis* (5.75%) and *Apis dorsata* (4.5%) was the second most abundant insect pollinators in mustard. *Danaus* sp. (3.25%), *Eurema hecabe* (2.5%) was the moderate abundant.

And *Tirumala limniace* (0.75 %) and *Papilio polytes* (0.5%) was the least abundant species in mustard. In order Hymenoptera *Apis cerena* (62.5%) was most abundant honey bee species in mustard followed by *Apis dorsata* (4.5%) during onset respectively. In order Diptera *Eupeodes corollae* (14%) was most abundant hoverfly species followed by *Tabanus maculicornis* (5.75%) during onset respectively.

Various studies have been carried out to find out the diversity and abundance of insect species in mustard crops. Roy *et al.*, (2014) found that the Hymenoptera was most abundant in the field followed by Coleoptera and Lepidoptera and similarly, Nishant and Negi (2021) recorded Hymenoptera was most diverse insect pollinator. However the diversity and activity of Coleoptera was least whereas Diptera and Lepidoptera were second and third most abundant order. In our

experiment also, in mustard crop, Hymenoptera was most diverse insect pollinator and Lepidoptera was least whereas Diptera was second most abundant order (Table 3).

In this study area, *Apis cerena* (62.5%), *Eupeodes corollae* (14%) were most abundant species on mustard crops. *Tabanus maculicornis* (5.75%), *Melanitis leda* (6.25%), *Danaus* sp. (3.25%), and *Eurema hecabe* (2.5%) were moderately abundant species on mustard crops, while *Tirumala limniace* (0.75%) and *Papilio polytes* (0.5%) were least abundant species on mustard crops.

Previous studies, showed that Hymenoptera was more diverse and Lepidoptera was less diverse (Siregar *et al.*, 2016). Similarly in our study Honey bees and Hoverflies were more active during morning and afternoon, butterflies were less diverse and showed less activity.

The most prominent pollinating insects were found to be *Apis cerena* (250 individuals), followed by *Eupeodes corollae* (56 individuals), *Melanitis leda* (25 individuals), *Tabanus maculicornis* (23 individuals), *Apis dorsata* (18 individuals), *Danaus* sp. (13 individuals), *Eurema hecabe* (10 individuals), *Tirumala limniace* (3 individuals) and *Papilio polytes* (2 individuals) [Table 3]. The study clearly indicated that Hymenopterans were the most diverse insect pollinators in field of Chakberia area of south 24 Parganas, supporting pollination of crops in the region. Honey bees are the excellent indicators of the environmental quality as their intensive foraging behaviour allows them to sense presence of food within 3 kilometres from their hives (Das *et al.*, 2018). In the present study individuals of *Apis dorsata* actively took part in the task of pollination.

They have got special values in crop pollination as they can be managed according to flowering duration and crops need. Dipteran species were the most abundant and second most diverse pollinators supporting pollination of crops in the region and *Tabanus maculicornis* also actively took part in the task of pollination.

And the diversity of the Lepidopterans was less but they were also capable to crop pollinators. The foraging activity of hoverflies and bees were maximum in the morning and afternoon, whereas butterflies showed maximum activity during afternoon session supporting the earlier study of Siregar *et al.*, (2016) and Das *et al.*, (2018).

**Table.1** List of insect pollinators along with the Scientific name, Order & Family on Mustard crops of South 24 Parganas, West Bengal.

S. No.	Order	Family	Common name	Scientific name	Individual number of species
1.	Hymenoptera	Apidae	Honey bee	<i>Apis cerena</i> Fabricius, 1793	250
2.			Giant honey bees	<i>Apis dorsata</i> Fabricius, 1793	18
3.	Diptera	Syrphidae	Hover fly	<i>Eupeodes corollae</i> (Fabricius, 1794)	56
4.		Tabanidae	Narrow winged horsefly	<i>Tabanus maculicornis</i> Egger, 1859	23
5.	Lepidoptera	Pieridae	Common Grass yellow butterfly	<i>Eurema hecabe</i> (Linnaeus, 1758)	10
6.		Nymphallidae	Tiger milkweed butterfly	<i>Danaus</i> sp.	13
7.			Evening brown butterfly	<i>Melanitis leda</i> (Linnaeus, 1758)	25
8.			Blue tiger	<i>Tirumala limniace</i> (Cramer, [1775])	3
9.		Papilionidae	Common mormon	<i>Papilio polytes</i> Linnaeus, 1758	2
Total					400

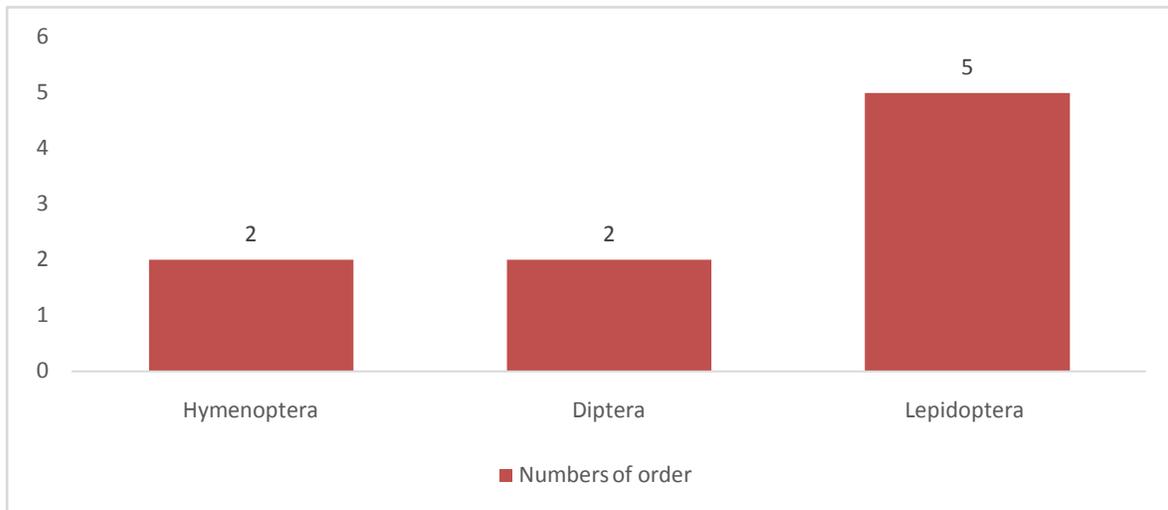
**Table.2** List of insect pollinators Order, Family along with calculation of relative abundance based on number of individuals species and percentage of total species that were observed

Order	Family	Name of species	No.of individuals specimens observed	Percent abundance of individuals
Hymenoptera	Apidae	<i>Apis cerena</i> Fabricius, 1793	250	62.5
		<i>Apis dorsata</i> Fabricius, 1793	18	4.5
Diptera	Syrphidae	<i>Eupeodes corollae</i> (Fabricius, 1794)	56	14
	Tabanidae	<i>Tabanus maculicornis</i> Egger, 1859	23	5.75
Lepidoptera	Pieridae	<i>Eurema hecabe</i> (Linnaeus, 1758)	10	2.5
	Nymphallidae	<i>Danaussp</i>	13	3.25
		<i>Melanitis leda</i> (Linnaeus, 1758)	25	6.25
		<i>Tirumala limniace</i> (Cramer, [1775])	3	0.75
	Papilionidae	<i>Papilio polytes</i> Linnaeus, 1758	2	0.5
<b>Total</b>			400	

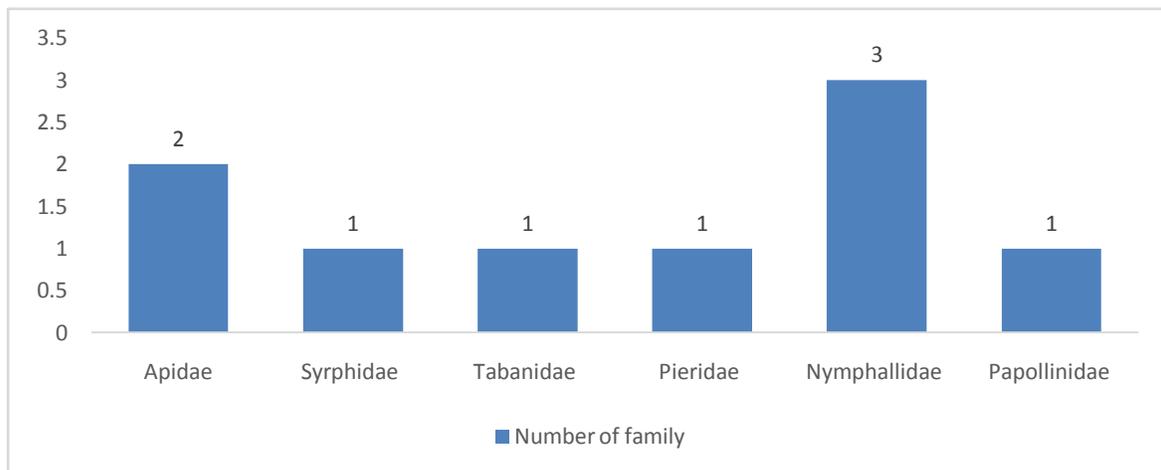
**Table.3** Dominant insect pollinators recorded from the observations made in agricultural fields of Chakberia, West Bengal.

Species (Common name)	Order	Total records
<i>Apis cerena</i> ( Honey bee)	Hymenoptera	250
<i>Eupeodes corollae</i> ( Hover fly)	Diptera	56
<i>Melanitis leda</i> (Evening brown butterfly)	Lepidoptera	25
<i>Tabanus maculicornis</i> (Narrow winged horsefly)	Diptera	23
<i>Apis dorsata</i> (Giant honeybee)	Hymenoptera	18
<i>Danaussp</i> (Tiger milkweed butterfly)	Lepidoptera	13
<i>Eurema hecabe</i> (Common grass yellow butterfly)	Lepidoptera	10
<i>Tirumala limniace</i> (Blue tiger)	Lepidoptera	3
<i>Papilio polytes</i> (Common mormon)	Lepidoptera	2

**Fig.1** Distribution of total number of insect pollinator species in each order



**Fig.2** Distribution of Insect pollinators orders in Family level.



### Acknowledgement

The authors record deep sense of gratitude to Dr. Nirmal Debnath, In-charge of Entomology Laboratory, Department of Zoology and, Head of the Department, Post-graduate Department of Zoology, Vidyasagar College, Kolkata, for providing the laboratory facilities.

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**How to cite this article:**

Rubina Khatun and Sagata Mondal. 2022. Study on the Insect Pollinators Associated with Mustard Crop Cultivated in Chakberia Town of South 24 Parganas District, West Bengal, India. *Int.J.Curr.Res.Aca.Rev.* 10(08), 93-99. doi: <https://doi.org/10.20546/ijcrar.2022.1008.003>