

# Documentation of Insects as Flower Visitors in Selected Domesticated and Wild Plants in Lower Gangetic Plain of West Bengal

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## Abstract

The pollination of plants is greatly affected by a variety of insects, which are flower visitors. They indirectly determine the survival and reproduction of plant populations. Bees, butterflies, moths, and flies are among the most common insects that regularly visit and feed on flowers. Plant pollination is essential to both native and domesticated plants. However, they are now under threat for a number of reasons. These include the indiscriminate use of pesticides, habitat fragmentation, and increased cultivation practices. The proposed research seeks to come up with an elaborate dataset on the diversity of common flower visiting insects between the domesticated and wild vegetation in North 24 Parganas, West Bengal, India. To observe flower visiting insects, three domesticated plants which included *Solanum melongena*, *Brassica nigra* and *Cucumis sativus* and one wild plant, *Ziziphus mauritiana* were taken in this study. In the *Solanum melongena*, *Brassica nigra*, *Cucumis sativus* and *Ziziphus mauritiana*, 7, 5, 3 and 13 species of insects were detected in the flowers accordingly. These insects are under the orders Lepidoptera, Coleoptera, Hymenoptera, and Diptera. This information will become an invaluable asset in the future and will contribute to the conservation of local flora and fauna.

**Keywords:** Flower, Visitor, Insect, Pollination, Plant, Diversity.

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## INTRODUCTION

The flower visiting insects are extraordinary organisms that significantly contribute to the biology of the flowering plants. These insects are also referred to as pollinators and they interact in complex ways with flowers in search of nectar or pollen. They move between flowers and indirectly carry pollen between anthers and stigma and fertilisation takes place. This is essential in production of seed which finally defines the survival and reproduction of plant populations (Kearns et al.,1998). Losey and Vaughan (2006) argued that flower visiting insects are very important in crop production around the world due to the pollination services they offer. Some of the most common insects that visit the flowers include bees, butterflies, moths and flies. The existence of herbaceous flowering plants and flower visiting insects belongs to order Diptera, Coleoptera, Lepidoptera, Hymenoptera in urban and rural green environment have been documented by Matteson et al. (2013). All these species possess their distinctive features that allow them to interact with flowers differently. Over the past few years, pollination, particularly by insects in crop plants, has become a subject of increasing importance (Klein et al.,2007). Fruits, vegetables, spices, plantation crops, pulses, and oil seeds are some of the significant crops that require pollinating agents. The global economic contribution of crop pollination is estimated to be approximately EUR 153 billion per year (Gallai et al.,2009). Klein et al. (2007) believe that 35 percent of the world's food production is dependent on animal pollinators. Further, the pollinator- dependent crops have been increasing by more than 300-fold over the past half-century (Aizen et al.,2008; Aizen & Harder,2009). The interaction between the plants and pollinators, which is vital to both wild and domesticated plants, is currently threatened by a number of reasons (Biesmeijer et al.,2006). These are the indiscriminate application of pesticides (Kremen et al.,2002), habitat fragmentation (Mustijarvi et al.,2001; Aguilar et al.,2006) and the increased cultivation activities (Tscharrntke et al.,2005; Ricketts et al.,2004). There is also an anticipated additional concern about climate change affecting pollination services (Memmott et al., 2007; Schweiger et al., 2010; Hegland et al., 2009). Even though climate change has been studied to have some effects on the interaction between the plants and the pollinators, the core of the issue is that there is yet little empirical research that has been conducted to connect the impact of climate change and the interaction between the plants and the pollinators (Visser & Both, 2005). Additionally, no studies have been conducted on pollination of crops concerning climate change. Consequently, these life-supporting animals and their habitats should be preserved and safeguarded to ensure the ability to maintain the health and well-being of our ecosystems. The natural habitats are being affected by the rapid growth of the human settlements as a result of land-use and urbanization. This is putting pressure on the ecosystem services provided by wild pollinators. At the same time, agricultural production requires the continued increase in the need of pollination

to sustain food production. The connection between plants and insects should be known in order to make our environment healthy and sustainable. In particular, the awareness of the pollinators in a certain region plays a vital role in the existence of the flora in that region. Based on this, my research seeks to establish a holistic data set concerning the diversity of common flower visiting insects on both the domesticated and wild plants at Gangulia, North 24 Parganas, West Bengal, India. Such information will become a source of valuable information in future research and will help to preserve the local flora and fauna.

## MATERIALS AND METHODS

The present study was carried out in Gangulia, North 24 Parganas, West Bengal. It is situated between 22.8°N and 88.6°E. This region has an average rainfall of 1579 mm/year, maximum average temperature of 30.6°C, and the lowest average temperature of 18°C. Three domesticated plants *Solanum melongena*, *Brassica nigra*, *Cucumis sativus* and one wild plant *Zizyphus mauritiana* were observed respectively to record the incidence of insects visiting the flowers of these plants. The field observation was conducted between August 2021 and January 2022 separated by one week as an observation period which includes phenological characteristics of flower bud development, flower anthesis, flowering completion, and flowering. The number of insects arriving at the blossom at every observation was noted. A number of insect species were also caught during the study period, anaesthetised using chloroform, and sent back to the laboratory for further examination. Field visits were made on a regular basis every fortnight to survey and collect insects. Some of the meteorological parameters such as rainfall and temperature also had to be recorded during the period of this study. Both handpicking and sweep netting method were used to collect insects at random locations within the study sites. Insects were then caught in a container containing 70% alcohol in order to identify them. It was identified with the assistance of literature, books, and museum specimens.

## RESULTS AND DISCUSSION

Visiting plant	Order	Family	Common Name	Scientific Name
<i>Solanum melongena</i>	Diptera	Tabanidae	Deer fly	<i>Chrysops</i> sp.
		Sarcophagidae	Flesh fly	<i>Sarcophaga</i> sp.
	Lepidoptera	Nymphalidae	Ruddy dagger wing	<i>Ariadne</i> sp.
		Pieridae	Grass Yellow	<i>Eumera hecabe</i>
	Hymenoptera	Apidae	Giant Honeybee	<i>Apis dorsata</i>
		Vesoidae	Yellow Paper Wasp	<i>Ropalidia</i> sp.
Potter wasp	<i>Rynchium brunneum</i>			
<i>Brassica nigra</i>	Diptera	Sarcophagidae	Flesh fly	<i>Sarcophaga</i> sp.
		Chironomidae	Non - biting midge	<i>Chironomus</i> sp.
		Calliphoridae	Green bottle fly	<i>Lucilia sericata</i>
		Syrphidae	Marmalade hoverfly	<i>Episyrphus balteatus</i>
	Coleoptera	Chrysomelidae	Flea beetle	<i>Phyllotreta</i> sp.
Lepidoptera	Eribidae	Handmaiden moth	<i>Syntomoides imaon</i>	
<i>Cucumis sativus</i>	Hymenoptera	Apidae	Western honey bee	<i>Apis mellifera</i>
			Leafcutter bee	<i>Megachile brevis</i>
			Giant honeybee	<i>Apis dorsata</i>
<i>Zizyphus mauritiana</i>	Hymenoptera	Vespidae	Common tiger wasp	<i>Vespa affinis</i>
			Yellow paper wasp	<i>Ropalidia</i> sp.
			Potter wasp	<i>Eumeninae</i> sp.
		Apidae	Giant honeybee	<i>Apis dorsata</i>
	Diptera	Calliphoridae	Green bottle fly	<i>Lucilia sericata</i>
		Sarcophagidae	Flesh fly	<i>Sarcophaga</i> sp.
		Syrphidae	Hoverfly	<i>Eristalinus</i> sp.
		Dolichopodidae	Long-legged fly	<i>Condyllostylus</i> sp.
Lepidoptera	Hesperiidae	Paranas Swift	<i>Parnara</i> sp.	
		Pied Flat	<i>Pseudocoladenia</i> sp.	

		Lycaenidae	Line Blue	<i>Prosotas nora</i>
		Nymphalidae	Gray pancy	<i>Junonia atlities</i>
			Blue moon butterfly	<i>Hapolimnas bolina</i>

Table 1. Flower visiting insects in *S. melongena*, *B. nigra*, *C. sativus* and *Z. mauritiana*.

Brinjal or eggplant (*Solanum melongena*) is an important crop which is cultivated in the sub-tropical and tropical areas. Brinjal is an Arabic and Sanskrit name and is widespread in the Indian subcontinent. The name of the eggplant, however, is based on the form of the fruit of certain varieties, which is white and resembles chicken eggs. The flowers of brinjal are single or in groups of two or more, and they are violet in colour. Brinjal is primarily self-pollinated, though it can be cross-pollinated with a cross-pollination rate of up to 48%. This is the reason why it falls under cross-pollinated crops. The fact that the anthers form a cone shape, which enables the process of self-pollination, though because the stigma eventually protrudes even more than the anthers, cross-pollination is also possible. Natural rate of cross pollination can be adjusted depending on genotype, place, and activity of insect. According to reports, the level of outcrossing is 3-7 percent in China and 0-8.2 percent in the Asian Vegetable Research Development Centre (Chen & Li, 2000). Nonetheless, the researchers in India have reported outcrossing rates of 2-48 between the brinjal varieties in India (Kumar & Singh, 2013). The survey period was 20 days and a total of seven species of insects were observed on *Solanum melongena* (Table.1). There are three species of Hymenoptera; they are *Apis dorsata*, *Ropalidia sp.*, and *Rynchiium brunneum* among the seven species. There are two species of Lepidoptera: *Eumera hecabe* and *Ariadne sp.*, two species of Diptera: *Chrysops sp.* and *Sarcophaga sp.* *Solanum melongena* is a cultivated plant which is absolutely reliant on the pollination. However, the incidence of insects on the flowers is lower with the extent of pesticide utilisation. *Apis dorsata* has a significant role in pollination among seven insects observed on *Solanum melongena*. They make multiple visits on *Solanum melongena* compared to other insects. *Rynchiium brunneum* is highly functional since it preys on harmful insects of *Solanum melongena*. *Brassica nigra* is a growing plant that they harvest to harvest the seeds of the plant and they are normally consumed as a spice. The flower-blooming period of *Brassica nigra* is the summer. The survey periods were 7 days of study of a total of five species of insects on *Brassica nigra* (Table.1). One of them is of Lepidoptera, *Syntomoides imaon*. Diptera has three species namely, *Episyrphus balteatus*, *Lucilia sericata* and *Sarcophaga sp.* and one species *Phyllotreta sp.* is of Coleoptera. Production of *Brassica nigra* fully requires the process of pollination. *Brassica nigra* is mostly pollinated by *Syntomoides sp.*, *Episyrphus sp.* and *Chironomus sp.* It was noted that they frequented during study time, and were more abundant than other pollinator on *Brassica nigra*. *Cucumis sativus*, cucumber plant is a creeping vine plant belonging to the family Cucurbitaceae. It has long and green fruit, tapered ends, and great leaves and fine yellow flowers. The three insect species were examined in the blossom of *Cucumis sativus* over 15 days of observations in the high flowering seasons (Table.1). They are *Apis dorsata*, *Apis melifera* and *Megachile brevis*. They have significant roles in pollination and the cucumber production relies completely on pollination by this pollinator. It was noted that pollination is largely done by *Apis sp.* *Ziziphus mauritiana* is a spiny evergreen shrub which is wild and uncultivated. The flowers of this plant are greenish yellow, which are approximately 5mm in diameter. During the observation period, thirteen insect species were seen to visit the blossoms of *Z. mauritiana* (Table.1). These insects comprise four species of flies, three species of wasps, five species of butterflies and one species of bee. Therefore, the insect population was mainly made up of flies and wasps. *Eristalinus sp.*, *Lucilia sericata*, *Sarcophaga sp.*, *Condylostylus sp.*, *Vespa affinis*, *Ropalidia sp.*, *Eumeninae sp.*, *Junonia atlities*, *Hapolimnas bolina*, *Parnara sp.*, *Pseudocoladenia sp.*, *Prosotas nora*, and *Apis dorsata* were the insects that were identified. These insects are regarded as good pollinators of this plant. The green bottle fly *Lucila cericata* is also a dung visitor and the other three representatives of the order Diptera that are *Sarcophaga sp.*, *Chondylostylus sp.* and *Eristalinus sp.* are also pollinated by it. The order Hymenoptera which includes three out of four species, including *Apis dorsata* and *Ropalidia sp.*, are important pollinators. The common tiger wasp *Vespa affinis* is unclear in its role as a pollinator due to the fact that it is a predator of other insects. Nevertheless, it can act as a pollinator since the adults feed on nectar, which is the most common activity among the four Lepidoptera species.

## CONCLUSION

In conclusion, flower-visiting insects play an important role in plant pollination, which ultimately influences the survival and reproduction of plant populations. These insects are also vital for pollination services of crops worldwide. However, their greatest threats are habitat loss, pesticide use, and climate change. Therefore, it is necessary to conserve and protect these essential organisms and their natural habitats to sustain the health and

biodiversity of our ecosystems. The research conducted in the study area is valuable for understanding differences among common flower-visiting insects on some domesticated and wild plants. This information will help preserve local flora and fauna and will be useful for future studies.

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