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ABUNDANCE, DIVERSITY AND FORAGING BEHAVIOR OF THE FLOWER-VISITING INSECTS OF MANGO IN GAZIPUR, BANGLADESH

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ABSTRACT

To investigate the abundance, diversity, and diurnal dynamics of insect visitors associated with mango flowers, the present study was conducted in a mango orchard of Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh from June 2020 to August 2021. The observed insect visitors represented 13 families of four taxonomic orders: Hymenoptera, Diptera, Lepidoptera, and Coleoptera. Hymenoptera showed the highest abundance (47.2%), with ants being the most abundant species (21.2±3.5/30 sweeps), followed by honeybees (11.2±0.9/30 sweeps). Furthermore, Hymenopteran insects showed the highest diversity (H'= 2.85), richness (D^{mg}= 0.56), and dominance (D_{BP}=0.27) among the four orders. *Epilachna* beetles had the highest foraging speed (27.8±2.4 s/flower), followed by blister beetles (27.1±1.9 s/flower). Blow flies showed the lowest foraging speed (16.5±1.3 s/flower) but the highest visitation frequency (13.7±0.9 flowers/min). The abundance of ants, honeybees, and blowflies showed significant positive correlations with visitation frequency (0.905, 0.972, and 0.926, respectively) but a significant negative correlation with foraging speed (−0.968, −0.933, and −0.931, respectively). The diurnal pattern of insect visitors showed that the highest foraging activities occurred in the first part of the day (7.00 to 11.00 h) and then declined, with the lowest activity at 15.00 h.

Keywords: Abundance, diversity, *Mangifera indica*, richness, visitation

ABSTRAK

Untuk mengkaji kelimpahan, kepelbagaian dan dinamik harian serangga pelawat yang dikaitkan dengan bunga mangga, kajian ini dijalankan di kebun mangga Universiti Pertanian Sheikh Mujibur Rahman Bangabandhu, Gazipur, Bangladesh dari Jun 2020 hingga Ogos 2021. Serangga pelawat yang diperhatikan mewakili 13 famili daripada empat order: Hymenoptera, Diptera, Lepidoptera dan Coleoptera. Hymenoptera menunjukkan kelimpahan tertinggi

(47.2%), dengan semut merupakan spesies yang paling banyak (21.2±3.5/30 sapuan), diikuti oleh lebah madu (11.2±0.9/30 sapuan). Tambahan pula, Hymenoptera menunjukkan kepelbagaian tertinggi (H'= 2.85), kekayaan (D^{mg} = 0.56) dan dominasi (D_{BP} = 0.27) antara empat order. Kumbang *Epilachna* mempunyai kelajuan mencari makan tertinggi (27.8±2.4 s/bunga), diikuti oleh Kumbang Lepuh (27.1±1.9 s/bunga). Langau menunjukkan kelajuan mencari makan yang paling rendah (16.5±1.3 s/bunga) tetapi kekerapan lawatan tertinggi (13.7±0.9 bunga/min). Kelimpahan semut, lebah madu dan lalat menunjukkan korelasi positif yang signifikan dengan kekerapan lawatan (0.905, 0.972, dan 0.926, masing-masing) tetapi korelasi negatif yang signifikan dengan kelajuan mencari makanan (-0.968, -0.933, dan -0.931, masing-masing). Corak harian serangga pelawat menunjukkan aktiviti mencari makan paling tinggi berlaku pada waktu pagi (7.00 hingga 11.00 h) dan kemudian menurun, dengan aktiviti terendah pada jam 15.00.

Kata kunci: Kelimpahan, kepelbagaian, *Mangifera indica,* kekayaan, lawatan

INTRODUCTION

Mango (*Mangifera indica* L.) is one of the most popular and economically important fruits and is widely cultivated in tropical and subtropical areas worldwide (Saeed et al. 2016). It is known as the king fruit of Bangladesh because of its high adaptability in subtropical climates, large-scale production, high nutritive value, attractive appearance, marketing facilities, and popularity among growers and consumers (Matin et al. 2008). According to the Bangladesh Bureau of Statistics (BBS 2020), Bangladesh produced approximately 1.2 million metric tons of mangoes in 2019-20. Many insect species play a vital role in pollination and fruit set in many horticultural crops, and better pollination results in more uniform ripening and higher yields (Klein et al. 2007). Although mango panicles have many hermaphrodite flowers, cross-pollination contributes to an increase in mango fruit set. Nectar production by these flowers for the attraction of insects also indicates the entomophilous pollination of mango trees (Jain et al. 2009).

Insects are pollinators of approximately 75% of crop plant species and, interestingly, many flowering plants depend on pollination because of the incapability of self-fertilization to set fertile seeds and maintain genetic diversity (Kumar et al. 2016; Idris et al. 2023; Siti Zulaikha et al. 2024). Among the flower-visiting insects, pollinator insects enhance the seed and fruit production of many plants, such as medicinal, food, and ornamental plants, and thus increase yield by amplifying pollination (Mingjian & Jianguo 2003). The important role of insect pollinators in mango production has been recognized in many mango-producing countries worldwide. To encourage artificial pollination using insects, research has focused on insect pollinators, their abundance, management, foraging, etc. Insect pollinators in mango orchards mostly belong to the orders Hymenoptera, Diptera, Coleoptera, Neuroptera, and Lepidoptera (Amin & Afroz 2021). Various insects of these orders, such as wasps, ants, flies, butterflies, beetles, and bees, visit mango flowers (Bally 2006). Different species of bees, such as honeybees (*Apis cerana* and *A. mellifera*), bumblebees (*Bombus* spp.), stingless bees (*Melipona beecheii*), and sweat bees (*Halictus* spp. and *Lassioglossum* spp.) are well known pollinators of mango (Sung et al. 2006).

Since not all pollinators arrive at the same time in the mango orchard, different hours of the day show a variation in the peak abundance of pollinator insects. Synchronization of insect visitation with the period of flower anthesis and stigma receptivity is a crucial factor in obtaining better results from insect pollination in mango production. Furthermore, flowers intensively visited by pollinators show higher success in pollination than the flowers which are infrequently visited as they rarely get touch at the stigma or anthers. Thus, higher pollinator visitation rates result in a higher percentage of seed set (Bora et al. 2022).

From a biodiversity perspective, it is important to identify the insects associated with different plants. In Bangladesh, very few studies have focused on the insect species that visit mango flowers, including their behaviors. The present study was designed to determine the abundance, diversity indices, visitation frequency, foraging speed, and diurnal dynamics of insect visitors to mango flowers in Gazipur, Bangladesh.

MATERIALS AND METHODS

Study Area

This study was conducted from June 2020 to August 2021 in the mango orchard and laboratory of the Department of Entomology, Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur, Bangladesh. The experimental site was located at 25º25' N and 89º5' E.

Characteristics of the Mango Orchard

This study was conducted in a five-year-old mango orchard. There were 27 mango plants in total in three rows, with a planting distance of 3.0 m between trees and 4.0 m between rows. The average height of the plants was 2.5 meters. There is a natural *Shorea robusta* forest to the east and north of the orchard. A rose garden was located on the south side of the orchard. On the western side of the orchard, different types of vegetables are grown throughout the year.

Insect Collection

To determine the relative abundance and diurnal dynamics of the insect visitors of mango, insects were collected using a sweep net (30.0 cm diameter with a 1.5 mm mesh). Sweeping was performed weekly (for a total of six weeks) at five different hours (07.00, 09.00, 11.00, 13.00, and 15.00 h) of the day during the entire flowering season. Each observation consisted of 30 sweeps encompassing the total foliage of the plant. The abundance of ants on the inflorescence was observed and recorded through visual observation. Ants were collected manually in polybags by gently shaking the inflorescence.

Insect Identification

The collected insects were brought from the experimental field to the BSMRAU Entomology Laboratory for identification and counting. The insects were killed by overnight storage in a freezer (temperature maintained at 4ºC), mounted on points, dried, and morphotyped. Insects were identified up to the species or genus level using Saxon Researcher Stereo Microscope 10x-40x by comparison with museum specimens and images from published book and scientific articles (Akter et al. 2019, 2020; Bashar 2014).

Visitation Frequency and Foraging Speed of the Insect Visitors

Insect visitation frequency rates were estimated to determine the number of flowers probed per unit time by the insect. Visitation frequency is expressed by the visitor activity rate:

$$\mathrm{VAR} = \Sigma \frac{\mathrm{NF}}{\mathrm{Dmin}}$$

where VAR is the visitor activity rate, NF is the number of flowers visited by the visiting insect, and D_{min} is the observation duration (min).

The foraging speed of the insects was observed with the time spent on each flower using a stopwatch. The arrival and departure times of the visiting insects on the flowers were recorded and the foraging speed was calculated. Observations were performed between 10:00 and 11:30 h of the day, and data were recorded 25 times for each insect.

Diversity, Dominance, and Richness of the Mango Visiting Insects

The Shannon-Weaver diversity(H') (Shannon & Weaver 1963), Margalef's richness (D^{mg}) (Margalef l958), and Berger-Parker dominance (D_{BP}) (Berger & Parker 1970) indices were calculated for the observed insect visitors. The indices were computed using the following formulae.

Shannon-Weaver diversity index (H'):

$$H' = -\sum_{i=1}^{S} (Pi)\ (ln\ Pi)$$

where S is the total number of species and *Pi* is the relative abundance of each species.
Margalef's species richness index (D^{mg}) is:

$$D^{mg} = \frac{S-1}{lnN}$$

where S is the total number of species and N is the total number of individuals in the sample.

Berger-Parker dominance index (D^{BP}):

$$D_{BP} = \frac{N_{max}}{N}$$

where N_{max} is the total number of individuals in the most abundant species.
N = the total number of individuals in the sample.

Data Analysis

The formulae for calculating the diversity, dominance, and richness were inserted manually in Microsoft Excel 2010 and then the calculation was done. One-way analysis of variance (ANOVA) followed by Tukey's HSD posthoc test was used to compare the means of insect abundance, diversity, richness, dominance, foraging speed, visitation frequency and diurnal dynamics of the insect visitors. The correlation matrix among insect abundance, visitation frequency, and foraging speed was determined. All analyses were performed using IBM SPSS 20.0.

RESULTS

A total of 17 insect species, representing 13 families and four orders, were recorded visiting mango trees in the orchard during the study period (Table 1). The most speciose order was Hymenoptera, with six species (honeybees, *Apis mellifera* and *A. cerana*; ant, *Camponotus* *rufoglaucus*; wasps, *Polistes olivaceus* and *Vespula tropica*; and sawfly, *Tenthredo mesomela*), followed by Diptera, with five species (blow fly, *Calliphora erythrocephala*; house fly, *Musca domestica*; syrphid fly, *Eristalinus aeneus*; mosquito, *Aedes albopictus*; and horse fly, *Tabanus rubidus*).

Table 1. Taxonomic positions of the captured insect visitors in the mango orchard of Gazipur, Bangladesh from June 2020 to August 2021

Insect Pollinator	**Species**	**No. Of Insects Sampled**
Honeybee	*Apis mellifera* Linnaeus (Hymenoptera: Apidae)	45
	A. cerana Fabricius (Hymenoptera: Apidae)	22
Ant	*Camponotus rufoglaucus* Jerdon (Hymenoptera: Formicidae)	126
Wasp	*Polistes olivaceus De Geer*, (Hymenoptera: Vespidae)	20
	Vespula tropica Smith (Hymenoptera: Vespidae)	12
Sawfly	*Tenthredo mesomela* Gerstäcker, (Hymenoptera: Cimbicidae)	14
Blow fly	*Calliphora erythrocephala* Meigen (Diptera: Calliphoridae)	44
House fly	*Musca domestica* Linnaeus (Diptera: Muscidae)	66
Syrphid fly	*Eristalinus aeneus* Scopoli (Diptera: Syrphidae)	10
Mosquito	*Aedes albopictus* Skuse (Diptera: Culicidae)	10
Horse fly	*Tabanus rubidus* Wiedemann (Diptera: Tabanidae)	30
Sulphur butterfly	*Colias eurytheme* Boisduval (Lepidoptera: Pieridae)	35
Lemon butterfly	*Papilio demoleus* Linnaeus (Lepidoptera: Papilionidae)	26
Swallow tail butterfly	*P. polytis* Linnaeus (Lepidoptera: Papilionidae)	26
Blister beetle	*Hycleus lugen,* Gyllenhaal (Coleoptera: Meloidae)	5
Coccinelid beetle	*Epilachna dodecastigma* Wied (Coleoptera: Coccinellidae)	10
	E. vigintioctopunctata Fabricius (Coleoptera: Coccinellidae)	5

The four taxonomic orders identified based on the percent abundance of insects showed variations ranging from 4.0% to 47.2% (χ^2= 41.5, df = 3, *P<0.01*) (Figure 1). The highest percent abundance of insect visitors was recorded for the order Hymenoptera (47.2%), followed by Diptera (31.6%), Lepidoptera (17.2%), and Coleoptera (4.0%).

Ants represented the most abundant species (21.2±3.5/30 sweeps). Honeybees and house flies showed statistically similar abundance (11.2±0.9 and 11.0±2.9/30 sweeps, respectively) (Figure 2). Together, these three species represented more than 60.0% of the total collected individuals (Figure 3). On the other hand, the lowest weekly abundances were observed for syrphid fly (1.7±0.7/30 sweeps), mosquito (1.7±0.7/30 sweeps), sawfly (2.3±0.7/30 sweeps), and *Epilachna* beetle (2.5±0.4/30 sweeps), which were statistically similar (Figure 2). In the rank abundance curve (Figure 3), X axis shows the total kinds of insects observed and Y axis shows the abundance of each insect. From the curve, it can be inferred that the richness of insect visitors was high in the studied mango orchard, as a total of 14 types of insects were observed visiting the mango trees. On the other hand, the fluctuating pattern of the curve showed that there was a high variation in the abundance of the insects, which explained lower evenness among them.

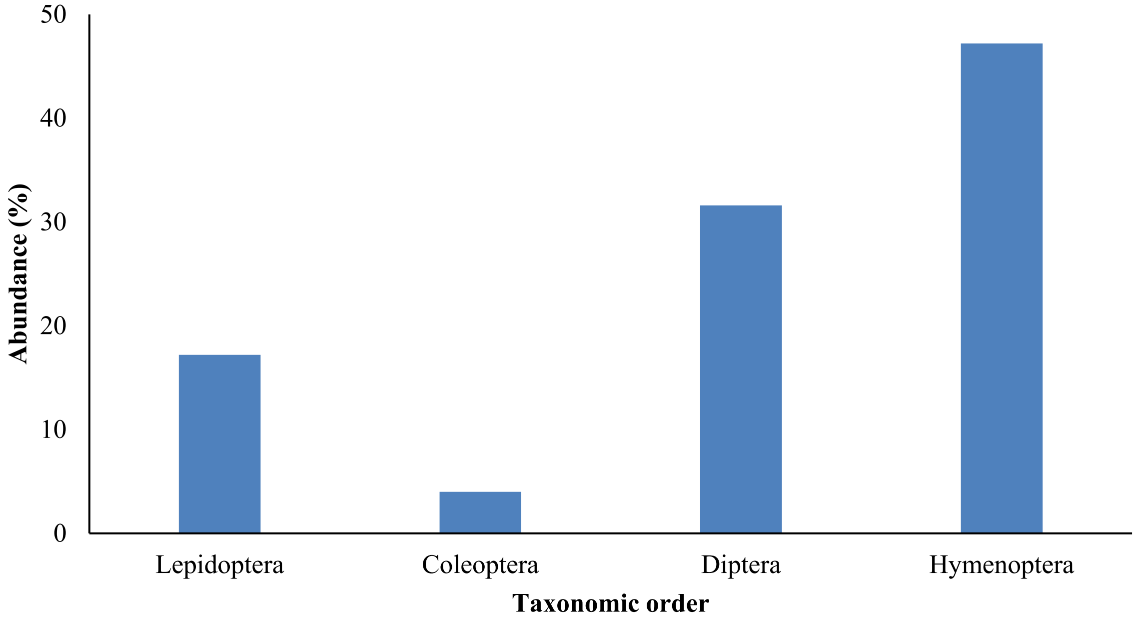

Figure 1. Percent abundance of insect visitors of different taxonomic orders found in the mango orchard of Gazipur, Bangladesh from June 2020 to August 2021

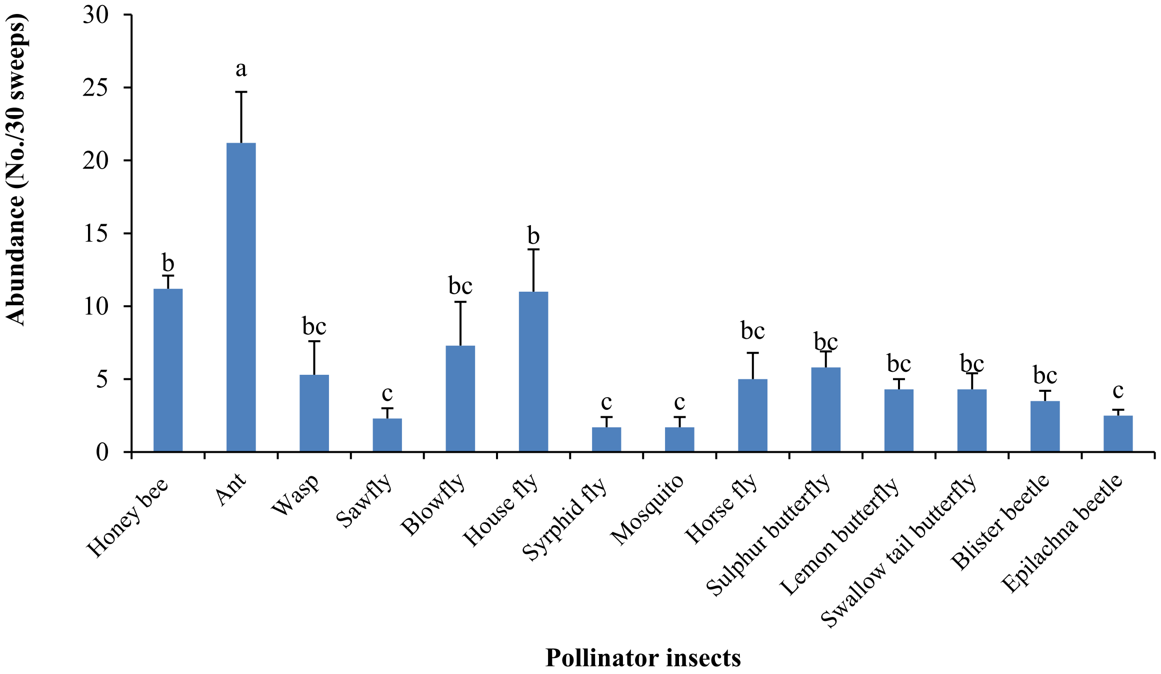

Figure 2. Mean abundance of the insect pollinators associated with the mango orchard of Gazipur, Bangladesh from June 2020 to August 2021

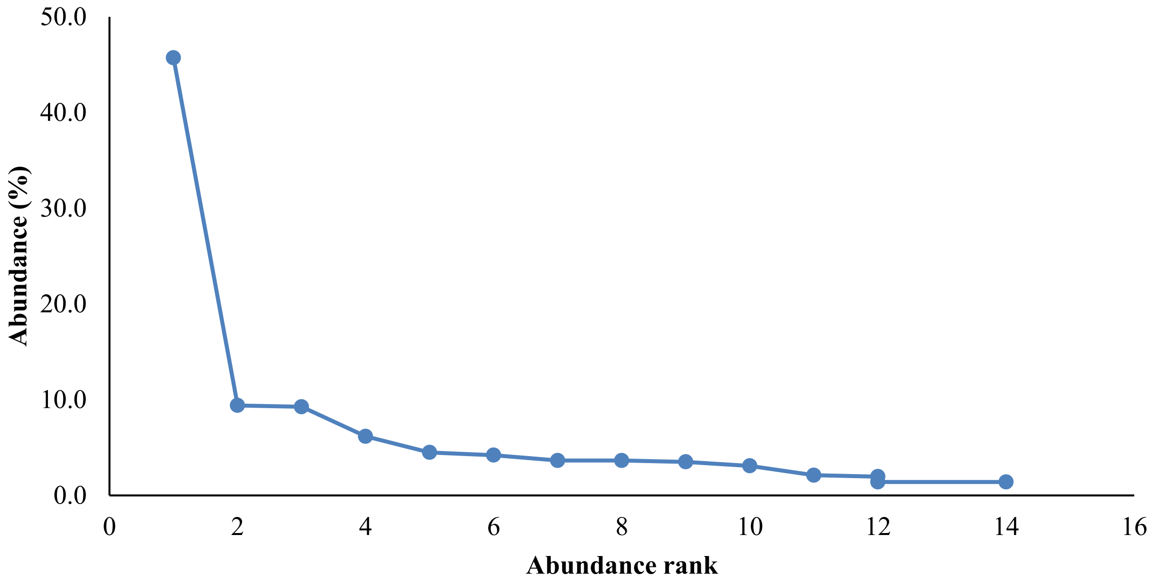

Figure 3. Rank abundance curve of the insect visitors in the mango orchard of Gazipur, Bangladesh from June 2020 to August 2021

Diversity, richness, and dominance of insect pollinators from different orders ranged from 0.10 to 2.85, 0.12 to 0.56, and 0.03 to 0.27, respectively. Hymenopteran visitors showed the highest diversity (2.85), richness (0.56), and dominance (0.27), while Coleopterans showed the lowest diversity (0.10), richness (0.12) and dominance (0.03) among the four orders (Table 2).

Table 2. Diversity indices of different insect visitors associated with the mango orchard in Gazipur, Bangladesh from June 2020 to August 2021

Category	**Diversity (H′)**	**Richness (D^{mg})**	**Dominance (D_{BP})**
Hymenoptera	2.85	0.56	0.27
Diptera	1.88	0.53	0.16
Lepidoptera	1.02	0.42	0.08
Coleoptera	0.10	0.12	0.03

Shannon-Weaver diversity index (H′), Margalef's richness (D^{mg}), and Berger-Parker dominance index (D_{BP}).

In this study, foraging speed varied from 16.5±1.3 to 27.8±2.4 s/flower, and the results differed significantly ($F_{13, 336} = 2.9$, $P<0.001$) (Table 3). *Epilachna* beetles showed the highest foraging speed (27.8±2.4 s/flower), followed by blister beetles (27.1±1.9 s/flower). Blow flies and house flies had the lowest and statistically similar foraging speeds (16.5±1.3 and 16.6±1.3s/flower, respectively), followed by syrphid flies (16.8±2.3 s/flower).

The visitation frequency per minute differed significantly among pollinators ($F_{13, 26}$ = 8.0, $P<0.01$) (Table 3). The highest visitation frequency was recorded for blow flies (13.7±0.9 flowers/min), followed by horseflies, mosquitoes, and syrphid flies (12.0±1.5, 12.0±2.3, and 11.7±0.9 flowers/min). In contrast, the lowest visitation frequencies were recorded for epilachna beetles and ants (3.0 and 3.3 flowers/min, respectively), followed by the sulfur butterfly and blister beetles (5.3±1.2 and 5.3±2.0 flowers/min, respectively).

Table 3. Foraging speed and flower visitation frequency (Mean±SE) of different insect visitors associated with the mango orchard of Gazipur, Bangladesh from June 2020 to August 2021

Insect Pollinator	Foraging Speed (Seconds/Flower)	Flower Visitation Frequency (Per Minute)
Honeybee	21.0±2.2ac	9.3±2.6ac
Ant	25.8±1.9ac	3.3±0.3c
Wasp	21.3±1.9ac	7.3±0.7ac
Sawfly	22.1±3.3ac	9.0±1.7ac
Blow fly	16.5±1.3c	13.7±0.9a
House fly	16.6±1.3c	7.3±1.2ac
Syrphid fly	16.8±2.3bc	11.7±0.9ab
Mosquito	22.8±2.6ac	12.0±2.3ab
Horse fly	19.6±2.3ac	12.0±1.5ab
Sulphur butterfly	24.6±2.3ac	5.3±1.2bc
Lemon butterfly	23.4±2.4ac	8.3±1.8ac
Swallow tail butterfly	24.3±2.1ac	7.3±1.2ac
Blister beetle	27.1±1.9ab	5.3±2.0bc
Epilachna beetle	27.8±2.4a	3.0±0.6c

Means within a column followed by the same letter(s) are not significantly different according to Tukey's HSD posthoc test at the 5% significance level.

The correlation matrix showed the relationships between pollinator insect abundance, visitation frequency, and foraging speed (Table 4). The abundance of honeybees and ants showed a significant positive correlation with visitation frequency (0.972 and 0.905, respectively) but a significant negative correlation with foraging speed (−0.933 and −0.968, respectively). In contrast, visitation frequency and foraging speed of both honeybees and ants were significantly negatively correlated (−0.982 and −0.921, respectively). The abundance of blow flies showed a significant positive correlation with visitation frequency (0.926) but a significant negative correlation with foraging speed (−0.931). Furthermore, the visitation frequency of blow flies had a significant negative correlation with foraging speed (−0.998).
Considering the diurnal dynamics pattern of the studied insect pollinators, most of the observed insect visitors of all four orders had their activity from 7.00 to 11.00 h of the day, with the highest activity recorded at 11.00 (Figure 4). Their activity declined with time, and the lowest activity was observed at 15.00 h.

Table 4. Correlation matrix of the abundance and foraging behavior of flower-visiting insects found in the mango orchard of Gazipur, Bangladesh from June 2020 to August 2021

Insect pollinator	Parameters	Abundance	Visitation frequency
Ant	Visitation frequency	0.905^{*}	
	Foraging speed	-0.968^{*}	-0.921^{*}
Honeybee	Visitation frequency	0.972^{*}	
	Foraging speed	-0.933^{*}	-0.982^{**}
Wasp	Visitation frequency	-0.753^{NS}	
	Foraging speed	-0.758^{NS}	0.223^{NS}
Saw fly	Visitation frequency	-0.289^{NS}	
	Foraging speed	-0.518^{NS}	0.110^{NS}

Blow fly	Visitation frequency	0.926*	
	Foraging speed	−0.931*	−0.998**
House fly	Visitation frequency	0.179NS	
	Foraging speed	−0.778NS	0.453NS
Syrphid fly	Visitation frequency	−0.625NS	
	Foraging speed	−0.905NS	0.286NS
Mosquito	Visitation frequency	−0.289NS	
	Foraging speed	−0.142NS	-0.082NS
Horse fly	Visitation frequency	0.487NS	
	Foraging speed	−0.489NS	0.298NS
Sulphur butterfly	Visitation frequency	0.488NS	
	Foraging speed	−0.404NS	0.077NS
Lemon butterfly	Visitation frequency	0.471NS	
	Foraging speed	−0.146NS	-0.695NS
Swallow tailed butterfly	Visitation frequency	−0.661NS	
	Foraging speed	−0.680NS	0.926NS
Blister Beetle	Visitation frequency	0.675NS	
	Foraging speed	0.854NS	0.920NS
Coccinelid beetle	Visitation frequency	0.632NS	
	Foraging speed	0.919NS	0.810NS

NS = Nonsignificant, * = Significant; ** = highly significant; *P<0.05*.

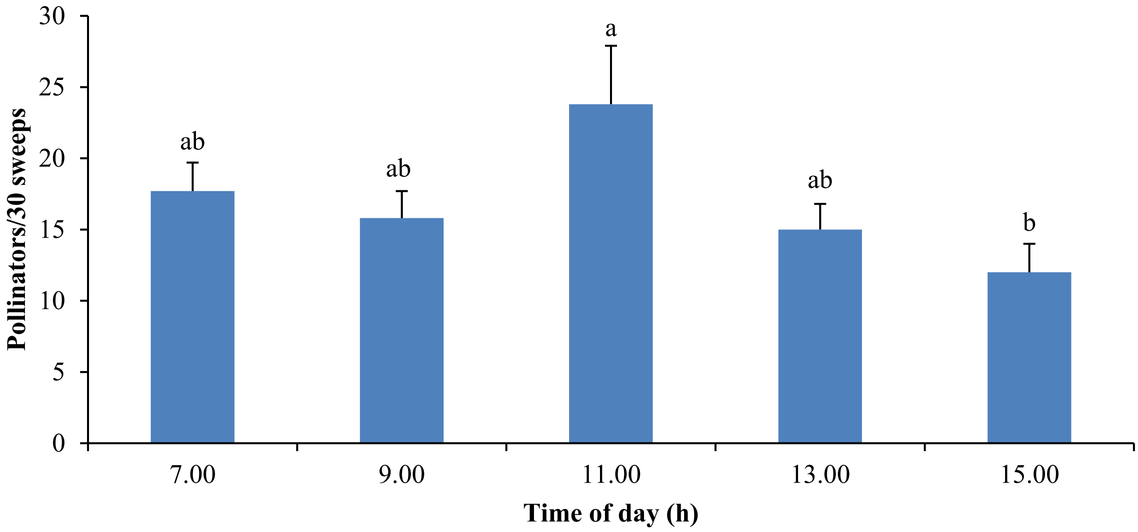

Figure 4. Diurnal dynamics of the insects visiting flowers of the mango orchard at Gazipur, Bangladesh from June 2020 to August 2021

DISCUSSION

The highest abundance of insect visitors was found in the order Hymenoptera, which was also the most speciose order. The present findings are similar with Chauhan et al. (2018), who found that Hymenoptera had the highest abundance (48%) among mango insect pollinators, followed by Hemiptera (23%), Diptera (19%), Coleoptera (5%), and Orthoptera (2%). The results also partially supported the findings of Sung et al. (2006) and Saeed and Masood (2008), who reported Diptera as the most abundant group, representing 42.0% and 87.0% of all the collected insects, respectively.

A total of 17 insect species from 13 families and four orders were recorded in the current study; these values are much lower than those obtained by Sung et al. (2006), who reported 39 species of insect from 23 families and five orders which visited mango orchard. The present study was conducted in a comparatively newer orchard, with short plants having small foliage. This may be the reason for the lower species abundance observed in this study.

In the current study, ants (*C. rufoglaucus)* represented the most abundant species. In another study conducted by Dag and Gazit (2000), *Apis mellifera* was the most prevalent visitor from the Hymenoptera order on mango bloom. The reason for this variation could be the short stature of the plants in the present study, which might have encouraged the arrival and movement of a greater number of ants. In the present study, we observed mosquitoes to visit mango flower blossoms, although lower in number with less frequency. The report of Fang (2010) can be a good reference to support the current findings who found mosquito particularly the males as the accidental pollinator and to pollinate several crops including orchids.

The abundance, visitation frequency, and foraging speed of flower-visiting insects vary depending on their nesting sites, flowering plant species, and geographic locations (Mondal et al. 2018). The current findings suggested that *Epilachna* and blister beetles have longer foraging speeds (27.8±2.4 and 27.1±1.9 s/flower, respectively). In contrast, blow and house flies had shorter foraging speeds (16.5±1.3 and 16.6±1.3 s/flower, respectively). Kumar et al. (2012) reported that flesh flies spent the longest time on flowers (33.1 s/flower visit), while ants spent the shortest time (2.8 s/flower visit). The results indicated that Hymenopterans visited more flowers per minute than dipterans did. However, the current study did not confirm this result. In the current study, Coleopteran insects spent the longest time, while Dipteran pollinators spent the shortest time on mango flowers during their visits. Consequently, the highest visitation frequency was recorded for blow flies (13.7±0.9 flowers/min), followed by horseflies, mosquitoes, and syrphid flies (12.0±1.5, 12.0±2.3, and 11.7±0.9 flowers/min), and the lowest visitation frequency was recorded for epilachna beetles (3.0 flowers/min) and blister beetles (5.3±1.2 flowers/min). These findings are similar with Amin et al. (2015), who observed that house flies and syrphid flies were rapid foragers and had statistically similar visitation frequency. Honeybees, a well-known pollinator, showed moderate visitation frequency (9.3±2.6 flowers/min) with a foraging speed of 21.0±2.2 s/flower. On the other hand, ants, the most abundant species of the current investigation, showed higher foraging speed (25.8±1.9 s/flower) with lower visitation frequency (3.3±0.3 flowers/min). The wingless structure of ants might be the reason for their slow movement from flower to flower. The observed results showed close conformity with the findings of Amin et al. (2020), who reported one Coleopteran species to have the lowest frequency of flower visitation (3.4 flowers/min) while a Hymenopteran species showed the highest flower visitation frequency (8.3 flowers/min) in a mango orchard. Saeed et al. (2012) reported that the visitation frequency of honeybees and wasps was 5.3 and 5.9 flowers/min, respectively.

Diurnal dynamics of the insect pollinators of different orders showed their peak activities in the morning, mostly from 9.00 to 11.00 h. Saeed et al. (2012) studied the pollinators of bitter gourd and reported that the activity of Hymenopteran pollinators was the highest from 10.00 to 11.00 h, became lower after 12.00 h, and was the lowest from 14.00 to 15.00 h. Amin et al. (2015) observed the diurnal pattern of insect pollinators belonging to different orders and reported that the peak foraging activity of pollinators was observed at 11.00 h and declined at mid-day (13.00 h). These findings are consistent with our results. Most flowers remain open in the morning, and the air temperature and light intensity at this time might be favorable for pollinator insects to show more activity during this period.

CONCLUSION

In conclusion, it can be said that the insects of Hymenoptera, especially ant and honey bee were most abundant insects in the investigated orchard to visit mango flowers. On the other hand, blow fly visited the highest number of flowers per minute. Morning time was found to be the most suitable for the studied pollinators to forage. The current findings on the prevalent flower-visiting insects of mango and their foraging behaviors may help in understanding the diversity of insects associated with mango in the corresponding geographical location.

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Conflict of Interest
All authors declare that there is no conflict of interest among them.

Ethics Declarations
Ethics declarations are not applicable for this research.

Data Availability Statement
This manuscript has no associated data.

Authors' Contributions
M.Z. Hasan: Conducting research and writing the draft manuscript; M.R.U. Miah: Reviewing and editing the manuscript, M.M. Islam: Reviewing and editing the manuscript, M. Afroz: Data analysis, reviewing and editing the manuscript, S.J. Suh: Reviewing and editing the manuscript, M.R. Amin: Designing the experiment, research supervision, reviewing and editing the manuscript.

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