



Diversity of bee (Insecta: Hymenoptera: Apoidea) pollinators of Ash gourd [*Benincasa hispida* (Thunb.) Cogn.] in Malappuram district, Kerala

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Abstract

Eleven species of bees under 8 genera were collected from flowers of ash gourd [*Benincasa hispida* (Thunb.) Cogn.] from Malappuram district of Kerala, India. Out of the 8 genera present, 7 belong to family Apidae and the highest number of individuals belong to genus *Tetragonula* Moure. Diversity of bee pollinators of ash gourd in the study area is in a good state.

Keywords: ash gourd, bee pollinators, diversity

Introduction

Ash gourd [*Benincasa hispida* (Thunb.) Cogn.] is a vegetable from the family Cucurbitaceae which have many medicinal properties as well as economic values [1]. This vegetable is grown in tropical and subtropical regions and it contains water, carbohydrate, minerals and vitamins [2]. It has a long storage life and also known by the names wax gourd, white gourd, winter melon, white pumpkin and so on [3]. Ash gourd is monoecious and hence it depends on insects for pollination [4]. Bees which belong to the order Hymenoptera of class Insecta are the important group of insect pollinators. They are efficient pollinators of many crops including Cucurbits [5]. To increase crop yield and to ensure propagation of plants, optimum pollination is required [6]. Many studies have been conducted so far regarding the insect pollinators of cucurbits and their effects in pollination and fruit setting. These studies revealed the importance of insect pollinators in these cross-pollinated crops [7, 8, 9]. The flowers of ash gourd attract many insect pollinators. Hence conservation and management of these pollinators are very crucial. Here we conducted a short-term study to know exclusively about the bee pollinators of ash gourd and their diversity in Malappuram district of Kerala.

Materials and methods

Study area

Study was conducted in Pattarakka (11.267555°N, 76.247175°E), a place in Malappuram district of Kerala, India in the months of October and November 2019 and 2020.

Collection of bees

Bees were collected in between 08.00 am and 03.00 pm, in the 5×5m transect. Observations were made once in each month of study. Bees were collected using sweep nets (10 sweeps/5m). Collected specimens were killed using ethyl acetate and stored in 70% alcohol. Later the specimens were pinned and dried. Identification up to morpho species level was done using published keys.

Statistical analysis

Diversity indices were calculated using PAST

(Paleontological Statistics Software Package) software version 4.03 [10]. Relative abundance of the species was also determined using the formula,

$$\text{Relative abundance of species A} = \frac{\text{Number of individuals of species A}}{\text{Total number individuals collected}} \times 100$$

Results and Discussion

A total of 142 specimens were collected during the study. The collected specimens belong to eleven species under 8 genera. Out of the 8 genera present, 7 belong to family Apidae and only one genus belongs to family Halictidae (genus *Halictus* Latreille). Table 1 provides the month wise data of bees collected from the study area. Highest number of individuals collected from ash gourd flowers belong to genus *Tetragonula* Moure (35 individuals).

Diversity indices were calculated for species level. The number of species was higher in the month of November 2019 (9 species) and lower in other months (8 species). Total number of individuals collected was also higher in November 2019 (37 individuals) and lower in the month of October 2020 (33 individuals). The Shannon-Wiener index and Simpson's index were also higher in the month of November 2019 (1.997 and 0.8459 respectively) and lower in the month of November 2020 (1.916 and 0.8318 respectively). Evenness was higher in October 2019 and lower in November 2019 (0.8927 and 0.8185 respectively). The diversity indices used in this study are given in table 2. Even though the diversity indices show only slight differences across the study period, it indicates that diversity of bee pollinators of ash gourd is in good state in the study area.

Relative abundance of bees collected from ash gourd were determined (Table 3). *Tetragonula* sp. has the highest relative abundance (24.64 per cent) followed by *Apis cerana* Fabricius (17.60 per cent). A study conducted on the relative abundance and foraging activity of hymenopteran pollinators in cucurbits of Kerala revealed *Tetragonula travancorica* Shanas and Faseeh as the dominant pollinator in ash gourd with relative abundance of 33.50 per cent and *Apis cerana indica* Fabricius with second largest relative abundance of 27.41 per cent [7]. Another study examined the role of insect pollination on fruit production of ash gourd revealed *Tetragonula iridipennis* (Smith) as the most

frequent pollinator^[11]. Study on the pollination potential of *Tetragonula iridipennis* (Smith) in ash gourd observed a huge increase in fruit set and quality^[12].

Many studies conducted on other members of Cucurbitaceae family also revealed bees as important pollinators. In Punjab, Pakistan, the insect pollinators of pumpkin consist of 18 species belong to 3 orders and 6 families and bees like *Nomia* sp., *Apis dorsata* Fabricius and *Halictus* sp. were the major pollinators^[8]. A study conducted on bitter gourd recorded *Tetragonula iridipennis* (Smith) as the most abundant pollinator followed by *Apis florea* Fabricius, *Halictus* sp. and *Apis cerana indica* Fabricius^[9]. So, bees play a major role in the pollination of cucurbits along with other insect pollinators. The results of our study also reveal the diversity of bee pollinators of ash gourd from the study site.

Table 1: Month wise data of bees recorded from study area.

Bee species	October 2019	November 2019	October 2020	November 2020
<i>Apis cerana</i>	+	+	+	+
<i>Apis dorsata</i>	+	+	+	+
<i>Apis florea</i>	-	+	+	-
<i>Amegilla</i> sp.	+	+	+	+
<i>Tetragonula</i> sp.	+	+	+	+
<i>Ceratina</i> sp. 1	+	+	+	+
<i>Ceratina</i> sp. 2	+	-	-	+
<i>Xylocopa</i> sp. 1	+	+	+	+
<i>Xylocopa</i> sp. 2	-	-	-	-
<i>Braunsapis</i> sp.	-	+	+	+
<i>Halictus</i> sp.	+	+	-	-

Table 2: Diversity indices for bees collected from ash gourd.

Diversity indices	October 2019	November 2019	October 2020	November 2020
Taxa (S)	8	9	8	8
Individuals	36	37	33	36
Simpson (1-D)	0.8457	0.8459	0.8448	0.8318
Shannon (H)	1.966	1.997	1.947	1.916
Evenness (e ^H /S)	0.8927	0.8185	0.8756	0.8493

Table 3: Relative abundance of bees collected from ash gourd.

Bee species	Relative abundance
<i>Tetragonula</i> sp.	24.64%
<i>Apis cerana</i>	17.60%
<i>Apis dorsata</i>	14.80%
<i>Ceratina</i> sp. 1	14.80%
<i>Xylocopa</i> sp. 1	9.90%
<i>Amegilla</i> sp.	4.92%
<i>Apis florea</i>	4.22%
<i>Ceratina</i> sp. 2	3.52%
<i>Braunsapis</i> sp.	2.11%
<i>Halictus</i> sp.	2.11%
<i>Xylocopa</i> sp. 2	1.40%

Conclusion

Bees along with other insect pollinators play an important role in the pollination of ash gourd. During this study we come across 11 species of bee pollinators of ash gourd, which indicates the richness of bee pollinators for this single crop. Other indices also reveal the high diversity of bee pollinators in this crop. Detailed studies are required to establish the importance of these bee pollinators in successful fruit setting and fruit quality of ash gourd.

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