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## Foraging activity and pollination diversity of insect pollinators on ridge gourd (*Luffa acutangula* L.)

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### Abstract

Field experiments on the foraging activity and pollination diversity of insect pollinators on ridge gourd (*Luffa acutangula* L.) were conducted at University Apiary, Dr. Rajendra Prasad Central Agricultural University Pusa, Samastipur (Bihar) during the *Kharif* season 2019-2020. The foraging activity of insect pollinators visiting the ridge gourd (*Luffa acutangula*) revealed that two orders Hymenoptera and Diptera were identified as the major insect pollinators of ridge gourd. The order Hymenoptera include four species i.e., *Apis mellifera* L., *A. dorsata* F., *A. florea* F., *Xylocopa fenestrata* F., and were found to be most frequent pollinators. Among Dipterans viz., *Eristalinus* sp. from Syrphidae family and *Musca domestica* from family Muscidae were found during crop season. The abundance of different insect visitors species revealed that the mean population of *Apis mellifera* (22.6) was highest followed by *Apis dorsata* (18.04), *Xylocopa fenestrata* (12.12) and the least population of *Apis florea* being 9.32 was recorded among different insect foraging complex on ridge gourd bloom. This might be due to fact that more number of opened flower density were observed during mid-flowering period and lower open flower density during initiation of bloom and near maturity of crop. With the increase in temperature the foraging activity of pollinators increases while the relative humidity suppresses the foraging activity of pollinators.

**Keywords:** Foraging activity, pollinators, relative abundance, ridge gourd

### Introduction

Pollination is most important activity in the ecosystem for the biodiversity of plants on earth. Insects play vital role to maintain the sustainability and continuity of the ecosystem (Ali and Breeze, 2011) [2]. Ridge gourd, *Luffa acutangula* is one of the important vegetable crops cultivated during summer in Bihar and its flowering generally starts from 45-50 days after sowing depending upon the environmental conditions. Ridge gourd being a predominantly monoecious in nature and is essentially a cross pollinated crop (Kalloo and Bergh, 1993) [9]. Due to the presence of diversified insect visitors or pollinators such as honeybees, butterflies, wasps, flies, beetles, moths, ants that carry pollen grains from male to female parts of flowers for reproduction. Without pollination plants are unable to reproduce or produce seeds and fruits are decreased. Pollination also increases the quality and efficiency of crop production. Pollination plays an important role in the reproduction and fruit set of flowering plants (Buchmann and Nabhan, 1996) [4]. Flowers of both the sexes typically open for only a single day, after which, the male and insufficiently pollinated female flowers are dropped. Female flowers are visited more than the male flowers (Nepi and Pacini, 1993) [11]. Pollination by insects (Entomophily) increases the production of many crops. About 75% of the total crops depend on pollination through insects for their reproduction. 87 of the total food crops depend entirely on pollinators hence 35% of the global food production is from the crops which depend on pollinators (Klien, 2007) [10]. *Apis mellifera* is considered as the most contributing towards the crop pollination but the bumble bees are more effective pollinators because of their buzz pollination ability (Oronje *et al*, 2012) [12]. The production of the farm can be increased by the proper management of honey bees, solitary bees and other pollinators (Pateel, 2007) [13]. The carpenter bees (*Xylocopa* spp.) are effective pollinators of cucurbitaceous crops, and largely distributed in tropical and subtropical habitats around the world, and occasionally in temperate areas (Hurd and Moure, 1963) [8]. There are many native bee species in India with varied foraging behaviour in different agroclimatic regions, pollinating these. It is essential to estimate their foraging behaviour and contribution in pollinating.

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Also, due to the narrow blooming period this is important. Keeping in view the importance of Entomophily in the crop production the present investigation was conducted on foraging activity and pollination diversity of insect pollinators on ridge gourd (*Luffa acutangula*) to observe the peak foraging time of insect pollinators.

### Materials and Methods

To study the foraging activity and pollination diversity of insect pollinators on ridge gourd (*Luffa acutangula*) the field experiments were conducted at University Apiary, Dr. Rajendra Prasad Central Agricultural University Pusa, Samastipur (Bihar) during the *Kharif* season of 2019-2020. The crop was grown as per recommended package of practices except insecticidal application. The crop was grown in RBD with three replications and the numbers of insect pollinators visited the ridge gourd flowers were counted in an area of one square meter for 10 minutes visual observation which were randomly marked in the experimental plots. The number of foragers was recorded dated from 15.09.2019 to 13.10.2019 at different time intervals, i.e. 0700, 0900, 1100, 1300 and 1500 and 1700 hours of the day at weekly intervals for 10 minutes. The temperature and relative humidity were also recorded at different times and on different dates simultaneously at the time of observation with the help of thermo-hygrometer. The foraging activity and pollination

diversity of insect pollinators was correlated with temperature and relative humidity to know the influence of weather parameters on insect pollinators.

### Results and Discussion

#### Foraging activity and pollination diversity of insect pollinators on ridge gourd

In order to study the foraging activity and pollination diversity of insect pollinators on ridge gourd (*Luffa acutangula*) experiment was conducted at experimental plots of University Apiary, RPCAU, Pusa. The insect pollinators visiting ridge gourd bloom were recorded in the open plot during flowering period. The ridge gourd (*Luffa acutangula*) came into bloom from 10.09.2019. The observations on insect visitors were recorded from 10% flowering stage to 90% flowering stage. The number of insect visitors were collected and identified from ridge gourd flowers by insect collecting net and identified that are listed in table-1. A total of six insect species belonging to three families were recorded as the pollinator from ridge gourd flowers out of which, four insect species were from Hymenoptera and two were from Diptera. Among the insect species Hymenopterans were found most dominant pollinator viz., *Apis mellifera* L., *Apis dorsata* Fab *Xylocopa fenestrata* Fab and *Apis florea* Fab. Among Dipterans viz., *Eristalinus* sp. from Syrphidae family and *Musca domestica* from family Muscidae were found.

**Table 1:** Insect pollinators visiting on ridge gourd (*Luffa acutangula* L.)

S. No.	Scientific name	Common	Order	Family
1.	<i>Apis mellifera</i> L.	Italian bee	Hymenoptera	Apidae
2.	<i>Apis dorsata</i> Fab.	Rock bee	Hymenoptera	Apidae
3.	<i>Xylocopa fenestrata</i> Fab.	Carpenter bee	Hymenoptera	Apidae
4.	<i>Apis florea</i> Fab.	Little bee	Hymenoptera	Apidae
5.	<i>Eristalinus</i> sp.	Hover fly	Diptera	Syrphidae
6.	<i>Musca domestica</i> L.	House flies	Diptera	Muscidae

#### Relative abundance of different pollinators on ridge gourd bloom

The-evaluate the relative abundance of insect pollinators on ridge gourd bloom the observations were recorded on the insect pollinators visiting ridge gourd bloom. The number of different insect pollinator species visiting ridge gourd flowers were counted in an area of one square meter for 10 minutes

which were randomly marked in the experimental plots. The numbers of foragers were also recorded at 0700, 0900, 1100, 1300, 1500 and 1700 hours of the day at weekly interval on five different dates and time during the flowering period. The average temperature and relative humidity were also recorded at different time on different dates. The details of the recorded data have been presented in Table -2 In the present

**Table 2:** Relative abundance (No. of insect pollinator/m<sup>2</sup>/10 minute) of insect pollinators on Ridge gourd bloom on different dates.

Date of observation	<i>Apis mellifera</i>	<i>Apis dorsata</i>	<i>Apis florea</i>	<i>Xylocopa fenestrata</i>	Mean	Av. Temp.	Av. RH
15.09.2019	26.4	19.0	10.2	14.0	17.4	29.6	84.0
22.09.2019	23.6	16.4	9.0	12.2	15.3	27.8	88.0
29.09.2019	29.0	23.0	12.0	16.4	20.1	30.4	82.0
06.10.2019	20.0	19.0	8.0	12.0	14.75	26.4	76.0
13.10.2019	14.0	12.8	7.4	6.0	10.05	25.2	70.0
Mean	22.6	18.04	9.32	12.12	15.52	-	-

Factors	Sem (±)	CD (P=0.05)	CV (%)
Date	0.69	2.22	9.24
Species	0.75	2.13	
Date × species	0.68	1.17	

In The investigation, differential patterns in visits of insect pollinators on ridge gourd flowers were observed. The population of insect visitors was recorded quiet low at the flowering initiation stage in the beginning of bloom and near the maturity of crop but found high during mid-flowering

period. This might be due to variation in the floral density during the span of blooming on ridge gourd, changes in climatic conditions and availability of floral rewards to the insect pollinators. The abundance of different insect visitors species revealed that the mean population of *Apis mellifera* (22.6) was highest followed by *Apis dorsata* (18.04), *Xylocopa fenestrata* (12.12) and the least population of *Apis florea* being 9.32 was recorded among different insect foraging complex on ridge gourd bloom. This might be due to fact that more number of opened flower density were

observed during mid-flowering period and lower open flower density during initiation of bloom and near maturity of crop. Therefore, the insect pollinator species were getting maximum floral rewards during mid-flowering period showing abundance of insect pollinators. The present findings are in agreement with earlier workers those also found *Apis* spp. as dominant visitor of ridge gourd. With the increase in temperature the foraging activity of pollinators increases while the relative humidity suppresses the foraging activity of pollinators. For all the vegetable crops the peak foraging activity was observed early in the morning from 6-7 am which largely decrease at noon 12-1 pm and in afternoon 5-6 pm due to the hot weather in May-June. Other researchers also found that the peak foraging time of pollinators is in morning during hot weather (Ahmad and Aslam, 2002)<sup>[1]</sup> and (Dobromilska, 1997)<sup>[4]</sup>. Pollinators from the order Hymenoptera are most abundant and diverse in foraging behavior. The most preferred time by the pollinators for foraging in summer is early in the morning from 6-7am. The pollinators which prefer a specific vegetable can be used commercially for the economical pollination and high production of cross-pollinated as well as for the self-pollinated crops. The major insect pollinators of plants are bees, hoverflies, butterflies and moths reported that the total eight insect species visited ridge gourd flowers, viz. five hymenopterans, two dipterans and one from odonata. Among these *Apis mellifera* L., *A. dorsata* F., *A. florea* F., *Xylocopa fenestrata* F. and *Polistes* sp. were found to be most frequent pollinators. The relative abundance (no. of insect/m<sup>2</sup> /10 minutes) revealed that *Apis mellifera* was most dominant species and followed by *Apis dorsata*, *Xylocopa fenestrata*, *Apis florea*, *Eristalinus* sp., *Polistes* sp., *Paragomphus* sp. and *Musca domestica* (Gautam and Kumar, 2018)<sup>[6]</sup>. Pollination by bees increases the production of many crops (Greenleaf and Kremen, 2006)<sup>[7]</sup>. *Apis mellifera* is considered as the most contributing towards the crop pollination but the bumblebees are more effective pollinators because of their buzz pollination ability (Oronje, 2012)<sup>[12]</sup>. The production of the farm can be increased by the proper management of honey bees, solitary bees and other pollinators (Pateel, 2007)<sup>[13]</sup>.

### Conclusion

The foraging activity of insect pollinators visiting the Ridge gourd (*Luffa acutangula*) revealed that two orders Hymenoptera and Diptera were identified as the major insect pollinators of ridge gourd. The order Hymenoptera include four species i.e., *Apis mellifera* L., *A. dorsata* F., *A. florea* F., *Xylocopa fenestrata* F., were found to be most frequent pollinators. Among Dipterans viz., *Eristalinus* sp. from Syrphidae family and *Musca domestica* from family Muscidae were found during crop season. The abundance of different insect visitors species revealed that the mean population of *Apis mellifera* was highest followed by *Apis dorsata*, *Xylocopa fenestrata* and the least population of *Apis florea* being was recorded among different insect foraging complex on ridge gourd bloom. This might be due to fact that more number of opened flower density were observed during mid-flowering period and lower open flower density during initiation of bloom and near maturity of crop.

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