

POLLINATOR DIVERSITY AND RELATIVE ABUNDANCE IN RIDGE GOURD IN MID ALTITUDE OF MEGHALAYA

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ABSTRACT

Pollination plays an important role in the reproduction and fruit set for flowering plant communities. The yields of agricultural crops can be significantly increased through good management practices including effective pollination. Most gourd flowers open at night and usually last only one night. Pollen viability in a newly opened male flower is about 92% but by the time it closes that same morning the viability will be 75% and by the next day it will be only. The present study was carried out in ridge gourd crop at Lowland Agronomy farm, ICAR Research Complex for NEH Region, Umiam, Meghalaya. In our study, a total of 12 species were identified on ridge gourd flowers. Lepidopterans were the major floral visitors comprising of six species viz., *Diaphania indica* Saunders and *Glyphodes bivitalis* Guenee from Crambidae, *Hippotion celerio* L. from Sphingidae, *Delias eucharis* Drury and *Pieris brassicae* L. from Pieridae. It was followed by Dictyopterans viz., *Mantis religiosa* L. and *Blatta orientalis* L., hymenopterans viz., *Oecophylla smaragdina* Fab. (Formicidae), Coleopteran viz., *Aulacophora foenicollis* Lucas and Orthopteran viz., *Hieroglyphus banian*. Relative abundance was higher Lepidoptera (70.47%) followed by Orthoptera (9.52%) and Dictyoptera (8.31%). Hymenoptera (7.85%) and Coleoptera (5.81%). Mean foraging activity in ridge gourd was high for *Diaphania indica* started its foraging activity from 1800 h to 1830 h onwards (2.73 visitors/m²/5 minutes) and its peak activity was also observed at 1900 h (4.21 visitors/m²/5 minutes). After 1900 h its foraging activity slowly declined with 1.95 visitors/m²/5 minutes at 2000 h.

INTRODUCTION

Ridge gourd, *Luffa acutangula* (L.) Roxb, native to old tropics probably India, constitutes an important green vegetable. It is commonly cultivated throughout the tropical region (Herklots, 1972). It is highly cross pollinated crop and mainly depends on various pollinating agents, essentially insects for its pollination. The flowering ratio in ridge gourd is 25 to 30:1. Male flowers are yellow and born in clusters (raceme) and female flowers are born solitary and have tiny slender ovary. Ovary is inferior with a short style. Flowers open normally in late afternoon between 1600 h to 1800 h of the day. The fruits are used as salad or for cooking or for pickling or for soups or curries (Herklots, 1972 and Nem Pal Singh, 2004).

Hence, the pollinators especially bees are the important agents for successful fertilization in cucurbit species. In recent days, the pollinators are disappearing at an alarming rate, which are need to help out by conserving and augmenting the efficient pollinators to enable them to perform the pollination, the most essential ecosystem service.

The conservation and management of insect pollinators is gaining importance day by day for which studies on pollinator's diversity, species richness and abundance are essential. So, to generate information about the pollinators abundance, diversity and their contribution to ridge gourd's

pollination, present investigations have been taken up in ridge gourd at mid altitude of Meghalaya.

MATERIALS AND METHODS

The present study was carried out in bitter gourd crop at Lowland Agronomy farm, ICAR Research Complex for NEH Region, Umiam, Meghalaya. To document the diversity of different insects visiting the flowers of ridge gourd, sweepings were made throughout the blooming period at two days intervals during June to September at hourly intervals from morning 0600 up to night 2000 to collect both diurnal and nocturnal visitors.

Abundance of different insect visitors/pollinators of ridge gourd crop was studied during their blooming period. The total number of different insect visitors visiting the gourd flowers in a square metre area was observed for five minutes at hourly interval, using a hand tally counter and stopwatch following the method given by Free (1993). The data was then documented for further analysis. These observations were started when 50 per cent of the plants came into bloom. The documented data was then subjected to ANOVA analysis.

RESULTS AND DISCUSSION

A field study was conducted at Lowland Agronomy farm, ICAR Research Complex for NEH Region, Umiam, Meghalaya to study the pollinator diversity and abundance

in ridge gourd. Ridge gourd is one of the most important widely grown cucurbitaceous vegetable in North East region. The yield gap from its actual yield potential is increasing in the recent years. Lower pollinator diversity may be one of the causal factors for this increasing yield gap from 10t/ha to 8.5t/ha (*indiastat.com*. 2013). In our study, a total of 12 species were identified on ridge gourd flowers. Two insect species were un-identified and rest ten belonged to eight families of five insect orders. The lepidopterans were the major floral visitors comprising of six species viz., *Diaphania indica* Saunders and *Glyphodes bivitalis* Guenee from Crambidae, *Hippotion celerio* L. from Sphingidae, *Delias eucharis* Drury and *Pieris brassicae* L. from Pieridae. It was followed by Dictyopterans viz., *Mantis religiosa* L. and *Blatta orientalis* L., hymenopterans viz., *Oecophylla smaragdina* Fab. (Formicidae), Coleopteran viz., *Aulacophora foenicollis* Lucas and Orthopteran viz., *Hieroglyphus banian* Fab (Fig. 1).



Fig. 1. *Diaphania indica*, *Glyphodes bivitalis* and Lepidopteran pest in ridge gourd crop

The proportion of different pollinator species on the ridge gourd flowers were accounted at different hours of the night during June – September, 2013. Among all orders, relative abundance lepidoptera was dominant (70.47%) followed by Orthoptera (9.52%) and Dictyoptera (8.31%). Hymenoptera (7.85%) and Coleoptera (5.81%) (Fig. 2). Lepidopteran insects were most dominant in ridge gourd ecosystem compare with other orders of insect (Subhakar et al., 2011 and Jeffrey, 1980). The abundance of diurnal visitors on ridge gourd was less as compared to nocturnal visitors.

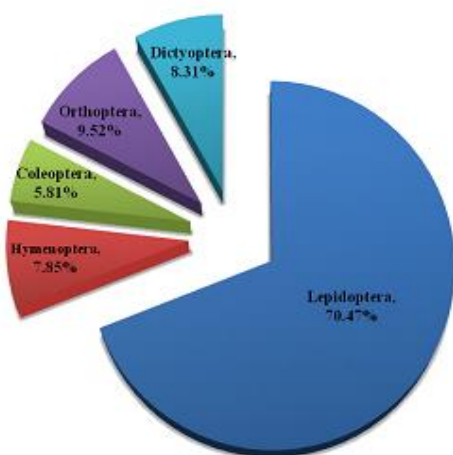


Fig. 2. Relative abundance of different insect pollinators in bitter gourd

Only pierids, *P. brassicae* and *D. eucharis* were diurnal to crepuscular visitors among the total foraging species on

ridge gourd. The total population of *D. indica* constituted 30.14% followed by *H. celerio* 24.51% and unidentified lepidopteran moth 15.62% on ridge gourd flowers at Umiam, indicating high species evenness (Fig. 3). *D. indica* was main pollinator among all other pollinator followed by *H. celerio* in ridge gourd ecosystem in Umiam, Meghalaya.

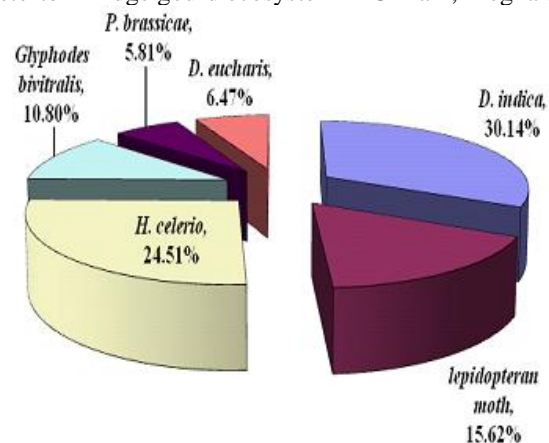


Fig. 3. Relative abundance of different bee species in bitter gourd

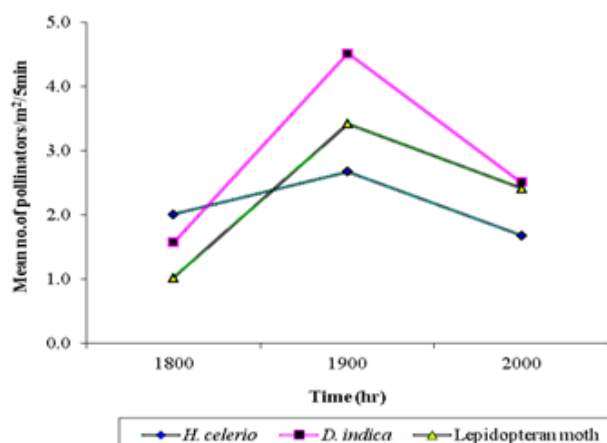


Fig. 4. Foraging activity of major pollinators in ridge gourd

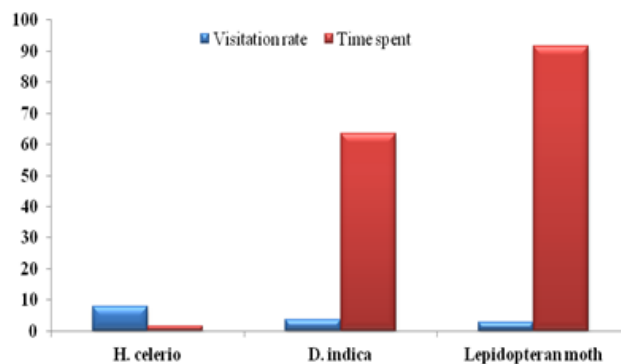


Fig. 5. Foraging behavior of three lepidopteran pollinator on ridge gourd

Ridge gourd flowers are in yellow colour which is mostly preferred by lepidopterans (Selcuk et al., 2010) and lepidopterans, sphingids, pyralids and noctuids activity synchronized with the floral anthesis 1700 h – 1730 h and 1730 h to 1800 h for ridge gourd, respectively and hence, can be considered as efficient pollination time for ridge gourd flowers. In our study, we concluded that pollinators were most efficient in 1900h compare to 1800h and 2000h. Nocturnal visitation is mainly enhanced by floral scent

emitted as a strong floral reward to visitors apart from nectarines (Morimoto et al., 2004) (Fig. 4). In lepidopteran pest spent more time compare to *D. indica* and *H. celerio*. Visitation rate *H. celerio* was high compare to *D. indica* and lepidopteran pest. (Fig. 5). So, unidentified spent more time than *D. indica* and *H. celerio* but visitation was more recorded in *H. celerio* followed *D. indica* and unidentified lepidopteran insect.

Table 1. Foraging activity of major insect visitors in ridge gourd

Time (h)	Mean number of pollinators/m ² /5 min at different hours of the day		
	<i>H. celerio</i>	<i>D. indica</i>	Unidentified Lepidopteran pest
1800	2.14 (1.70) ^a	2.59 (1.43) ^{bc}	1.45 (1.24) ^c
1900	2.73 (1.60)^a	4.21 (1.72)^a	2.81 (1.57)^a
2000	1.57 (1.51) ^b	2.51 (1.24) ^b	1.95 (1.31) ^b
Mean	1.42 (1.75)	1.67 (2.38)	1.29 (1.34)
S.Em±	0.04	0.11	0.06
CD at 5%	0.19	0.45	0.24
CD at 1%	0.17	0.42	0.28

- Each value represents mean of 25 observations at each sampling time
- Figures in parentheses are $\sqrt{x(x+1)}$ transformed values
- Means followed by same letter in a column do not differ significantly by DMRT at 5 per cent level.

Foraging rate of major pollinators in ridge gourd

The data presented in (Table 1) revealed that *H. celerio* started its foraging activity at 1730 h recording 2.14 sphingids/m²/5 minutes at 1800 h and showed an increasing trend from 1800 to 1900 h with maximum activity at 1900 h (2.59 sphingids/m²/5 minutes) after which the foraging activity declined and was minimum at 2000 h (1.45 sphingids/m²/5 minutes). *Diaphania indica* in ridge gourd started its foraging activity from 1800 h to 1830 h onwards (2.73 visitors/m²/5 minutes) and its peak activity was also observed at 1900 h (4.21 visitors/m²/5 minutes). After 1900 h its foraging activity slowly declined with 1.95 visitors/m²/5 minutes at 2000 h (Table no 1). Similarly, unidentified moth started the foraging activity a little later than *H. celerio* and *D. indica* and its peak activity at 1900 h (2.81 visitors/m²/5 minutes) and decreased by 2000 h (1.95 visitors/m²/5 minutes). Most of the insect visitors started their activity by 1800 h - 1830 h and peaked the activity at 1900 h. The activity then declined by 2000 h.

CONCLUSION

Lepidopteran insects were most dominant in ridge gourd ecosystem compare with other orders of insect. The abundance of *D. indica* was high among major pollinators on ridge gourd, but the foraging rate or visitation was maximum for *H. celerio*. Among major pollinators, Lepidopteran moth visited least number of gourd flowers. Most of the insect visitors started their activity by 1800 h - 1830 h and peaked the activity at 1900 h. The activity then declined by 2000 h.

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