

# Insect visitors on Ridged gourd as Recorded from an Agro-Ecosystem Near Bikaner, Rajasthan



**Dheeraj Bhati, Harshwardhan Bhardwaj and Meera Srivastava\***

Laboratory of Entomology, Department of Zoology, Govt Dungar College, India

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**\*Corresponding author:** Meera Srivastava, Laboratory of Entomology, Department of Zoology, Govt Dungar College, Bikaner 334001 Rajasthan, India

## Abstract

During the present study, a survey on insect visitors to flowers of ridged gourd *Luffa acutangula* was carried out in an agro-ecosystem near Bikaner, Rajasthan. In all, 66 insects belonging to 7 orders and 33 families were collected from the crop, of which based on density 6 were dominant, 36 frequent and 24 were rare forms. The maximum density as well as diversity was found in the month of May, while minimum in the month of February.

**Keywords:** Insect floral visitors; Ridged gourd; Agro-ecosystem; Density; Diversity

## Introduction

Amongst pollinators, key role is played by the insects. The interrelationship between plants and insects has influenced flower shape and three biochemical factors in plants viz., scent, flower color, and the nutritional value of nectar. The average yield of crops in India is much below optimum; one of the major reasons for this is inadequate pollination, as has been suggested by [1]. According to [2] about one third of the total human diet comes from bee pollinated crops. A decline in pollinators can cause a decline in crop yields of various plants. It is, therefore, essential to survey and collect insect species on various crop plants during their flowering periods, identify and conserve them, and explore their potentiality as crop pollinators. Ideally, pollination investigations are necessary in each general locality where crop is grown and the present study was therefore planned to observe and document different kinds of insects visiting ridged gourd in an agro-ecosystem near Bikaner, Rajasthan and monitor insect diversity and density associated with this crop.

## Materials and Methods

The agro-ecosystem Vallabh Garden Agriculture Farm, area under study, lies 10 km away from Bikaner, at Gharsisar village. It is a crop field where seasonal crops are grown. It is irrigated by sewage water. One of the major crops cultivated in the agro-ecosystem is ridged gourd. The flowers are solitary, yellow in color, scentless and although both male and female flowers are present on the same plant, cross pollination takes place. The

documentation of insect visitors was carried out in the agro-ecosystem from January to August. For the study, the field area was divided into five stations from where the insect visitors on flowers were collected. Sweep net was used for insect collection. The insect visitors were surveyed and collected every week. The insects were collected, and visits were monitored during forenoon (7 a.m. to 12 noon) and afternoon (12 noon to 5 p.m.). Visit of a particular insect species to a flower was documented and expressed as number of visits/man/h. The insects collected were transferred to killing bottles, killed, and preserved. Large winged insects were put to dry preservation by pinning them in insect boxes, while smaller insects were preserved in 70% alcohol. A count of insects collected was made so as to adjudge the population density and dynamics of specific insects on different crops.

The fauna was sorted out group wise and identifications were made following pertinent literature. Help from the Section of Entomology, Department of Agriculture, Bikaner and Desert Regional Station of the Zoological Survey of India, Jodhpur was also taken for identification and for confirmation. Besides, the reference collection in the Department of Zoology, Dungar College was also consulted.

## Results and Discussion

Ridged gourd (*Luffa acutangula*) was one of the major crops grown in the agro-ecosystem studied belonging to family *Cucurbitaceae*, commonly known as "Toru". The entomo-fauna

collected from this crop has been presented in (Table 1). In all, 66 insects belonging to 7 orders and 33 families were collected from the crop, of which based on density 6 were dominant, 3 frequent and 5 were rare forms. The maximum density as well as diversity was found in the month of May, while minimum in the month of February. Except for *Hymenia* sp. all other lepidopterans were frequently observed which included *E. hecabe*, *A. aorta*, *C. pomona*, *C. vestalis*, *C. fieldii*, *H. recurvalis*, *Tephрина sp.*, *U. pulchella*, *H. peltigera*, *S. exigua* and *A. ipsilon*. None were documented as dominant species. of the ten coleopteran species observed, eight species were observed as frequent (*A. bengalensis*, *O. catta*, *O. bonasus*, *P. nasutus*, *A. ferruginea*, *M. sexmaculatus*, *Cicindella sp.* and *C. pictus*) and two species (unidentified species A and B) as rare forms. Eighteen hymenopteran species were found on this crop of which *X. fenestrata*, *A. cerana* and *A. mellifera* were dominant, fifteen (*Enicospilus sp.*, *Campsomeris sp.*, *Scoliasoror sp.*,

*D. affinis*, *Formica sp.*, *Pepsis sp.*, *P. carolina*, *Prionyx sp.*, *Halictus sp.*, *X. violacea*, *A. dorsata*, *A. florea*, unidentified species A, B and C) were frequent forms. None of the hemipteran documented were dominant, six (*D. cingulatus*, *Clavigrella sp.*, *N. viridula*, *A. janus*, *Oncocephalus sp.* and unidentified species B) were frequent and only one species (*D. koenigii*) was a rare form. No orthopteran was observed as dominant or frequent species. All the nine species viz., species which included *G. assimilis*, *Chrotogonus sp.*, *S. gregaria*, *Ochrilidia sp.*, *O. chinensis*, *Pyrgomorpha sp.*, *Atractomorpha sp.*, *Acrida sp.* and unidentified species A were rarely observed. The two rarely visiting odonates were *A. femina* and *B. geminata*. Eight dipteran species were reckoned on this crop of which, three (*C. quinquefasciatus*, *S. peregrina*, *M. domestica*) were dominant, *D. cucurbitae* was frequently noted while, four (*Stichopogon sp.*, *syrrhid fly*, *C. megacephala*, *C. rufifacies* and) were rare forms.

**Table 1:** Entomo-faunal diversity and density (number/trap\*) on ridged gourd as documented from the agro-ecosystem during the period of study.

|                                   | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Status |
|-----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--------|
| Order:Lepidoptera                 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |        |
| Family:Pieridae                   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |        |
| <i>Eurema hecabe</i> Linn.        | 1   | 1   | 1   | 1   | 7   | 10  | 11  | 1   | -   | -   | -   | -   | 1   | 1   | 1   | 1   | 5   | F      |
| <i>Anaphaeis aurota</i> Fab.      | -   | -   | -   | -   | 12  | 8   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | 6   | F      |
| <i>Catopsila pomona</i> Cramer    | -   | -   | -   | -   | 6   | 11  | 7   | -   | -   | -   | -   | -   | -   | -   | -   | -   | 1   | F      |
| <i>Colotis vestalis</i> Butler    | -   | -   | -   | -   | 5   | 6   | 3   | 1   | -   | -   | -   | -   | -   | -   | -   | -   | 3   | F      |
| <i>Colias fieldii</i> Menetries   | -   | -   | -   | -   | 5   | 7   | 4   | -   | -   | -   | -   | -   | -   | -   | -   | -   | 6   | F      |
| Family:Crambidae                  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |        |
| <i>Hymenia recurvalis</i> Fab.    | -   | -   | -   | 1   | 4   | 9   | 6   | -   | -   | -   | -   | -   | -   | -   | -   | -   | 5   | F      |
| <i>Hymenia</i> sp.                | -   | -   | -   | -   | 1   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | R      |
| Family:Geometridae                |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |        |
| <i>Tephрина sp.</i>               | -   | -   | -   | -   | 4   | 8   | -   | -   | -   | -   | -   | -   | -   | -   | -   | 1   | 3   | F      |
| Family:Arctidae                   |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |        |
| <i>Utethesia pulchella</i> Linn.  | -   | -   | -   | -   | 4   | 3   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | 5   | F      |
| Family:Noctuidae                  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |        |
| <i>Heliothis peltigera</i> Schiff | -   | -   | -   | 1   | 3   | 3   | 2   | -   | -   | -   | -   | -   | 1   | 1   | -   | -   | 2   | F      |
| <i>Spodoptera exigua</i> Hubner   | -   | -   | -   | 2   | 4   | 1   | 1   | -   | -   | -   | -   | -   | -   | -   | -   | 1   | 3   | F      |
| <i>Agrotis ipsilon</i> Hufnagel   | -   | -   | -   | -   | 5   | 2   | -   | -   | -   | -   | -   | -   | -   | -   | -   | 2   | 2   | F      |
| Order:Coleoptera                  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |        |
| Family:Cicindelidae               |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |        |
| <i>Cicindella sp.</i>             | -   | -   | -   | -   | 7   | 3   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | 2   | F      |
| Family:Carabidae                  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |        |
| Unidentified sp. A                | 2   | 1   | 1   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | R      |

|                                     |   |   |   |    |    |    |   |   |   |   |   |   |   |   |   |    |    |   |
|-------------------------------------|---|---|---|----|----|----|---|---|---|---|---|---|---|---|---|----|----|---|
| Family:Scarabaeidae                 |   |   |   |    |    |    |   |   |   |   |   |   |   |   |   |    |    |   |
| <i>Anomala bengalensis</i> Blanch.  | 2 | 2 | 2 | 2  | 2  | -  | - | - | - | - | - | - | 1 | 1 | - | -  | -  | F |
| <i>Onthophagus catta</i> Fab.       | 2 | 2 | 1 | 2  | -  | -  | 3 | 2 | - | - | - | - | - | - | - | -  | 5  | F |
| <i>Onthophagus bonus</i> Fab.       | - | - | - | -  | -  | -  | 8 | - | - | - | - | - | 2 | 2 | - | -  | -  | F |
| <i>Peltonotus nasutus</i> Arrow     | - | - | - | -  | 6  | -  | - | - | - | - | - | - | - | - | 5 | -  | -  | F |
| <i>Apogonia ferruginea</i> Fab.     | - | - | - | -  | -  | -  | - | - | - | - | - | - | - | 7 | - | -  | 4  | F |
| Unidentified sp. B                  | - | 1 | - | -  | -  | -  | - | - | - | - | - | - | - | - | - | -  | -  | R |
| Family:Coccinellidae                |   |   |   |    |    |    |   |   |   |   |   |   |   |   |   |    |    |   |
| <i>Menochilus sexmaculatus</i> Fab. | - | - | - | -  | -  | 3  | 3 | - | - | - | - | - | 3 | 2 | - | -  | -  | F |
| Family:Meloidae                     |   |   |   |    |    |    |   |   |   |   |   |   |   |   |   |    |    |   |
| <i>Cylindrothorax pictus</i> Fab.   | - | - | - | -  | -  | -  | - | - | - | - | - | - | 5 | - | 3 | -  | 4  | F |
| Order:Hymenoptera                   |   |   |   |    |    |    |   |   |   |   |   |   |   |   |   |    |    |   |
| Family:Ichneumonidae                |   |   |   |    |    |    |   |   |   |   |   |   |   |   |   |    |    |   |
| <i>Enicospilus</i> sp.              | - | - | - | -  | 6  | 5  | - | - | - | - | - | - | - | - | - | -  | 2  | F |
| Family:Scoliidae                    |   |   |   |    |    |    |   |   |   |   |   |   |   |   |   |    |    |   |
| <i>Campsomeris</i> sp.              | - | - | - | 1  | 5  | 3  | - | - | - | - | - | - | - | - | - | -  | 2  | F |
| <i>Scoliasoror</i> sp.              | - | - | - | -  | 4  | 3  | 2 | - | - | - | - | - | - | - | - | -  | 2  | F |
| Family:Formicidae                   |   |   |   |    |    |    |   |   |   |   |   |   |   |   |   |    |    |   |
| <i>Dolichoderus affinis</i> Emery   | - | - | - | -  | 4  | 5  | - | - | - | - | - | - | - | - | - | -  | 4  | F |
| <i>Formica</i> sp.                  | - | - | - | -  | 4  | 3  | 1 | - | 3 | - | - | 2 | - | - | - | 3  | 2  | F |
| Family:Pompilidae                   |   |   |   |    |    |    |   |   |   |   |   |   |   |   |   |    |    |   |
| <i>Pepsis</i> sp.                   | - | - | - | -  | 6  | 5  | - | - | - | - | - | - | - | - | - | -  | 2  | F |
| Family:Vespidae                     |   |   |   |    |    |    |   |   |   |   |   |   |   |   |   |    |    |   |
| <i>Polistes carolina</i>            | - | - | - | -  | 4  | 4  | - | - | - | - | - | - | - | - | - | 1  | 3  | F |
| Family:Sphecidae                    |   |   |   |    |    |    |   |   |   |   |   |   |   |   |   |    |    |   |
| <i>Prionyx</i> sp.                  | - | - | - | -  | 5  | 3  | - | - | - | - | - | - | - | - | - | -  | 3  | F |
| Family:Halictidae                   |   |   |   |    |    |    |   |   |   |   |   |   |   |   |   |    |    |   |
| <i>Halictus</i> sp.                 | - | - | - | -  | 7  | 3  | - | - | - | - | - | - | - | - | - | -  | 2  | F |
| Family:Apidae                       |   |   |   |    |    |    |   |   |   |   |   |   |   |   |   |    |    |   |
| <i>Xylocopa fenestrata</i> Fab.     | - | - | - | 22 | 25 | 33 | - | - | - | - | - | - | - | - | - | 12 | 16 | D |
| <i>Xylocopa violacea</i> Linn.      | - | - | - | -  | 9  | 4  | - | - | - | - | - | - | - | - | - | -  | 3  | F |
| <i>Apis cerana</i> Fab.             | - | - | - | 12 | 15 | 16 | 2 | - | - | - | - | - | - | - | - | -  | 15 | D |
| <i>Apis mellifera</i> Linn.         | - | - | - | 12 | 18 | 16 | - | - | - | - | - | - | - | - | - | 12 | 14 | D |
| <i>Apis dorsata</i> Fab.            | - | - | - | -  | 8  | 4  | - | - | - | - | - | - | - | - | - | -  | 4  | F |
| <i>Apis florea</i> Fab.             | - | - | - | -  | 3  | 5  | - | - | - | - | - | - | - | - | - | -  | 3  | F |

|                                      |    |    |    |    |    |    |    |    |   |   |   |   |    |    |    |    |    |   |
|--------------------------------------|----|----|----|----|----|----|----|----|---|---|---|---|----|----|----|----|----|---|
| <i>Unidentified sp. A</i>            | -  | -  | -  | -  | 4  | 4  | -  | -  | - | - | - | - | -  | -  | -  | -  | 4  | F |
| <i>Unidentified sp. B</i>            | -  | -  | -  | 3  | 2  | 3  | -  | -  | - | - | - | - | -  | -  | -  | -  | 3  | F |
| <i>Unidentified sp. C</i>            | -  | -  | -  | -  | 5  | 2  | -  | -  | - | - | - | - | -  | -  | -  | -  | 4  | F |
| Order:Hemiptera                      |    |    |    |    |    |    |    |    |   |   |   |   |    |    |    |    |    |   |
| Family:Pyrrhocoridae                 |    |    |    |    |    |    |    |    |   |   |   |   |    |    |    |    |    |   |
| <i>Dysdercus cingulatus</i> Fab.     | -  | -  | 3  | 2  | -  | -  | 2  | 1  | - | - | - | - | -  | -  | -  | -  | 4  | F |
| <i>Dysdercus koenigii</i> Fab.       | -  | -  | -  | -  | -  | -  | -  | -  | - | - | - | - | 2  | 2  | 2  | -  | 2  | R |
| Family:Coreidae                      |    |    |    |    |    |    |    |    |   |   |   |   |    |    |    |    |    |   |
| <i>Clavigrella</i> sp.               | -  | -  | -  | -  | -  | -  | 3  | 5  | - | - | - | - | 2  | 1  | 2  | -  | -  | R |
| Family:Penatodidae                   |    |    |    |    |    |    |    |    |   |   |   |   |    |    |    |    |    |   |
| <i>Nezara viridula</i> Linn.         | -  | -  | 2  | -  | 1  | -  | -  | -  | - | - | - | - | -  | -  | -  | -  | -  | R |
| <i>Aspongopus janus</i> Fab.         | 2  | -  | -  | -  | -  | -  | -  | -  | - | - | - | - | -  | -  | -  | -  | -  | R |
| <i>Oncocephalus</i> sp.              | -  | -  | -  | -  | 2  | -  | -  | -  | - | - | - | - | -  | -  | -  | -  | -  | R |
| <i>Unidentified sp. B</i>            | -  | -  | -  | -  | 1  | 1  | -  | -  | - | - | - | - | -  | -  | -  | -  | -  | R |
| Order:Orthoptera                     |    |    |    |    |    |    |    |    |   |   |   |   |    |    |    |    |    |   |
| Family:Gryllidae                     |    |    |    |    |    |    |    |    |   |   |   |   |    |    |    |    |    |   |
| <i>Gryllus assimilis</i> Fab.        | -  | -  | 1  | 1  | -  | -  | -  | -  | - | - | - | - | 1  | 1  | 1  | -  | 2  | R |
| Family:Acrididae                     |    |    |    |    |    |    |    |    |   |   |   |   |    |    |    |    |    |   |
| <i>Chrotogonus</i> sp.               | 2  | -  | -  | -  | -  | 2  | -  | -  | - | - | - | - | -  | -  | -  | -  | -  | R |
| <i>Schistocerca gregaria</i> Forskal | 2  | 2  | -  | -  | -  | -  | 2  | 1  | - | - | - | - | -  | -  | -  | -  | -  | R |
| <i>Ochridia</i> sp.                  | -  | -  | -  | 1  | -  | -  | -  | -  | - | - | - | - | -  | -  | -  | -  | 1  | R |
| <i>Oxya chinensis</i> Thunberg       | -  | -  | -  | -  | -  | -  | 3  | -  | - | - | - | - | 3  | 2  | -  | -  | -  | R |
| <i>Acrida</i> sp. Linn.              | -  | -  | -  | -  | -  | -  | -  | -  | - | - | - | - | -  | -  | 1  | 1  | -  | R |
| Family:Pyrgomorphidae                |    |    |    |    |    |    |    |    |   |   |   |   |    |    |    |    |    |   |
| <i>Pyrgomorpha</i> sp.               | -  | -  | -  | -  | 1  | 1  | -  | -  | - | - | - | - | -  | -  | -  | -  | -  | R |
| <i>Atractomorpha</i> sp.             | 1  | -  | 1  | 1  | 1  | 1  | 1  | -  | - | - | - | - | -  | -  | -  | -  | -  | R |
| <i>Unidentified sp. A</i>            | -  | -  | -  | -  | -  | -  | 1  | 1  | - | - | - | - | -  | -  | -  | 2  | -  | R |
| Order:Odonata                        |    |    |    |    |    |    |    |    |   |   |   |   |    |    |    |    |    |   |
| Family:Coenagrionidae                |    |    |    |    |    |    |    |    |   |   |   |   |    |    |    |    |    |   |
| <i>Agriocnemis femina</i> Brauer     | 1  | -  | -  | 2  | 1  | -  | -  | -  | - | - | - | - | -  | -  | -  | -  | -  | R |
| Family:Libellulidae                  |    |    |    |    |    |    |    |    |   |   |   |   |    |    |    |    |    |   |
| <i>Bardinopyga geminata</i> Ramer    | -  | -  | -  | -  | -  | -  | -  | -  | - | - | - | - | 1  | 1  | 1  | -  | -  | R |
| Order:Diptera                        |    |    |    |    |    |    |    |    |   |   |   |   |    |    |    |    |    |   |
| Family:Culicidae                     |    |    |    |    |    |    |    |    |   |   |   |   |    |    |    |    |    |   |
| <i>Culex quinquefasciatus</i> Say    | 13 | 12 | 14 | 13 | 12 | 13 | 14 | 13 | - | - | - | - | 16 | 14 | 15 | 13 | 12 | D |
| Family:Asilidae                      |    |    |    |    |    |    |    |    |   |   |   |   |    |    |    |    |    |   |

|                                      |    |   |    |   |   |   |    |    |   |   |   |   |   |   |    |   |   |   |
|--------------------------------------|----|---|----|---|---|---|----|----|---|---|---|---|---|---|----|---|---|---|
| <i>Stichopogon sp.</i>               | -  | - | -  | - | - | - | 1  | 1  | - | - | - | - | - | - | -  | - | 1 | R |
| Family:Syrphidae                     |    |   |    |   |   |   |    |    |   |   |   |   |   |   |    |   |   |   |
| <i>Syrphid fly</i>                   | -  | - | -  | - | - | - | -  | 2  | - | - | - | - | - | - | -  | - | 2 | R |
| Family:Calliphoridae                 |    |   |    |   |   |   |    |    |   |   |   |   |   |   |    |   |   |   |
| <i>Chrysomya megacephala Fab.</i>    | 2  | 1 | 1  | 1 | - | - | -  | -  | - | - | - | - | - | 1 | 1  | - | - | R |
| <i>Chrysomya rufifacies Mucucurt</i> | 2  | 2 | 2  | 2 | - | - | -  | -  | - | - | - | - | 2 | - | -  | - | - | R |
| Family: Tephritidae                  |    |   |    |   |   |   |    |    |   |   |   |   |   |   |    |   |   |   |
| <i>Dacus cucurbitae</i>              | 10 | - | 11 | - | - | - | -  | -  | - | - | - | - | - | 7 | 1  | - | - | F |
| Family:Sarcophagidae                 |    |   |    |   |   |   |    |    |   |   |   |   |   |   |    |   |   |   |
| <i>Sarcophaga peregrina</i>          | -  | 7 | 6  | 5 | - | - | 3  | 2  | - | - | - | - | 3 | 1 | 2  | 4 | - | D |
| Family:Muscidae                      |    |   |    |   |   |   |    |    |   |   |   |   |   |   |    |   |   |   |
| <i>Musca domestica Fab.</i>          | 5  | 7 | 3  | 2 | 4 | 8 | 11 | 12 | 2 | 1 | 1 | - | 3 | 8 | 15 | 7 | 5 | D |

Earlier [3-10] have carried out work in relation to insect visitors to various crops and also different insect groups visiting specific crops and corroborate the present findings. [11] reported bees to pollinate *Luffa*. Pests attacking *Luffa cylindrica* (sponge gourd) as suggested by [12] include *Aulacophora intermedia* and *Raphidopalpa fovicollis*. Pests attacking *Luffa actungula* include *Riptortus pedestris*, *Taeniothrips claratris*, *Hymenia recurvalis*, *Dacus cucurbitae*, *Aulacophora intermedia* and *Raphidopa* as reported by [12]. The present findings are in conformation with the studies done by [13] who also noticed hymenopterans on the flowers of *Luffa cylindrica*. [14] also recorded members belonging to family Braconidae on cucurbit plant *Luffa cylindrica*. The members of Formicidae on *Luffa* were documented by [15,16] reported hymenopterans like bumble bee *Bombus*, golden wasp *Vespa magnifica* and oriental wasp *Vespa orientalis* as pollinators of sponge gourd. Earlier [17] also observed *Apis dorsata* and *A. florea* as pollinators of another gourd *Momordica charantia* which corroborate the present findings.

Butterflies were also noted as pollinators of a gourd by [17,16] reported lemon butterfly (*Papilio machon*), yellow butterfly (*Therias sp.*), cabbage butterfly (*Pieris brassicae*) and castor butterfly (*Ergolis merione*) as pollinators of sponge gourd which corroborate the present findings. Earlier [18] noted the hawk moth as pollinator of *Luffa acutangula*. The present study also gets support from the reports of [19] who also recorded fruit fly on the flowers of ridged gourd. Earlier *Musca domestica* was noted as a pollinator of a cucurbit crop *Momordica charantia* by [20,16] also reported fruit fly *Bactrocera sp.* and Tabanid fly *Tabanus sp.* as pollinators of sponge gourd. On the contrary, an oligophagous pentatomid bug *Coridius obscurus* was noted as an egg parasitoid on *Luffa cylindrica* by [21]. The findings suggest

that the insect population is affected by abiotic factors and their role in the ecosystem is of great significance.....may it be as a pest, predator or pollinator, and therefore such surveys must be carried out regularly for documenting insect population fluctuations in relation to diversity as well as density.

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