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Studies on important insect visitors of yam bean flowers

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Abstract

The current investigation was carried out during *Kharif* seasons of 2020-21 at the experimental field of TCA (Dholi), RPCAU, Pusa, Bihar. The number of important insect visitors on Yam bean flowers was counted in an area of one square meter marked randomly in the experimental plot. It was kept free from any spray during the entire flowering period. Observations were recorded at 07:00, 11:00, 13:00, and 15:00 hours of the day at weekly intervals on different dates for 10 minutes. Results obtained showed that in Hymenopteran order the most frequent insect visitors were Giant honeybee (*Apis dorsata* Fabricius 1793), Eastern honeybee (*Apis cerana* Fabricius 1798), Dwarf honeybee (*Apis florea* Fabricius 1787), European honeybee (*Apis mellifera* Linnaeus 1758), *Megachile* sp. Fabricius 1781 and Violet carpenter bee (*Xylocopa fenestrata* Linnaeus 1758). The mean population (different dates) of *Apis mellifera* with 12.23 insects/m²/min was highest followed by *Xylocopa fenestrata* with 12.12 insects/m²/min, *Apis cerana indica* with 11.38 insects/m²/min, *Apis dorsata* with 11.21 insects/m²/min, *Megachile* sp. with 9.85insects/m²/min and lowest population of *Apis florea* with 7.67 insects/m²/min. All the insect pollinators were found to be highest during 13:00 hrs of the day and lowest during 07:00 hrs of the day.

Keywords: Yam bean, Insect visitors, honeybee, *Apis dorsata*, *Apis cerana*, *Apis florea*, *Apis mellifera*, *Xylocopa fenestrata*, *Megachile*

Introduction

Yam bean (*Pachyrhizus erosus* L.) is an underutilized leguminous tuber crop originated in Mexico and Central America belongs to family Leguminaceae and sub family papilionaceae. It is also commonly known as *Mishrikand*, *Kesaur*, *Sankeshalu*, *Shankalu* in different regions of India. *P. erosus* is widely cultivated species around the world (Nersekhar *et al.*, 2018) [9]. The crop is now cultivated in the Philippines, China, Indonesia, Nepal, Bhutan, Burma and India. Root and tuber crops production in India was 62.3 million tonnes with yield of 2.4 lakh hg/ha and land area of 2.54 million ha (World Data Atlas, 2021) [13]. Large area under yam bean is in Bihar state about 600 ha from where it is marketed all over the country and in adjoining countries viz., Nepal, Bangladesh etc. (Singh *et al.*, 2019) [11]. Almost one third of the overall human food supply depends on the pollination by insects (Klein *et al.*, 2007) [6]. According to Johannsmeier (2001) [4] honeybees are considered to be responsible for 75-80% of all pollination. Fohouo *et al.* (2009) [3] observed *Apis mellifera adansonii* species being the most abundant (53.2%) whereas insect visitors of other families viz. Coccinellidae and Vespidae represented 0.22% and 0.45% of the total, respectively. Marzinzig *et al.* (2018) [8] observed that faba bean (*Vicia faba* L.) flowers were visited by a total of 2,106 forager bees comprising of 6 different orders. *Apis mellifera* with 56.1% abundance were the most frequent visitor observed.

Material and Methods

The experiment was carried out entitled "Studies on important insect visitors of Yam bean flowers" at experiment field of TCA, Dholi, RPCAU, Pusa during *Kharif* seasons of the year 2020-21. The number of insect visitors (pollinators and other insects) on the flowers was counted in an area of one square meter marked randomly in the experimental plot (Quadrate method). Experimental plot was kept free from any spray during the entire flowering period. Insects were collected using sweeping net during the whole time of blooming season at different times of the day. Observations were recorded at 07:00, 11:00, 13:00, and 15:00 hours of the day at weekly intervals on different dates for 10 minutes. Collected specimens were mounted using insect pins, properly dried and preserved for further identification.

Result and Discussion

Results revealed that the population of Giant honeybee (*Apis dorsata*) was seen first on 17/10/2020 (42nd SMW) with 11.42 insects/m²/10 min, increases up to 14.88 insects/m²/10 min on 24/10/2020 (43rd SMW) then the population gradually decreases to a minimum of 8.79insects/m²/10 min on 28/11/2020 (48th SMW). Eastern honeybee (*Apis cerana*) population was first observed on 17/10/2020 (42nd SMW) with mean of 11.88 insects/m²/10 min, attained peak (13.83 insects/m²/10 min) on 24/10/2020 (43rd SMW) and reached lowest (9.00 insects/m²/10 min) on 28/11/2020 (48th SMW). Dwarf honeybee (*Apis florea*) population appeared first on 25/10/2020 (43rd SMW) with 8.17 insects/m²/10 min, attained maximum on 01/11/2020 (44th SMW) with 9.88 insects/m²/10 min and lowest (5.42 insects/m²/10 min) on 29/11/2020 (48th SMW). The European Honeybee (*Apis mellifera*) population was first recorded on 17/10/2020 (42nd SMW) (12.63 insects/m²/10 min) then increases up to 14.67 insects/m²/10 min on 24/10/2020 (43rd SMW) and the minimum of 10.08insects/m²/10 min on 28/11/2020 (48th SMW). Population of *Megachile* sp. was recorded first on 17/10/2020 (42nd SMW) with mean of 10.83 insects/m²/10 min, reached peak on 24/10/2020 (43rd SMW) with 11.88 insects/m²/10 min and lowest (7.00 insects/m²/10 min) on 28/11/2020 (48th SMW). Violet Carpenter bee (*Xylocopa fenestrata*) population was first observed on 16/10/2020 (42nd SMW) with mean of 12.71 insects/m²/10 min, attains peak on 23/10/2020 (43rd SMW) with 14.42 insects/m²/10 min and minimum (10.92 insects/m²/10 min) on 27/11/2020 (48th SMW). Weekly population on different time intervals for *Apis dorsata*, *Apis cerana*, *Apis florea*, *Apis mellifera*, *Megachile* sp. and *Xylocopa fenestrata* showed that the population was maximum during 13:00 hrs (15.83 insects/m²/10 min, 14.55 insects/m²/10 min, 11.61 insects/m²/10 min, 15.38insects/m²/10 min, 13.12 insects/m²/10 min and 16.10 insects/m²/10 min) of the day and minimum during 07:00 hrs

(8.43 insects/m²/10 min, 9.38 insects/m²/10 min, 4.92 insects/m²/10 min, 10.02 insects/m²/10 min, 7.86 insects/m²/10 min, 9.50 insects/m²/10 min) of the day, respectively. Also the mean population of *Apis dorsata*, *Apis cerana*, *Apis florea*, *Apis mellifera*, *Megachile* sp. and *Xylocopa fenestrata* during 2020-21 were 11.21 insects/m²/10 min, 11.38 insects/m²/10 min, 7.67 insects/m²/10 min, 12.23 insects/m²/10 min, 9.85 insects/m²/10 min and 12.12 insects/m²/10 min, respectively. These findings were in conformity with Thangjam *et al.* (2016) [12] observed *Apis dorsata* recorded the maximum number of *A. dorsata* with maximum 6.67±0.33 during 10:00–11:00 hrs and minimum was 1.33±0.33 during 16:00–17:00 hrs. Paikara and Painkra (2020) [10] recorded a mean population of *Apis cerana* (2.74 bees/m²/5min) with highest population during 11:00-13:00 hrs (3.66 bees/m²/5min) and lowest during evening 15:00-17:00 hrs (2.16 bees/m²/5min). Bharti *et al.* (2015) [1] observed the average population of *Apis florea* (9.23 /m²/5min) with maximum during 11:00-13:00 hrs (14.27 bees/m²/5min) and minimum during 07:00-09:00 hrs (3.13 bees/m²/5min). Chaudhary and Singh (2007) [2] recorded *Apis mellifera* population reached peak of 21.2-23.8 bees/m² during 11:00-15:00 hr of the day. Kambrekar *et al.* (2019) [5] who also observed mean population of *Megachile* sp. on broad bean with 8 insects/m²/5min, contributing 5.30% of total. Kumar and Rai (2020) [7] also found the mean population of *Xylocopa fenestrata* i.e. 7.07 insects/m²/min with minimum of 4.67 insects/m²/min and maximum of 9.33 insects/m²/min. Maximum flower resources and favourable environment were present during mid day and minimum during morning and evening hours, hence the mean population of bees/important pollinators were highest during mid day and minimum during morning and evening hours. Mean population were found to increase with rise in avg. temperature and decline in avg. relative humidity and vice-versa.

Table 1: Mean population (No. of insects/ m²/10 min) of *Apis dorsata*, *Apis cerana* and *Apis florea*

| SMW | 07:00 | | | 11:00 | | | 13:00 | | | 15:00 | | | Mean | | |
|------|------------|-----------|-----------|------------|-----------|-----------|------------|-----------|-----------|------------|-----------|-----------|------------|-----------|-----------|
| | A. dorsata | A. cerana | A. florea | A. dorsata | A. cerana | A. florea | A. dorsata | A. cerana | A. florea | A. dorsata | A. cerana | A. florea | A. dorsata | A. cerana | A. florea |
| 42 | 8.50 | 10.50 | - | 9.67 | 11.67 | - | 15.50 | 14.67 | - | 12.00 | 10.67 | - | 11.42 | 11.88 | - |
| 43 | 10.17 | 10.00 | 6.00 | 14.83 | 12.17 | 9.33 | 20.33 | 20.17 | 9.50 | 14.17 | 13.00 | 7.83 | 14.88 | 13.83 | 8.17 |
| 44 | 7.17 | 8.00 | 7.17 | 11.17 | 10.17 | 10.17 | 22.33 | 19.33 | 14.83 | 12.17 | 13.50 | 7.33 | 13.21 | 12.75 | 9.88 |
| 45 | 9.67 | 10.17 | 5.17 | 8.83 | 9.00 | 7.50 | 15.17 | 14.33 | 15.83 | 11.50 | 13.50 | 9.67 | 11.29 | 11.75 | 9.54 |
| 46 | 10.33 | 9.17 | 4.83 | 7.67 | 10.33 | 5.67 | 13.33 | 12.50 | 11.33 | 9.17 | 9.50 | 7.50 | 10.13 | 10.38 | 7.33 |
| 47 | 6.67 | 9.67 | 1.50 | 7.33 | 10.17 | 3.33 | 13.00 | 10.83 | 11.67 | 8.00 | 9.50 | 6.17 | 8.75 | 10.04 | 5.67 |
| 48 | 6.50 | 8.17 | 4.83 | 8.33 | 8.83 | 5.00 | 11.17 | 10.00 | 6.50 | 9.17 | 9.00 | 5.33 | 8.79 | 9.00 | 5.42 |
| Mean | 8.43 | 9.38 | 4.92 | 9.69 | 10.33 | 6.83 | 15.83 | 14.55 | 11.61 | 10.88 | 11.24 | 7.31 | 11.21 | 11.38 | 7.67 |

*Data is mean of 6 observations

| Factors | C.D (P=0.05) | | | SEm (±) | | | C.V (%) | | |
|-------------|--------------|-----------|-----------|------------|-----------|-----------|------------|-----------|-----------|
| | A. dorsata | A. cerana | A. florea | A. dorsata | A. cerana | A. florea | A. dorsata | A. cerana | A. florea |
| Date | 0.87 | 0.97 | 0.69 | 0.31 | 0.35 | 0.25 | 13.58 | 14.97 | 15.68 |
| Time | 0.66 | 0.73 | 0.56 | 0.23 | 0.26 | 0.20 | | | |
| Date x Time | 1.74 | 1.94 | 1.37 | 0.62 | 0.70 | 0.49 | | | |

Table 2: Mean population (No. of insects/ m²/10 min) of *Apis mellifera*, *Megachile* sp. and *X. fenestrata*

| SMW | 07:00 | | | 11:00 | | | 13:00 | | | 15:00 | | | Mean | | |
|------|---------------------|----------------------|----------------------|---------------------|----------------------|----------------------|---------------------|----------------------|----------------------|---------------------|----------------------|----------------------|---------------------|----------------------|----------------------|
| | A. <i>mellifera</i> | <i>Megachile</i> sp. | X. <i>fenestrata</i> | A. <i>mellifera</i> | <i>Megachile</i> sp. | X. <i>fenestrata</i> | A. <i>mellifera</i> | <i>Megachile</i> sp. | X. <i>fenestrata</i> | A. <i>mellifera</i> | <i>Megachile</i> sp. | X. <i>fenestrata</i> | A. <i>mellifera</i> | <i>Megachile</i> sp. | X. <i>fenestrata</i> |
| 42 | 9.50 | 9.50 | 11.67 | 10.17 | 10.67 | 10.17 | 16.83 | 13.50 | 15.33 | 14.00 | 9.67 | 13.67 | 12.63 | 10.83 | 12.71 |
| 43 | 11.67 | 8.33 | 8.17 | 13.67 | 10.17 | 15.50 | 17.83 | 18.00 | 18.83 | 15.50 | 11.00 | 15.17 | 14.67 | 11.88 | 14.42 |
| 44 | 11.67 | 6.67 | 10.17 | 10.33 | 8.50 | 12.83 | 16.17 | 17.33 | 19.00 | 12.83 | 11.50 | 13.17 | 12.75 | 11.00 | 13.79 |
| 45 | 9.33 | 8.17 | 11.50 | 12.83 | 7.50 | 10.67 | 16.50 | 14.67 | 16.33 | 14.17 | 11.50 | 11.83 | 13.21 | 10.46 | 12.58 |
| 46 | 10.50 | 8.33 | 7.00 | 10.50 | 9.50 | 8.50 | 15.67 | 11.50 | 14.67 | 11.17 | 8.83 | 10.33 | 11.96 | 9.54 | 10.13 |
| 47 | 9.33 | 7.83 | 7.17 | 9.83 | 8.50 | 8.83 | 12.50 | 8.83 | 15.50 | 9.67 | 7.67 | 9.67 | 10.33 | 8.21 | 10.29 |
| 48 | 8.17 | 6.17 | 10.83 | 9.50 | 6.83 | 8.67 | 12.17 | 8.00 | 13.00 | 10.50 | 7.00 | 11.17 | 10.08 | 7.00 | 10.92 |
| Mean | 10.02 | 7.86 | 9.50 | 10.98 | 8.81 | 10.74 | 15.38 | 13.12 | 16.10 | 12.55 | 9.60 | 12.14 | 12.23 | 9.85 | 12.12 |

* Data is mean of 6 observations

| Factors | C.D (P=0.05) | | | SEm (±) | | | C.V (%) | | |
|-------------|---------------------|----------------------|----------------------|---------------------|----------------------|----------------------|---------------------|----------------------|----------------------|
| | A. <i>mellifera</i> | <i>Megachile</i> sp. | X. <i>fenestrata</i> | A. <i>mellifera</i> | <i>Megachile</i> sp. | X. <i>fenestrata</i> | A. <i>mellifera</i> | <i>Megachile</i> sp. | X. <i>fenestrata</i> |
| Date | 0.98 | 0.76 | 1.07 | 0.35 | 0.27 | 0.38 | 14.04 | 13.48 | 15.44 |
| Time | 0.74 | 0.57 | 0.81 | 0.26 | 0.20 | 0.29 | | | |
| Date x Time | 1.96 | 1.52 | 2.14 | 0.70 | 0.54 | 0.76 | | | |

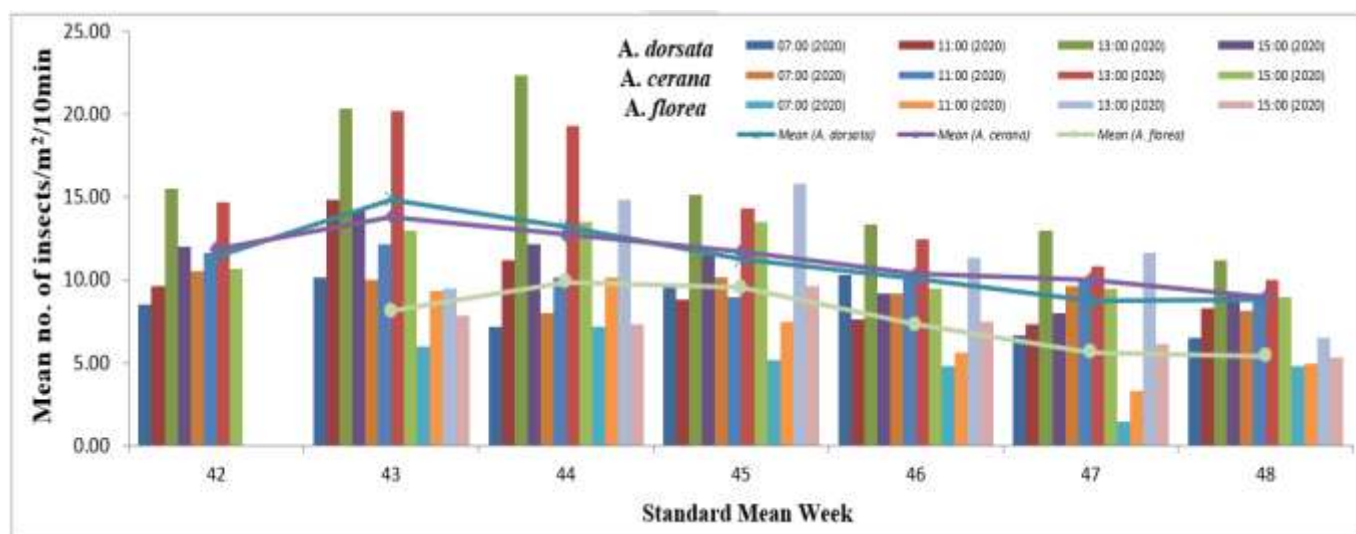


Fig 1: Graphical Representation of *Apis dorsata*, *Apis cerana* and *Apis florea* mean population during 2020-21.

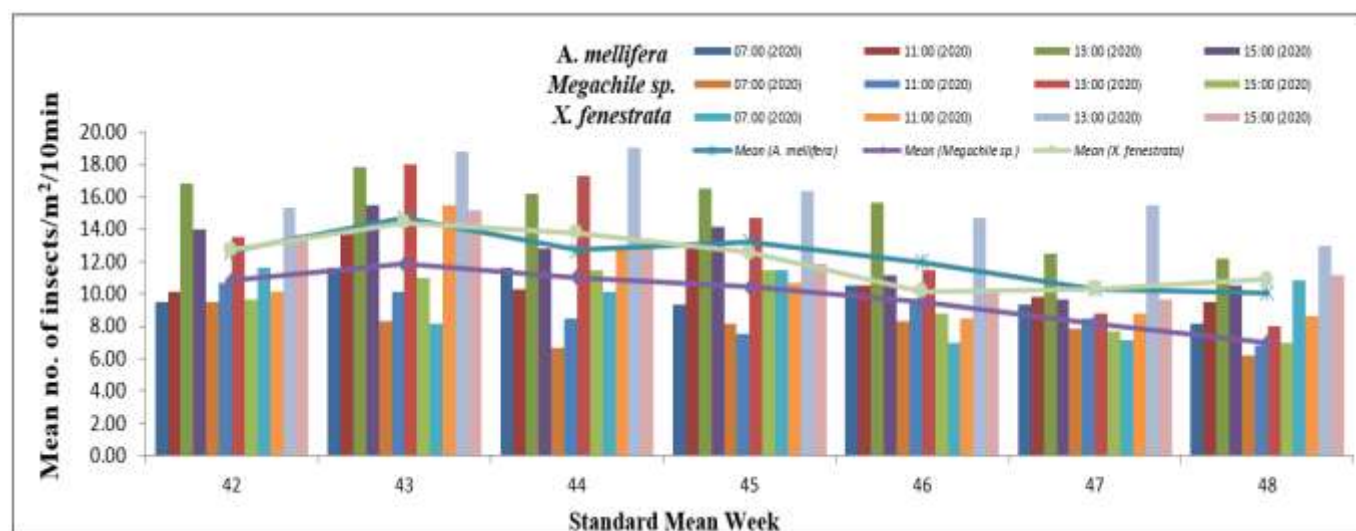


Fig 2: Graphical Representation of *Apis mellifera*, *Megachile* sp. and *X. fenestrata* mean population during 2020-21.

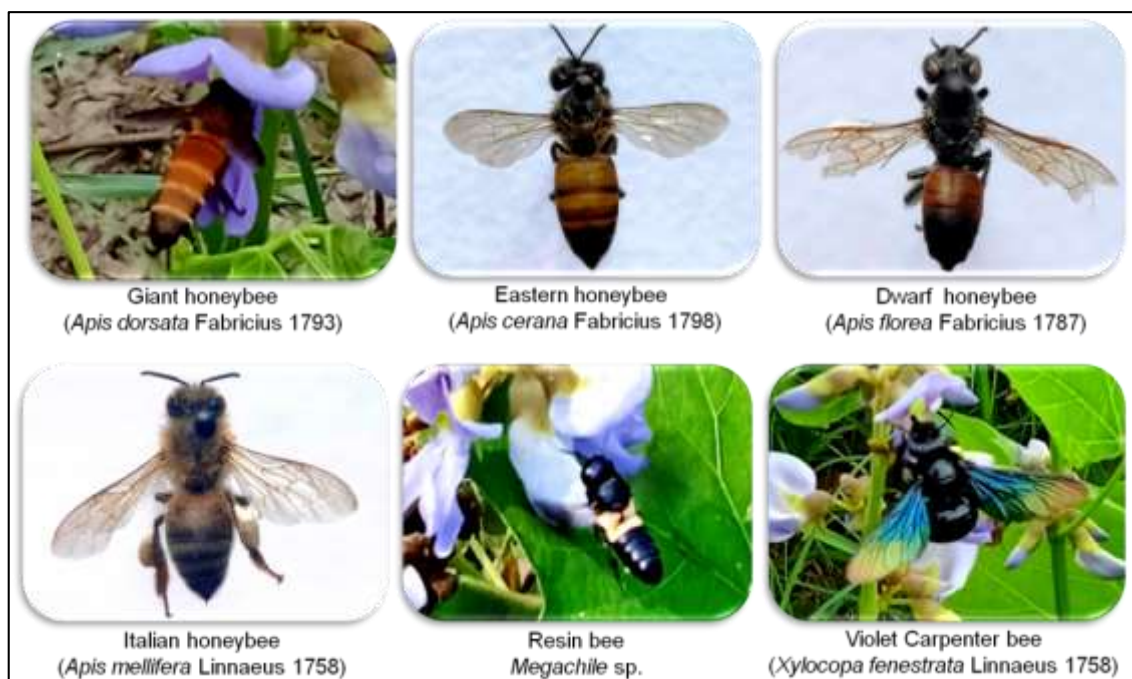


Fig 1: Important insect visitors on Yam bean flowers during 2020-21

Conclusion

From above results it can be concluded that Yam bean flowers were most dominantly visited by Hymenopteran order including *Apis mellifera* with 12.23 insects/m²/min was highest followed by *Xylocopa fenestrata* with 12.12 insects/m²/min, *Apis cerana indica* with 11.38insects/m²/min, *Apis dorsata* with 11.21 insects/m²/min, *Megachile* sp. with 9.85 insects/m²/min and lowest population of *Apis florea* with 7.67 insects/m²/min. All the insect pollinators were found to be highest during 13:00 hrs of the day and lowest during 07:00 hrs of the day.

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