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Diurnal abundance of different pollinators on *Ricinus communis*

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Abstract

Diurnal abundance of insect pollinators on *R. communis* flower at different fortnight intervals during flowering period were recorded. Total number of visitors abundance in between two castor hybrid (GCH-7 and DCH-177) during 2018, the observed abundance were (24.90, 23.23), (19.36, 20.68), (23.39, 20.72) and (23.89, 21.75) in first fortnight of August, second fortnight of August, first fortnight of September and second fortnight of September respectively. During the year 2019, the total number of visitor abundance reached maximum value (28.43, 29.43) in first fortnight of August followed by (28.28, 29.16) in second fortnight of September, (27.06, 28.44) in first fortnight of September and the minimum value was recorded (26.87, 27.30) during second fortnight of August when comparing abundance between two hybrids.

Keywords: Castor, *R. communis*, abundance, pollinators, fortnight interval

1. Introduction

Being cross pollinated, castor (*Ricinus communis* L.), is an important non-edible oilseed crop, which commonly known as castor oil belongs to family Euphorbiaceae. Pollination is an important phenomenon in agricultural systems where the major pollinator-dependent crops are fruit, vegetable and oilseed crops, spices and plantation crops, pulses, etc (Anjani, 2012) [3]. Long-lasting coevolution between flowering plants and pollinators association has made the both partners intimately connected and reciprocally dependent on each another. Their interaction rests mostly on a mutualistic exchange: plants invest in the production of nectar and pollen to reward pollinators in return, sustain plant reproduction by vectoring their pollen to the conspecific flower (Ahmad *et al.*, 2017) [2]. In castor, wind play major role and insects may play some part in pollination process. For effective pollination pollinators should do visits the crop (Abrol, 2016) [1]. So in this experiment we have observed the diurnal abundance of different insect pollinators at different fortnight intervals during flowering period on castor crop and to know their pollination efficiency.

2. Materials and Methods

For recording diurnal abundance the most common (12) visitors of castor hybrids was taken into account. Observations were made on *R. communis* cv. GCH -7 and DCH -177 for consecutive two years *i.e.* 2018 and 2019. Experiment was conducted at Research Farm and Apicultural laboratory of Department of Entomology, CCS Haryana Agricultural University (CCS HAU), Hisar. The abundance data collected at two hourly time intervals of the day, starting from 0600 to 1800 h and repeated at fortnightly intervals during the crop flowering period (August and September) was used to determine the diurnal abundance in terms of mean no. of insects/m²/5 min in different castor pollinators.

3. Results

3.1 Diurnal abundance of insect visitors/pollinators of *R. communis* at different fortnight intervals during flowering period

While considering the data on diurnal abundance of insect visitors/pollinators of the two selected hybrids of *R. communis* *i.e.*, GCH-7 and DCH-177 during different fortnight intervals during flowering period. The significant variation was found within the two months *i.e.* August and September during observation period. Among the four flowering fortnights, the maximum abundance of insect visitors/pollinators was observed in first fortnight of August

followed by second fortnight of September and first fortnight of September, meanwhile comparatively low abundance was observed in second fortnight of August, during observation period.

3.2 Diurnal abundance of insect visitors/pollinators in *R. communis* cv. GCH-7 and DCH-177 at different fortnight intervals during flowering period in 2018

The mean data of GCH-7, during the year 2018 showed that total flower visitors in first fortnight of August and second fortnight of September were 24.90 and 23.89 insects/m²/5 min, respectively, whereas, in second fortnight of August and first fortnight of September, a total of 19.36 and 23.39 insects/m²/5 min were recorded, respectively. In DCH-177, same trend of abundance as in GCH-7 was observed, the overall abundance 23.23, 20.68, 20.72 and 21.75 insects/m²/5 min were recorded in first fortnight of August, second fortnight of August, first fortnight of September and second fortnight of September, respectively (Fig. 1). There was significant variation found in between insect visitors, time of observation and their interactions of visitors and time during

this year.

3.3 Diurnal abundance of insect visitors/pollinators in *R. communis* cv. GCH-7 and DCH-177 at different fortnight intervals during flowering period in 2019

In GCH-7 hybrid, the abundance of total flower visitors recorded in first fortnight of August, second fortnight of August, first fortnight of September and second fortnight of September were 28.43, 26.87, 27.06 and 28.28 insects/m²/5 min respectively. Significant variation was also found in between insect visitors, time of observation and their interactions. A total abundance of 29.43, 27.03, 28.44 and 29.16 insects/m²/5 min were observed on first fortnight of August, second fortnight of August, first fortnight of September and second fortnight of September, in DCH-177 hybrid respectively (Fig. 2). There was also significant variation found in between insect visitors, time of observation and their interactions of visitors and time during this year of study. While comparing two hybrid, DCH-177 is showing more pollinators/visitors abundance than GCH-7 hybrid.

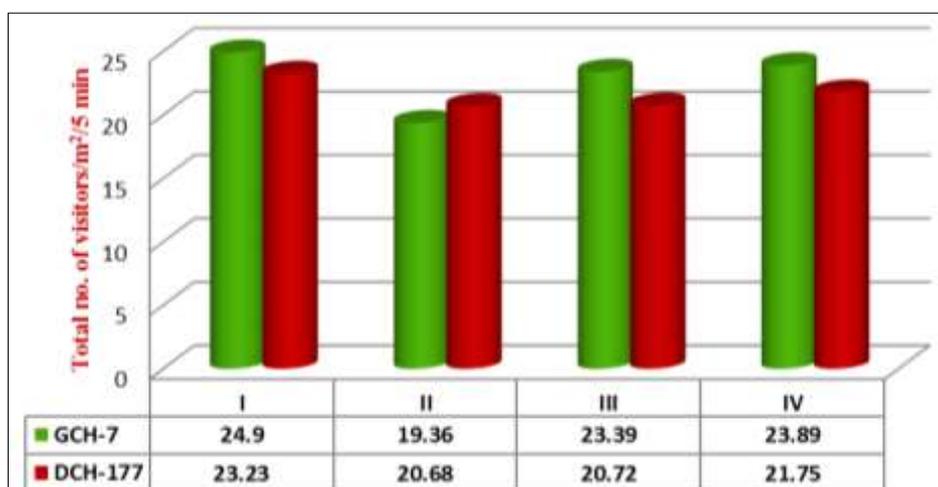


Fig 1: Comparative abundance of insect visitors during different fortnights on *R. communis* cv. GCH-7 and DCH-177 during 2018

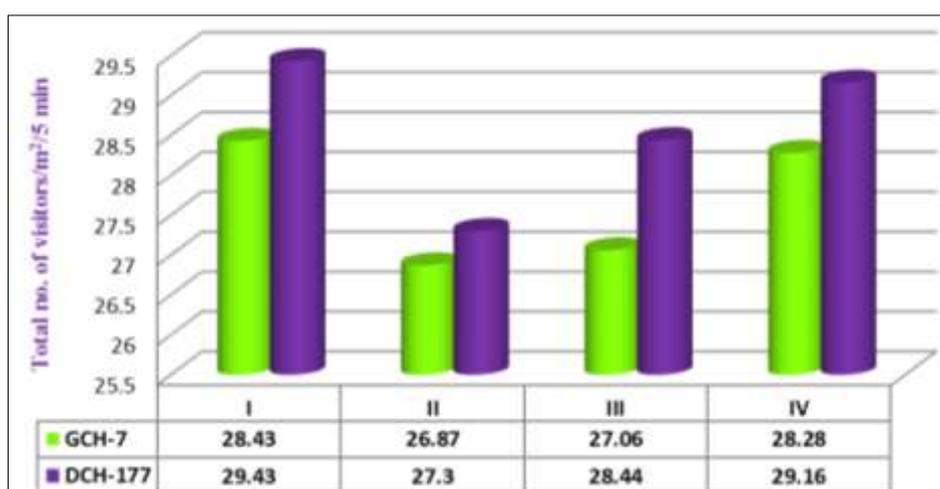


Fig 2: Comparative abundance of insect visitors during different fortnights on *R. communis* cv. GCH-7 and DCH-177 during 2019

3.4 Comparative diurnal abundance of insect visitors/pollinators in *R. communis* cv. GCH-7 and DCH-177 at different fortnight intervals during flowering period

Pooled mean data on diurnal abundance of insect visitors/pollinators on *R. communis* cv. GCH-7 and DCH-177

during different fortnight intervals of flowering period presented in Table 12 revealed that there was significant difference in abundance of the different insect species in relation to year where their abundance was comparatively more in 2019 than 2018 in the both years of study.

Table 1: Comparative diurnal abundance of insect visitors/pollinators of *R. communis* cv. GCH-7 and DCH-177 during different flowering periods in 2018 and 2019 (pooled)

Insect visitor/ pollinator	Mean no. of insects/m ² /5 min						Pooled mean
	GCH-7			DCH-177			
	2018	2019	Mean	2018	2019	Mean	
<i>A. dorsata</i>	1.32 (1.52)	2.06 (1.75)	1.69 (1.64)	0.94 (1.39)	2.18 (1.78)	1.56 (1.60)	1.62 (1.62)
<i>A. cerana</i>	4.32 (2.30)	4.29 (2.43)	4.30 (2.30)	4.21 (2.28)	5.48 (2.54)	4.84 (2.41)	4.57 (2.36)
<i>A. mellifera</i>	2.05 (1.74)	3.36 (2.08)	2.70 (1.92)	2.21 (1.79)	3.65 (2.15)	2.93 (1.98)	2.81 (1.95)
<i>A. florea</i>	11.96 (3.60)	12.98(3.73)	12.47 (3.67)	10.96(3.45)	13.82(3.84)	12.39 (3.65)	12.43 (3.66)
<i>Polistes</i> sp.	0.25 (1.11)	1.03 (1.42)	0.64 (1.28)	0.97 (1.40)	0.34 (1.16)	0.65 (1.28)	0.64 (1.28)
<i>X. iridipennis</i>	0.32 (1.15)	0.26 (1.12)	0.29 (1.13)	0.21 (1.10)	0.30 (1.14)	0.25 (1.12)	0.27 (1.12)
<i>M. lanata</i>	0.80 (1.34)	0.81 (1.34)	0.80 (1.34)	0.57 (1.25)	0.60 (1.26)	0.58 (1.25)	0.69 (1.30)
<i>Vespa</i> sp.	0.15 (1.07)	0.50 (1.22)	0.32 (1.15)	0.25 (1.11)	0.46 (1.21)	0.35 (1.16)	0.34 (1.15)
<i>M. bicolor</i>	0.55 (1.24)	0.70 (1.30)	0.62 (1.27)	0.57 (1.25)	0.63 (1.27)	0.60 (1.26)	0.61 (1.26)
<i>Camponotus</i> sp.	0.32 (1.14)	0.39 (1.18)	0.35(1.16)	0.26 (1.12)	0.42 (1.19)	0.34 (1.15)	0.34 (1.16)
<i>Calliphora</i> sp.	0.39 (1.18)	0.30 (1.14)	0.34 (1.15)	0.28 (1.13)	0.38 (1.17)	0.33 (1.15)	0.33 (1.15)
<i>Eristalinus</i> sp.	0.42 (1.19)	0.30 (1.14)	0.36 (1.16)	0.13 (1.06)	0.28 (1.13)	0.20 (1.09)	0.28 (1.13)
Total Visitors	22.88 (4.88)	27.66 (5.35)	25.27 (5.12)	21.59 (4.75)	28.58 (5.43)	25.08 (5.10)	25.17 (5.11)
Mean	1.90 (1.70)	2.30 (1.81)	2.10 (1.76)	1.79 (1.67)	2.38 (1.83)	2.08 (1.75)	2.09 (1.75)

*Figures in parentheses are square root transformed values

Factors	CD (P<0.05)	SE(m)
Variety	NS	(0.007)
Visitors	(0.049)	(0.018)
Variety x Visitors	NS	(0.025)
Year	(0.035)	(0.013)
Variety x Year	NS	(0.018)
Visitors x Year	(0.120)	(0.043)
Variety x Visitors x year	NS	(0.061)

However, there was no varietal impact on them as total number of visitors in GCH-7 and DCH-177 were more or less similar with a mean abundance of 25.27 and 25.08 insects/m²/5 min, respectively. In GCH-7, total of 22.88 and 27.66 insects/m²/5 min were recorded in 2018 and 2019, respectively, while DCH -177 had a total population of 21.59 and 28.58 insects/m²/5 min during the respective years. The mean diurnal abundance of 2.10 and 2.08 insects/m²per 5 min were recorded in GCH-7 and DCH-177, respectively. Further, the crop was totally visited by 25.17 insects/m²/5 min during the flowering period where the *A. florea* (12.43) was the predominant species followed by *A. cerana* (4.57), *A. mellifera* (2.81) and *A. dorsata* (1.62), while *X. iridipennis* (0.27) and *Eristalinus* sp. (0.28) were the least abundant species followed by *Calliphora* sp. (0.33), *Camponotus* sp. (0.34) and *Vespa* sp. (0.34) which were at par, *M. bicolor* (0.61), *Polistes* sp. (0.64) and *M. lanata* (0.69) were remained low abundance. There was no significant difference in between interactions of variety, insect visitors and year of observations.

4. Discussion

The recorded data clearly showed the variation in abundance of insect fauna during different fortnight intervals of flowering period. Among the four fortnights, the maximum abundance of insect visitors/pollinators was observed during first fortnight of August followed by second fortnight of September, meanwhile comparatively low abundance was observed in second fortnight of August followed by first fortnight of September. It could be due to the interdependence of insect visitation with flower density of the crop. As the flower density was relatively high at initial phase of flowering period, i.e. first fortnight of August the numbers of insect visitors were also high, whereas the opposite trend was observed when the flower density was low. During second fortnight of August flower density decreases, while it is increases due course of time, hence noticeable increase number of total visitors abundance was recorded in first fortnight of September and second fortnight of September on castor field. It is the well-known fact that pollinators and

plants are always in mutualistic relationship, when the plant provides more rewards in terms of nectar and pollen, higher number of the pollinators will visit and thereby higher will be the abundance. This type of study was also conducted by many researchers i.e. Kumar (2002) [4], Pashte and Shylesha (2013) [5] and Rao (2019) [6] on sesame crop, found that the *Apis* spp. were low on early stage of flowering but reached its peak during mid-flowering and declined in successive weeks and recorded lowest when crops reached to maturity. From the above study, it is evident that diurnal abundance is positively correlated with flower density. As the flower density was relatively high at initial phase of flowering period, i.e. first fortnight of August the numbers of insect visitors were also high, whereas the opposite trend was observed when the flower density was low.

5. References

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