



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(8): 910-912
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www.thepharmajournal.com
Received: 14-06-2022
Accepted: 18-07-2022

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Feeding efficiency of predatory coccinellid beetle, *Menochilus sexmaculatus* (Fabricius) on cowpea aphid (*Aphis craccivora* Koch) under laboratory conditions at Raipur, Chhattisgarh

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Abstract

Studies on the Feeding efficiency of *Menochilus sexmaculatus* on cowpea aphid, *Aphis craccivora* conducted in the Biocontrol laboratory, College of Agriculture, IGKV, Raipur, Chhattisgarh during 2021-22, indicated that, the feeding efficiency of *M. sexmaculatus* increased consequently from 1st, 2nd, 3rd and 4th instar grubs by consuming an average number of 16.38±0.136, 34.50±0.052, 54.63±0.032, 75.50±0.056 aphids per day respectively. Mean consumption of aphids by male was 85.66±0.058 aphids/day, while the mean maximum number of aphid consumption by adult female of *M. sexmaculatus* was 92.55±0.017 aphids/day.

Keywords: Coccinellid beetle, *Menochilus sexmaculatus*, feeding efficiency, cowpea aphid

Introduction

Coccinellids belong to family Coccinellidae of order Coleoptera and are commonly called as ladybird beetles. Coccinellids are of high economic importance due to their predatory activity against soft bodied insects viz., aphids, leafhoppers, psyllids, whiteflies, scales and mealy bugs (Vasista *et.al.* 2021) [10]. The predaceous coccinellids have been successfully utilized in various biocontrol programs with spectacular success rates. For that reason, ladybird beetles have drawn the attention of many researchers (Moreton, 1969) [3].

Menochilus sexmaculatus (Fabricius) is one of the major predatory species among coccinellids. Both the grubs and adults feed voraciously on soft-bodied insects, including aphids, scale insects, mealy bugs, thrips, leafhoppers, and whiteflies (Omkar & Pervez, 2000) [6]. *M. sexmaculatus* preferably feeds on *Aphis craccivora* infesting cowpea, *Vigna unguiculata* (Omkar and Bind, 1998) [5]. The flowering capacity of plants badly affected by infestation of aphids, resulting in losses ranging from 20-40 percent. Natural conditions are favourable for rapid increase in population of aphids. However, in the presence of predatory coccinellid beetles, they are unable to grow abundantly due to predation by both grubs and adults (Islam, 2007) [1].

Information generated on the predatory potential of coccinellids provide a preliminary step in exploitation of coccinellids in biological control of aphids associated with cowpea and pulse crop ecosystems. Therefore, an attempt was made in the present study to determine the predatory efficiency of grubs and adults of *M. sexmaculatus* on cowpea aphid *Aphis craccivora* Koch at Raipur, Chhattisgarh.

Material and Methods

Feeding efficiency of *M. sexmaculatus* on cowpea aphid, *A. craccivora* was studied in the Biocontrol laboratory, College of Agriculture, IGKV, Raipur, Chhattisgarh. Four grubs of *M. sexmaculatus* were reared separately in petri dishes from hatching to pupation. Known number of cowpea aphid (*A. craccivora*) were fed to each grub daily till pupation. The number of aphids consumed were recorded daily and then fresh aphids as food were supplied. The feeding capacity was worked out for individual instars as well as for entire larval period. This experiment was replicated five times.

The newly emerged adults *i.e.* 4 males and 4 females were kept individually in petri dishes and counted number of cowpea aphids were given to each adult daily during the entire adult

period. The number of aphids consumed was recorded daily and then fresh aphids were given. The feeding potentiality of adult was worked out. This experiment was also repeated five times.

The experimental data were statistically analyzed by analysis of variance (ANOVA) developed by Fisher. The value of data was converted into square root transformed values. The critical difference (CD) values at 5 per cent was determined by using the following expression:

CD at 5 percent = SE of difference $\times t_{0.05}$ for error degrees of freedom.

Result and Discussion

Feeding efficiency of *Menochilus sexmaculatus* on cowpea aphid (*Aphis craccivora*)

Feeding efficiency of *M. sexmaculatus* Fab. was studied for their effectiveness against cowpea aphid (*A. craccivora*) under laboratory conditions. The predatory efficiency of grub and adult were determined by counting the total number of aphids consumed by each larval instar, adult male and female. The data presented in Table 1 indicated that the rate of consumption increased gradually from the first to fourth instar. Consumption by the first instar as (16.38±0.136 aphids/day) while predation of 2nd instar grub of (34.50±0.052 aphids/day) was recorded. Third instar grub showed better predatory activity than the preceding two instars. Fourth and final instar grubs were very active until pupal transformation, as they required more food than the previous instar due to bigger size, longer duration and to accumulate nutrient for pupal period. In the 3rd instar, the mean consumption was estimated to be (54.63±0.032 aphids/day). During 4th instar, these devoured maximum number of *A. craccivora* (75.50±0.056 aphids/day). Duration of all the four instars were found to be of two days in the present studies however, the adult stage prolonged for about 25-40 days.

Comparing the predatory efficiency of both male and female adults revealed that the females consumed more prey than the male. The average rate of *A. craccivora* predation by the female was (92.55±0.017 aphids/day) and of male was (85.66±0.058 aphids/day).

Thus, the studies conducted on the feeding potential of

coccinellid predator, *M. sexmaculatus* on cowpea aphid, *A. craccivora* revealed that the mean number of aphids consumed increased from 1st to 4th instar with maximum number of aphids consumed by adult female. Feeding potential of *M. sexmaculatus* grubs increased consequently from 1st, 2nd, 3rd, and 4th instar.

This is in the line with the findings of Singh and Singh (2014)^[9], who also reported more devouring properties in adults as compared to larval stages. Roy and Sinha (2002)^[8] also found that consumption rate based on number of prey individuals consumed daily was far greater in female than males is also in agreement with the present findings. Pandi *et al.* (2012)^[7] observed that the 4th instar grubs consumed significantly more aphids when compared to 1st, 2nd and 3rd instars. The per day predation rate (number of aphids) by female beetle on *A. craccivora* was 37.2±3.32 and Male could feed only 35.8±2.67 of *A. craccivora*. The present findings are in total concurrence with Kolhekar (2018)^[2] who also reported that among all the stages adult stage was found to be highly efficient as it consumed highest number of aphids, *i.e.*, (92.33) followed by 4th instar (67.37), 3rd instar (38.75), 2nd instar (32.5), and 1st instar (23.5) but 1st instar and 2nd instar were statically at par and minimum number of aphids were consumed by 1st instar of *M. sexmaculatus*. Nag (2019)^[4] also reported that the feeding capacity of *M. sexmaculatus* were increased consequently from 1st to 4th instar grubs by consuming an average number of 8.00, 17.50, 43.75, 59.50 and adult female consumed 92.76 aphids/ day.

Table 1: Feeding potential of grub and adult stages of *Menochilus sexmaculatus* on cow pea aphid (*Aphis craccivora* Koch) under laboratory conditions

S.N.	Stages	Mean
1.	1 st instar	16.38±0.136
2.	2 nd instar	34.50±0.052
3.	3 rd instar	54.63±0.032
4.	4 th instar	75.50±0.056
5.	Adult male	85.66±0.058
6.	Adult female	92.55±0.017
	SE(m) ±	0.07
	C.D.	0.208

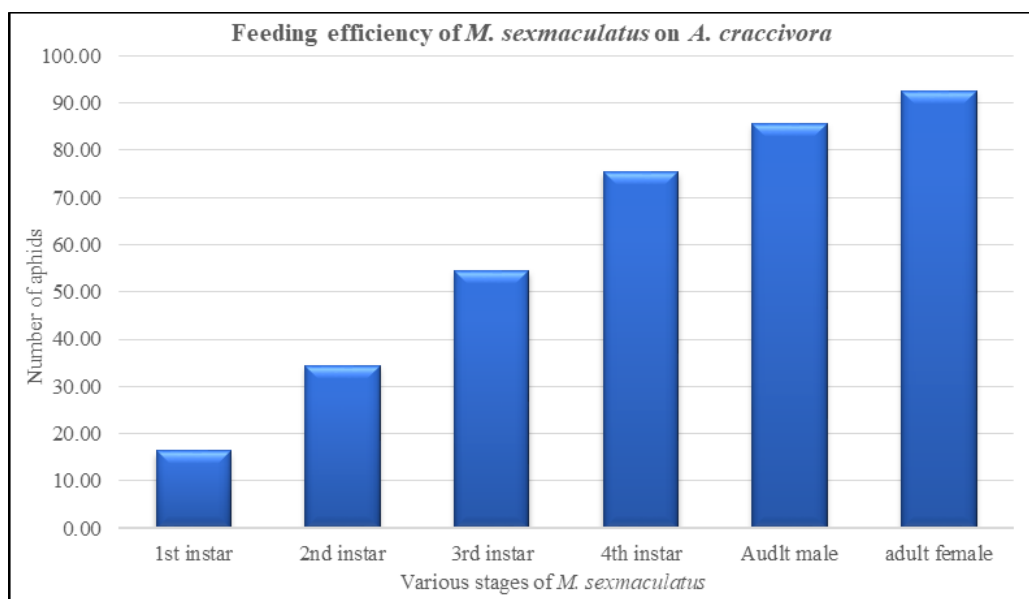


Fig 1: Consumption rate of aphids by grub and adult stages of *Menochilus sexmaculatus*

Conclusion

Thus, the present studies conducted on the feeding potential of *M. sexmaculatus* on cowpea aphids under laboratory conditions at Raipur, Chhattisgarh revealed that the feeding efficiency of *M. sexmaculatus* increased consequently from 1st, 2nd, 3rd, and 4th instars. Maximum number of aphid consumption was by adult female of *M. sexmaculatus* with a mean of 92.55 ± 0.017 aphids/day.

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