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Feeding potential of predominant predators against safflower aphid

Pranav NN, FS Khan and Dilip Zate

Abstract
Predators are boon to farmers in controlling pests naturally and eco-friendly manner. The feeding potential studies revealed how effective predators are in pest management. The feeding potential of 1st, 2nd and 3rd grub instar of *Mallada* sp. on *Uroleucon compositae* were 20.78, 37.92 and 61.62 aphids and the total aphids consumed during total grub period was 120.32 aphids. The feeding potential value of *Coccinella transversalis* 1st, 2nd, 3rd and 4th instar grub against *U. compositae* were 13.25, 14.15, 18.40 and 37.33 aphids, respectively. The adult beetles of *C. transversalis* displayed a higher feeding potential of 407.09 aphids. The total feeding potential of *C. transversalis* during its entire life cycle was found to be 490.22 aphids.

Keywords: Predators, feeding potential, *Mallada* sp., *Coccinella transversalis*, *Uroleucon compositae*

Introduction
Safflower pests are one of the many factors responsible for the reduction in safflower area. The safflower aphid, *Uroleucon compositae* (Theobald), is a major pest, causing 30 to 80 percent yield loss depending on weather conditions. (Mallapur *et al*., 2001) [3]. The major pests found on safflower were aphid (*Uroleucon compositae* Theobald), capsule borer (*Heliothis* spp.) and gujhia weevil (*Tanymecus indicus* Faust). *Coccinella* spp., *Endaphis aphidimyza*, and *Chrysoperla* spp. were the predominant natural enemies attacked on *Uroleucon compositae* (Akashe *et al*., 2013) [1]. Aphids exhibit parthenogenesis mode of reproduction which leads to rapid multiplication of aphid population due to their high reproductive rates. Overlapping generations are peculiar phenomenon observed in aphid population.
Predators play a key role in lowering population of aphids in different ecosystem. Predators like coccinellids (*Cheilomenes sexmaculata, Coccinella transversalis* etc.) and *Chrysopa* feed on soft bodied insects like aphids. The predator population peaked in the third week of January, around the same time as the aphid population peaked. (Patil *et al.*, 2008) [7]. *U. compositae* are less mobile, confined to feeding part and overlapping generation gives a light of scope in the field of biological control (predation) due to quick availability and preferred stages of aphids for predators. The datas of life cycle and feeding potential of predators collected during lab studies enable us to compare the predator efficiency of different predators on a specific pest. Hence selection of suitable predator for the crop ecosystem can be planned efficiently to control pest in an economical and eco-friendly manner.

Material And Methods
The experiment was conducted in Insect Parasitology Laboratory, VNMKV, Parbhani, to find out feeding potential of predominant predators against safflower aphid *viz*., coccinellids and *Chrysopa* spp. under lab condition (25 ± 2^{0}C; and RH – 65 ± 5%)

A) Coccinellids (*Coccinella transversalis)*
Rearing of *Coccinella transversalis*
The eggs of *Coccinella transversalis* were collected from safflower and cabbage plot. The grubs emerged were reared individually in plastic vials and fed with prey collected from unsprayed field of safflower (*U. compositae*) till pupation. The adults emerged uniformly after pupation were kept for mating and oviposition purpose in plastic container. Leaves of cabbage or twigs of safflower kept inside jar along with tissue paper(folded) hanged inside for aiding oviposition. The eggs laid in leaves, twigs and tissue paper were collected by gently removing with camel brush. The eggs collected will be further used for multiplication of predator.

Method of observation

50 hatched *Coccinella transversalis* grubs were placed individually in plastic vials. Each replication consisting of 10 grubs (5 replication were carried out). Each grub of *C. transversalis* was fed with known number of *U. compositae* daily (24 hrs). The observations of aphids consumed by 1st, 2nd, 3rd and 4th instar grub and grub duration of respective instars were recorded till pupation. The emerged adults were fed daily till their death and their total consumption and adult duration were recorded. Per day consumption of each instar were calculated by dividing total consumption of each instar with their respective instar duration.

B) *Chrysopa* spp. (*Mallada* sp.)

Rearing of *Mallada* sp.

The eggs of *Mallada* sp. were collected from fields of sorghum and cotton. The collected eggs after hatching were individually reared in a clean and hygienic plastic vial. The grubs were fed daily with *U. compositae* till pupation. Uniformly emerged adults were kept in oviposition cage for egg laying. The food served for *Mallada* sp. adults were honey, proteinex mixture and water dipped in cotton swabs and placed inside the container along with pollen grains. The substrate for oviposition is made by covering the walls with black century thick paper. The eggs laid by adults were used for feeding potential against *U. compositae*.

Method of observation

The grubs emerged from eggs were placed individually in plastic vials and fed with known number of *U. compositae* daily (24 hrs). 50 grubs of *Mallada* sp. were taken for the study comprising of 10 grubs in each replication. The observations of *U. compositae* consumed by 1st, 2nd and 3rd instar *Mallada* sp. were taken daily till pupation. Total consumption of each instar and their grub duration were recorded separately. The per day consumption of each instar of grub were calculated by dividing the average aphids consumed by each instar with their respective average grub duration.

Results And Discussion

Coccinellids

Grubs

The grub instar duration (Table. 1) of 1st, 2nd, 3rd and 4th instar of *C. transversalis* when predated upon *U. compositae* were 2.88, 2.44, 2.33 and 3.33 days, respectively. *C. transversalis* (10.98 days) exhibited a shorter grub period than *Mallada sp.* (17.49 days). The feeding potential study revealed that higher consumption of *U. compositae* by 4th instar grub (37.33) followed by 3rd (18.40), 2nd (14.15) and 1st instar grub (13.25 aphids). The total consumption of grub during research was found to be 83.13 aphids and the average grub consumption on *U. compositae* was 20.78 aphids. Per day consumption rate of 1st, 2nd, 3rd and 4th instar grub of *C. transversalis* was 4.6, 5.8, 7.9 and 11.2 aphids/ day, respectively. (Table 2)

Table 1: Feeding potential of *C. transversalis* on *U. compositae*

Stage	Duration in days	Total consumption (aphids)
I Instar	2.88	13.25
II Instar	2.44	14.15
III Instar	2.33	18.40
IV Instar	3.33	37.33
I to IV instar	10.98	83.13
	Average grub consumption (aphids/instar)	20.78
Adult	32.83	407.09

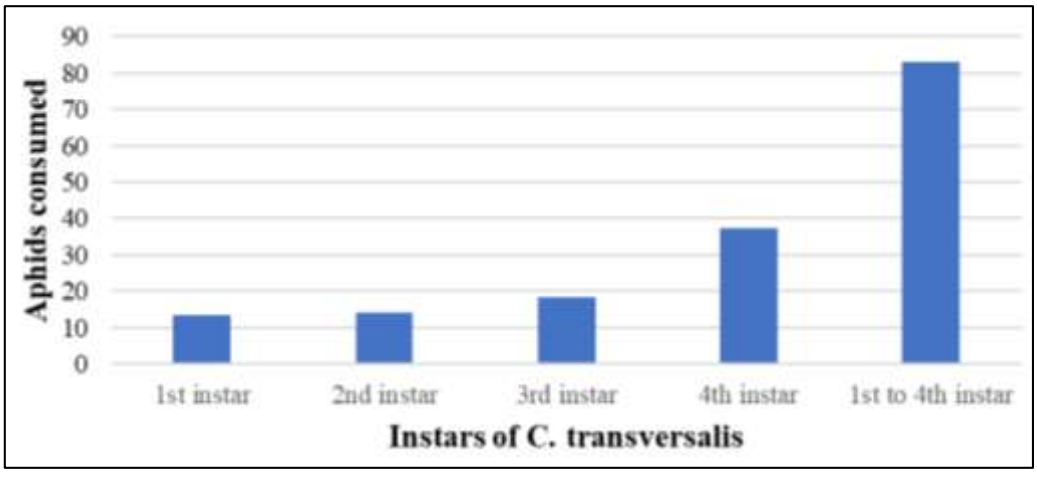

Fig 1: Feeding potential of *C. transversalis* grub on *U. compositae*

Table 2: Per day consumption of *C. transversalis* on *U. compositae*

Sr. No	Stage	No. of aphids per day
1	I instar	4.6
2	II instar	5.8
3	III instar	7.9
4	IV instar	11.2
5	Adult	12.4

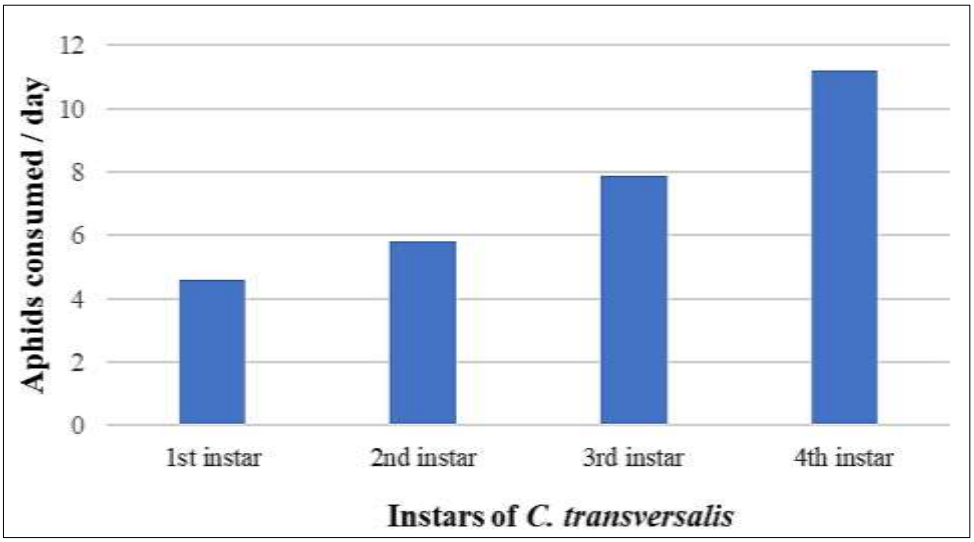

Fig 2: Per day consumption of *C. transversalis* grub

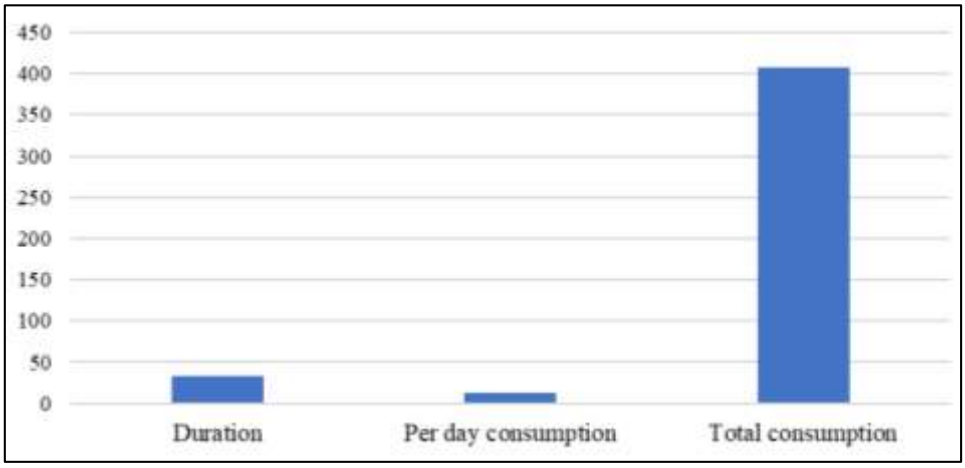

Fig 3: Per day consumption and total consumption of adult *C. transversalis*

Adults

Duration of adult when fed on *U. compositae* was 32.83 days. The feeding potential of adult beetle of *C. transversalis* was 407.09 aphids. The study concluded that per day consumption of beetle (12.4 aphids / day) was found to be higher than grub instars of both *Mallada* sp. (9.48 aphids/day for 3rd instar grub) and *C. transversalis* (11.2 aphids/ day for 4th instar grub).

The feeding potential of *C. transversalis* (grub and adult combined) was 490.22 aphids. The study concluded that total feeding potential of *C. transversalis* was more efficient than *Mallada* sp. due the absence of aphidophagous nature of *Mallada* adults, where the adults feed on pollen and honey for survival.

The present findings were more or less parallel to findings of Omkar and James (2004) [5] reported the feeding potential of 1st, 2nd, 3rd, 4th instar and total larval consumption of *Coccinella transversalis* on *Uroleucon compositae* to the tune of 15.40 ± 0.58, 39.30 ± 1.43, 125.80 ± 2.09, 315.20 ± 2.32 and 495.70 ± 4.99, respectively. The daily consumption (male), daily consumption (female), total consumption (male) and total consumption(female) were found be 30.90 ± 0.89, 32.80 ± 1.04, 1435.70 ± 72.79 and 1689.70 ± 61.19, respectively.

Panchal (2011) [6] reported the 1st, 2nd, 3rd, 4th instar and total larval duration of *Coccinella septempunctata* fed on *Uroleucon compositae* were 3.03, 2.70, 2.52, 3.03 and 11.28 days. The feeding potential of 1st, 2nd, 3rd ,4th instar and total grub stage were 15.08, 24.56, 37.0, 80.2 and 156.84 aphids. Average longevity of male and female adults was 37.4 and 43.8 days. The predatory potential value of male and female adults were 1466.4 and 1893.9 aphids.

Chrysopa* spp. *(Mallada* sp.*)

Mallada sp. was species taken under study to determine the feeding potential against safflower aphid. The table no. 3 revealed that the duration of 1st, 2nd and 3rd instar grub of *Mallada* sp. were 5.33, 5.66 and 6.5 days, respectively. The average grub duration when fed by *Uroleucon compositae* was 17.49 days.

The data in table 3 showed that the feeding potential of 1st, 2nd and 3rd instar grub of *Mallada* sp. on *U. compositae* were 20.78, 37.92 and 61.62 aphids, respectively. The total *U. compositae* consumed by *Mallada* sp. during its grub period was found to be 120.32 aphids. The average grub consumption was 40.11 aphids/instar.

The results on per day consumption of *Mallada* sp. were presented in table 4. The results revealed that per day consumption of 1st, 2nd and 3rd instar grub of *Mallada* sp. were 3.9, 6.7 and 9.48 adult aphids/day, respectively. Results showed that 3rd instar grub consumed significantly higher number of aphids followed by 2nd and 1st instar grub. Since adult of *Mallada* sp. feed on pollen and honey, feeding potential of adults were not worked out.

Table 3: Feeding potential of *Mallada* sp. on *U. compositae*

Stage	Duration in days	Total consumption (aphids)
I Instar	5.33	20.78
II Instar	5.66	37.92
III Instar	6.5	61.62
I to III instar	17.49	120.32
	Average grub consumption (aphids/instar)	40.11

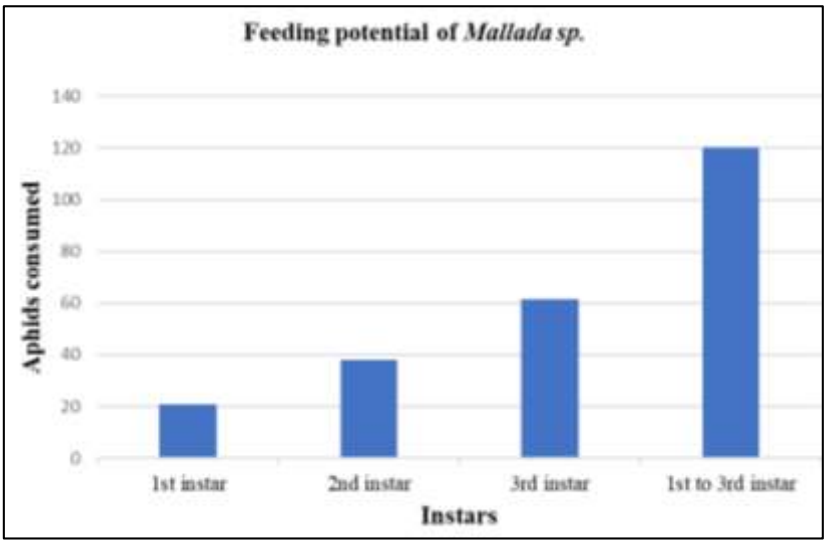

Fig 4: Feeding potential of *Mallada* sp. on *U. compositae*

Table 4: Per day consumption of *Mallada* sp. (Grub) on *U. compositae*

Sr. No	Stage	No. of aphids per day
1	I instar	3.9
2	II instar	6.7
3	III instar	9.48

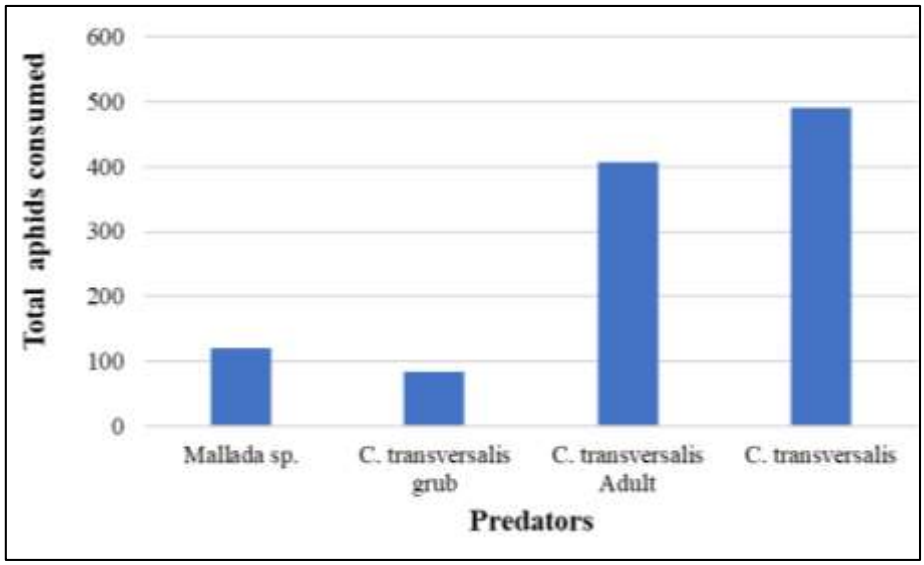

Fig 5: Feeding potential of predominant predators against *U. compositae*

The present findings are in corroboration with those reported by Nehare *et al.*, (2004) [4] who reported that the 1st, 2nd, 3rd and total grub duration of *Mallada boninensis* when fed on *U. compositae* to the tune of 3.03, 4.76, 8.60 and 16.66 days. The feeding potential of *M. boninensis* was found to be 155.0 aphids. Similarily, Gade and Shetgar (2010) reported the 1st, 2nd, 3rd instar grub and total grub duration of *M. boninensis* were 4.46, 4.52, 6.45 and 15.43 days, respectively.

Conclusion

Coccinella transversalis exhibited higher feeding efficiency (490.22 aphids) against safflower aphid than *Mallada* sp. (120.32 aphids) while considering a single life cycle as a study reference.

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