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Predatorty potential of two aphidophagous coccinellids, *Chilomenus sexmaculata* Fabricus and *Coccinella transversalis* Fabricus on two aphid hosts *Aphis craccivora* Koch and *Aphis gossypii* glover

T Vasista, MSV Chalam, KV Hariprasad and G Mohan Naidu

Abstract
Feeding potential of two aphidophagous predators *viz.*, *C. sexmaculata* Fabricus and *C. transversalis* Fabricus was studied on aphid hosts *viz.*, *Aphis craccivora* Koch and *Aphis gossypii* Glover. First, second, third, fourth instar grub, adult male beetle and adult female beetle of *C. sexmaculata* consumed 11.60±1.16, 36.80±1.77, 57.80±4.95, 121.00±8.63, 764±23.89 and 940.00±21.62 adults of *A. craccivora* respectively. First, second, third, fourth instar grub, adult male beetle and adult female beetle of *C. sexmaculata* consumed 8.20±0.58, 24.60±1.50, 38.60±0.74, 115.20±3.04, 593.20±11.46 and 730.00±14.32 adults of *A. gossypii* respectively whereas, first, second, third, fourth instar grub, adult male beetle and adult female beetle of *C. transversalis* consumed 16.20±1.88, 32.80±2.55, 66.00±1.37, 81.20±4.07, 579.80±20.45 and 746.20±16.02 adults of *A. craccivora* respectively. First, second, third, fourth, adult male beetle and adult female beetle of *C. transversalis* consumed 11.00±0.70, 25.60±2.20, 59.00±2.28, 101.00±4.34, 502.60±8.32 and 647.00±20.54 adults of *A. gossypii* respectively. *C. sexmaculata* consumed 1167.20±28.83 and 949.80±44.90 adults of *A. craccivora* and *A. gossypii* respectively in its entire life cycle (grubs & adults) whereas, *C. transversalis* consumed 950.60±20.93 and 843.60±17.54 adults of *A. craccivora* and *A. gossypii* respectively in its entire life cycle (grubs & adults). The entire grub stage lasted for 9.8±0.37 and 11.00±0.31 days when *C. sexmaculata* was fed on *A. craccivora* and *A. gossypii* respectively whereas, the entire grub stage of *C. transversalis* lasted for 10.4±0.24 and 11.4±0.24 days when fed on *A. craccivora* and *A. gossypii* respectively.

Keywords: predatory potential, *Chilomenus sexmaculata*, *Coccinella transveralsis*, *Aphis gosspyii*, *Aphis craccivora*

Introduction
Coccinellids belong to family Coccinellidae of order Coleoptera and are commonly called as ladybird beetles. These are oval to hemispherical in shape with clavate antennae, securiform maxillary palpi, pseudotrimerous tarsi and are often brightly coloured with red, orange (or) yellow shades. Coccinellids are of high economic importance due to their predatory activity against soft bodied insects *viz.*, aphids, leafhoppers, psyllids, whiteflies, scales and mealy bugs. They also prey upon small larvae, insect eggs and phytophagous mites which are injurious to agricultural and forest plantations. The predaceous Coccinellids have been successfully utilized in various biocontrol programs with spectacular success rates. Some of the examples include *Radolia cardinalis* (Mulsant) against *Iceria purchasi* Maskell, *Cryptolaemus montruzeri* Mulsant against *Maconellisoccus hirusutus* (Green) and *Planococcus citri* (Risso) *etc*. Less famous but just as important are the naturally occurring Coccinellids, for without these species in our crop ecosystems pest problems would have been far more intense. Aphids (Aphididae: Hemiptera) are soft bodied, sucking pests and approximately 4000 species of aphids have been observed so far feeding over 250 agricultural and horticultural crops. On several occasions insecticidal applications have accentuated the aphid populations and quite often resulted in outbreaks. However, predatory Coccinellids play a major role in keeping these under control (Kristopher *et al.*, 2002) [5]. Coccinellids are generalized predators that feed on a diverse range of foods. Aphids are the principal food of Coccinellids, whereas coccids, mites honeydew, pollen, nectar and mildew are recorded as secondary foods. (Bianchi *et al.*, 2004; Deligeorgidis *et al.*, 2005) [2, 4]. Both grubs and adults of Coccinellids feed on aphids. Aphids *viz.*, *Aphis craccivora* in pulses and *Aphis gossypii* in groundnut are considered as important sucking pests causing economic damage.

Cowpea aphid (*Aphis craccivora*) and groundnut aphid (*Aphis gossypii*) infesting pulses and groundnut respectively were the most devastating aphids in the Rayalseema region. Generally the aphids are being predated by various species of Coccinellids (aphidophagous Coccinellids). *Cheilomenes sexmaculata* Fabricius and *Coccinella transversalis* Fabricius are important aphidophagous predators that control aphid population to great extent in nature (Omkar and Bind 2003, Reddy *et al.*, 2001) [13]. The development and potential feeding of Coccinellids vary with their choice of food. The information generated on predatory potential of Coccinellids will provide a preliminary step in exploitation of Coccinellids in biological control of aphids associated with pulse and groundnut crop ecosystems. Therefore an attempt was made in the present study to determine the predatory efficiency of grubs and adults of two most abundant Coccinellids associated with pulse and groundnut crop ecosystems of Chittoor district on two aphid hosts *viz*., *Aphis gossypii* Glover and *Aphis craccivora* Koch.

Material and Methods

To estimate the predatory potential, two majorly abundant Coccinellids *viz., Chilonemus sexmaculata* and *Coccinella septumpunctata* were selected and the predatory potential of two selected Coccinellids was studied on two aphid species *viz., Aphis gossypii* and *Aphis craccivora*. For culturing of the aphid species small plots of 2×2m plots with cowpea and groundnut plants were raised. Groundnut was used as a host for rearing of *A. gossypii* and cowpea was used as a host for *A. craccivora*. Adults of Coccinellid beetles collected from the field were used as nucleus culture for mass multiplication. The Coccinellid beetles were transferred to plastic jar of 22.5×15 centimeters and were kept at a temperature of 27 ± 1^0C and a relative humidity of 60 ± 5% for healthy growth of grubs and adults. The bottom of jar was covered with Whatmann no. 1 filter paper. Cowpea twigs infested with *A. craccivora and* groundnut twigs infested with *A. gossypii* were provided as food for adults. A tissue paper with multifolds was kept inside the jar to serve as oviposition substratum. Eggs laid on tissue paper, plant twigs were carefully removed and were kept for hatching. Tender twigs of cowpea and groundnut containing known number of aphid species *viz., A. craccivora* and *A. gossypii* respectively were placed over the filter paper which was then placed in a petriplate of size 9 cm with the help of a camel hair brush. Single grub of test Coccinellid was released into each plate. For newly born grubs, 30-40 nymphs of respective aphid species were provided as food. The number of aphids were subsequently increased, reaching maximum up to 100 nymphs daily with advancement in age of grubs. The procedure was followed till pupation.

The experiment was replicated five times to avoid any possible error. The same procedure was followed till the pupation, the formed pupa were carefully collected and were kept for adult emergence after the adult emergence, the adult was sexed and was again provided with 100 aphids daily till the death of adult. The total number of aphids consumed by each grub/ adult were counted along with number of dead and unconsumed aphids. The aphids were replaced by fresh aphids daily. Observations were recorded at 12 hour interval to record the duration of each instar, the summation of each which gives total grub period. The pupal period and the developmental period (egg to adult) were recorded for each coccinellid species on each aphid host. The adult longetivity was also recorded and the data was analyzed by CRD

Results and Discussion

Predatory potential of *Cheilomenes sexmaculata* on *Aphis craccivora* and *Aphis gossypii*

Predatory potential and duration of grub stage

The mean consumption (number of aphids consumed/ instar) of first instar grub of *C. sexmaculata* was 11.60 ± 1.16 (range 9-15), 8.20 ± 0.58 (range 7-10) on *A. craccivora* and *A. gossypii* respectively during the entire first instar stage (Table 1). When day wise consumption of aphid hosts was studied it was clearly evident that first instar grub of *C. sexmaculata* consumed more number of *A. craccivora* (5.80 $\pm$ 0.58) than *A. gossypii* (4.10 ± 0.29) and the difference was found to be statistically significant (Table 3). The first instar stage lasted for 2.00 ± 0.20 days when *C. sexmaculata* was fed on *A. craccivora* and 2.40 ± 0.24 days when *C. sexmaculata* was fed on *A. gossypii* respectively (Table 5).

The mean consumption (number of aphids consumed/ instar) of second instar grub of *C. sexmaculata* was 36.80 ± 1.77 (range 30-40), 24.60 ± 1.50 (range 21-30) on *A. craccivora* and *A. gossypii* respectively during the second instar stage (Table 1). When day wise consumption of aphid hosts was studied it was clearly evident that second instar grub of *C. sexmaculata* consumed more number of *A. craccivora* (13.24 ± 0.47) than *A. gossypii* (11.30 ± 0.47) and the difference was found to be statistically significant (Table 3). The second instar stage lasted for 2.8 ± 0.20 days when *C. sexmaculata* was fed on *A. craccivora* and 2.2 ± 0.20 days when *C. sexmaculata* was fed on *A. gossypii* respectively (Table 5).

The mean consumption (number of aphids consumed/ instar) of third instar grub of *C. sexmaculata* was 57.80 ± 4.95 (range 46-73), 47.80 ± 5.84 (range 36-63) on *A. craccivora* and *A. gossypii* respectively during the entire third instar stage (Table 1). When day wise consumption of aphid hosts was studied it was clearly evident that third instar grub of *C. sexmaculata* consumed more number of *A. craccivora* (24.28 $\pm$ 0.94) than *A. gossypii* (19.76 ± 0.50) and the difference was found to be statistically significant (Table 3). The duration of third instar stage was found to be 2.40 ± 0.24 days when *C. sexmaculata* was fed on *A. craccivora* and 3.00± 0.20 days when *C. sexmaculata* was fed on *A. gossypii* respectively (Table 5).

The mean consumption (number of aphids consumed/ instar) of fourth instar grub of *C. sexmaculata* was 121.00 ± 8.63 (range 87-135), 115.20 ± 3.04 (range 108-125) on *A. craccivora* and *A. gossypii* respectively during the entire third instar stage (Table 1). When day wise consumption of aphid hosts was studied it was clearly evident that fourth instar grub of *C. sexmaculata* consumed more number of *A. craccivora* (43.22 ± 0.50) than *A. gossypii* (38.36 ± 1.01) and the difference was found to be statistically significant (Table 3). The duration of fourth instar stage was found to be 2.80 ± 0.20 days when *C. sexmaculata* was fed on *A. craccivora* and 3.00 ± 0.00 days when *C. sexmaculata* was fed on *A. gossypii* respectively (Table 5). The fourth instar grub of *C. sexmaculata* consumed more number of aphids when compared to third instar grub and the difference was significant (Table 1).

The mean consumption (number of aphids consumed/ entire grub) of entire grub stage of *C. sexmaculata* was 227.20 ± 13.47, 194.20 ± 8.89 on *A. craccivora* and *A. gossypii* respectively (Table 1). The grub of *C. sexmaculata* has consumed more number of *A. craccivora* than *A. gossypii*. The entire grub stage lasted for 9.80 ± 0.37 days when *C.*

sexmaculata was fed on *A. craccivora* and 11.00 ± 0.31 days when *C. sexmaculata* was fed on *A. gossypii* respectively (Table 5). The mean duration of entire grub stage was less when *C. sexmaculata* was fed on *A. craccivora* compared to *C. sexmaculata* when fed on *A. gossypii* and the difference was found to be statistically significant (Table 6).

Predatory potential and duration of adult beetles

The mean consumption (number of aphids consumed/ male beetle) with respect to adult male beetle of *C. sexmaculata* was 764.00 ± 23.89 (range 702-825), 593.20 ± 11.46 (range 546-622) on *A. craccivora* and *A. gossypii* respectively (Table 1) during its entire life period. When day wise consumption of aphid hosts was studied it was clearly evident that adult male beetle consumed more number of *A. craccivora* (75.00 ± 0.83) than *A. gossypii* (62.40 ± 0.65) and the difference was found to be significant (Table 3). The duration of adult male beetle stage was found to be 9.40 ± 0.24 days when *C. sexmaculata* was fed on *A. craccivora* and 10.2 ± 0.37 days when *C. sexmaculata* was fed on *A. gossypii* respectively (Table 5). The adult male beetle of *C. sexmaculata* has consumed more number of aphids when compared to grub stages and the difference was statistically significant (Table 1).

The mean consumption (number of aphids consumed/ female beetle) with respect to adult female beetle of *C. sexmaculata* was 940.00 ± 21.62 (range 913-1008), 730.00 ± 14.32 (range 640-897) on *A. craccivora* and *A. gossypii* respectively during its entire life period (Table 1). When day wise consumption of aphid hosts was studied it was clearly evident that adult female beetle of *C. sexmaculata* consumed more number of *A. craccivora* (82.44 ± 0.66) than *A. gossypii* (66.00 ± 1.04) and the difference was found to be statistically significant (Table 3). The adult female beetle stage lasted for 11.20 ± 0.24 days when *C. sexmaculata* was fed on *A. craccivora* and 11.40 ± 0.51 days when *C. sexmaculata* was fed on *A. gossypii* respectively (Table 5). The adult female of *C. sexmaculata* has consumed more number of aphids when compared to adult male beetle and the difference was found to be statistically significant (Table 1).

Total consumption of aphid hosts by *C. sexmaculata* (during entire life cycle)

The Coccinellid, *C. sexmaculata* has consumed 1167.20 ± 28.83 and 949.80 ± 44.90 *A. craccivora* and *A. gossypii* respectively during the entire lifecycle (Table 7). The consumption of *C. sexmaculata* on *A. craccivora* was more when compared on *A. gossypii* and the difference was found to be statistically significant (Table 7).

Predatory potential of *Coccinella transversalis* on *Aphis craccivora* and *Aphis gossypii*

Predatory potential and duration of grub stage

The mean consumption (number of aphids consumed/ instar) of first instar grub of *C. transversalis* was 16.20 ± 1.88 (range 11-21), 11.00 ± 0.70 (range 9-13) on *A. craccivora* and *A. gossypii* respectively during the first instar stage (Table 2). When day wise consumption of aphid hosts was studied, it was clearly evident that first instar grub of *C. transversalis* has consumed more number of *A. craccivora* (6.24 ± 0.52) than *A. gossypii* (4.32 ± 0.35) and the difference was found to be statistically significant (Table 1).The first instar stage lasted for 2.60 ± 0.24 days when *C. transversalis* was fed on *A. craccivora* and 2.60 ± 0.24 days when *C. transversalis* was fed on *A. gossypii* respectively (Table 5).

The mean consumption (number of aphids consumed/ instar) of second instar grub of *C. transversalis* was 32.80 ± 2.55 (range 23-38), 25.60 ± 2.20 (range 18-31) on *A. craccivora* and *A. gossypii* respectively during the second instar stage (Table 2). When day wise consumption of aphid hosts was studied it was clearly evident that second instar grub of *C. transversalis* consumed more number of *A. craccivora* (11.66 ± 0.24) than *A. gossypii* (9.12 ± 0.36) and the difference was found to be statistically significant (Table 4). The duration of second instar stage was found to be 2.60 ± 0.20 days when *C. transversalis* was fed on *A. craccivora* and 2.80 ± 0.20 days when *C. transversalis* was fed on *A. gossypii* respectively (Table 5).

The mean consumption (number of aphids consumed/ instar) of third instar grub of *C. transversalis* was 66.00 ± 1.37 (range 62-69), 59.00 ± 2.28 (range 53-64) on *A. craccivora* and *A. gossypii* respectively during the entire third instar stage (Table 2). When day wise consumption of aphid hosts was studied it was clearly evident that third instar grub of *C. transversalis* consumed more number of *A. craccivora* (21.98 ± 0.47) than *A. gossypii* (19.62 ± 0.75) and the difference was found to be statistically significant (Table 4). The third instar stage lasted for 3.00 ± 0.00 days when *C. transversalis* was fed on *A. craccivora* and 3.00 ± 0.24 days when *C. transversalis* was fed on *A. gossypii* respectively (Table 5).

The mean consumption (number of aphids consumed/ instar) of fourth instar grub of *C. transversalis* was 81.20 ± 4.07 (range 72-120), 101.00 ± 4.34 (range 93-113) on *A. craccivora* and *A. gossypii* respectively during the fourth instar stage (Table 2). When day wise consumption of aphid hosts *viz.*, *A. craccivora* and *A. gossypii* was studied it was clearly evident that fourth instar grub of *C. transversalis* consumed more number of *A. craccivora* (37.86 ± 1.09) than *A. gossypii* (33.64 ± 1.43) and the difference was found to be statistically significant (Table 4). The fourth instar stage lasted for 2.40 ± 0.24 days when *C. transversalis* was fed on *A. craccivora* and 3.00 ± 0.20 days when *C. transversalis* was fed on *A. gossypii* respectively (Table 5). The fourth instar grub of *C. transversalis* consumed more number of aphids when compared to third instar grub and the difference was statistically significant (Table 2).

The mean consumption (number of aphids consumed/ entire grub) of entire grub stage of *C. transversalis* was 206.00 ± 11.41, 196.60 ± 7.38 when fed on *A. craccivora* and *A. gossypii* respectively (Table 2). The grub of *C. transversalis* consumed more number of *A. craccivora* than *A. gossypii*. The entire grub stage lasted for 10.40 ± 0.24 days when the *C. transversalis* was fed on *A. craccivora* and 11.40 ± 0.24 days when the *C. transversalis* was fed on *A. gossypii* respectively (Table 5).

Predatory potential and duration of adult beetles

The mean consumption (number of aphids consumed/ male beetle) with respect to adult male beetle of *C. transversalis* was 579.80 ± 20.45 (range 488-638), 502.60 ± 8.32 (range 484-524) on *A. craccivora* and *A. gossypii* respectively (Table 2). When day wise consumption of aphid hosts was studied it was clearly evident that adult male beetle of *C. transversalis* consumed more number of *A. craccivora* (56.10 ± 0.70) than *A. gossypii* (52.38 ± 0.63) and the difference was significant (Table 4). The duration of adult male beetle was found to be 10.00 ± 0.44 days when *C. transversalis* was fed on *A. craccivora* and 9.60 ± 0.24 days when *C. transversalis* was

fed on *A. gossypii* respectively (Table 5). The adult male beetle of *C. transversalis* consumed more number of aphids when compared to grub stages and the difference was statistically significant (Table 2).

The mean consumption (number of aphids consumed/ female beetle) of adult female beetle of *C. transversalis* was 746.20 ± 16.02 (range 710-789), 647.00 ± 20.54 (range 576-700) on *A. craccivora* and *A. gossypii* respectively (Table 2). When day wise consumption of aphid hosts was studied it was clearly evident that adult female beetle of *C. transversalis* consumed more number of *A. craccivora* (65.29 ± 0.23) than *A. gossypii* (58.78 ± 0.57) and the difference was found to be statistically significant (Table 1). The adult female beetle stage lasted for 11.40 ± 0.24 days when *C. transversalis* was fed on *A. craccivora* and 11.00 ± 0.31 days when *C. transversalis* was fed on *A. gossypii* respectively (Table 5). The adult female beetle of *C. transversalis* consumed more number of aphids when compared to adult male beetle and the difference was statistically significant (Table 2).

Total consumption of aphid hosts by *C. transversalis* (during entire life cycle)

The Coccinellid *C. transversalis* has consumed 950.60 ± 20.93 and 843.60 ± 17.54 number of *A. craccivora* and *A. gossypii* respectively during the entire lifecycle (Table 7). *C. transversalis* has consumed more number of *A. craccivora* when compared to *A. gossypii* and the difference was found to be statistically significant (Table 7). The present studies have revealed that the mean number of aphids consumed by the first instar, second, third and fourth instar grubs of *C. sexmaculata* on *A. craccivora* were 11.60±1.16 (range 9-15), 36.80 ± 1.77 (range 30-40), 57.80 ± 4.95 (range 46-73) and 121.00 ± 8.63 (range 87-135) respectively, and 8.20±0.58 (range 7-10), 24.60 ± 1.50 (range 21-30), 47.80 ± 5.84 (range 36-63) and 115.20 ± 3.04 (range 108-125) respectively on *A. gossypii*. The mean consumption (number of aphids consumed per day by each stage) of *C. sexmaculata* on *A. craccivora* was more when compared to *A. gossypii* and the difference was found to be statistically significant. Among all the stages of grubs, final instar has consumed more number of aphids when compared with the third, second and first instar grubs and the difference was found to be statistically significant. The higher consumption of fourth instar grubs may be due to their bigger size, longer duration and need to accumulate nutrients for pupal period. The obtained results are in conformity with Kumar *et al.,* (2013) [6] who reported that the first instar grub of *Menochilus sexmaculatus* consumed 16 aphids (*A. craccivora*) during its first instar grub period. Verma *et al.* (1983) [16] reported predatory capacity of *C. sexmaculata* as 32.20 aphids (*A. craccivora*) during the second instar grub. Seshadri (1970) [14] reported the predatory potential of third instar grub of *C. sexmaculata* as 40.21 aphids (*A. craccivora*). Verma *et al.* (1983) [16] reported that the third instar grub of *C. sexmaculata* has fed on 35.40 (*A. craccivora*) aphids, throughout its grub stage. Megha *et al.* (2015) [9] found that fourth instar grub of *C. sexmaculata* fed upto 141.5 aphids (*A. gossypii*) during its grub period. Yogeshbhai (2005) [17] reported that *M. sexmaculatus* has consumed 107- 146 (Average 126.37 ± 9.35) adults of *A. craccivora* during the entire fourth instar grub stage. The present results were in close agreement to the results of Kumar (1992), Verma *et al.* (1983) [16], Mani *et al.* (2005) and Yogeshbhai (2005) [17]. Kundoo and Khan (2017) [7] reported that a single grub of *M. sexmaculatus* consumed 270.0 to 367.0 *A. craccivora* during its entire grub stage. Singh *et al.* (2008) [15] reported that *M. sexmaculatus* consumed 62.00 ± 0.78 to 211.40 ± 2.68 aphids (*Lipaphis erysimi*). The present results revealed that *C. sexmaculata* has consumed more number of *A. craccivora* (227.20 ± 13.47) than *A. gossypii* (194.20 ± 8.89) in its grub stage. The consumption of *C. sexmaculata* was more on *A. craccivora* when compared to *A. gossypii.* Pandi *et al.* (2012) [11] reported that *C. sexmaculata* consumed more number of *A. craccivora* (410) than *A. gossypii* (337) in its grub stage. The mean consumption of adult male and adult female beetle of *C. sexmaculata* on *A. craccivora* were 764.00 ± 23.89 (range 702-825) and 940.00 ± 21.62 (range 913-1008) respectively. The mean consumption of adult male and adult female beetle of *C. sexmaculata* on *A. gossypii* were 593.20 ± 11.46 (range 546-622) and 730.00 ± 14.32 (range 640-847) respectively. It was found that the mean consumption of adult male beetle was lower than adult female beetle due to its lower longetivity than female beetle. Kumar *et al.* (2013) [6] reported that adult male and female beetle of *C. sexmaculata* consumed 510.33 ± 9.82 (500-521 aphids) and 718.00 ± 17.21 (ranged 710-725 aphids) number of *A. craccivora* respectively. The mean consumption reported in the present study was slightly more because of more longevity of adult male and female beetle of *C. sexmaculata* under laboratory conditions. The present results were in close agreement with the results of Yogeshbhai (2005) [17] who reported that *Menochilus sexmaculatus* has consumed 900 aphids (*A. craccivora*) in its entire lifecycle (grub and adult stages). The present studies revealed that the mean duration of entire grub stage of *C. sexmaculata* on *A. craccivora* and *A. gossypii* were 9.80 ± 0.37 and 11.00 ± 0.31 days respectively. The duration of entire grub stage of *C. sexmaculata* when fed on *A. craccivora* was less when compared to *A. gossypii* and the difference was found to be statistically significant. Rajamohan and Jayraj (1974) [12] reported that the total larval duration is 8.60 days when *C. sexmaculata* was reared on *A. craccivora*. Yogeshbhai (2005) [17] reported that the total larval period varied from 6.0 to 10.0 days (Av. 6.17 + 0.44 days) when *C. sexmaculata* was reared on *A. craccivora*. Pandi *et al.* (2012) [11] reported that the mean developmental period of *C. sexmaculata* on *A. craccivora* and *A. gossypii* were 8.2 ± 0.58 days and 9.4 ± 0.51 days respectively. The present results showed that the mean consumption of first, second, third and fourth instars of *Coccinella transversalis* on *A. craccivora* were 16.20±1.88, 32.80±2.55, 66.00±1.37 and 81.20±4.07 respectively. The mean consumption of first, second, third and fourth instars of *Coccinella transversalis* on *A. gossypii* were 11.00±0.70, 25.60±2.20, 59.00±2.28 and 101.00±4.34 respectively. The mean consumption of fourth instar was more compared to first, second and third instar grubs and the difference was found to be statistically significant. The more consumption of fourth instar compared to first, second and third instar grubs was may be due to their bigger size, longer duration and to accumulate nutrients for pupal period and increased requirement of energy. The lower consumption of first instar may be due to small size and they were slow crawling, hence spent long in prey finding and thus resulted in minimum aphid consumption. Ali *et al.* (2007) [1] reported that the total consumption of *C. transversalis* on *A. craccivora* and *L. erysimi* were 807.30 ± 6.25 and 838.30 ± 6.59 respectively. The present results were in close accordance with Ali *et al.* (2009). *Coccinella transiversalis* consumed more number of *A. craccivora* (950.60 ± 20.93) than *A. gossypii* (843.60 ±

17.54) in its entire life cycle (grubs and adult). The consumption of *C. transversalis* was more on *A. craccivora* compared to *A. gossypii*. Chakraborty and Korat (2014) [3] reported that *C. transversalis* consumed more number of *A. craccivora* (528.47 ± 11.79) than *A. gossypii* (402.67 ± 4.75) during its entire life cycle (grub and adult stages). The present results were in close agreement with the results of Chakraborty and Korat (2014) [3]. The present studies indicated that the mean duration of entire grub stage of *C. transversalis* on *A. craccivora* and *A. gossypii* were 10. 40 ± 0.24 and 11.40 ± 0.24 respectively. The duration of entire grub stage of *C. transversalis* when fed on *A. craccivora* was less when compared to *A. gossypii* and the difference was found to be statistically significant. This may be due to the fact *C. transversalis* developed rapidly when fed on *A. craccivora* due to its more nutrient quality than *A. gossypii*. Lyla *et al.* (2008) [8] reported that larval stage of *C. transversalis* lasted for 10.3 days when fed on *A. craccivora*. Chakraborty and Korat (2014) [3] reported that the entire grub stage of *C. transversalis* lasted for 21.33 ± 1.02 days when fed on *A. craccivora*. A comparison of predatory potential (number of aphids consumed during entire lifecycle) between the two predatory Coccinellids *viz., C. sexmaculata* and *C. transversalis* revealed that both Coccinellids have consumed more number of *A. craccivora* than *A. gossypii* during their entire life cycle (Table 7). In between the predatory Coccinellids, *C. sexmaculata* has consumed more aphids (*A. craccivora* and *A. gossypii*) when compared to *C. transversalis* (Table 7) and the difference was found to be statistically significant. Both Coccinellids (*C. sexmaculata* and *C. transversalis*) consumed more number of aphids (*A. craccivora*) may be due to the fact that *A. craccivora* is more nutritious than *A. gossypii*.

Table 1: Feeding potential of *Cheilomenes sexmaculata* (mean consumption of aphids/ instar)

S. No.	Instar	(Number of aphids consumed/ instar) Mean ± SEM	
	Stage	*Aphis craccivora*	*Aphis gossypii*
1	First instar	11.60 ± 1.16	8.20 ± 0.58
2	Second instar	36.80 ± 1.77	24.60 ± 1.50
3	Third instar	57.80 ± 4.95	47.80 ± 5.84
4	Fourth instar	121.00 ± 8.63	115.20 ± 3.04
5	Total grub	227.20 ± 13.47	194.20 ± 8.89
6	Adult male	764 ± 23.89	593.20 ± 11.46
7	Adult female	940.00 ± 21.62	730.00 ± 14.32
	C.D (0.05)	40.50	22.39
	S.E. (m)	13.79	7.62
	S.E. (d)	19.51	10.78
	C.V	9.58	6.77

Table 2: Feeding potential of *Coccinella transverslais* (mean consumption of aphids/ instar)

S. No.	Instar	(Number of aphids consumed/ instar) Mean ± SEM	
	Stage	*Aphis craccivora*	*Aphis gossypii*
1	First instar	16.20 ± 1.88	11.00 ± 0.70
2	Second instar	32.80 ± 2.55	25.60 ± 2.20
3	Third instar	66.00 ± 1.37	59.00 ± 2.28
4	Fourth instar	81.20 ± 4.07	101.00 ± 4.34
5	Total grub	206.00 ± 11.41	19.60 ± 7.38
6	Adult male	579.80 ± 20.45	502.60 ± 8.32
7	Adult female	746.20 ± 16.02	647.00 ± 20.54
	C.D (0.05)	31.79	27.35
	S.E. (m)	10.82	9.31
	S.E. (d)	15.31	13.17
	C.V	9.54	9.28

Table 3: Mean consumption (number of aphids consumed per day by each stage) of *Cheilomenes sexmaculata* on *Aphis cracivora* and *Aphis gosyppii*

S. No	Aphid Host	Mean consumption (Number of Aphids consumed /Day)					
		First instar	Second instar	Third instar	Fourth instar	Adult male	Adult female
1	*Aphis craccivora*	5.80 ± 0.58[a]	13.24 ± 0.47[a]	24.28 ± 0.94[a]	43.22 ± 0.50[a]	75.00 ± 0.83[a]	82.44 ± 0.66[a]
2	*Aphis gosyppi*	4.10 ± 0.29[b]	11.30 ± 0.46[b]	19.76 ± 0.50[b]	38.36 ± 1.01[b]	62.40 ± 0.65[b]	66.00 ± 1.04[b]
	C. D	1.52	1.54	2.60	2.62	2.48	2.84
	S. E. (m)	0.46	0.46	0.78	0.79	0.75	0.85
	S. E. (d)	0.05	0.66	1.11	1.12	1.06	1.21

Note: Values followed the same letter are not significantly different at 5% dof

Table 4: Mean consumption (number of aphids consumed per day by each stage) of *Coccinella transversalis* on *Aphis cracivora* and *Aphis gosyppi*

S. No.	Aphid Host	Mean consumption (Number of Aphids consumed /Day)					
		First instar	Second instar	Third instar	Fourth instar	Adult male	Adult female
1	*Aphis craccivora*	6.24 ± 0.52[a]	11.66 ± 0.24[a]	21.98 ± 0.47[a]	37.86 ± 1.09[a]	56.10 ± 0.70[a]	65.29 ± 0.23[a]
2	*Aphis gosyppi*	4.32 ± 0.35[b]	19.12 ± 0.36[b]	19.62 ± 0.75 [b]	33.64 ± 1.43 [b]	52.38 ± 0.63 [b]	58.78 ± 0.57 [b]
	C. D	1.49	1.03	2.08	4.21	2.23	1.44
	S. E. (m)	0.45	0.31	0.63	1.27	0.67	0.43
	S. E. (d)	0.63	0.44	0.89	1.80	0.95	0.61

Note: Values followed the same letter are not significantly different at 5% dof

Table 5: Mean Duration of each stage of grub and adults of *Cheilomenes sexmaculata* and *Coccinella transversalis* on two aphid hosts (*Aphis craccivora* and *Aphis gossypii*)

S. No	Stage	Mean duration of each stage (no. of days)			
		C. sexmaculata		*C. transversalis*	
		A. craccivora	*A. gossypii*	*A. craccivora*	*A. gossypii*
1	First instar	2.00 ± 0.20	2.40 ± 0.24	2.60 ± 0.24	2.60 ± 0.24
2	Second instar	2.80 ± 0.20	2.20 ± 0.20	2.60 ± 0.20	2.80 ± 0.2
3	Third instar	2.40 ± 0.24	3.00 ± 0.20	3.00 ± 0.00	3.00 ± 0.24
4	Fourth instar	2.80 ± 0.20	3.00 ± 0.00	2.40 ± 0.24	3.00 ± 0.20
5	Total grub	9.80 ± 0.37	11.00 ± 0.31	10.40 ± 0.24	11.40 ± 0.24
6	Adult male	9.40 ± 0.24	10.20 ± 0.37	10.00 ± 0.44	9.60 ± 0.24
7	Adult female	11.20 ± 0.24	11.40 ± 0.51	11.40 ± 0.24	11.00 ± 0.31

Table 6: Mean duration of grub stage of *Cheilomenes sexmaculata* and *Coccinella transversalis* on *Aphis craccivora* and *Aphis gossypii*

S. No	Mean duration of entire grub stage(no. of days)			
	C. sexmaculata		*C. transversalis*	
1	*A. craccivora*	9.80 ± 0.37[a]	*A. craccivora*	10.40 ± 0.2437[a]
2	*A. gossypii*	11.00 ± 0.3137[b]	*A. gossypii*	11.40 ± 0.2437[b]
	C. D(0.05)	1.14	C D(0.05)	0.811
	S. E. (m)	0.34	S. E. (m)	0.24
	S. E. (d)	0.49	S. E. (d)	0.54
	C. V	7.448	C. V	5.025

Note: Values followed the same letter are not significantly different at 5% dof

Table 7: Mean Consumption (number of aphids consumed per entire life cycle) of *Aphis craccivora* and *Aphis gossypii* by *Cheilomenes sexmaculata* and *Coccinella transversalis*

S. No	Aphid hosts	Mean number of aphids consumed		C.D	S. E. (m)	S. E. (d)	C. V
		Cheilomenes sexmaculata	*Coccinella transversalis*				
1	*A. craccivora*	1167.20 ± 28.83	950.60 ± 20.93	83.43	25.19	35.62	5.32
2	*A. gossypii*	949.60 ± 44.90	843.60 ± 17.54	61.22	34.08	48.20	8.50
	C.D	124.93	63.95	XX	XX	XX	XX
	S. E. (m)	37.73	19.31	XX	XX	XX	XX
	S. E. (d)	53.36	27.31	XX	XX	XX	XX
	C. V	7.97	4.81	XX	XX	XX	XX

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