The Bioscan 9(1): 17-22, 2014
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.in

BIOLOGY OF *COCCINELLA TRANSVERSALIS* (FABRICIUS) ON DIFFERENT APHID SPECIES

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KEYWORDS
Biology
Coccinella transversalis
Aphids

Received on :
29.06.2013

Accepted on :
17.10.2013

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ABSTRACT

The average biology of *C. transversalis* were showed that when it was reared on *A. craccivora* the egg, total larval, pupal and adult male and female periods was 2.70 ± 0.76, 12.90 ± 1.44, 2.62 ± 0.63, 31.58 ± 3.22 and 39.10 ± 3.37 days, respectively, whereas on *L. erysimi* these periods were 2.70 ± 0.76, 12.68 ± 1.63, 2.62 ± 0.69 and 30.12 ± 4.49 and 33.88 ± 2.56 days, respectively, while on *M. persicae* these periods were 2.70 ± 0.76, 12.98 ± 1.93, 2.52 ± 0.61 and 29.08 ± 4.25 and 37.12 ± 2.27 days, respectively. The mean fecundity of *C. transversalis* on *A. craccivora, L. erysimi* and *M. persicae* were 376.46 ± 47.32, 364.88 ± 27.44 and 377.36 ± 28.96 eggs per female, respectively. Total life cycle of male and female *C. transversalis* on *A. craccivora, L. erysimi* and *M. persicae* were 50.80 ± 3.92, 49.12 ± 4.87 and 48.28 ± 5.38 days and 58.32 ± 3.92, 52.88 ± 3.48 and 56.32 ± 3.07 days, respectively. The average length and width of adult female was 5.37 ± 0.598 mm and 4.26 ± 0.498 mm, respectively, whereas male length and width was 4.85 ± 0.446 mm and 3.82 ± 0.414 mm, respectively.

INTRODUCTION

The ladybird beetles have been associated with good fortune in many myths and legends. They have been honored through the centuries as they vernacular indicate that the term 'Lady' is in reference to biblical Mother Mary (Roache, 1960). The ladybird beetles have been known worldwide as a predator of a number of insects. They are distributed in many countries of Asia, including India (Singh and Brar, 2004). They are the most commonly known of all beneficial insects. They are the great economic important as predaceous both in their larval and adult stages on various important crop pests such as aphids, coccids and other soft bodies insects including aphids (Hippa *et al.,* 1978) while the species *C. transversalis* feed on many species of aphids (Mani,1995). This predaceous coccinellids is also found in association with those insects infesting beans, cotton, mustard, brinjal, groundnut and cabbage (Gautam *et al.*, 1995). The aphid is one of the most destructive pests and its distribution is worldwide. Both adult and nymphs cause damage by sucking the sap from the flowers, buds, pods, tender shoots and reduce the market value of the product (Srivastava and Singh, 1986). At the time of infestation plants fail to give flowering and pods setting resulting in considerable yield loss (Islam, 2007).In India farmers use various insecticides to control the aphid. Insecticidal control is not only expensive but also its residues left over the sprayed surface of the crops or in the soil and have become a matter of concern of environmental pollution. The indiscriminate use of pesticides causes phytotoxicity and destruction of beneficial organisms such as predators, parasitoids, microorganism and pollinators (Luckman and Metcalf, 1978). Global warming has cautioned us and the adverse consequences of insecticide use are always alarming and also inducing pest out break because of pest resistance. These entomological backlashes have compelled the scientists to be concerned with entomologically compatible pest management programme (Hodek, 1967).Now a days, Integrated Pest Management (IPM) is well known to all of us where all the suitable pest control techniques are being used to find ecologically sound and environmentally safe ways of pest control. Biological control should be regarded as the backbone of any IPM programme and about 90% of all potential pests are already under biological control (Debach and Rosen, 1991). The biological control is one of the most effective means of achieving insect control (Pedigo, 2004). In recent years, pest control particularly for aphids has been revolutionized by the application of predators and parasitoids (Bari and Sardar, 1998). The coccinellid beetles are considered to be a great economic importance in agro-ecosystem through their successful employed in the biological control of many injurious insects (Agarwala *et al..,* 1988). The study of the biology of *C. transversalis* on different aphid species would help to use this insect of proper biological control. But the reviews of biology of *C. transversalis* is limited. So, the present study was undertaken to observe the biology of *C. transversalis* on three different species of aphid under the laboratory conditions.

MATERIALS AND METHODS

The experiment was conducted at the P.G. Laboratory of the Department of Entomology, N.M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat, India during the period of 2012 to February 2013 at 23.27 ± 1.04°C temperature and 52.84 ± 13.78 per cent relative humidity. A culture of large number of larvae and adult predator of *Coccinella transversalis* was established in the laboratory in order to supply necessary insects for the experiment. The standard mass rearing technique for the coccinellid predators as described by Soni *et al.,* (2008) was adopted. For this some males and females of the *C. transversalis* were collected by sweep net from the unsprayed fields and were confined in petridishes. Bean aphid (*Aphis craccivora*) were also collected daily with infested bean leaves, stems, twigs and inflorescences from the same unsprayed field and supplied as food. These beetles were sexed and paired in petridishes (6.0 × 1.0 cm). The bottom of the petridishes were covered with the blotting paper. After hatching of eggs, the grubs were transferred to medium sized petridishes and fed on these three species of aphids viz., *A. craccivors, Lipaphis erysimi* (Kalt.) and *Myzus persicae* (Sulzer). Thirty sets of each aphid species were maintained for the present study.

The eggs laid by each female during 24 hours were counted and kept in separate petridish to determine the total number of eggs laid per female and also hatching period including the hatching percentage (%) of eggs was recorded. After hatching of eggs young larvae were then transferred individually in petridishes (6.0 × 1.0 cm), containing the blotting paper at the bottom. Aphids of all three species were in each petridish to provide the food for the instars and period of each instar were recorded reared on three aphid species. The pupae were kept undisturbed in the respective petridishes until the emergence of adult. At the same time pre-pupal and pupal period was recorded. The adult emerged were also provide three aphid species as food and the adult period, pre-oviposition, oviposition and post oviposition period were also recorded.

RESULTS AND DISCUSSION

The biology of the *C. transversalis* was presented under the following headings.

Egg

During the present study, it was observed that *C. transversalis* did lay eggs where aphid colonies present in field condition. In laboratory condition, the eggs were laid on the undersurface of lid and periphery of petridish. The eggs were usually laid in singly or in the groups of 6 to 11 and each group consist of 3 to 31 eggs. The freshly laid eggs of *C. transversalis* were cigar shaped bright yellow in colour with smooth chorion and without any reticulations. The eggs turned blackish with advancement of age and became completely black before hatching. The length of eggs varied from 0.94 to 1.04 mm with an average 0.98 ± 0.025 mm, whereas the width varied from 0.38 to 0.49 mm with an average 0.42 ± 0.026 mm (Table 1). The similar description of egg laying pattern, shape and colour was also reported by Lyla *et al.* (2008) on *C. transversalis*. Thus confirms the present findings. The incubation period under laboratory condition varied from 2 to 5 days with an average 2.70 ± 0.766 days. Incubation period of *C. transversalis* was found to be 2 days under laboratory conditions at a temperature of 27°C and 79 % relative humidity by Lyla *et al.* (2008). Lohar *et al.,* (2012) from Pakistan recorded the incubaton period of *Hippodamia convergence* as 3.6 days when reared on *L. erysimi*. It can be seen from Table 1, that the hatching percentage of eggs of *C. transversalis* varied from 67.85 to 97.43 per cent with an average 84.73 ± 8.114 per cent, which is in agreement with the finding of Tank and Korat (2007) who recorded 85.96 per cent hatching in *C. sexmaculata* at Anand.

Grub

During the present studies, *C. transversalis* was observed to pass through four larval instars when reared on three different aphid species.

First instar - The newly hatched larva was silvery shine pale black in colour with shining dark head capsule and legs later on it turns black in colour and having spiny structure over body. This is partially in accordance with the larval description given by Tank and Korat (2007) on *C. sexmaculata* and Lohar *et al.* (2012) from Pakistan on *H. convergence*. It can be seen that the length of the first instar larva ranged from 1.22 to 1.55 mm with an average of 1.55 ± 0.170 mm, while width varied from 0.30 to 0.47 mm with an average 0.47 ± 0.07 mm (Table 1). More or less similar measurements were reported by Tank and Korat (2007) who recorded average length and width of coccinellid larvae as 1.41 ± 0.16 and 0.42 ± 0.02 mm, respectively. The development of first instar larva of *C. transversalis* was completed on 2 to 4 days in all species of aphid with an average 2.48 ± 0.579, 2.60 ± 0.638 and 2.66 ± 0.650 days when reared on *A. craccivora, L. erysimi* and *M. persicae*, respectively (Table 1). According to Lyla *et al.* (2008) first instar larva of *C. transversalis* lasted for 1 day on *A. craccivora*. This is in accordance with the present findings.

Second instar - Freshly moulted second instar larva was slender globular in shape and glistening black in colour with pale yellow head capsule and black legs. Development of orange coloured transverse patches was observed on meso thorax and also on fourth and sixth abdominal segment. Larval body posses the spiny structure. This is in agreement with the report of Tank and Korat (2007a) on *C. sexmaculata* in this species orange coloured transverse patches instead of white patches. The length of second instar larva ranged from 2.07 to 3.32 mm (Mean 3.32 ± 0.709 mm) while width varied from 0.59 to 0.93 mm (Mean 0.93 ± 0.161 mm) (Table 1). The average length and width of larva of *C. sexmaculata* was 4.25 ± 0.18 and 0.75 ± 0.17 mm as reported by Tank and Korat (2007b). The second instar larva lasted for 2 to 4 days with an average 2.54 ± 0.578, 2.76 ± 0.655 and 2.50 ± 0.582 days when reared on *A. craccivora, L. erysimi* and *M. persicae*, respectively (Table 1). Sattar *et al.* (2008) reported that the *C. septempuata* second instar larva required an average 4.6 ± 0.47 days when fed on cotton aphid, *A. gossypii,* second instar larva of *M. sexmaculatus* and *C. undecimpunctata* lasted for 4.3 ± 0.2 and 4.4 ± 0.1 days, respectively when fed on alfalfa aphid, *Therioaphis trifolii* Monell. Lohar *et al.* (2012) also reported that the second instar period for *H. convergence* as 2.4 days when fed on *L. erysimi*.

Third instar - The third instar larva of *C. transversalis* was similar in general appearance to second instar larva, except larger in size. In third instar larva the spiny structure were little larger than in second instar. Freshly moulted third instar larva

Table 1: Biology of *C. transversalis* under laboratory condition on different species of aphid

Particulars			Minimum	Maximum	Av. ± S.D.
Incubation period (Days)			2	5	2.70 ± 0.766
Hatching percentage (%)			67.85	97.43	84.73 ± 8.114
Larva (days)					
	I Instar	*A. craccivora*	2	4	2.48 ± 0.579
		L. erysimi	2	4	2.60 ± 0.638
		M. persicae	2	4	2.66 ± 0.650
	II Instar	*A. craccivora*	2	4	2.54 ± 0.578
		L. erysimi	2	4	2.76 ± 0.655
		M. persicae	2	4	2.50 ± 0.582
	III Instar	*A. craccivora*	2	5	3.74 ± 0.926
		L. erysimi	2	5	3.58 ± 0.831
		M. persicae	2	5	3.46 ± 0.990
	IV Instar	*A. craccivora*	3	6	4.14 ± 0.888
		L. erysimi	3	5	3.74 ± 0.823
		M. persicae	2	6	4.36 ± 1.084
Total larval development period(days)		*A. craccivora*	10	15	12.90 ± 1.443
		L. erysimi	10	17	12.68 ± 1.633
		M. persicae	9	18	12.98 ± 1.934
Prepupal period (days)		*A. craccivora*	1	1	1.00 ± 0.00
		L. erysimi	1	1	1.00 ± 0.00
		M. persicae	1	1	1.00 ± 0.00
Pupal period (days)		*A. craccivora*	2	4	2.62 ± 0.633
		L. erysimi	2	4	2.62 ± 0.696
		M. persicae	2	4	2.52 ± 0.611
Adult emergence (%)			57.14	100	80.36 ± 10.830
Sex ratio (male : female)		*A. craccivora*	1:1.08		
		L. erysimi	1:1.32		
		M. persicae	1:1.38		
Adult longevity (days)					
	Male	*A. craccivora*	26	38	31.58 ± 3.224
		L. erysimi	21	40	30.12 ± 4.492
		M. persicae	22	47	29.08 ± 4.25 2
	Female	*A. craccivora*	34	50	39.1 ± 3.370
		L. erysimi	29	41	33.88 ± 2.566
		M. persicae	32	43	37.12 ± 2.275
Total life cycle (days)					
	Male	*A. craccivora*	42	59	50.80 ± 3.923
		L. erysimi	40	64	49.12 ± 4.870
		M. persicae	37	58	48.28 ± 5.385
	Female	*A. craccivora*	50	67	58.32 ± 3.925
		L. erysimi	46	63	52.88 ± 3.480
		M. persicae	49	63	56.32 ± 3.097
Pre-oviposition period (days)		*A. craccivora*	4	7	5.50 ± 0.789
		L. erysimi	4	8	5.22 ± 0.883
		M. persicae	4	7	5.74 ± 0.757
Oviposition period (days)		*A. craccivora*	24	39	28.24 ± 2.817
		L. erysimi	21	28	24.08 ± 1.826
		M. persicae	23	32	27.22 ± 2.088
		A. craccivora	3	8	5.36 ± 1.178
Post-oviposition period (days)		*L. erysimi*	3	6	4.58 ± 0.831
		M. persicae	3	6	4.16 ± 0.866
Fecundity (no. of eggs)		*A. craccivora*	234	467	376.46 ± 47.323
		L. erysimi	319	423	364.88 ± 27.446
		M. persicae	325	433	377.36 ± 28.969
Sex ratio		*A. craccivora*	1:1.08		
		L. erysimi	1:1.32		
		M. persicae	1:1.38		

was dark black in colour. The colour pattern was more intensified with additional development of orange transverse patches on mid-dorsal line of other segments except prothorax. Lyla *et al*. (2008) quoted that after moulting of *C. transversalis* they turned black with a pair of yellowish orange patch on dorsal side near head. The length of third instar larva ranged from 4.21 to 4.86 mm with an average 4.86 ± 0.275 mm, while width varied from 1.20 to 1.49 mm with an average 1.49 ± 0.138 mm (Table 1). These observations are in agreement with the report of Tank and Korat (2007) who recorded the average length and width of larvae of *C. sexmaculata* as 5.83 ± 0.29 and 0.83 ± 0.05 mm, respectively.

The duration of third instar was in the range of 2 to 5 days in all prey species with an average of 3.74 ± 0.926, 3.58 ± 0.831 and 3.46 ± 0.990 days when reared on *A. craccivora, L. erysimi* and *M. persicae*, respectively. Chowdhary *et al.* (2008) found that the duration of the third instar larvae of *M. discolor* lasted from 2 to 4 days with the mean 3.10 ± 0.17 days when fed on bean aphid. Further, Tank and Korat (2007) reported that the third instar larvae of *C. sexmaculata* lasted for 1.88 ± 0.53 days when reared on *A. gossypii*. This is supported with Solangi *et al.* (2007) who reported that third instar larvae of *C. undecimpunctata* required 3.5 ± 1.26 days when reared on mustard aphid, *L. erysimi*. The third instar period of *H. convergence* was 2.6 days when reared on *L. erysimi* (Lohar *et al*., 2012).

Fourth instar - The fourth instar larva of *C. transversalis* was similar in general appearance to third instar larva, excluding larger in size. Larvae were deep black in colour, when freshly moulted but changed to black in colour before pre-pupation. It developed additional rectangular dark orange spots in a continuous series mid-dorsally on abdominal segments, whereas the spots on fourth abdominal segment were orange. Here also, the spiny structure were little larger as compared to third instar and when larvae disturbed, it excludes a yellow fluid from the dorsal surface of the body for defensive purpose, also larval body turn into 'C' shape. After third moult of *C. transversalis* orange coloured patches turned to a ring like pattern on the dorsal and dorsolateral side as reported by Lyla *et al*. (2008). The length of fourth instar larva varied from 5.09 to 6.05 mm with an average 6.05 ± 0.566 mm, while the width varied from 1.55 to 1.73 mm (Mean 1.73 ± 0.098 mm) (Table 1). Tank and Korat (2007) also reported that the average length and width of fourth instar larvae of *C. sexmaculata* as 7.17 0.20 and 1.29 ± 0.14 mm, respectively. The duration of fourth instar larvae of *C. transversalis* varied from 3 to 6, 3 to 5 and 2 to 6 days with an average 4.14 ± 0.888, 3.74 ± 0.823 and 4.36 ± 1.084 days when reared on *A. craccivora, L. erysimi* and *M. persicae*, respectively (Table 1). Mean duration of fourth instar larvae of *C. sexmaculata* was 1.96 ± 0.73 days when reared on *A. gossypii* (Tank and Korat, 2007). However, Solangi *et al.* (2007) recorded that fourth instar larvae of *C. undecimpunctata* lasted for 3.3 ± 0.94 days when reared on mustard aphid, *L. erysimi*. Khursheed *et al.* (2006) found that the mean duration of fourth instar larvae of *C. septempunctata* was 4.0 ± 0.58 days when reared on *L. erysimi* while it was 2.1 days in case of *H. convergence* when fed *L. erysimi* (Lohar *et al.,* 2012).

Total larval period

The total larval development period of *C. transversalis* varied from 10 to 15, 10 to 17 and 9 to 18 days with an average 12.90 ± 1.443, 12.68 ± 1.633 and 12.98 ± 1.934 days when reared on *A. craccivora, L. erysimi* and *M. persicae*, respectively. According to Lyla *et al.* (2008) larval stage of *C. transversalis* lasted for 10.3 days when fed on *A. craccivora*. However, Jagadish and Jayaramaiah (2004) found that the total larval period of *C. semptempuctata* was 11.86 days when fed on *M. nicotianae*.

Pre-pupa

The final instar larvae stopped feeding and then searched for a suitable place and became stationary and sluggish. This was the beginning of pre-pupal stage. The caudal region was firmly attached to the substratum, the body was shrunken during the formation of pre-pupa. Pre-pupa formed by *C. transversalis* larva was more or less rectangular in shape, formed 'C' shaped. The colour of pre-pupa was similar to the last larval instar. It undergoes a very short pre-pupal period. Similar observations have been made by Tank and Korat (2007) in case of *C. sexmaculata*. The length of pre-pupa of *C. transversalis* varied from 4.43 to 5.54 mm with a mean of 4.86 ± 0.290 mm, while width ranged from 1.97 to 2.73 mm with an average 2.28 ± 0.162 mm (Table 1).The duration of pre-pupal stage varied from 1 day with an average 1.00 ± 0.00 days when reared on *A. craccivora, L. erysimi and M. persicae*, respectively. Khursheed *et al.* (2006) quoted that the mean pre-pupal period of *C. septempunctata* was 1.5 0.29 days when reared on *L. erysimi*.

Pupa

When the larva was about to pupate, the spiny structure was disappeared. Freshly formed pupae were shining yellow in colour and later on turned to pale orange yellow. There were symmetrically orange black spots on each segment. The body turned into orange in colour later on blackish orange in colour and attached itself on dry leaf surface. This is in accordance with the report of Tank and Korat (2007) on *C. sexmaculata*. The pupae measured about 4.48 to 5.57 mm in length with an average 4.96 ± 0.290 mm and 2.63 to 3.58 mm in width with an average 3.08 ± 0.233 mm. According to Tank and Korat (2007) the length and width of pupae of *C. sexmaculata* was 3.88 0.19 mm and 2.30 to 0.45 mm, respectively.

The duration of pupal stage varied from 2 to 4 days in all species with an average 2.62 ± 0.633, 2.62 ± 0.696 and 2.52 ± 0.611 days when reared on *A. craccivora, L. erysimi* and *M. persicae*, respectively (Table 1). This is partly in accordance with Khursheed *et al.* (2006) who recorded pupal period of *C. septempuctata* as 6.0 ± 0.58 days.

Adults

Newly emerged adults were soft bodied, yellowish in colour without any marking which turned shining yellow or warm buff with black spots which developed gradually. The adult was medium sized, red and black coloured ladybird beetle, with elongate oval, convex shaped body. Head is black with a pair of creamy yellow, sub triangular frontal spots, one on either side of inner margins of eyes. Pronotum black, anterolateral corners light cream. Scutellum is black. Elytra bright carmine red or orange or yellow, with an oval subscutellar spot, a large trilobed spot on humeral callus, a transverse band at apical third not reaching lateral margin and three smaller apical spots-one sutural and two lateral, usually fused to form a transverse marking, sutural line with an irregular black stripe, which is accordance with the report of Lyla *et al.* (2006). Males were smaller in size than females. The last abdominal segment of male beetle was roundish, while in case of female it was pointed, for egg laying. The data on measurements of adult body length and width of female and male *C. transversalis* are presented in Table 1.The data revealed that the length of female varied from 4.28 to 5.37

mm with an average 5.37 ± 0.598 mm and width varied from 3.23 to 4.26 mm with an average 4.26 0.498 mm. In case of male, the length varied from 4.27 to 4.85 mm with an average 4.85 ± 0.446 mm and width varied from 3.39 to 3.82 with mean 3.82 ± 0.414 mm. These results are in agreement with the reports of Tank and Korat (2007) who recorded the average length and width of *C. sexmaculata* female as 5.20 ± 0.13 and 4.25 ± 0.11 mm, respectively, whereas it was 4.23 ± 0.25 and 3.84 ± 0.14 mm, in case of male.

Per cent adult emergence

The percentage of adult *C. transversalis* emergence varied from 57.14 to 100 per cent with an average 80.36 ± 10.830 per cent. Previously, it was reported as 89.84 ± 2.790 by Shinde (2009) for *P. trinotatus* which are more or less in support to present findings. Similarly, the mean adult emergence percentage was 83.93 ± 2.11 for *M. discolors* as reported by Chowdhary *et al.* (2008).

Sex ratio

Hundred beetles were observed for judging the sex ratio. There were 48, 43 and 42 males and 52, 57 and 58 females when reared on *A. craccivora, L. erysimi* and *M. persicae* and sex ratio was 1: 1.08, 1: 1.32 and 1: 1.38, respectively (Table 1). It was reported as 1:1.35 by Tank and Korat (2007) for *C. sexmaculata* when reared on *A. gossypii*. Thus partially confirms the present findings.

Pre-oviposition period

The pre-oviposition period varied from 4 to 7, 4 to 8 and 4 to 7 days when reared on *A. craccivora, L. erysimi* and *M. persicae* with an average 5.50 ± 0.789, 5.22 ± 0.883 and 5.74 ± 0.757 days, respectively (Table 1). Solangi *et al.* (2007) reported pre-oviposition period as 4.1 ± 1.28 days for *C. undecempunctata* when reared on *L. erysimi*. It is partially confirms the present findings.

Oviposition period

The oviposition period varied from 24 to 39, 21 to 28 and 23 to 32 days when reared on *A. craccivora, L. erysimi* and *M. persicae* with an average 28.24 ± 2.817, 24.08 ± 1.826 and 27.22 ± 2.088 days, respectively (Table 1). Thus partially supports the findings of Tank and Korat (2007) who recorded oviposition period as 16.09 ± 2.54 days for *C. sexmaculata* when reared on *A. gossypii*. Solangi *et al.* (2007) observed the mean oviposition period as 37.7 ± 6.88 days for *C. undecimpunctata* when reared on *L. erysimi*.

Post-oviposition period

The post oviposition period varied from 3 to 8 days, 3 to 6 and 3 to 6 when reared on *A. craccivora, L. erysimi* and *M. persicae* with an average 5.36 ± 1.178, 4.58 ± 0.831 and 4.16 ± 0.866 days, respectively. Post-oviposition period of *C. undesempunctata* was 4.00 ± 1.00 days when reared on *L. erysimi* (Solangi *et al.,* 2007).

Fecundity

The egg laying capacity of laboratory reared female beetle varied from 234 to 467, 319 to 423 and 325 to 433 eggs when reared on *A. craccivora, L. erysimi* and *M. persicae* with an average 376.46 ± 47.323, 364.88 ± 27.446 and 377.36 ± 28.969 eggs, respectively. The difference in fecundity might be due to different rearing conditions and the prey species on which it was reared. Tank and Korat (2007) observed the mean fecundity of *C. sexmaculata* as 382 ± 163.17 eggs per female when reared on *A. gossypii*. Mari *et al.* (2004) also observed mean fecundity as 602.3 ± 13.8 and 761.6 ± 1.00 eggs for *M. sexmaculatus* and *C. undecimpunctata,* respectively, when reared on alfalfa aphid, *T. trifolii*.

Adult longevity

The longevity of male varied from 26 to 38, 21 to 40 and 22 to 47 days when reared on *A. craccivora, L. erysimi* and *M. persicae* with an average 31.58 ± 3.224, 30.12 ± 4.492 and 29.08 ± 4.252 days, respectively. The female longevity varied from 34 to 50, 29 to 41 and 32 to 43 days with an average 39.1 ± 3.370, 33.88 ± 2.566 and 37.12 ± 2.275 days, respectively. According to Mari *et al.* (2004) the mean longevity of male *M. sexmaculatus* and *C. undecimpunctata* were 29.7 ± 1.2 and 50.7 ± 4.2 days, respectively whereas female longevity were 34.9 ± 4.8 and 56.7 ± 5.8 days when reared on alfalfa aphid, *T. trifolii*. Khursheed *et al.* (2006) also recorded the mean male longevity as 15.24 ± 8.10 and female longevity as 20.18 ± 0.41 days for *C. septempuctata* when reared on *L. erysimi*.

Total life cycle

The total life cycle of male varied from 42 to 59, 40 to 64 and 37 to 58 days when reared on *A. craccivora, L. erysimi* and *M. persicae* with an average 50.80 ± 3.923, 49.12 ± 4.870 and 48.28 ± 5.385 days, respectively. While in case of female it varied from 50 to 67, 46 to 63 and 49 to 63 days with an average 58.32 ± 3.925, 52.88 ± 3.480 and 56.32 ± 3.097 days, respectively. The difference in entire lifespan might be due to the different prey species and due to the variation in the host nutrition. According to Jagadish and Jayaramaiah (2004) the total life cycle of *C. septempunctata* was 62.2 days when reared on tobacco aphid, *M. nicotianae*.

ACKNOWLEDGEMENTS

The authors are thankful to Professor and Head, Department of Entomology, N.M. College of Agriculture, Navsari, Principal, N.M. College of Agriculture, Navsari and Director of Research and Dean Post Graduate Studies, Navsari Agricultural University, Navsari for providing necessary facilities during the course of the study.

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