

### Biology of Ladybird Beetle, *Cheilomenes sexmaculata* (Fab.) in Middle Gujarat Conditions\*

The ladybird beetle belongs to the family coccinellidae of order coleoptera. The members of the family are exclusively predator on aphids, mealybugs, scale-insects, whiteflies, thrips, leafhoppers, mites and other small soft bodied insect pests (Omkar and Pervez, 2000). It is known to prey on about 39 arthropod species (Gautam, 1989). The predatory coccinellids occupy all the habitats and niches of their preys and distributed worldwide. Nine different species of ladybird beetle have been recorded in middle Gujarat. Of these, *Cheilomenes sexmaculata* (Fab) was found to be predominant species in middle Gujarat region. In spite of rich biodiversity of this important predator in the region, information on its biology is lacking. The knowledge of biology plays an important role in mass rearing and its utilization in pest management programme. To insight the information on description and duration of different stages of *C. sexmaculata*, the present study was undertaken.

Biology of *C. sexmaculata* was studied at B. A. College of Agriculture, Anand Agricultural University, Anand during November 2004 to January 2005. The initial culture of the beetle was collected from the cotton crop and reared under laboratory at room temperature of  $20.15 \pm 1.06^{\circ}\text{C}$  and relative humidity of 55.8 % following the method adopted by Patel (1985) and Zala (1995). A conical flask of 250 ml capacity (Plate-IA), flask with cotton plug (Plate-1B), glass petridish having 9 cm diameter (Plate-1C) and plastic bowl (Plate-1D) were used for the purpose of rearing. Cotton aphid (*Aphis gossypii* Glover) was used as food. Different stages of *C. sexmaculata* were critically observed for its description. The number of larval instars was determined on the basis of exuviae casted off. The duration of each instar was determined separately along with prepupal period. The size of different stages was measured with the help of an ocular and stage micrometer as well as measuring scale. Laboratory reared and field collected beetles were sexed based on the morphological characters and sex ratio was determined. Freshly laid eggs were cigar shaped, yellow in colour with smooth chorion and without any reticulations. The eggs turned blackish with advancement of age and became completely black before hatching. These observations are in agreement with the reports of Sureja (1991) and Patel (1998). The eggs were usually laid in clusters of 5 to 12 and each cluster consist 4 to 27 eggs. These observations are supported by the findings of Zala (1995) and Patel (1998). Length of eggs varied from 0.86 to 1.19 mm with a mean of  $1.01 \pm 0.11$  mm and the breadth ranged from 0.34 to 0.43 mm with a mean of  $0.39 \pm 0.03$  mm (Table 1). This is corroborated with the measurements made by earlier workers (Patel 1985, Sureja 1991, Zala 1995 and Patel 1998). Incubation period varied from 1 to 3 days with an average of  $1.40 \pm 0.66$  days (Table 1), which is in accordance with the report of Patel (1985) and Patel (1998).

Hatching percentage of the eggs was 85.96, which is in agreement with the finding of Zala (1995) and Patel (1998) who recorded 82.85 and 87.50 % of egg hatching in *Menochilus sexmaculata* Fab. respectively. In present study larvae of *C. sexmaculata* moulted thrice and thus there were four instars. Freshly hatched larvae were dark grey in colour with shining dark head capsule and legs. This is in accordance with the description given by Subramanyam (1923). Average length and breadth of larvae was  $1.41 \pm 0.16$  and  $0.42 \pm 0.02$  mm, respectively (Table 1). Average width of head capsule was  $0.25 \pm 0.02$  mm. More or less similar measurements were recorded by Patel (1985) and Patel (1998). Second instar larvae were glistening black in colour with yellow coloured head capsule and black legs. Development of white coloured patches were observed on meso and metathorax and also on fourth and sixth abdominal segments. The average length and breadth of larvae was  $4.25 \pm 0.18$  and  $0.75 \pm 0.17$  mm, respectively. This is in agreement with the report of Patel (1998). Head width measured from 0.36 to 0.51 mm with an average of  $0.41 \pm 0.04$  mm (Table 1). Freshly moulted third instar larvae were dull black in colour with yellow head capsule. The colour pattern was more intensified with additional development of white spots on mid-dorsal line of other segments except prothorax. Average length and breadth of larvae was  $5.83 \pm 0.29$  and  $0.83 \pm 0.05$  mm, respectively, which are corroborated by the report of Seshadri (1969) and Patel (1998). Fourth instar larvae were deep black in colour, when freshly moulted but changed to black in colour before pre-pupation. It developed additional rectangular dark grey spots in a continuous series mid-dorsally on abdominal segments, whereas the spots on the fourth abdominal segment were white. Average length and breadth of larvae was  $7.17 \pm 0.20$  and  $1.29 \pm 0.14$  mm, respectively. Mean head width was  $0.64 \pm 0.04$  mm. These measurements are in accordance with the finding of Patel (1985) and Patel (1998). Mean duration of first, second, third and fourth instar larvae were  $1.80 \pm 0.50$ ,  $1.72 \pm 0.46$ ,  $1.88 \pm 0.53$  and  $1.96 \pm 0.73$  days, respectively. More or less nearest values of duration of different larval instars have been recorded by Patel (1985), Patel (1998) and Rai *et al.* (2003). Total larval period ranged from 5 to 10 days with an average of  $7.36 \pm 1.22$  days which is tallied with the report of Patel (1998). When larva is about to pupate, it undergoes a very short prepupal period, turns wood brown in colour and assumes curved shape and attached itself posteriorly to the leaf surface. Similar observations have been made by Patel (1985) in case of *M. sexmaculatus*. 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. This is in accordance with the report of Sureja (1991). Mean length and breadth of pupae was  $3.88 \pm 0.19$  mm and  $2.30 \pm 0.45$  mm., respectively. These results

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are supported by the report of Zala (1995) and Patel (1998). Newly emerged adults were soft bodied, yellowish in colour without any markings which turned shining yellow or warm buff with black spots which developed gradually. The adults were small, oval, convex dorsally and flat ventrally. Abdomen and eyes were light yellow in colour whereas elytra and pronotum were marked with zigzag markings. Similar description has been also narrated by Patel (1985); Sureja (1991) and Patel (1998). Average length and breadth of female was  $5.20 \pm 0.13$  and  $4.25 \pm 0.11$  mm, respectively, whereas it was  $4.23 \pm 0.25$  and  $3.84 \pm 0.14$  mm, in case of male. These results are in agreement with the reports of Zala (1995) and Patel (1998). Mean pre-oviposition, oviposition and post-oviposition period was  $2.61 \pm 0.76$ ,  $14.38 \pm 2.36$  and  $3.23 \pm 0.72$  days, respectively (Table 1). Male and female beetles survived from 10 to 21 and 15 to 26 days with a mean

survival period of  $16.09 \pm 2.54$  and  $20.23 \pm 2.80$  days, respectively. The longevity of beetles revealed in present study is in accordance with the report of Patel (1985) and Zala (1995). Longevity of male without food (prey) was 2 to 4 ( $2.5 \pm 0.68$ ) days while female it was 3 to 5 ( $3.35 \pm 0.58$ ) days, indicating females survived slightly longer than the males in absence of food. Number of eggs laid by an individual female of *C. sexmaculata* ranged from 195 to maximum 839 eggs with a mean of  $382 \pm 163.17$  eggs (Table 2). These observations are more or less similar to the results of Zala (1995) and Patel (1998). Average duration of entire life-span for male and female was  $29.72 \pm 2.20$  and  $34.15 \pm 2.54$  days, respectively. This is corroborated with the findings of Patel (1985) and Zala (1995). Male to female ratio of field collected and laboratory culture were 1: 1.43 and 1: 1.35, respectively (Table 2). These findings are strongly supported by the reports of Sureja (1991), Zala (1995) and Patel (1998).

Table 1. Measurement and duration of different stages of *C. sexmaculata*

Stage	Length (mm)	Breadth (mm)	Head width (mm)	No. of insect stages observed	Duration (days)
Egg	$1.01 \pm 0.11$	$0.39 \pm 0.03$	-	25	$1.40 \pm 0.66$
Larva					
1 <sup>st</sup> instar	$1.41 \pm 0.16$	$0.42 \pm 0.02$	$0.25 \pm 0.02$	25	$1.80 \pm 0.50$
2 <sup>nd</sup> instar	$4.25 \pm 0.18$	$0.75 \pm 0.17$	$0.41 \pm 0.04$		$1.72 \pm 0.46$
3 <sup>rd</sup> instar	$5.83 \pm 0.29$	$0.83 \pm 0.05$	$0.57 \pm 0.04$		$1.88 \pm 0.53$
4 <sup>th</sup> instar	$7.17 \pm 0.20$	$1.29 \pm 0.14$	$0.64 \pm 0.04$		$1.96 \pm 0.73$
Total	-	-	-		$7.36 \pm 1.22$
Prepupa	-	-	-	25	$1.72 \pm 0.45$
Pupa	$3.88 \pm 0.19$	$2.30 \pm 0.45$	-	13	$3.36 \pm 0.70$
Adult Male	$4.23 \pm 0.25$	$3.84 \pm 0.14$	-	11	$20.23 \pm 2.80$
	$5.20 \pm 0.13$	$4.25 \pm 0.11$	-	13	$2.61 \pm 0.76$
Female				13	$14.38 \pm 2.36$
				13	$3.23 \pm 0.72$
Preoviposition					
Oviposition					$16.09 \pm 2.54$
Post-oviposition					
Entire life-span	-	-	-	11	
Male	-	-	-	13	$29.72 \pm 2.20$
Female					$34.15 \pm 2.54$
Longevity without food					
Male	-	-	-	-	$2.5 \pm 0.68$
Female	-	-	-	-	$3.35 \pm 0.58$

Table 2. Hatching percentage, fecundity and sex ratio of *C. sexmaculata*.

Stage	Number observed	No of eggs hatched on day			Hatching (%)	No of eggs laid / female			Sex ratio (M:F)
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>		Min	Max	Mean	
Eggs	57	33	12	4	85.96	-	-	-	-
Adults									
Females	13					195	839	$382 \pm 163.17$	-
Field									
collected	29	-	-	-	-	-	-	-	1:1.41
	27	-	-	-	-	-	-	-	1:1.45
Laboratory reared	31	-	-	-	-	-	-	-	1:1.38
	30	-	-	-	-	-	-	-	1:1.30

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