

- and ———. 1962. Further studies on the effect of sound waves of *Nadaivaram* on the growth and yield of paddy. *Ibid.* III, 305.
- and Krishnan. 1960. The effect of sound waves of violin on the growth and yield of tobacco. *Ibid.* III, 394-95.
- and Stella Ponniah. 1953. On the effect of sound on protoplasmic streaming in the cells of *Hydrilla verticillata*. *Presl. Ibid.* III, 119-20.
- Stella Ponniah. 1956. Further studies on the effect of musical sounds on the growth of plants. *Ibid.* III, 272-3.
- . 1957. Further studies on the effect of musical sound on the growth of plants. *Ibid.* III, 273.

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The Bionomics of the Syrphid Fly, *Xanthogramma Scutellare* Fab. * (Syrphidae : Diptera)

by

J. R. PATEL¹ and H. K. PATEL²

Very few cultivated plants escape the attention of one or other kind of aphid. In nature aphids are always accompanied by their natural enemies *viz.*, the larvae of syrphid flies, lace-wings and the larvae and adults of lady bird beetle to a smaller or greater extent. Of the various predators recorded, syrphid fly is of different species and one of the most common predators prevalent in this region. In view of its importance, studies on its biology were undertaken to help and understand various phases of life and behaviour. It appears that *Xanthogramma* sp. is prevalent in Delhi, Meerut, Saharanpur, Bulandshahr and Agra. (Anand *et al.* 1967 & Nayar and Nayar 1965). According to Patel *et al.* (1968) *Xanthogramma scutellare*, Fab. is prevalent in Gujarat also.

Records of the incidence of *Xanthogramma scutellare*, Fab. indicate that it feeds on *Aphis persicae*, Boyer. on peach (Hardenberg 1913), on *Lipaphis erysimi*, Kalt. on cabbage (Patel *et al.* 1968) *Toxoptera graminum* on wheat (Moore 1913). Studies on the biology of *Xanthogramma* sp. made by Deoras (1942) are only of general nature, and much remains to be known about its behaviour *etc.*

Materials and Methods: Initial culture was started by collecting large number of larvae and pupae of *Xanthogramma scutellare*, Fab. from the fields of the College Farm. They were reared in the laboratory. The adult syrphid

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1. Lecturer in Entomology, B.A. College of Agriculture, Institute of Agriculture, Anand.

2. Professor and Head of the Dept. of Entomology, B.A. College of Agriculture, Institute of Agriculture, Anand.

flies as they emerged were paired and introduced in individual 30×30×30 cm wooden cages. The cage was prepared by using red coloured muslin cloth in all the four sides to facilitate the examination of eggs, as the eggs are best seen in red back ground. The top of the cage was closed by a transparent glass. On one side a round hole was prepared in a cloth and a sleeve fitted in the centre for easy handling inside the cage.

For studies on egg laying, cabbage leaves with good number of aphids were kept in cage. To maintain the leaf fresh and succulent wet cotton plug was wrapped at the cut end of the leaf and placed in a petridish. Five percent honey solution in water, soaked in cotton plugs was provided as food. Two to three plugs were fixed by a pin in the wall cloth.

For studies on larval and pupal durations, larvae emerging on the same day were transferred on the cabbage leaf with aphids, with the help of a fine camel hair brush and kept in individual petridishes. Leaves were maintained fresh and succulent by wrapping wet cotton plug at the cut end. The number of times the larvae moulted together with their duration were noted separately for each one of them and records maintained. Moulting was confirmed by observing the exuviae.

Results and Discussion: *Life History: Fecundity and Oviposition:* In nature female syrphid flies were observed to lay eggs on the lower surface of the aphid infested leaf. The total number of eggs laid by individual females varied from 17 to 26 with an average of 21. The average size of the egg is 0.69 mm in length and 0.26 mm in width. (Fig. 1-A). The pre-oviposition, oviposition and post-oviposition periods varied from 9 to 13, 3 to 5 and 0 to 9 days with an average of 10.83, 3.83 and 3.83 days respectively.

Studies on the effect of larval food on the fecundity of *X. scutellare*, Fab. show that the female reared from the larvae fed on *Uroleucon (Uromelan)* sp. ? *compositae*, Theob. laid more number of eggs than the females from the larvae fed on *Lipaphis erysimi*, Kalt. and that the consumption of more number of aphids during their larval life does not increase the fecundity of female as expected but reduces the fecundity of the female. However, this needs to be confirmed again.

Incubation period: To study the incubation period of eggs, several number of eggs were maintained at varying room temperatures as well as at constant controlled temperature. The results obtained from the experiments indicated that the optimum temperature for the shortest incubation period of 2 days is $25.29 \pm 2.32^{\circ}\text{C}$ and that for the longest incubation period of 3 days is $20.82 \pm 1.39^{\circ}\text{C}$.

The percentage of hatching of eggs varied from 63.00 to 81.92 and that percentage hatching decreases with increase in room temperature as well as at controlled temperature. This probably is the reason for the drop in the population with the start of the summer months.

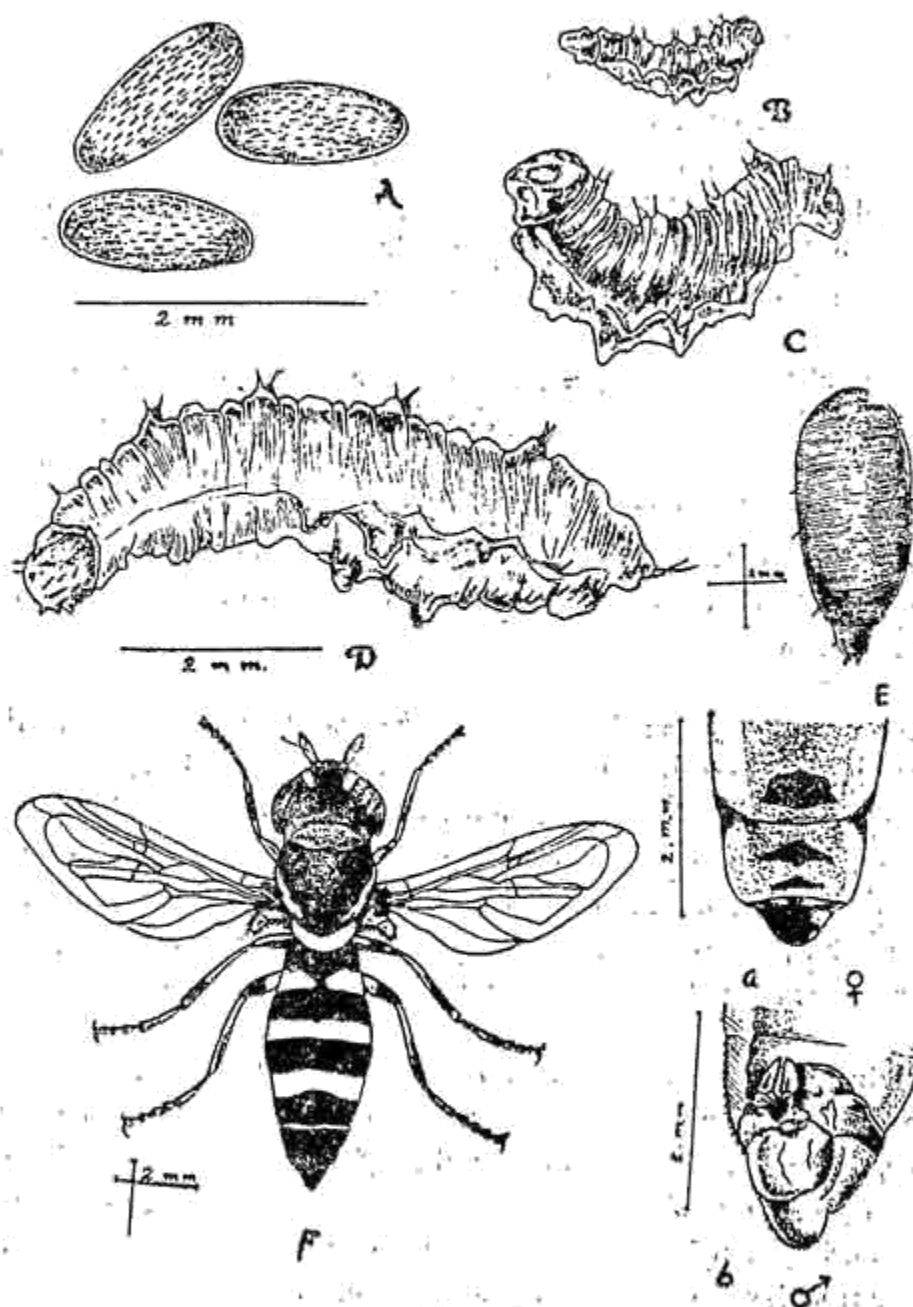


Fig. 1.

Stages of *X. scutellare*, Fab.

A. Eggs. B. First instar larva. C. Second instar larva. D. Third instar larva.
E. Pupa. F. Adult (a) Female genitalia. (b) Male genitalia.

Larval duration: Data on the duration of the larval period were obtained by rearing the larvae in petridishes containing fresh cabbage, safflower and wal leaf infested with respective species of aphids provided as food.

Humidity and such other factors were not controlled. Observations were taken every morning till they pupated. The observations indicated that when the larvae were provided with *Aphis craccivora*, Koch. (wal aphids) as food, the duration of the larval stage was the shortest as compared to that of the larvae reared on *Lipaphis erysimi*, Kalt. and *Uroleucon*, (*Uromelan*) sp.? *compositae*, Theob., at varying room temperatures of $27.87 \pm 2.93^{\circ}\text{C}$ and $20.59 \pm 1.25^{\circ}\text{C}$ respectively.

The larva passes through three instars and moults twice. The average size of the third instar larva is 8.53 mm in length and 2.54 mm in breadth. (Fig. 1, B. C. D.).

Studies were also made to determine the number of aphids of different species consumed by the larvae of *X. scutellare*, Fab. at different room temperatures. The results obtained have been summarized in Table.

The results in Table revealed that the larvae of syrphid fly consumed more number of safflower aphids (*Uroleucon* (*Uromelan*) sp.? *compositae*, Theob.) than cabbage aphids (*L. erysimi*, Kalt.) at a room temperature of $10.59 \pm 1.25^{\circ}\text{C}$ and that more number of cabbage aphids (*L. erysimi*, Kalt.) are consumed at $20.59 \pm 1.25^{\circ}\text{C}$ than at $24.65 \pm 2.15^{\circ}\text{C}$.

Pupal stage: Prior to pupation syrphid larvae come to rest and the caudal segments are cemented to a leaf and the pupa remains attached to the leaf. (Fig. 1, E.). The pupal period varies from 5 to 6 days and 10 to 11 days with an average of 5.92 and 10.36 days at varying room temperatures of $28.89 \pm 4.92^{\circ}\text{C}$ and $20.68 \pm 1.53^{\circ}\text{C}$ respectively when larvae were reared on *L. erysimi*, Kalt. The average size of the male pupa is 6.54 mm in length and 2.78 mm in width while female pupa is 6.25 mm in length and 2.64 mm in width.

Adult: The adult syrphid fly (Fig. 1, F. a & b.) emerges from the puparium by making a split on the plates at the anterior end. The head of the adult is hemispherical in shape. Face is yellow except the base of the antennae. Scape and pedicel of the aristate type of antennae are black in colour dorsally and brown in colour ventrally. Flagellum and arista are brown in colour. The thorax is black in colour with a narrow yellow band at the sides of the thorax extending from the humeri to scutellum. Scutellum is lemon-yellow in colour and covered with hairs. Abdomen is deep brown to shining black in colour with yellow spots on the dorsal side. The male and female fly measures on an average 14.74 mm and 14.35 mm in wing expanse and 8.85 mm and 8.46 mm in length respectively. The mated adults lived for a longer period than unmated adults and adults lived longer with 5% sugar solution than with 5% honey solution in both the cases.

TABLE. Day to day consumption of different species of Aphids by the larvae of *X. scutellare*, Feb.

Period of study	Room Temp. °C	No. of larvae observed	Host species of aphid	Number of aphid consumed daily by the larvae on days											No. of aphids consumed during the larval period
				1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	
1967 Feb.	24.65 ± 2.15	20	<i>Lipaphis erysimi</i> , Kalt.	3.50 (2-5)	3.60 (1-5)	4.70 (1-5)	5.20 (5-9)	8.55 (6-10)	10.25 (10-15)	13.95 (8-24)	23.95 (18-27)	17.35 (3-30)	15.67 (15-17)	10.00 (10-10)	91.80 (70-125)
Jan- Feb. 1968	20.59 ± 1.25	25	<i>L. erysimi</i> , Kalt.	2.65 (2-5)	3.36 (2-6)	4.24 (3-6)	7.04 (4-12)	12.64 (8-19)	15.36 (8-25)	20.52 (12-36)	27.92 (7-38)	16.90 (6-36)	10.41 (3-24)	4.00 (3-5)	114.84 (60-153)
Jan- Feb. 1968	20.59 ± 1.25	25	<i>Uroleucon</i> (<i>Uromelan</i>) sp.? <i>compositae</i> , Theob.	2.28 (2-3)	2.84 (2-4)	5.52 (2-8)	8.72 (5-16)	10.76 (7-19)	18.84 (5-31)	27.60 (10-34)	28.84 (8-41)	24.50 (6-56)	12.58 (4-20)	8.50 (4-21)	136.32 (95-186)
Mar. 1967	27.37 ± 2.93	34	<i>Aphis craccivora</i> , Koch.	4.53 (2-10)	10.35 (2-21)	21.32 (4-16)	27.29 (8-48)	21.50 (6-38)	18.93 (7-34)	18.80 (8-13)	—	—	—	—	94.94 (52-129)

The figures in the bracket indicate the minimum and maximum number of aphids consumed.

Precopulation and copulation: Premating period varied from 2 to 7 days with an average of 4.95 days of emergence. The duration of first copulation varied from 24 to 73 minutes with an average of 42.05 minutes. Second mating occurred after a period varying from 5 to 10 days from the day of emergence with an average of 7.13 days. The duration of 2nd copulation varied from 23 to 70 minutes with an average of 43.33 minutes. Third mating occurred after about two days of the 2nd mating and continued on an average for 77.77 minutes. During the study it was observed that same male mated three times with the same female or with new ones. To promote mating sunlight or artificial light is a necessity. Males remain attached to the females during flight also, and even during the copulation females fly with males on their bodies. The duration of flight in mating condition ranged from 90 to 235 seconds. Copulation also occurred in flying condition and it continued for 69 minutes on an average.

Seasonal incidence: The incidence of this insect starts from the 3rd week of August. The population increases and becomes maximum during the 2nd to 4th week of February, and the activity gradually decreases from the 1st week of March. Larvae and adults remain active from August to March if aphids are available.

Summary: *Xanthogramma scutellare*, Fab. is one of the natural enemy of aphids. The number of eggs laid by an individual female varied from 17 to 26 with an average of 21 eggs. The pre-oviposition, oviposition and post-oviposition periods at a varying room temperature of $21.21 \pm 1.18^{\circ}\text{C}$ was 10.83, 3.83 and 3.83 days respectively.

Under varying room temperature of $20.82 \pm 1.39^{\circ}\text{C}$, $20.95 \pm 1.82^{\circ}\text{C}$, $23.98 \pm 1.22^{\circ}\text{C}$ and $25.29 \pm 2.32^{\circ}\text{C}$ the duration of the egg stage was 3, 2.5, 2.5 and 2 days respectively and at a controlled temperature of $26.7 \pm 1.1^{\circ}\text{C}$ it was 2.5 days. Under varying laboratory temperatures of $24.65 \pm 2.15^{\circ}\text{C}$, $26.11 \pm 2.85^{\circ}\text{C}$ and $20.59 \pm 1.25^{\circ}\text{C}$ the larval duration were 9.25, 7.92 and 8.76 days on *Lipaphis erysimi*, Kalt. whereas at $20.59 \pm 1.25^{\circ}\text{C}$ and $27.87 \pm 2.93^{\circ}\text{C}$ the larval duration were 9.20 and 5.59 days on *Uroleucon (Uromelan) sp. ? compositae*, Theob. and *Aphis craccivora*, Koch. respectively. The larva moults twice.

The larvae of syrphid fly consume more number of safflower aphids (*Uroleucon (Uromelan) sp. ? compositae*, Theob.) than cabbage aphids (*Lipaphis erysimi*, Kalt.) at a room temperature of $20.59 \pm 1.25^{\circ}\text{C}$.

The shortest and longest pupal period was 5.67 and 10.86 days at a varying room temperatures of $27.93 \pm 2.38^{\circ}\text{C}$ and $20.85 \pm 1.47^{\circ}\text{C}$ respectively.

The effect of food on the longevity of the adults indicated that the males and females lived longest with 5% sugar solution. The mated adults lived longer than unmated adults.

Observations on the seasonal incidence indicated that the larvae and adults remain active from August to March if aphids are available.

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REFERENCES

- Anand, R. K., Samarjit Rai and V. K. Sharma. 1967. Notes on hover flies (Diptera : Syrphidae) from Delhi and adjoining areas. *Indian J. Ent.*, 29 : 307-8.
- Deoras, P. J. 1942. Description and biological notes on a new species of Syrphidae from India. *Indian J. Ent.*, 4 : 217-9.
- *Hardenberg, C. B. 1913. Peach-tree Aphides, *Agric. Jl. Union S. Africa, Pretoria.*, 6: 224-35.
- *Moore, B. A. 1913. The Wheat Louse (*Toxoptera graminum*) *Agric. Jl. Union S. Africa. Pretoria.*, 6: 482-92; 767-72; 973-7., 7 : 50-60.
- Nayar, J. L. and Nayar, Lalita. 1965. Some interesting Syrphids of Agra. *Indian J. Ent.*, 27 : 240-1.
- Patel, H. K., V. C. Patel and J. R. Patel. 1968. Records of predators and parasites naturally prevalent in the Gujarat State. *Pl. Prot. Bull.*, 19 (in press.)
- *Veitch, R. 1919. Notes on the more important insects in Sugar-cane plantations in Fiji - *Bull. Ent. Res. London.*, 10 : 21-39.
- * Original not referred.

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