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Studies on the Biology of *Athalia proxima* Klug (Tenthredinidae ; Hymenoptera)

by

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Introduction : *Athalia proxima* Klug., the mustard saw fly causes extensive damage to the *Cruciferous* crops, the larvae of which make irregular holes in the leaves and skeletonise them. Besides feeding on leaves, the female does indirect damage by injuring leaf tissues while inserting the eggs with her saw like ovipositor. Sometimes due to severe infestation resowing becomes a necessary event. The distribution of the pest has been reported from U. S. A. (Klug, 1816), East Indies (Cameron, 1876), Pakistan (Lefroy, 1907), Jahre (Marstatt, 1913), Malaya (Susainathan, 1924), Rangoon, Burma and Sumatra (Ghosh, 1924), and Formosa (Benson, 1932). In India this insect has been noted in erstwhile Bombay State and Bengal as early as 1894 by Middleton. Later on it was recorded from Assam (Mc Swiney, 1919), Bihar (Dutt, 1919), Hilly districts of South India (Ayyar, 1932), Delhi (Isaac, 1934), Bengal (Hedayetullah, 1939), Uttar Pradesh (Lal, 1946),

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Punjab and Pepsu, Madhya Pradesh (Singh, 1965), Nagpur, Wardha and Amraoti (now in Maharashtra) (Gupta and Joshi, 1955), Mysore (Usman and Puttarudriah, 1955) and Rajasthan (Shriwastava and Sharma, 1965).

Considering the importance of the insect on so many vegetables like cabbage, cauliflower, mustard rape, sarson, knol-khol, turnip, radish and other *cruciferous* crops as a potent pest and as information on the biology of the pest available is much variable, investigations were, therefore, undertaken during 1964—'65 in the Agricultural College, Sehore (Madhya Pradesh).

Life History Studies: The observations on the life history of *Athalia proxima* Klug were taken from middle of July 1964 to mid of March 1965 in the laboratory. The different developmental periods are given below.

Mating: The adult sawflies reproduce parthenogenetically as well as by sexual means. The flies start mating soon after emergence. Copulation takes place two to three times during day time only. An act of copulation lasts for 15 to 20 minutes. Male is more active than the female. It catches the female with its forelegs and then turns back, resulting in the end to end position of copulation.

Preoviposition and Oviposition: Adults emerged in the laboratory were confined in pairs on radish seedlings grown in pots and covered by the glass chimnies. Oviposition period was observed by changing the mated pairs to fresh plant and noting the number of eggs laid by the female. The female selects the site for oviposition by tapping the antennae on the margin of the leaves, and with her saw like ovipositor eggs are inserted into the leaf tissues singly on the under surface. However, at times two to three eggs are laid at one place. The site of eggs laying can be made out easily by the presence of circular pin head like projections on the lower surface of leaves. The preoviposition period varies from few hours to 24 hours. The oviposition period varies from 1 to 4 and 1 to 3 days in case of mated and unmated females respectively.

Fecundity and Viability: Total number of eggs laid by the mated and unmated females vary from 32 to 67 and 47 to 54, and viability of eggs from 80·8 to 91% and 82 to 88·8% respectively.

Incubation period and Hatching: The incubation periods of the eggs laid by mated and unmated females range from 3 to 6 and 6 to 7·5 days respectively. The opening of slits through which the eggs are inserted in the leaf tissues are widened due to the bulging of the developing embryo inside the egg. They become dark in colour half-an-hour prior to hatching. The larva on hatching does not come out from the opening or the slit through which the eggs are laid, but it cuts another hole for coming out on the lower surface of leaf.

Larval Moults and Process of Moulting: Larvae undergo 4 and 5 moults before cocoon formation. A little before each ecdysis, larva stops feeding and attaches itself to the leaf by means of its caudal prolegs and hangs with its head downwards. Then the head capsule splits along the epicranial suture on each side of the frons. The head of the next instar larva projects forward followed by rest of the body. The moult of the head is not cast off separately as in case of caterpillars. The time required for each ecdysis varies from 10 to 15 minutes.

Larval period and Habits: The larval periods of the the mated and unmated progeny vary from 9 to 11 and 9·5 to 11·5 days respectively. They are seen in the fields during the early and late hours of the day and shun bright light and descend down to the ground. A common phenomenon of *play passum* (feigning death) is observed.

Sex differentiation in larval development: During the course of present studies it is noticed that the larvae which pupate after 4th moult develop into male sawflies and those which pupate after 5th moult give rise to female sawflies in case of the progeny of the mated female. The progeny of the unmated female undergoes five moults before pupation and give rise to male progeny only. The males thus produced are normal and can coupulate and fertilise the females. The prepupal and pupal period of mated and unmated progeny vary from 9 to 14 and 12·5 to 13·5 days respectively.

Emergence of an adult: An imago cuts a hole into the earthen cocoon with its mouth parts. First of all antennae come out and then the head. After cutting the edges of cocoon the adult finally creeps out. The whole sequence requires 10 to 20 minutes.

Sex ratio: It varies from 1 : 1 to 1 : 3·5 (Female : Male).

TABLE 1. *Sex ratio of Athalia proxima in the lab.*

S. No.	Month	Total No. of adults emerged	Male	Female	Sex ratio (F : M)
1.	August	12	7	5	1 : 1·4
2.	September	10	6	4	1 : 1·5
3.	October	18	11	7	1 : 1·5
4.	November	8	6	2	1 : 3·0
5.	December	8	4	4	1 : 1·0
6.	January	9	7	2	1 : 3·5
7.	February	8	5	3	1 : 1·6
	Average	10·428	6·571	3·857	1 : 1·9

F = Female M = Male

Longevity of adults: The Longevity of the adults of mated and unmated progeny vary from 3 to 6 and 4·5 to 5·5 days respectively. Generally the female lives for longer time than the male.

Life cycle: Periods required by the progeny of mated and unmated female for completion of one life cycle vary from 21 to 31 and 21·5 to 31·5 days respectively.

Seasonal history: The pest remains active throughout the year except April, May and June. In the middle of July (1964), larvae were found feeding on radish crop on which the pest completed five generations upto the end of October. In the first week of November it migrated on other cruciferous crops which were in seedling stage. There the pest completed four more generations, upto the third week of February (1965). The adults of ninth generation laid eggs, larvae emerged out from them were found entered into resting stage, till June end (1965).

Description of the Life history stages: *Egg:* The freshly laid egg is greenish in colour later turning dark before hatching. It is oblong and pointed at one end, measuring 0·66 × 0·35 mm. *First Instar Larva:* Length–1·87 mm. Body is greenish white and smooth. Head black, round and flat from the front. Thorax humped. Abdomen ten segmented. *Second Instar Larva:* Length – 3·20 mm Similar to first instar except in size and presence of small dark dots on the body. Thoracic legs darker. *Third Instar Larva:* Length – 4·85 mm Black longitudinal strip developes on each darso lateral side of the body. Body colour darkens. Mouth parts become more strong and sclerotized. *Fourth Instar Larva:* Length – 7·32 mm A black strip appears in the median line of the body. *Fifth Instar Larva:* Length – 8·98 mm Colour becomes more blackish. Two Blackish strips develop on the lateral side near the prolegs. *Sixth Inslar Larva:* Length – 12·53 mm Spiracles and prolegswell developed.

Pupa: It is enclosed in a cocoon which is parchment like, shiny and water proof, covered with soil particles. White with a greenish tinge. Head appendages, legs and wings white. Gradually the head becomes black and abdomen yellow.

Adult: Length – 8–10 mm Female is larger than the male and can be distinguished from the latter by the presence of black pointed ovipositor at the tip of the abdomen, which is the most characterstic and striking feature from which the common name "Saw fly" has been derived. Antenna nine segmented, clavate type with the basal segment enlarged and swoollen. Head, tibiae and tarsi black and wings smoky. Abdomen yellow and broadly attached to the thorax.

Natural Enemies: The only natural enemy of this pest recorded during the present studies was a larval parasite, *Perilissus cingulator* Morley., (Ichneumonidae: Hymentoptera) Thirty six percent parasitisation of the third and fourth instar larvae of the pest was recorded during the month of February. The longevity of adult parasite was found to vary from 4 to 8 days.

Discussion: The life cycle of the Mustard saw fly was studied earlier by many workers. The present findings regarding incubation period are more or less similar to those obtained by Gupta (1956), Tomar and Misra (1960) and Mehra and Bindra (1962). Larval period at Sehore has been observed to be shortest i. e. 9–11 days. The duration for this period reported by Lal (1953) Narayanan (1948), and Mehra and Bindra (1962) is identical. Pupal period varies from 9–14 days. Lefroy and Ghosh (1908), Lal (1953), Narayanan (1958), Kadam and Patel (1957), Gupta (1956), Tomar and Misra (1960), and Mehra and Bindra (1962) have reported this period varying from 5–6, 3–14, 10–12, 10, 7–24, 6–12 and 7–23 days respectively. Minimum and maximum time required for the completion of one generation is twenty one and thirty one days at Sehore. The latter period is identical to what is reported by Kadam and Patel (1957). Present finding regarding longevity of adult is in agreement with the results of Lefroy and Ghosh (1908). As regards number of generations the findings of Narayanan (1958) Tomar and Misra (1960) and Mehra and Bindra (1962) have been further confirmed by the present authors.

The oviposition, incubation periods, fecundity and viability of eggs of unmated female are 1 to 3, 6 to 7·5 days, 47 to 54 eggs and 82 to 88·8 per cent against 2 to 5, 3 to 7 days, 17 to 78 eggs and 80 to 94·5 per cent respectively reported by Mehra and Bindra (1962). Larval, pupal, preimaginal periods, and longevity of adults are 9·5 to 11·5, 12·5 to 13·5, 28·5 to 31·5 and 4·5 to 5·5 days against 12 to 23, 13 to 23, 28 to 53 and 2 to 7 days respectively reported by Mehra and Bindra (1962).

Morley (1913), Fletcher (1914), Lal (1953) and Narayanan (1953) have reported a parasite under the name *Exacrodus populans* Morley (Ichneumonidae; Hymenoptera). Adults of pentatomid bug, *Canthecona furcellata* Distant., are predaceous on the larvae of *Athalia proxima.*

The percentage parasitisation of the larvae of the pest recorded through *Peritissus cingulator* (Ichneumonidae; Hymenoptera) by Mehra and Bindra (1962) was 10·8 to 17 per cent during the months of November to March at Gwalior. During the course of current studies the larvae of the pest were found to be parasitised by the parasite to the extent of 36 per cent during the month of February 1965.

Summary: The biology of *A. Proxima* has been studied in detail. Mating occurs soon after emergence of the adults. Eggs are inserted into the leaf tissues singly by means of saw like ovipositor by the female. The preoviposition and oviposition periods of mated and unmated females range from 8 hours to one day and 1 to 4 and 1 to 3 days respectively. Fecundity varies from 32—67 and 47 to 54 eggs. The incubation period lasts 3 to 7 and 6 to 7·5 days. Percentage of viability of the eggs varies from 80·8 to 91·0 and 82 to 88·8. Total larval period varies from 9 to 11 and 9·5 to 11·5 days. Pupal period is of 8—14 and 12·5 to 13·5 days duration. Period required for completion of one generation varies from 21 to 31 and 28·5 to 31·5 days. Adults live for 3—6 and 4·5 to 5·5 days. Sex ratio studies carried out reveal that males dominate the females. Brief morphological description of the different life history stages are given. One larval parasite and its extent of parasitisation has also been recorded during the course of present study.

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