

STUDIES ON THE MORPHOLOGICAL DETAILS OF *LIPAPHIS ERYSIMI* (KALTENBACH) INFESTING *BRASSICA COMPESTRIS* VAR. SARSON OF GAYA DISTRICT (BIHAR)

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ABSTRACT : Morphological features of apterous viviparous females, alate viviparous females and all the four nymphal instars of mustard aphid, *Lipaphis erysimi* (Kalt.) were studied which were infesting the *Brassica compestris* var. sarson plants planted in Tekari and konch blocks of Gaya district (Bihar). Only anholocycly was noted in this aphid.

Key words : Morphology, *Lipaphis erysimi*, Gaya.

INTRODUCTION

During the surveillance of mustard crop *i.e.* *Brassica compestris* var. sarson in and around Gaya (Bihar) during September, 2014 to April, 2015, it was recorded that this crop was attacked by an aphid complex in which *Lipaphis erysimi* contributed a major role. Aphids in general, exhibited complexities because of polymorphism, interpolation of sexual and asexual generations, heteroecy, secondary monoecy and anholocycly. Considering the intricacies of aphid's biology and extent of losses to mustard crop due to them (Bakhetia, 1983 and Raychaudhary, 1980), the life cycle *L. erysimi* was studied in association with *B. compestris* var. sarson grown in Tekari and Konch area of Gaya district (Bihar) during 2014-2015.

The polymorphism in Aphidoidea was reviewed by Hillie Ris Lamber's D. (1966). The various aspects of population dynamics of mustard aphid, *Lipaphis erysimi* were noted by different workers (Roy, 1975; Prasad & Phadke, 1980; Gosh & Mitra, 1983; Ahuja, 1990; Sinha *et al.*, 1990 and Gupta & Mohan, 2011). The biology of mustard aphid was also variously studied by Sidhu & Singh (1964), Rout & Senapati (1986), Kalra *et al.* (1987) and Kawada & Murai (1970) studied the apterous male and holocycle reproduction of *L. erysimi* in Japan.

MATERIAL AND METHODS

Alate and apterous viviparous females and immature forms of *Lipaphis erysimi* were collected from *Brassica compestris* var. sarson plants cultivated in Tekari and Konch area of Gaya district. These were collected by snipping of the infested leaves and twigs. Sometimes, sweeping nets and picking then with wet camel hair brush number 4 were also utilized. The collected specimens were brought to laboratory in cotton made bags along with the twig of the plants to provide necessary food and adequate humidity. A collection diary was also maintained. Specimens for purpose were either killed by emerging them in hot water 80-85°C for a few seconds or putting them in a killing bottle having a cotton soaked in ethyl acetate. All stages of the aphids were also preserved in 70% alcohol for future use. The whole mount preparations were made by treating them with 5% KOH solution for 24 hrs and thereafter 2% KOH solution for another 48 hrs. The treated specimens were pressed gently in between two glass slides and washed for 1-2 hrs. Thereafter, they were treated with 2% acetic acid solution for 1-2 minutes and washed thoroughly. Finally the specimens were dehydrated, cleared in clove oil and mounted in canadabalsom. Some specimens after treatment with acetic acid and washing with water were directly mounted in lactophenol for microscopical examination biometric studies were also made through micrometer.

RESULTS AND DISCUSSION

The morphological features of *Lipaphis erysimi* as recorded of the *Brassica compestris* var. sarson plants cultivated in Tekari and Konch area of Gaya were grouped under following heads :

- I. Apterous viviparous females
- II. Alate viviparous females
- III. 1st Instar nymphs
- IV. 2nd Instar nymphs
- V. 3rd Instar nymphs
- VI. 4th Instar nymphs

I. Apterous viviparous females (Figs.1&2) : Such females were characterized by dorsally convex, ventrally flat, globular or oval in shape, pale green in colour; 1.90-2.20 mm long and 0.90-1.20 mm wide; cuticle weakly chitinized and reticulate; Body was divisible into head, thorax and abdomen.

A. Head : Small head was distinctly separated from the prothorax and it was bent downward so as to clypeus was disposed antero-ventrally and the rostrum was located underside of the head near the bases of the fore coxae. Antennal tubercles were marked and giving the antennal bases on each latero-frontal part of the head. In between the antennal tubercles a median tubercle, the front tubercle was present. The head was dusky in colour and hypognathous in orientation. Antennae were slender, long structure and composed of six segments. The last antennal segment was made up of wider basal part and a narrower terminal process, the unguis. At the junction of the base and unguis a distinct primary sensorium was present. Black hemispherical compound eyes were placed laterally to the head ocelli were absent. Mouth parts are adapted for typical homopteran piercing and sucking type. The rostral portion of the mouth parts was long, slightly broad at base and was 4 - segmented. It was reflexed backwards and reaching upto bases of 2nd pair of coxae when not in use. The stylets were long and retractile and its apical segments were provided with 4 sensory hairs on each of the lateral margin.

B. Thorax : All the three *i.e.* pro-meso and metathoracic segments were distinct and well defined. Lateral tubercles were evident on either side of the prothorax. Light green bands were present on each of the thoracic segments. One pair of legs were set to each of the segments and in general they were alike but the hind legs were longest to give adequate support and balance to large and heavy abdomen. The fore coxae were better developed to push against plants when stylets were withdrawn and also enabled the aphid to spring away from the plant in an escape reaction. Legs, in general, were long and slender and gradually darkened towards femur, tibia and tarsi. The legs, in general, were hairy but tibia was more hairy than other portions. The tarsi were two segmented in which 2nd one was large than the 1st and was terminated by forming a pair of claws, one pair of empodial hairs and also possessing 3 pair of hairs on its internal margin.

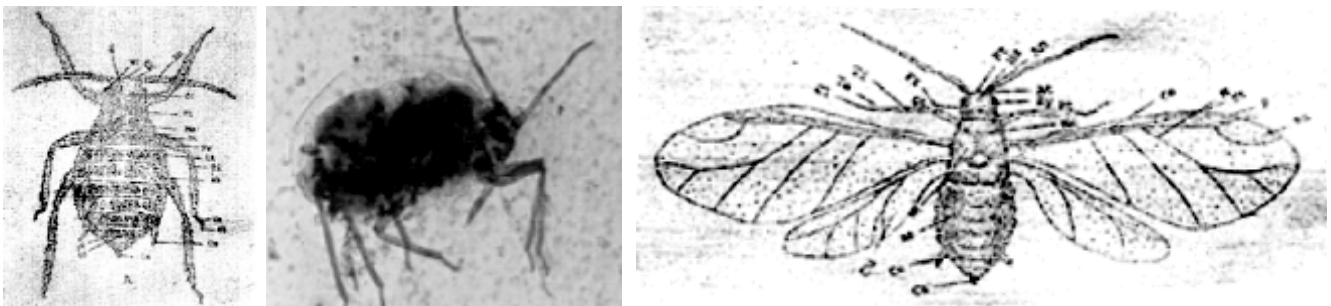


Fig. 1 Camera lucida diagram of apterous viviparous female of *L.erysimi* (Dorsal view).

Fig. 2 W.M of apterous viviparous. female of *L.erysimi*.

Fig. 3 Camera lucida diagram of an alate viviparous female of *L.erysimi* (Dorsal view).

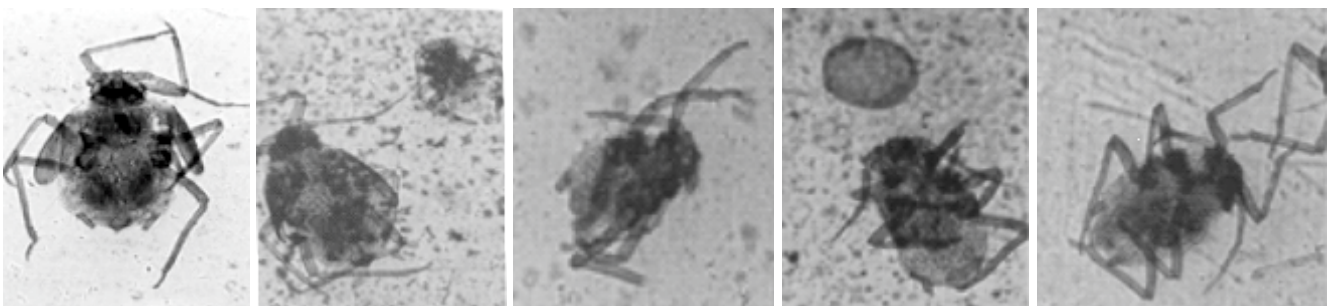


Fig. 4 W.M of alate viviparous female of *L.erysimi*

Fig. 5 W.M of the 1st nymphal instar of *L.erysimi*.

Fig. 6 W.M of the 2nd nymphal instar of *L.erysimi*.

Fig. 7 W.M of the 3rd nymphal instar of *L.erysimi*.

Fig. 8 W.M of the 4th nymphal instar of *L.erysimi*.

Fig. 1 Abbreviation : Ab-Abdomen; An-Antenna; Ap-Anal Plate; At-Anternal Tubercle; Ca-Cauda; Ce-Cornicle; Cl-Claw; Ey-Eye; Fr-Femur; Ft-Frontal Tubercle; Gp-Genital Plate; Hd-Head; Lt-Lateral Tubercle; Me-Mesothorax; Ot-Ocular Tubercle; Pt-Prothorax.
Fig. 3 Abbreviation : Ab-Abdomen; An-Antenna; Ap-Anal Plate; At-Anternal Tubercle; Ca-Cauda; Ce-Cornicle; Cl-Claw; Co-Costa; Cu-Cubitus; Ey-Eye; Fr-Femur; Ft-Frontal Tubercle; M-Media; Me-Mesothorax; Mt-Metathorax; Pt-Prothorax; R-Radius; Rs-Radial Sector; Sr-Secondary Sensorial; St-Stigma; Ta-Tarsus; Ti-Tibia; Ot-Ocular Tubercle.

C. Abdomen : There was eight visible segments in the abdomen terminating in a cauda and anal plate which are modified tergite and sternite of 9th or 10th segments. The dusky 8th tergite was longer than others and possessing 6-9 hairs. A conspicuous tubular structure, the siphunculus, was present dorso-laterally on each side of the posterior margin of 5th abdominal segment. The siphunculi were dusky dark in colour and clavate in appearance projecting backwardly beyond the body margin. Each siphunculus was about 0.20-0.26 mm in length. The cauda was distinct, pale brown in colour and tongue shaped and possessing 3-4 long basal hairs and 1-2 short apical hairs. The spiracles were ventrally located as minute inconspicuous structure. There were altogether 9 pairs of spiracles out of which 2 pairs were posted on thoracic segments and rest 7 pairs were disposed one pair each on the first seven abdominal segments. The genital plate was brown in colour and was nearly twice broad as long and possessing many hairs. The anal plate was almost rectangular in shape and exhibiting concavity antero posteriorly and convexity laterally. There were 3-9 hairs on its anterior half and 7-12 hairs on its posterior margin. Wax glands were scattered on the cuticular surfaces and due to these the aphid gave a dull waxy look.

II. Alate viviparous females (Figs.3&4) : Except the presence of wings, the alate viviparous females were alike to apterous viviparous females. They were better chitinised and pigmented and greenish black in colour. They were slightly shorter than apterous forms and were measured in between 1.60-2.10 mm in length and 0.80-1.20 mm in breadth. Antennae were 6 segmented. Secondary sensoria were present in between 3rd to 5th segments. Frontal and antennal tubercle were less developed than the apterous forms. Eyes and mouth parts were alike to apterous forms. Thoracic segments were heavily chitinised and shining black in colour. Pronotum was distinct and possessing a distinct thoracic furca. Legs were similar to apterous forms. Two pair of wings were present with greenish insertions. Fore wings were larger than the body and hind wings and were also of harder consistency. In the forewing, there was one major longitudinal vein probably made up of by the fusion of costa, subcosta, media and radiaveins. In hind wings medial and cubitus branches are independent. Cubitus and anals were unbranched. Costa and pterostigma were smoky & oblique and transverse veins were dusky in appearance. Hamuli were present as the wings coupling apparatus. Wings were disposed in roof like manner over the abdomen. Abdominal details were similar to apterous forms.

III. Ist Nymphal instar (Fig.5) : Both alate and apterous females were viviparous and give birth to 1st instar nymphs of similar nature. These were yellowish-green in colour and elongated oval in shape. The body length varied in between 0.8-1.0 mm. Antennae were 4 segmented. Primary sensoria were present in between 3rd and 4th antennal segments. Secondary sensoria were not evident. Mouth parts were typical homopteran piercing and sucking type in which rostrum was extended beyond the bases of 3rd pair of coxae. The siphunculi were short and dusky in appearance. Cauda was small and bluntly rounded. All the 3 pairs of legs were stout and possessing tibia without spinule and one segmented tarsi.

IV. 2nd Nymphal instar (Fig.6) : The body was more darker in colour than the 1st nymphal instar and it was measured 1.0-1.2 mm in length. The antennae were 5-segmented and primary sensoria were present on the junction of 4th and 5th segments. The mouthparts were extended upto the midway of 2nd and 3rd coxae. The siphunculi and cauda became more prominent than the 1st instar nymphs.

V. 3rd Nymphal instar (Fig.7) : The body length increased further and ranged in between 1.15 to 1.50 mm. Antennae were still 5 segmented with similar arrangement of primary sensoria. Siphunculi and cauda became more prominent than previous instars. Small wing pads appeared in those nymphs which were destined to develop as alate viviparous females.

VI. 4th Nymphal instar (Fig.8) : In apterous forms the 4th instar nymphs were recorded 1.60 to 1.90 mm. long but in alate forms their body length varied in between 1.70-2.10 mm. The chitinisation was much better than earlier instars. The antennae were 6-segmented in which 6th segment was longest than others & tapering towards apex. The primary sensoria were present at the junction of 5th and 6th segments of both alate & apterous forms. The rostrum was extended upto the 2nd pair of coxae. The siphunculi were black in colour and much longer than its width. The cauda was sub triangular and almost broad as long and was rounded posteriorly. The genital plate was elliptical and anal plate was sub rectangular. In alate forms the wing pads were extended beyond the mid body. Tarsi were 2 segmented clawed and having empodial hairs.

The details of the morphology of *L.erysimi* in the present studies are in conformity with the brief accounts given earlier by Doncaster (1954), Blackman & Eastop (1984), Ahuja (1990), Sinha *et al.* (1990). *Lipaphis Mordvilko* a genus of Aphidinae : Macrosiphini is closely associated with Cruciferae and is characterized by the presence of antennal tubercles, absence of secondary sensoria and weakly swollen siphunculi, closely related to *Brevicoryne* sp. but differing from *Hyadaphis* by having only 2 hairs on the 1st segment of the hind tarsus (Blackman & Eastop, 1984, Doncaster, 1954; Heinze, 1960 & Prior, 1971). The general morphology and appearance of *L.erysimi* support the notings made for this aphid by Blackman and Eastop (1984) but in the present observation it has been noted that the aphids are slightly larger than the noted past morphometric measurements and it may be due to the climatic effects. The present observation also reveals that *L.erysimi* in and around Gaya on *B. compesitris* in a case of anholocycly, however, in the present insect holocycly has been noted on radish in Japan, with apterous males (Kawada and Murai, 1979). It is possible that anholocycly predominates in warmer climates as in Gaya. In general the morphological details as described earlier by Heie (1980), Bromley *et al.* (1979), Shambough *et al.* (1978), Harris & Maramorosch (1977) and Kidd (1976) in one or other aphids stand in support of the present investigation.

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