



ORIGINAL ARTICLE

Morphometrics of Nymphal Instars and Adults of Mango Leafhopper *Idioscopus clypealis* (Leth.)**Akash Varshney**

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Email: akash82varshney@yahoo.comReceived: 4th Nov. 2017, Revised: 16th Dec. 2017, Accepted: 20th Dec. 2017**ABSTRACT**

Idioscopus clypealis is most common and destructive species of hoppers, which cause heavy damage to mango crop. Total five nymphal instars occurred during the life history of *Idioscopus clypealis*. They moulted five times to become adults. The body length of the first instar of *Idioscopus clypealis* varied from 0.705 to 1.162 mm and width of its head across the eyes varied from 0.362 to 0.698 mm. The body length of the second instar varied from 1.124 to 2.004 mm and width of its head varied from 0.438 to 0.616 mm. The body length of third instar varied from 2.140 to 2.624 mm and width varied from 0.825 to 1.205 mm. The length of the fourth instar varied from 2.564 to 3.188 mm and width varied from 1.412 to 1.504 mm. Moreover, the body length of fifth instar varied from 3.005 to 3.628 mm and the width of its head across the eyes varying from 1.465 to 1.678 mm. Mango leafhoppers are generally characterized by a broad, rounded head, extending little between the eyes and a general 'wedge' shape. In addition, the length of female and male varied from 3.80 to 4.20 mm and from 3.70 to 4.20 mm, respectively. The width of head of females and male *Idioscopus clypealis* across the eyes varied from 1.722 to 2.005 mm and from 1.733 to 1.840 mm, respectively.

Key words: Mango, *Idioscopus clypealis*, length, morphometrics, size, width

INTRODUCTION

The mango, *Mangifera indica* (Linn.) is grown in India in large extent and is considered as a king of all the fruits. The largest producer state of mango is Uttar Pradesh. In proportion to its area of cultivation, its production is very low due to attack of insect pests. Among the mango pests, mango hoppers are most serious and widespread pests throughout the country (Anufriev, 1970), Rehman and Kuldeep (2007), causing 25-60 % yield loss in mango (Hiremath and Hiremath, 1994). *Idioscopus clypealis* (Lethierry) is most common and destructive species of hoppers, which cause heavy damage to mango crop. Large number of nymphs and adult hoppers, puncture and suck the sap from tender shoots, inflorescence and leaves of mango crop, which cause non-setting of flowers and dropping of immature fruits, thereby reducing the yield. Hoppers also excrete a secretion, called honey dew, which encourages the development of fungi like *Meliola mangiferae*, resulting in growth of sooty mould on dorsal surface of leaves, branches and fruits in moist weather. This black coating interferes with the normal photosynthetic activity of the plant, ultimately resulting in non-setting of flowers and dropping of immature fruits. This damage is called as Honey Dew Disease (Butani, 1993). Hoppers remain active throughout the year in cracks and crevices of mango trunk, but they are recorded on twigs, when young leaves and inflorescence are available (Patel et al., 1994). For the effective control of the hoppers, it is necessary to have knowledge about the morphological features of various life stages of mango leaf hoppers. The present study incorporates morphometrics of various nymphal instars of *Idioscopus clypealis*.

MATERIAL AND METHOD

For the study of morphometrics of nymphal instars of mango leaf hoppers, adult hoppers were collected from the field and reared in the laboratory. In the laboratory, hoppers were released in to rearing cages, that were prepared by plastic jars (15 x 20 cm), having holes on either side. Jars were covered by fine muslin cloth in order to provide free circulation of air. Fresh spikes of mango were provided to hoppers in the jar regularly. To study the nymphal instars, the neonate nymphs, immediately after hatching, were transferred on to fresh mango spikes in the rearing cage.

Everyday these spikes were changed to provide fresh food for nymphs. The difference in the growth stages were observed by recording morphometrics in terms of body length and width of the head across the compound eyes of the larval instars, with the help of microscope.

RESULTS AND DISCUSSION

In the laboratory, the nymphal instars, hatched out from the field collected eggs and as well as from the eggs laid on the caged plants were reared. The duration of each larval instar, their morphology and behavior were closely observed in the laboratory.

During the study, it was observed that total five larval instars occurred during the life history of *Idioscopus clypealis*. They moulted five times to become adults. Moulting took place by means of a median longitudinal splitting in the region of the head and the thorax. Larval instars of *Idioscopus clypealis* were lazy and dull deep yellow in color.

FIRST INSTAR NYMPH:

Freshly hatched nymphs were very delicate creatures with a relatively large head, produced in front of the eyes and pale yellow colored. The body length of the first instar of *Idioscopus clypealis* varied from 0.705 to 1.162 mm with an average of 0.972 ± 0.135 mm and the width of its head across the eyes varied from 0.362 to 0.698 mm with an average of 0.462 ± 0.067 mm (Table 1).

Compound eyes of first instar were red in color. The three segments of the thorax were not marked separately from each other. Their abdomen was relatively small and tapering towards the posterior end. Numerous black and long bristles were present on abdomen, arising especially from the posterior margin of abdominal segments. Proboscis reached beyond the metasternum. Tarsi were two segmented. After one day, nymphs elongated and became greyish in color. The lateral region of the terga of the abdomen became black, but the ventral surface remained pale. The thoracic segments began to be distinct from each other and legs remained transparent.

Table 1: Morphometrical observations of different life stages of *Idioscopus clypealis*

Life Stages	Length (in mm)			Width of Head (in mm)		
	Min.	Max.	Ave.	Min.	Max.	Ave.
I instar	0.705	1.162	0.972 ± 0.135	0.362	0.698	0.462 ± 0.067
II instar	1.124	2.004	1.318 ± 0.197	0.438	0.616	0.546 ± 0.050
III instar	2.140	2.624	2.476 ± 0.113	0.825	1.205	1.006 ± 0.098
IV instar	2.564	3.188	2.986 ± 0.140	1.412	1.504	1.488 ± 0.019
V instar	3.005	3.628	3.288 ± 0.131	1.465	1.678	1.576 ± 0.048
Adult Male	3.700	4.200	3.910 ± 0.137	1.688	1.792	1.712 ± 0.023
Adult Female	3.800	4.200	3.960 ± 0.103	1.722	2.005	1.905 ± 0.080

SECOND INSTAR NYMPH:

Just after the first moult, the nymphs become yellow in color, but within 24 hours, they turned greyish-yellow. The body length of the second instar of *Idioscopus clypealis* varied from 1.124 to 2.004 mm with an average of 1.518 ± 0.135 mm and the width of its head across the eyes varied from 0.438 to 0.616 mm with an average of 0.546 ± 0.050 mm (Table 1).

The eyes of second instar were red, like those of first instar. The individuals were active. Three thoracic segments were quite distinct from each other, mesothorax was the widest segment. The thorax as a whole was separated from abdomen by means of a constriction. There were no rudiments of the wings till now. The lateral region of the head, thorax and abdomen were very dark as compared with the median longitudinal area. Ventral surface was pale. The antennae were also darker than that of first instar. The proboscis and legs were dirty white and tarsi were still two segmented. Abdominal segments were quite distinct.

THIRD INSTAR NYMPH:

The body of third instar was proportionately broader than that of second instar. The body length of third instar varied from 2.140 to 2.624 mm with an average of 2.476 ± 0.113 mm and width of its head across the eyes varied from 0.825 to 1.205 mm with an average of 1.006 ± 0.098 mm (Table 1).

The general color of third instars was yellow, while and ventral surface was pale in color. Towards the end of this stage, lateral regions of the body turned darker. Eyes were dark red. Two black spots were recognizable on the vertex. The pronotum started to overlap the head and antennae are pale in color. On the thorax, the rudiments of the future two pair of wings appeared in the form of blunt projections of the lateral posterior angles of mesonotum and metanotum. The wing rudiments were almost equal in length. There was no differentiation of meso-scutellum as yet. On the metanotum, two black spots appeared and abdominal segments were quite distinct. The lateral parts of the 9th abdominal segment turned black.

FOURTH INSTAR NYMPH:

The length of the fourth instar of *Idioscopus clypealis* varied from 2.564 to 3.188 mm with an average of 2.986 ± 0.140 mm and the width of its head across the eyes varied from 1.412 to 1.504 mm with an average of 1.488 ± 0.019 mm (Table 1).

On the second or third day of this stage, the nymphs elongated very much and became very active. The wing pads were quite distinct. The nymphs leaped from place to place by the movement of their abdomen, which was very flexible. The body color was dull yellow with dark red eyes. The black spots on the vertex, metanotum and 9th abdominal segment became very prominent. Slightly dark patches were also seen on pronotum. The prothorax was distinct from the remaining segments. The meso-scutellum was distinct from its adjacent parts and was easily recognized by its dark lateral margins. The abdomen was very much elongated. The male and female nymphs could be distinguished from each other at this time.

FIFTH INSTAR NYMPH:

The body length of fifth instar varied from 3.005 to 3.628 mm with an average of 3.288 ± 0.131 mm with the width of its head across the eyes varying from 1.465 to 1.678 mm with an average of 1.576 ± 0.048 mm (Table 1).

At this stage, the nymphs differed from the adults only in the size of their body and wings. Just after the fourth moult, nymphs become pale yellow, but then they rapidly turned light grey at first and then dark grey. The two spots on the vertex, areas of the metanotum and 9th abdominal segments were distinctly black. Distinct black patches were also present on pronotum, vertex and face. The meso-scutellum was quite prominent. The dorsum of the abdomen was dark, except the intersegmental areas. The ventral surface of the body was pale with very large wing pads.

ADULT:

Regarding the general description, the newly emerged adults were cream colored and after one hour, the color changed to brown dorsally and pale yellow ventrally. Mango leafhoppers are generally characterized by a broad, rounded head, extending little between the eyes and a general 'wedge' shape. The length of female varied from 3.80 to 4.20 mm with an average of 3.96 ± 0.103 mm (Table 1). In males, it varied from 3.70 to 4.20 mm with an average of 3.91 ± 0.137 mm (Table 1). In females of *Idioscopus clypealis*, the width of head across the compound eyes varied from 1.722 to 2.005 mm with an average of 1.905 ± 0.080 mm (Table 1). In males, it varied from 1.733 to 1.840 mm with an average of 1.777 ± 0.030 mm (Table 1). Thus, the females were slightly bigger than the male adults. Two black spots were present on anterior margin of vertex in female, but these spots were absent in males. Two large, triangular black spots were present on scutellum, one near each basal angle.

These findings are in conformity with Patel et al. (1975) and Mishra and Chaudhary (1994). However, Hiremath and Thontadarya (1991) reported that the newly emerged adults were yellow and later turned dull black. The general morphology of these hoppers is also in conformity with Distant (1908) and Srinavasa et al. (2017). In addition, Manseguiao and Demayo (2019) described wing shape variability in males and females *Idioscopus clypealis*. Hussain and Pruthi (1924), Patel et al. (1975), Sohi and Sohi (1990) and Mishra and Chaudhary (1994) also reported five nymphal instars during the life history of these hoppers but Hiremath and Thontadarya (1991) and Babu et al. (2002) recorded only four nymphal instars during the life history. These contradictions in the results may be due to the different ecological conditions of the areas, studied by these researchers.

Bato (1978) recorded five nymphal instars on shoots, compared with only four on inflorescence in the Philippines.

REFERENCES

1. Anufriev G.A. (1970): Description of a new genus *Amritodus atkinsoni* (Leth.) (Jassidae: Homoptera) in South India. *Journal of Natural History*, 4: 375-376.
2. Babu L.B., Maheshwari T.M. and Rao N.V. (2002): Seasonal incidence and biology of the mango hopper -*Amritodus atkinsoni* (Lethierry) (Homoptera; Cicadellidae). *Entomon*, 27(1):35-42.
3. Bato S.M. (1978): The biology, ecology and control of *Idioscopus clypealis* (Leth.). Ph.D. Thesis, University of Philippines, Los Banos.
4. Butani D.K. (1993): Mango Pest Problems. Periodical Expert Book Agency, New Delhi, pp: 38-43.
5. Distant W.L. (1908): The fauna of British India including Ceylon and Burma. Rhynota, IV, Taylor and Francis, London, pp: 184-190.
6. Hiremath S.C. and Hiremath I.G. (1994): Studies on seasonal incidence and nature of damage of mango hoppers. *Bulletin of Entomology*, 35 (1): 78-83.
7. Hiremath S.C. and Thontadarya T.S. (1991): Biology of mango leaf hoppers (Homoptera: Cicadellidae) in Dharwad region of Karnataka. *Karnataka Journal of Agricultural Sciences*, 4(3): 156-161.
8. Hussain M.A. and Pruthi H.S. (1924): Short note on the life history of the mango hoppers (*Idiocerus* spp.) in the Punjab. Report of Proc. of Vth Entomological Meeting, Pusa (Bihar), pp: 252-260.
9. Manseguiao M.R.S. and Demayo C.G. (2019): Intraspecific variation in wing shape of the mango leafhopper, *Idioscopus clypealis*, among orchards in the Philippines. *International Journal of Bioscience, Biochemistry and Bioinformatics*, 9(1): 27-34.
10. Mishra D.N. and Chaudhary A.K.S. (1994): Biology of mango hopper *Amritodus atkinsoni*, (Leth.) (Jassidae: Hemiptera) in West Bengal. *Annals of Entomology*, 12(2): 57-60.
11. Patel J.R., Shekh A.M. and Ratanpara H.C. (1994): Seasonal incidence and effect of minimum temperature and vapour pressure on the population of mango hopper *Amritodus atkinsoni* (Leth.) in middle Gujarat. *Gujarat Agricultural University Research Journal*, 20(1): 5-8.
12. Patel R.K., Patel S.R. and Shah A.H. (1975): Biology of mango hopper *Amritodus atkinsoni* (Leth.) (Jassidae : Hemiptera) in South Gujarat. *Indian Journal of Entomology*, 37(2): 150-153.
13. Rahman M.A. and Kuldeep (2007): Mango hopper: Bioecology and management - a review. *Agriculture Review*, 28(1): 49-55.
14. Sohi A.S. and Sohi A.S. Sr. (1990): Mango leaf hoppers (Homoptera: Cicadellidae) - A review. *Journal of Insect Science*, 3(1): 1-12.
15. Srinivasa N., Ramya N. and Meshram N.M. (2017): Taxonomic studies of leafhoppers (Hemiptera: Cicadellidae), fauna associated with mango from India. *International Journal of Current Microbiology and Applied Sciences*, 6(10): 2108-2124.