

Morphological study of adult male *Aspidiotus tamarindi* (Green) (Homoptera: Coccoidea: Diaspididae)

¹ AKS Chauhan, ² Rajvir Singh Ojha

¹ Department of Zoology, Narain College, Shikohabad, Uttar Pradesh, India

² Department of Zoology, Raja Balwant Singh College, Agra, Uttar Pradesh, India

Abstract

Aspidiotus tamarindi (Green) adult male collected from various localities of Shikohabad, Firozabad (U.P.), India and it is described a species of armoured scale insect, *Aspidiotus tamarindi* (Green) belongs to sub family Aspidiotinae and family Diaspididae. All the insects of this family are commonly known as armoured scales which are the successful group of plant parasitic insects and include some of the most damaging and notorious economical, agricultural or horticultural pests. These pests are found in the tropics, sub-tropics and warmer portions of the temperate zones. *Aspidiotus tamarindi* (Green) is an important pest of *Annona squamosa*, *Mimusops elengi* and *Tamarindus indica*. This pest attack on the both dorsal and ventral side of the host. *Aspidiotus tamarindi* (Green) is sexually dimorphic in nature. The body of the adult male *Aspidiotus tamarindi* is divided into head, thorax and abdomen. Head of male adult is conical, apex of head bears a pair of long apical setae, two pairs of round eyes. Thorax of an adult male *Aspidiotus tamarindi* is somewhat reduced and subdivided into pro, meso and metathorax. Meso and Metathorax bear one pair wings respectively. Thorax bears 3 pairs legs which located on each segment. The scutellum very characteristic for the adult male and it may help to this pest. Situation of the scutellum may also differ in different species. In *Aspidiotus tamarindi* (Green) the scutellum present just anterior to the centre of the mesothorax.

Keywords: *Aspidiotus tamarindi*, morphological status

1. Introduction

Aspidiotus tamarindi belongs to subfamily Aspidiotinae, family Diaspididae, superfamily Coccoidea, order Homoptera. All the insects of this family are commonly known as armoured scales. These armoured scale insects are cosmopolitan and distributed in the tropics, subtropics and warmer portions of the temperate areas. The body of the adult male *Aspidiotus tamarindi* is divided into head, thorax and abdomen distinctly. Head of *Aspidiotus tamarindi* (Green) is conical in shape. Apex of head bears a pair of apical setae. Mouth opening very minutes situating behind the cranial apophysis. There are two pairs of rounded eyes present on the head. One pair situated dorso-laterally and other pair ventro-laterally. The distance between the dorsal pair of eyes is more than ventral pair of eyes. Head bears a pair antennae, each antenna of adult male *Aspidiotus tamarindi* is nine segmented, 1st segment smallest, 5th largest and 9th segment is small spindle shaped which terminating into a short process. The thorax of adult male *Aspidiotus tamarindi* (Green) somewhat reduced and subdivided into pro, meso and metathorax. Two pair wings well developed present on meso and metathorax. There are three pairs well developed legs on thorax in which first pair legs are smallest, the second pair longer and the third pair legs are largest.

In *Aspidiotus tamarindi* (Green) adult male the abdomen formed by fusion of nine segments. First to eighth abdominal segments known as pregenital and last 9th one is the genital segment. The abdomen is wider anteriorly and gradually narrower posteriorly.

As a paurometabolous insects, the males are evolved through

a complete metamorphosis and small inconspicuous with well developed mesothoracic and reduced metathoracic wings (hamulohaltres), live free for few days and move normally. Family Diaspididae includes both pterous and apterous type of males. Ferris (1941 and 1953) ^[3, 4] reported upon genus *Aspidiotus*. Bodenheimer (1953) ^[2] studied the scale insects (Coccoidea) of Turkey Island University. Theron (1958) ^[9] studied comparative studies on the morphology of male scale insects (Hemiptera: Coccoidea). Ghauri (1962) ^[6] worked on the morphology and taxonomy of male scale insects (Homoptera: Coccoidea) from London. Giliomes (1966) ^[7] observed on morphology and taxonomy of adult males of the family Coccidae. Afifi (1968) ^[1] postulated morphology and taxonomy of the adult males of the family Pseudococcidae and Eriococcidae. Williams and Kosztarab (1970) ^[10] worked morphology and systematic study on the first instar nymph of the genus *Lecanodiaspis* (Homoptera: Coccoidea: Lecanodiaspididae). Komosinska (1974) ^[8] described studies on the morphology of *Mytilaspis conchiformis formaconchiformis* (Gmelin) (Homoptera: Coccoidea: Diaspididae). Gerson and Hazan (1979) ^[5] worked biosystematic study of *Aspidiotus nerii* (Homoptera: Diaspididae) with the description of one new species, Ben-Dov and Williams (2002) ^[11] discussed the identity of *Aspidiotus guianensis* Lindinger, 1957 (Hemiptera: Coccoidea: Diaspididae). Ben-Dov (2006) ^[12] studied taxonomy of *Aonidiella yehudithae* sp. nov. And *Lindingaspis misrae* (Laing) comb. nov. With a key to species of *Aonidiella* Berlese and Leonardi (Hemiptera: Coccoidea: Diaspididae).

2. Materials and Methods

The morphological studies were carried out in Zoology Department, Narain College, Shikohabad chiefly taken from different hosts and several localities of Shikohabad, Northern India. Measurement values in millimeters are given frequently with the description of particular features. All microscopic slides used for measurement were prepared by the method described by Williams and Kosztarab (1970) ^[10] either from dry material or after a prior fixing in conserving fluid consisting four parts of 95% alcohol and one part of glacial acetic acid.

3. Description

The adult male is pterygote yellowish to bright yellow in colour. The average length of adult male about 1.11 (1.11 - 1.15) mm including genital style. The width at the thorax is nearly 0.39 (0.35 - 0.41) mm. The average length of genital style is 0.22 (0.22 - 0.26) mm.

Scale of male (Fig 1)

Male scale nearly oval in shape with light and dark concentric lines at the whole margin. Average length nearly 1.25 (1.23 - 1.35) mm and width 0.68 (0.61 - 0.72) mm. The scale of male with single first large exuvia.

Segmentation of the body (Fig. 2)

The body of adult male is divided into head, thorax and abdomen distinctly. HEAD (Fig. 3, 4, 5, 6 and 7): Head of male is conical, average length of head from apex to occipital ridge nearly 0.142 mm across gena. Mouth opening is very minute situating behind the cranial apophysis. Eyes are two pairs rounded; one pair situated on dorso-laterally and one pair on ventro-laterally. The diameter of each dorsal eye is nearly 0.031 (0.031 - 0.032) mm and of ventral eye 0.034 (0.032 - 0.035) mm. The dorsally eyes are somewhat smaller than the ventral eyes. Antennae one pair, each antenna nine segmented with setae and the average length of each antenna is nearly 0.532 (0.550 - 0.565) mm. The length and width of each antennal segment various.

Thorax (Fig. 2)

Thorax is somewhat reduced and is subdivided into pro, meso and metathorax. The length and width are approximately 0.42 (0.42 - 0.46) mm and 0.38 (0.34 - 0.45) mm. Prothorax is much reduced and its sclerite bears first pair of legs and a pair of prothoracic spiracles. Mesothorax is strongly developed. The prescutum arch-like curved in which a scutum is attached. Prescutum and scutum both form a closed oval formation. Just anterior to the centre of the mesothorax a heavily chitinized disc-shaped scutellum present. It is long plate-like but mildly curved downwards, strongly chitinized than the other parts of the mesothorax. The length and width of the scutellum are 0.0136 (0.0120 - 0.0155) mm and 0.022 (0.020 - 0.023) mm. The second pair legs and the first pair spiracles are originated from the flat mesosternum. Metathorax is also less developed than the mesothorax. The third pair of legs and the second thorax spiracles are present on the ventral side. Wings two pairs normally well developed. First pair wings (Fig. 5)

present on meso and second pair on metathorax. In each mesothoracic wing the veins network greatly reduced. It has a short subcosta, radius and a media. The radius is running nearly two-third of the wing with upper margin. The media in beginning is attached with the radius about one third. At the root of the wing there is an alar lobe. The average length of the wing is approximately 0.568 (0.560 - 0.575) mm and width nearly half to its length. The second pair wings (Fig. 2) are very much reduced and present in the form of vestigial haltere which located on the metathorax laterally. Each vestigial haltere is club-shaped protuberance ending with a long curved terminal seta which is nearly equal to the length of the haltere's lobe. Legs of the adult male are three pairs and well developed. All the three pairs legs have same composition but differ in size. The first pair legs are smallest, second pair longer and third pair largest.

Abdomen (Fig. 3, 4, 6, 7 and 8)

Abdomen is formed by fusion of nine segments. First to eight abdominal segments are known as pregenital and last ninth one is the genital segment. The abdomen is wider anteriorly and gradually narrower posteriorly. First to eight segments typical and each segment formed by a dorsal tergum and ventral sternum. The plaurite is not distinct in any segment. The ninth segment is quite prolonged, modified into a conical, long and narrow genital sheath. Its length and width are 0.28 (0.25 - 0.35) mm and 0.022 (0.020 - 0.26) mm at the middle of the stylus. The posterior half of the genital sheath provided with five pairs of wart-like swellings, the genital sensilla. The length of the penis is 0.26 (0.25 - 0.30) mm and width 0.019 (0.018 - 0.022) mm. The penis is also provided with four pairs of wart-like swellings which are similar in appearance to that of genital sheath. The base of genital sheath bears one pair setae. On the ventral side at the base of the penis there are four or five pairs of small similar genital base setae present. A basal ridge of the penial sheath well developed and present on the ventral side of the stylus. Anus is situated on the dorsal surface of the base of penis.

Chaetotaxy (Fig. 3, 4, 6, 7 and 8)

The head of the adult male *Aspidiotus tamarindi* (Green) bears five pairs mid cranial setae on the dorso-lateral ridges and a pair of long setae at the apex of the head. The gena bears one pair of the genal setae. Each anterior arm of occipital ridge bears two setae near the apex. The first antennal segment is without setae, second with 3, third with 5, fourth with 6, fifth with 8, sixth with 9, seventh with 10 - 12, eighth with 11 - 12 and ninth antennal segment 13 - 14 setae. In each walking leg the coxa bears 1 - 3, trochanter with 1, femur with 5 - 7, tibia with 8 - 10 and tarsus with 12 - 14 setae. In the abdomen from first to fifth segment each segment bears one pair marginal and one pair submarginal setae. Each sixth to eighth segments bear one pair marginal, one pair submarginal and one pair median setae dorsally. On the ventral side one pair submarginal setae are present in each segment from fifth to eighth segments. The base of the genital sheath bears one pair setae. On the ventral side at the base of penis four or five pairs small and similar setae are present.

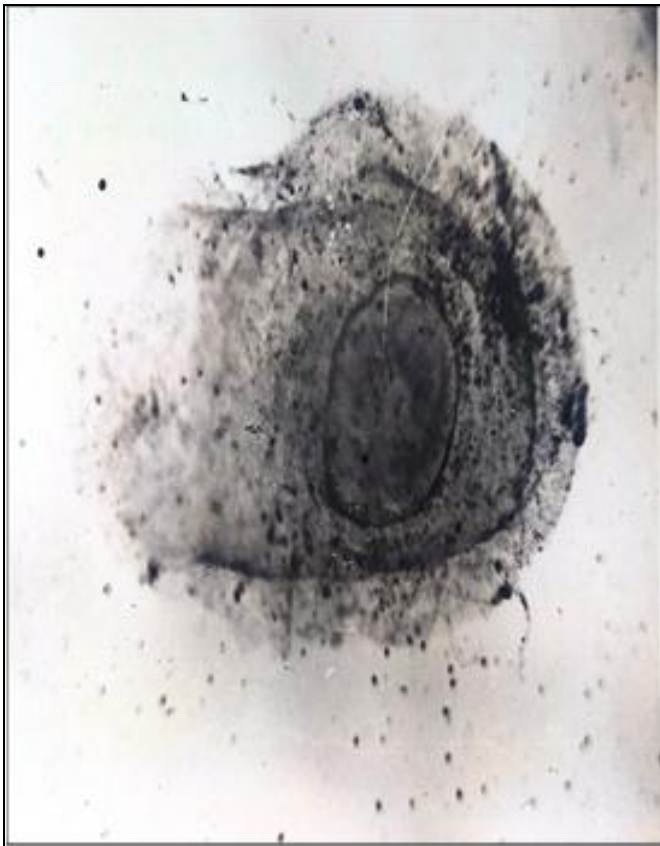


Fig. 1. Microphotograph of the scale of male *Aspidiotus tamarindi* (Green) (W.M.) (86.75X)

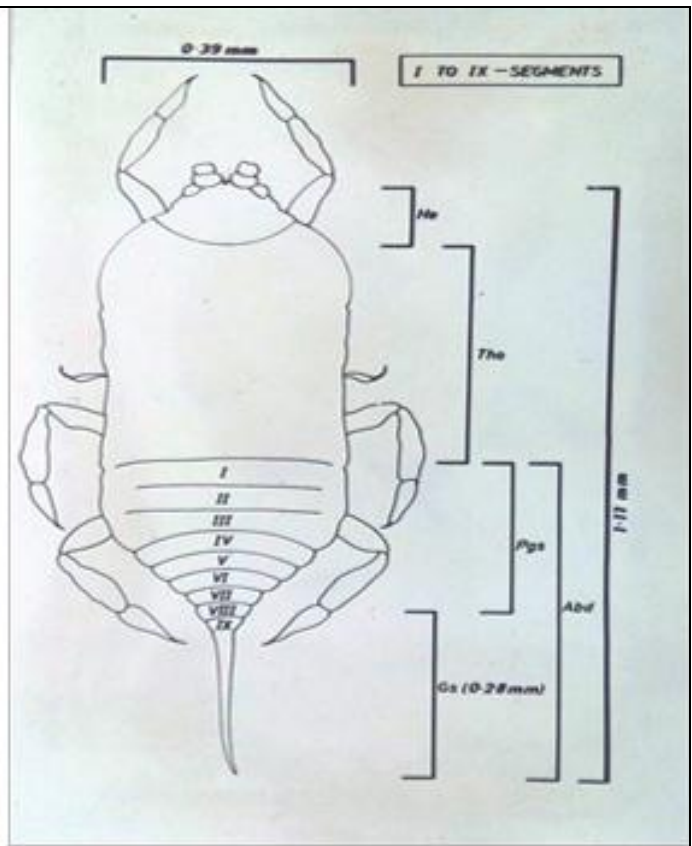


Fig. 2. Segmentation of the body of male *Aspidiotus tamarindi* (Green) (118.89X)

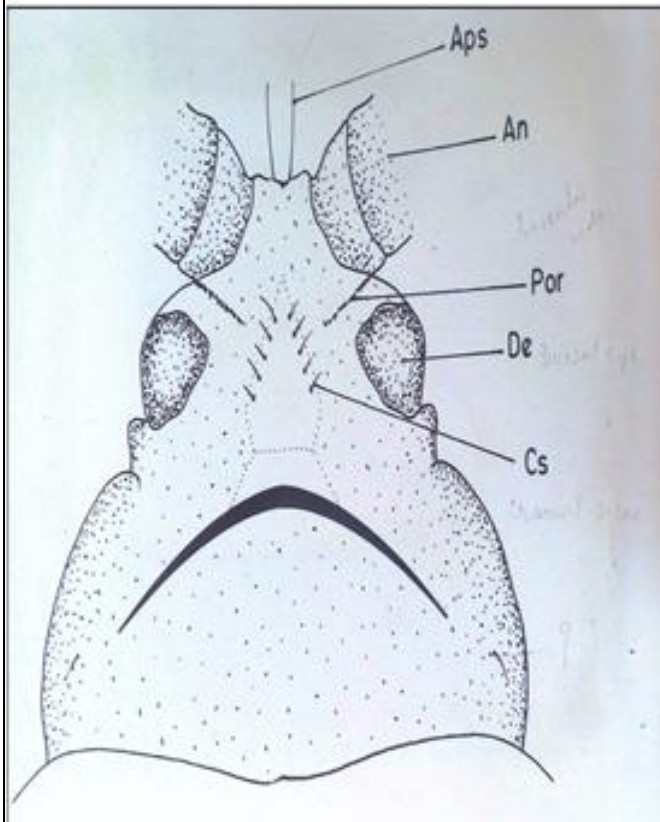


Fig. 3. Dorsal view of the head of male *Aspidiotus tamarindi* (Green) (80.85X)

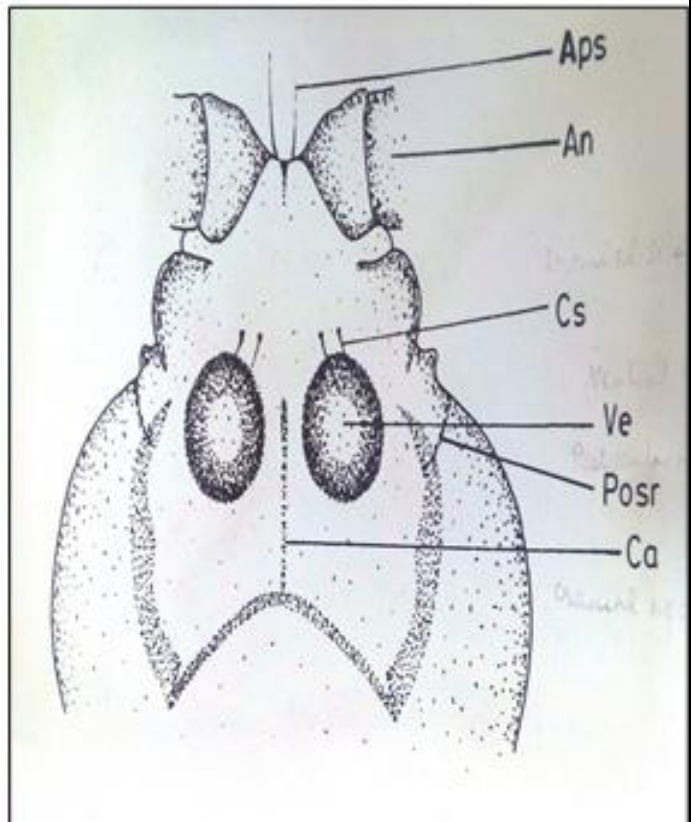


Fig. 4. Ventral view of the head of male *Aspidiotus tamarindi* (Green) (75.65X)

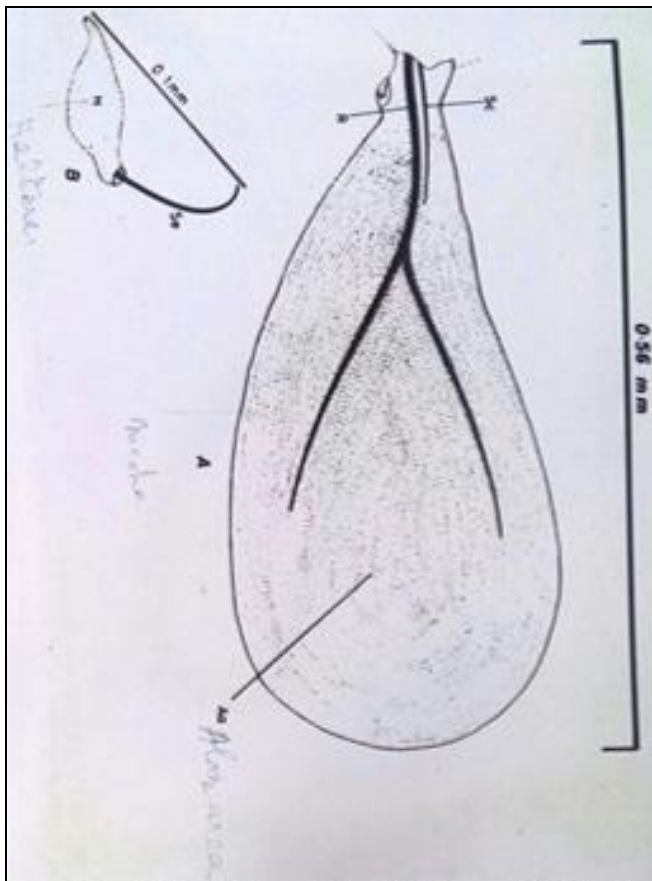


Fig. 5. Wing of the male *Aspidiotus tamarindii* (Green)
A. Mesothoracic wing (113.44X)
B. Halter (46.90X)

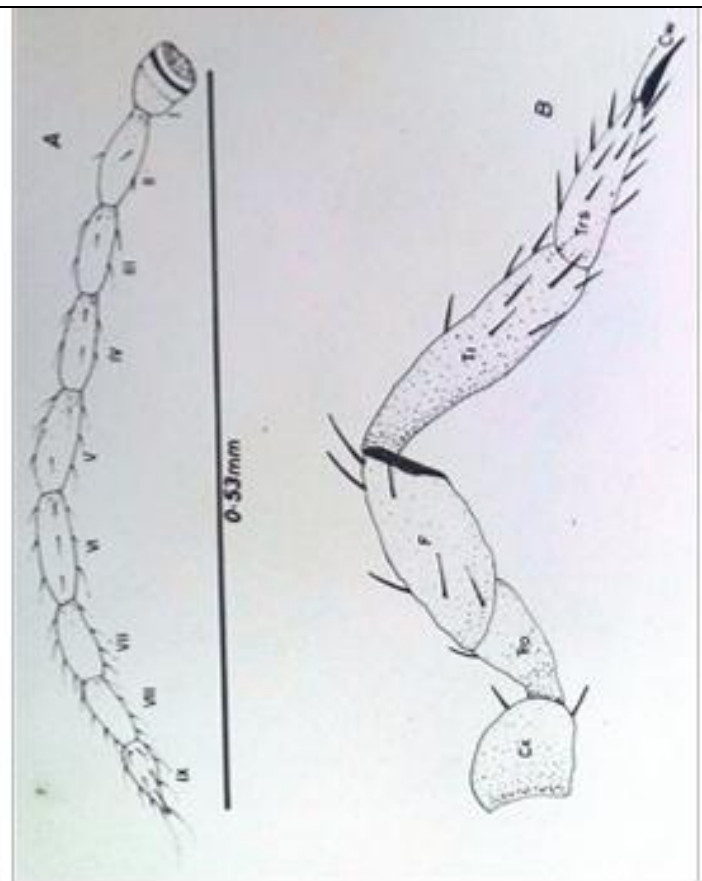


Fig. 6. Magnified view of the antenna and a metathoracic leg of male *Aspidiotus tamarindii* (Green): A. Antenna (124.47X); B. Metathoracic leg (123.70X)

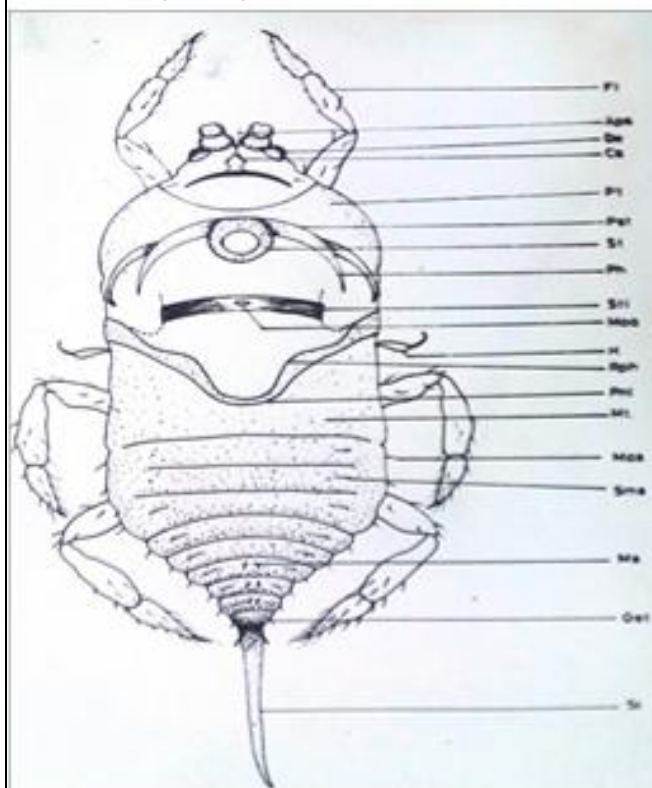


Fig. 7. view of the male *Aspidiotus tamarindii* (Green)
(128.89X)

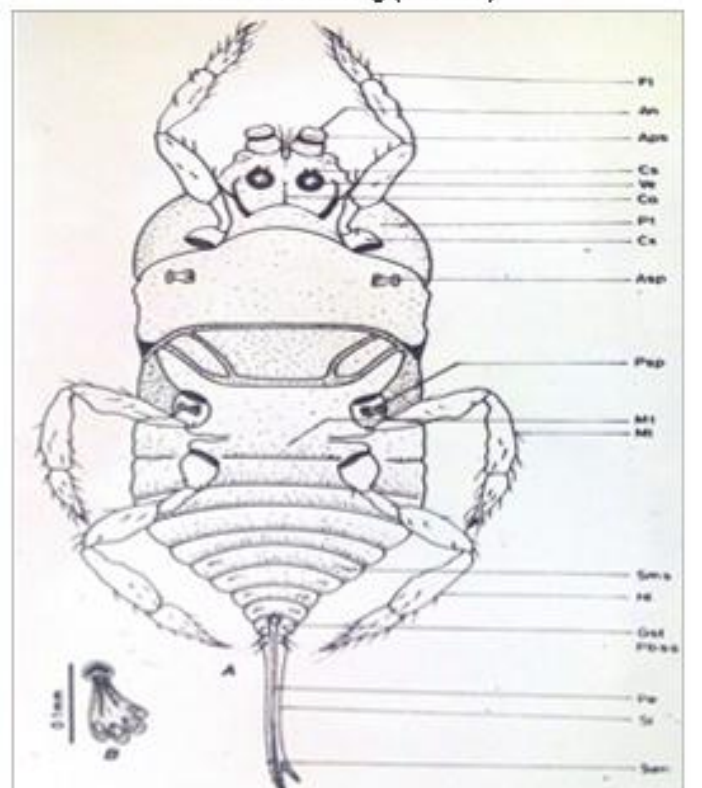


Fig. 8. Ventral view of the male *Aspidiotus tamarindii* (Green)
A. Ventral view (W.MX124.89X); B. Spiracle (15.90X)

4. Results and Discussion

Schmutterer (1952) referred only apterous males in his mentioned work on coccidian, while Ghauri (1962) observed apterous as well as winged males of *Parlatoria blanchardi* (Trag.) and *Chionaspis salicis* (Linn.). However Lellakova described winged males in *Quadraspidotus gigas*. Komosinska (1974) observed only apterous males in *Mytilaspis conchiformis formaconchiformis*. While our species *Aspidiotus tamarindi* (Green) has always pterous males. The shape and average size of the scale of adult males are different in different species. In *Mytilaspis conchiformis formaconchoformis* (Komosinska, 1974) the average length and width of scale of the male are 0.742 and 0.221 mm., while in *Quadraspidotus gigas* (Lellakova, 1963) the scale of the male is prolonged, rounded with 1.8 to 2.00 mm in diameter. However, in *Aspidiotus tamarindi* (Green) the scale of the male is oval in shape with average length and width 1.25 (1.23 - 1.35) mm and 0.68 (0.61 - 0.72) mm respectively. In *Mytilaspis conchiformis formaconchiformis* (Komosinska, 1974) the antennae are ten segmented. In *Aspidiotus tamarindi* (Green) like that of *Quadraspidotus gigas* (Lellakova, 1963) the antennae are nine segmented. The average gap between the dorsal pair of eyes in *Mytilaspis conchiformis formaconchiformis* (Komosinska, 1974) is 0.0290-0.0294 mm in *Aspidiotus tamarindi* (Green) the gap is 0.058 (0.052-0.071) mm. The average diameter of each dorsal and ventral eye in *Mytilaspis conchiformis formaconchiformis* (Komosinska, 1974) are 0.013 and 0.0193 mm., in *Aspidiotus tamarindi* (Green) the diameter of each dorsal and ventral eyes 0.031 (0.031-0.032) mm. and 0.034 (0.032-0.035) mm respectively. The scutellum has not described in *Mytilaspis conchiformis formaconchiformis* (Komosinska, 1974), Lellakova (1963) described well developed chitinized scutellum in *Quadraspidotus gigas* like that of *Aspidiotus tamarindi* (Green). The situation of the scutellum may also differ in different species. In *Aspidiotus tamarindi* (Green) the scutellum is present just anterior centre of the mesothorax but in *Quadraspidotus gigas* (Lellakova, 1963) the scutellum is present posterior to the centre of the mesothorax. The ratio of the length of the coxa and femur of the legs may be in different species. In *Mytilaspis conchiformis formaconchiformis* (Komosinska, 1974) the ratio is 1:1:6, in *Aspidiotus tamarindi* (Green) the ratio 1:1:3. In *Mytilaspis conchiformis formaconchiformis* (Komosinska, 1974) the ratio of the body length and stylus is nearly 3:1, in *Aspidiotus tamarindi* (Green) it's 4:1. The ratio in between the length of the stylus and the length of the whole abdomen in *Aspidiotus tamarindi* (Green) is 3:2. Komosinska (1974) described the number of the sensilla on the stylus are four to six pairs in *Aspidiotus tamarindi* (Green) the number of sensilla on the stylus five pairs.

5. References

1. Afifi SA. Morphology and taxonomy of the adult males of the family Pseudococcidae and Eriococcidae. Bull. Br. Mus. Nat. Hist Entomol, 1968; 13:1-21.
2. Bodenheimer FS. The scale insects Coccoidea of Turkey Istanb. University. Fen. Fak. Meca B, 1953; 17:315-357.
3. Ferris GF. The genus *Aspidiotus* Homoptera: Coccoidea: Diaspididae Microent. Stanford, 1941; 6:33-69.
4. Ferris GF. Report upon scale insect collected in China Homoptera: Coccoidea Micronet. Stanford, 1953; 18:59-84.
5. Gerson U, Hazan A. Biosystematic study of *Aspidiotus nerii* Homoptera: Diaspididae with the description of one new species. Fac, Agric. Rehoval. Isr. J. Nat. Hist. 1979; 19(3):275-284.
6. Ghauri MS. Morphology and taxonomy of adult male scale insects Homoptera: Coccoidea London, 1962, 221.
7. Giliomes JH. Morphology and taxonomy of adult males of the family Coccidae. Bull. Br. Mus. Nat. Hist. Entomol, 1966; 19:7-168.
8. Komosinska H. Studies on the morphology of *Mytilaspis conchiformis formaconchiformis* Gmelin Homoptera: Coccoidea: Diaspididae, 1974, 343-371.
9. Theron JG. Comparative studies on the morphology of male scale insects Hemiptera: Coccoidea. Ann. Univ. Stellenbosch. 1958; 24(A)(I):1-71.
10. Williams ML, Kosztarab M. Morphology and systematic study on the first instar nymph of the genus *Lecanodiaspis* Homoptera: Coccoidea: Lecanodiaspididae Res. Dev. Bull. Virg. Polytech. Inst. Blacksburg Va, 1970; 52:1-96.
11. Ben-Dev Y, Williams DJ. The identity of *Aspidiotus guianensis* Lindinger, 1857 Homoptera: Coccoidea: Diaspididae Bulletin de la Societe Entomologique de France. 2002; 108(2):166-167.
12. Ben-Dev Y. Taxonomy of *Aonidiella yehudithae* sp. nov. and *Lindingaspis misrae* Laing comb. nov. with a key to species of *Aonidiella* Berlese and *Leonardi* Hemiptera: Coccoidea: Diaspididae. Zootaxa, 2006; 1190:51-57.