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DESCRIPTIONS OF ALL FEMALE INSTARS OF THE MEALYBUG, *DYSMICOCCUS BREVIPES* (COCKERELL), (HOMOPTERA : PSEUDOCOCCIDAE)*

GHOSH, A. B.[1] AND GHOSE, S. K.
Department of Agril. Entomology,
Bidhan Chandra Krishi Viswavidyalaya,
Kalyani, W. Bengal, India.

(With 4 Text-figures)

INTRODUCTION

The mealybug, *Dysmicoccus brevipes* (Cockerell), is distributed in the Oriental, Australian, Palearctic, Ethiopian, Neotropical and Neartic regions (CAB Map no. A 50). The main host of the species is pine-apple and alternative hosts include sugarcane, groundnut, coconut, coffee and *Pandanus* (Hill, 1975). But its status as a pest and vector of wilt and spotting disease in severe form is only revealed in case of pineapple. It reproduces by both zygogenetically and parthenogenetically (Beardsley, 1960, 1965). In West Bengal the species reproduces parthenogenetically and therefore the males are absent (Ghose, 1983).

The intent of this study is to describe all the female instars of *D. brevipes* (Cockerell), to distinguish different instars and to reveal the significance of various wax secreting glands of the derm of the species in life.

METHODS

The specimens were mounted on slides following the usual methods (Ghose, 1971). Measurements in the descriptions are the averages of 5-10 specimens. Values are reported as the range and mean respectively. Roman numerals stand for abdominal segments.

DESCRIPTIONS

First instar female numphs (Text-fig. 1)

Body (mounted) 0.49-0.68 (0.55) mm long, 0.24-0.30 (0.27) mm wide.

Dorsum with 17 pairs of cerarii. Anal lobe cerarii each with 2 stout conical spines and 3 trilocular disc pores. Cerarii of other segments with 2 slender spines and 1-2 trilocular pores.

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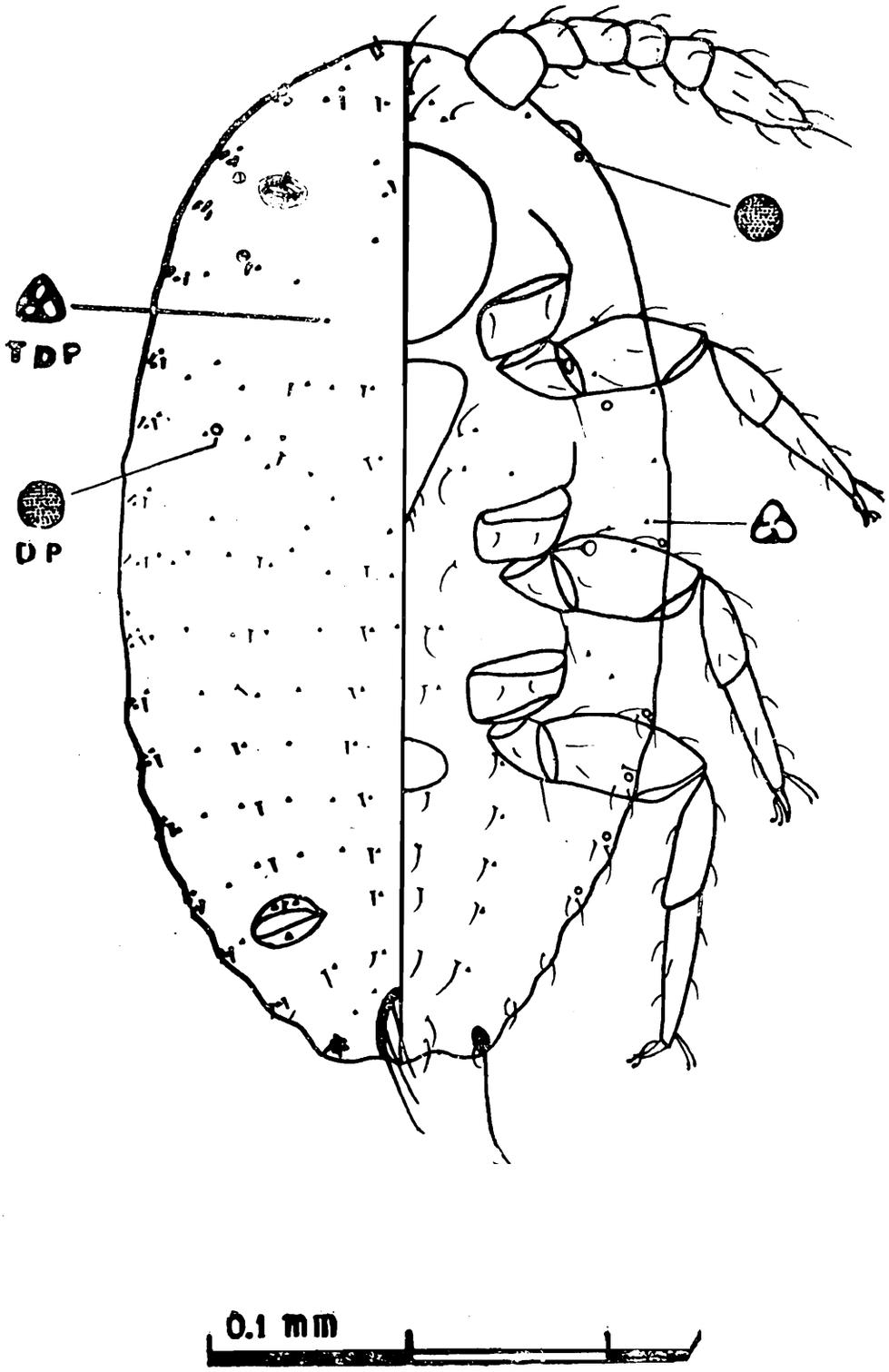
[1]Present Address : Bidhan Chandra Krishi Viswavidalaya, North Bengal Campus, Coochbehar 736101, W. B., India.

Discoidal pores on dorsum restricted to pro- and mesothorax. Trilocular pores present throughout dorsum, about 55 per cent being on thorax and head. Upper lip of both pairs of ostioles with 1 seta and 2 trilocular pores ; their lower lip with 2 setae and 1 trilocular pore. Body setae of segment VIII slender and longer than those of other segments.



Text-fig. 1. First instar female nymph of *D. brevipes* (Cockerell). TDP, Trilocular Disc Pore ; DP, Discoidal Pore.

Anal ring, 32-36 (34) μm in diameter with 6 anal ring setae, 48-52 (50) μm long.

Venter with discoidal and trilocular pores. Discoidal pores present on segments VI-IV, mesothorax and head and 1 attached to each eye. The number of trilocular pores, only about 28 per cent of dorsum. Anal lobes, a bit sclerotized ; apical setae, 52-56 (54) μm long. Body setae, longer and flagellate.

Circulus, 36-40 (39) μm long and 48-56 (50) μm wide. Eyes, 14-16 (15) μm in diameter at base, 4-6 (5) μm high. Beak, 76-88 (82) μm long, 48-60 (54) μm wide at base. Both pairs of spiracles, 8 μm wide at atrium, 24-28 (26) μm long.

Hind legs with tibia+tarsus, 104-144 (125) μm long ; apices of tarsal and claw digitules spatulated, 26-32 (29) μm and 24-28 (26) μm long respectively ; claws, 16-20 (18) μm long. Antennae 6-segmented, length being 179-201 (189) μm.

Second instar female nymphs (Text-fig. 2)

Body (mounted) 0.61-0.88 (0.70) mm long, 0.30-0.45 (0.33) mm wide.

Dorsum with 17 pairs of cerarii. Each anal lobe cerarius with 2 stout conical spines, 1 auxilliary spine and 8-12 trilocular pores. The remaining cerarii having 2 short thin conical spines. The number of trilocular pores in cerarii of segments VIII-IV are 4-5, 4, 4, 3, 3 respectively ; next 11 pairs of cerarii counting anteriorly each with 2, 2, 1-2, 2, 1-2, 1-2, 1-2, 1-2, 1-2, 1-2, 1-2 trilocular pores respectively.

Dorsum with more discoidal pores than on venter. Trilocular pores throughout dorsum, maximum being on mesothorax. Both lips of anterior pair of ostioles with 1 seta and 3 trilocular pores ; upper lip of postirior pair with 1 seta and 4 trilocular pores and lower lip with only 2 trilocular pores. Body setae short and thin, except in segment IX which are longer, 28-32 (30) μm.

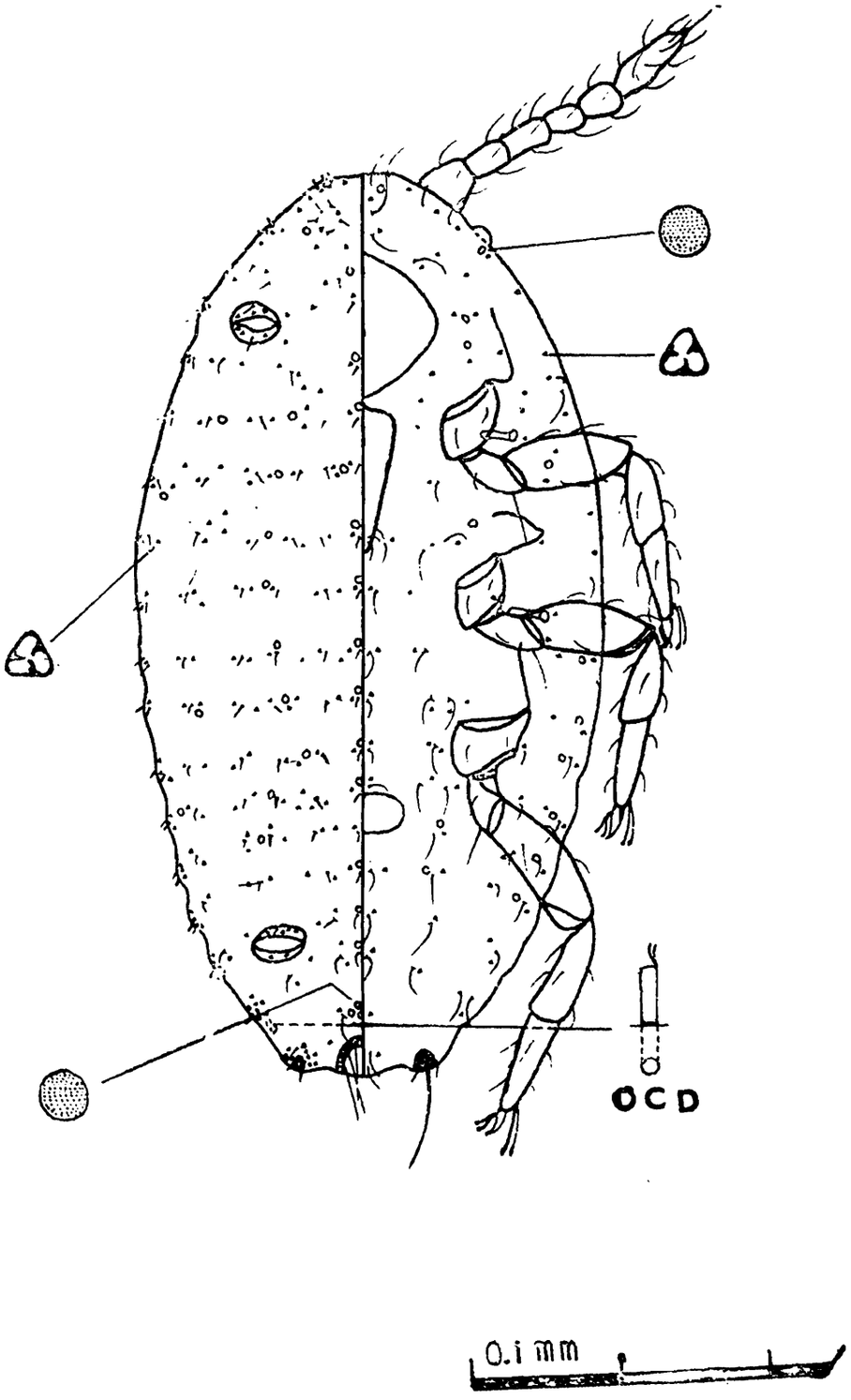
Anal ring 38-44 (42) μm in diameter with 6 setae, each 52-60 (57) μm long.

Venter with discoidal pores in segments VI-head. Trilocular pores more numerous on segments of thorax and head. Only 1 oral-collar tubular duct on segment VIII. Anal lobes slightly sclerotized with apical setae, 68-88 (76) μm long. Body setae, long and flagellate.

Circulus, 40-56 (45) μm long, 60-72 (63) μm wide. Eyes, 18-21 (20) μm in diameter, 6-8 (7) μm high. Beak, 92-100 (96) μm long, 60-68 (62)

μm wide. Both pairs of spiracles, 12 μm wide and 24-32 (28) μm long.

Hind legs with tibia + tarsus 128-156 (142) μm long ; tarsal and claw digitules 28-34 (31) μm and 16-24 (18) μm long respectively ; claws, 20-24 (21) μm long. Antennae, 6-segmented, 200-228 (213) μm long.



Text-fig. 2. Second instar female nymph of *D. brevipes* (Cockerell). OCD, Oral-Collar Duct.

Third instar female nymphs (Text-fig. 3)

Body (mounted) 0.97-1.30 (1.15) mm long, 0.51-0.79 (0.69) mm wide.

Dorsum with 17 pairs of cerarii. Each anal lobe cerarius with 2 stout conical spines, 3 auxilliary spines and 16-18 trilocular pores. Next seven pairs of abdominal cerarii counting anteriorly each with 12, 10, 10, 9, 8, 8, 6 trilocular pores respectively, also with 2 stout conical spines and 2 auxilliary spines. Next three cerarii, each with 2 stout conical spines, 1 auxilliary spine and 7 trilocular pores. Next cerarius of mesothorax with 3 conical spines, 1 auxilliary spine and 8 trilocular pores. Each of three cerarii of prothorax with 4 trilocular pores and 2, 2, 3 conical spines respectively. Each of two cerarii of head with 2, 3 conical spines and 7, 6 trilocular pores respectively with 1 auxilliary spine.

About 50 per cent of discoidal pores of dorsum are located on thorax and head. Trilocular pores more on segments of thorax, maximum being on mesothorax. Upper lip of anterior pair of ostioles with 3 setae and 5 trilocular pores ; their lower lip and upper lip of posterior pair with 3 setae and 7 trilocular pores ; lower lip of posterior pair with 2 setae and 7 trilocular pores. Body setae of segments IX and VIII long and flagellate, but those of other segments short and slender.

Anal ring, 52-26 (55) μm in diameter, with 6 setae, each 68-84 (78) μm long.

Venter with discoidal pores in segments VIII—head. Trilocular pores more numerous on segments of thorax and head. One oral-collar tubular duct in each segments of VIII, meso- and metathorax. Anal lobes sclerotized with apical seta 104-120 (114) μm long.

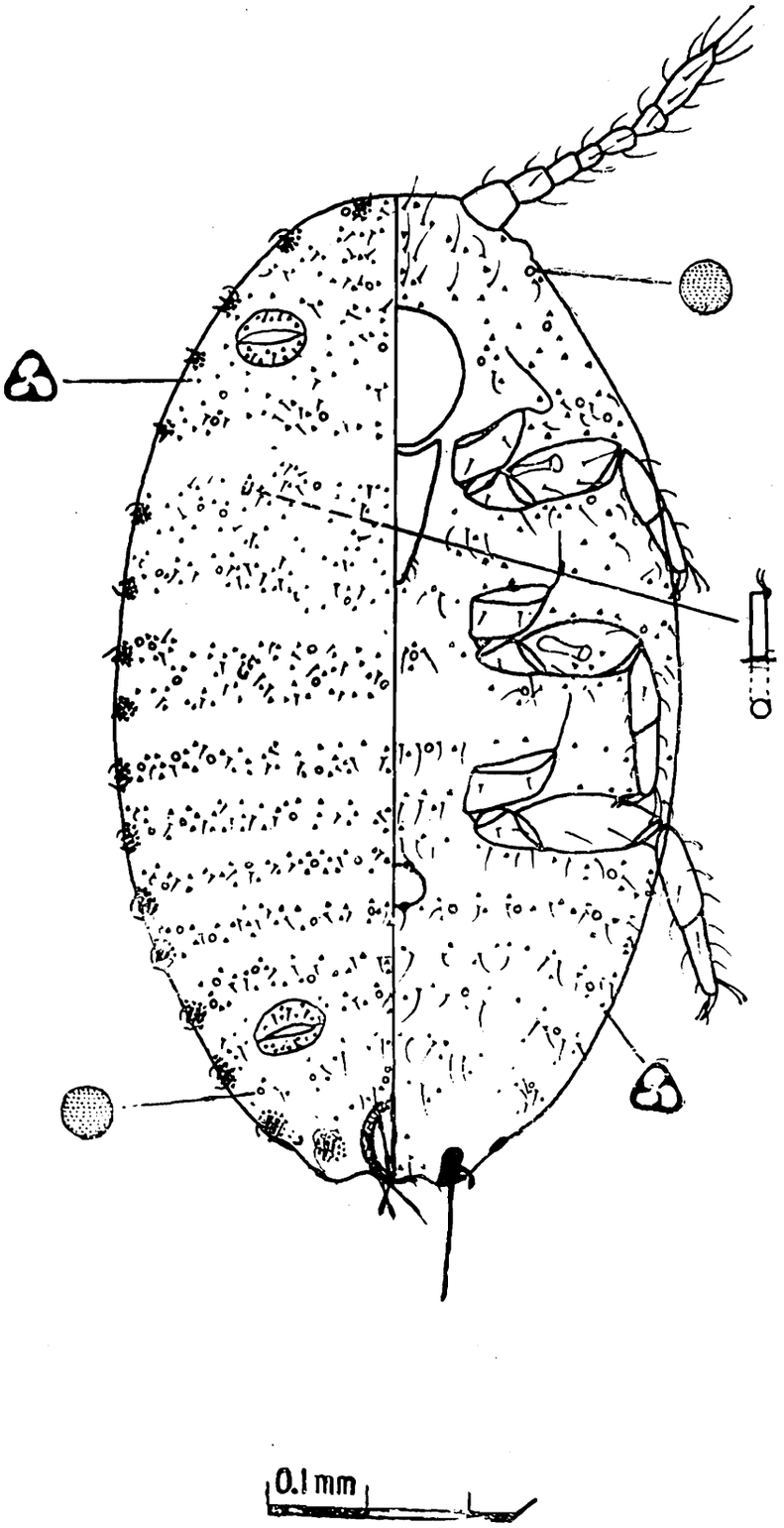
Circulus, 52-68 (62) μm long, 80-120 (97) μm wide. Eyes, 24-28 (27) μm in diameter, 8 μm high. Beak, 124-152 (137) μm long, 92-104 (97) μm wide. Both pairs of spiracles 40-44 (43) μm long, 20-24 (21) μm wide at atrium.

Hind legs with tibia+tarsus 180-192 (189) μm long ; tarsal and claw digitules 32-40 (35) μm and 22-26 (54) μm long respectively ; claw 22-26 (24) μm long. Antennae 7-segmented, 256-304 (281) μm long.

Adult females (Text-fig. 4) :

Body (mounted) 1.21-1.51 (1.37) mm long, 0.69-0·91 (0.81) mm wide.

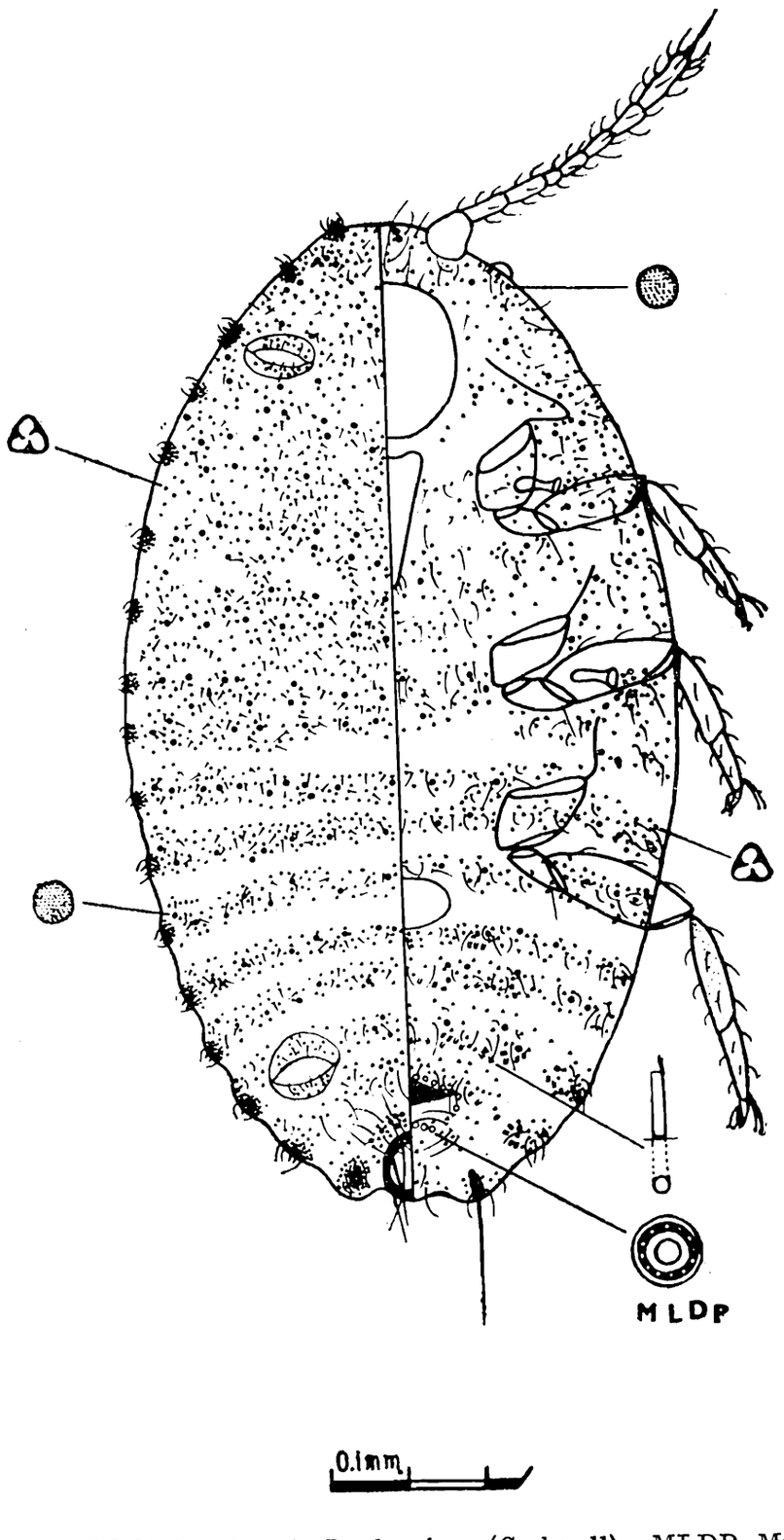
Dorsum with 17 pairs of cerarii. Each anal lobe cerarius with 2 stout conical spines, 6 slender auxilliary spines and 22-25 trilocular pores. The numbers of stout conical spines and auxilliary spines



Text-fig. 3. Third instar female nymph of *D. brevipes* (Cockerell).

respectively in remaining cerarii are : segments VIII, 2 and 4 ; VII, 3 and 2 ; VI, 2 and 2 ; V, 2 and 3 ; IV, 2 and 2 : III, 2 and 2 ; II, 2 and 1 ; metathorax, 2 and 1, 2 and 2 ; mesothorax, 2 and 2, 3 and 2 ; prothorax, 2 and 2, 2 and 2, 4 and 2 ; head, 2 and 2, 3 and 3. Trilocular pores in these cerarii are 15, 16, 15, 17, 14, 15, 11, 15, 15, 13, 16, 12, 13, 13, 15, and 15 respeetively.

Dorsum with discoidal pores more numerous on thoracic segments. Trilocular pores in transverse rows on abdominal segments, scattered over thorax and head. Upper lip of anterior pair and lower lip of posterior pair of ostioles with 4 setae and 13 trilocular pores ; lower lip of anterior pair and upper lip of posterior pair with 6 setae and 18 trilocular pores. Body setae of segment VIII noticeably longer



Text-fig. 4. Adult female of *D. brevipes* (Cockerell). MLDP, Multilocular Disc Pore.

with cluster of more than 8 large discoidal pores on dorsomedial area ; those of other segments 8-16 μm long.

Anal ring, 68-80 (77) μm in diameter ; 6 anal ring setae, 88-112 (95) μm long.

Venter with discoidal pores except segment IX ; 3 pores around the eyes. The number of trilocular pores is about half of dorsum but having similar arrangement. Multilocular pores around the vulva in segments IX and VII. Oral-collar tubular ducts are mainly located in segments VIII-VI and a few in V and head. Sclerotized anal lobes with 136-152 (148) μm long apical seta.

Circulus, 80-88 (82) μm long, 100-140 (121) μm wide. Eyes, 32-36 (33) μm in diameter, 8-12 (10) μm high. Beak, 176-184 (181) μm long, 112-132 (119) μm wide. Anterior pair of spiracles, 52-60 (55) μm long, 24-36 (32) μm wide at atrium ; posterior one, 60-64 (62) μm long, 32-40 (38) μm wide.

Hind legs with femur and tibia with 33-50 (4) and 45-65 (55) translucent pores respectively ; tibia+tarsus, 220-248 (238) μm long ; tarsal and claw digitule, 38-44 (42) μm and 28-32 (31) μm long respectively ; claw, 28-36 (32) μm long. Antennae, 8-segmented, the total length being 348-406 (372) μm.

KEY TO THE IDENTIFICATION OF FEMALE INSTARS OF *Dysmicoccus Brevipes* (COCKERELL)

1.	6-segmented antennae. ...	...	2
	7-or 8-segmented antennae. ...	...	3
2.	Anal lobe cerarii with 2 spines and 3 trioculars. ...		1st instar-nymph.
	Anal lobe cerarii with 3 spines and 8-12 trioculars. ...		2nd instar-nymph.
3.	7-segmented antennae, anal lobe cerarii with 5 spines and 16-18 trioculars. ...		3rd instar-nymph.
	8-segmented antennae, anal lobe cerarii with 8 spines and 22-25 trioculars. ...		Adult.

Discussion

The study on the morphology of all female instars of unisexual mealybug, *Dysmicoccus brevipes* (Cockerell) has resulted in some salient characters by which the different instars of the species can be differentiated.

The first and second instar female nymphs differ from all other instars in having 6-segmented antennae. The first instar nymphs have

3 trilocular pores in a cluster only in each anal lobe cerarius but the second instar nymphs have 3 or more pores in the cerarii of abdominal segments IX-IV, being 8-12 on IX.

The third instar female nymphs and adult females possess 7- and 8-segmented antennae respectively. The anal lobe cerarii of the former with 2 stout conical spines, 3 auxilliary spines and 16-18 trilocular pores and those of adult with 2 stout conical spines, 6 auxilliary spines and 22-25 trilocular pores.

Now an attempt is being made to throw light on the functions of dermal glands.

The trilocular disc pores are present both on the dorsum and venter and also in clusters of 3-25 in cerarian zones. The first instar nymphs possess no pores other than these on dorsum of abdomen. Therefore, the waxy dusts, found there in life, must be secreted by trilocular pores. It is, however, interesting to note that the secretions of these pores in clusters of 3 or more with the support of the stout conical spines of the cerarii form white waxy tassels.

The multilocular pores are found around the vulva of the adult females in addition to trilocular pores and oral-collar tubular ducts. Ghose (1971) is of opinion that oral-collar tubular ducts produce white cottony fibres of ovisac in *Maconellicoccus hirsutus* (Green). As the trilocular pores produce waxy dusts, the globular waxy particules found along with the cottony fibres must be the manifestation of the multilocular pores.

The discoidal pores of variable sizes are found both on dorsum and venter along with trilocular pores, but the function of these pores, if any, could not be revealed.

The glands associated with anal ring secrete a waxy tube.

The oral-collar tubular ducts are present mainly on segments VIII-V of adult females. These ducts secrete cottony fibres around the vulva to give protection to fully developed eggs after laying as well as to young off-springs after the hatching of eggs as the species is ovoviviparous (Ghose, 1983).

The presence of translucent pores on femur and tibia of hind leg is rather curious. Ferris (1950) did not mention about the possession of translucent and discoidal pores by the species. McKenzie (1964) in his key to the species of *Dysmicoccus* in North America included the presence of discoidal pores as one of the main characteristics of the species *brevipes* (Cockerell). Miller and McKenzie (1973) mentioned an interesting character of this species in the key to the species of

Dysmicoccus, i.e., the presence of noticeably longer body setae with cluster of more than 7 large discoidal pores on dorsomedial area of segment VIII.

Summary

Descriptions and illustrations are given of all female instars of the mealybug, *Dysmicoccus brevipes* (Cockerell), the males of which are completely absent in this locality. All instars possess 17 pairs of cerarii, of which 1 and 6 pairs respectively of first and second instar nymphs have 3 and more trilocular pores on segment IX and IX-IV. The third instar nymphs and adult females have 7- and 8- segmented antennae respectively. The trilocular and multilocular pores secrete waxy dusts and globular waxy particles respectively. The clustets of 3 or more trilocular pores secrete white waxy tassels on cerarian zones. Oral-collar tubular ducts produce cottony fibres and the glands of anal ring secrete a waxy tube.

Acknowledgement

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