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MORPHOLOGICAL IDENTIFICATIONS OF THE STAGES OF THE
FLORIDA WAX SCALE - CEROPLASTES FLORCDENSIS COMST. (COCCOIDEA)*

by

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INTRODUCTION

The Florida Wax Scale is an important citrus pest in Israel. In addition to weakening the tree by sucking the sap, the honey dew excreted by the insect stimulates the development of sooty mold which covers the foliage and fruit. This mold is hard to clean, and thus it mars the appearance of the fruit rendering it unmarketable.

Although the biology of this scale insect in Israel was studied by Bodenheimer (2) and Gothilf (3), the number of molts or its nymphal stages remained a matter of dispute. Whereas Bodenheimer speaks of three larval stages, Gothilf states that only two exist. Also Silvestry (5) describes only two larval stages in Ceroplastes rusci L.

The reason for this diversity of opinion lies in the fact that exuvia of the stages were never found imbedded in the wax scale as, for instance, in the case in Diaspinae. The criteria distinguishing the stages were based on external characteristics and in these no sharp distinction was observed between one or the other.

It was felt that this subject needs a revision which should be based on both external as well as micromorphological characteristics.

METHODS

It was imperative that the description of each larval stage should be made immediately after the moulting. For this purpose individuals were raised on citrus plants in a greenhouse under continuous observations. Attention was centered on the gradual changes in the appearance of the individual and on the search of the exuvia.

For microscopic examinations the newly molted states was treated according to the Hille Ris Lambers (4) method, and examined under phase contrast with a Wild research microscope.

RESULTS

It was found that the exuvium is pushed out from under the scale and may be found near the posterior part of the body soon after the moult. As a rule it is blown off by the wind or devoured by Psocids a short while afterwards.

By following the development of several individuals it was also established that this insect moults three times (Plate 1) which means that there are three larval stages. Furthermore it was found that the young adult female looks very much like the last larval stage, but is distinguished by the characteristics described below.

The following are the descriptions of the various stages:

A. The wax shield.

First instar nymph. (Plate 1A). The newly secreted wax shield is 480 μ . Secretion continues until it attains the length of 730 μ . There are about 15 marginal, not distinct, wax processes. On the dorsum there is a wax plate divided into four parts. Two long setae protrude at the end of the body.

Second instar nymph(Plate 1B). In the newly molted nymph the wax shield is 750 μ , and reaches the length of 950 μ . The fifteen marginal wax processes are distinct, and touch each other at the base; the dorsal plate is not divided. There is a small space between dorsal plate and bases of the processes.

Third instar nymph. (Plate 1C). The newly molted insect is 1100 μ and grows to the length of 1250 μ . The fifteen processes are large and separated from each other at their bases. The space between them and the dorsal plate widens. A brown red band surrounds the dorsal plate.

Young adult. (Plate 2A, B). The wax shield is 1300-1500 μ long. The brown red band of the 3rd stage nymph swells and becomes grey. As a result of marginal wax secretion the wax processes protrude upwards.

Laying females. (Plate 2C, D). The wax shield is 2000-3000 μ long and 1700-2000 μ wide. The color is purplish white. The marginal processes are pointed, the dorsal plate elevated.

Old spent female. (Plate 2E, F). 3100-4200 μ long, 2500-3200 μ wide. Wax color white (purplish tinge having disappeared). The wax processes are vestigial.

B. Description of microscopic characteristics.

First instar nymph. There are 26-28 marginal setae; at the posterior end there are two setae longer than the others. Opposite the spiracles there

are three conus-like marginal setae; between these and the spiracle there are 3-4 quinquelocular pores (Fig. 1). The anal plate is described in Fig. 5; there is one pair of fringe setae (B) four pairs of spical setae (C) in which one is very long, about 120 μ ; the length of the anal ring setae is 52 μ (A).

Second instar nymph. There are 26-28 marginal setae; at the posterior end there are two pairs of setae longer than the others. The conus-like setae opposite the spiracles are distinct and larger, and between them and the spiracles there are 5-8 quinquelocular pores (Fig. 2). In the anal plate (Fig. 6) there are two pairs of fringe setae, four pairs of apical setae, and the length of the anal ring setae is 76 μ .

Third instar nymph. There are 68-80 marginal setae. At the posterior end three pairs of setae are longer than the others. The conus-like marginal setae opposite the spiracles number 7-12, and between them and the spiracle there are 9-12 quinquelocular pores (Fig. 3). The anal plate (Fig. 7) has 3 pairs of fringe setae, four pairs of apical setae, and the length of the anal ring setae 116 μ (Table 1).

Young female. There are about 120 marginal true setae. Opposite the spiracle there are 29-36 conus-like marginal spines (Fig. 4) and there are 40-50 quinquelocular pores. In the anal plate (Fig. 8) there are four pairs of fringe setae, four pairs of apical setae, the length of the anal ring setae is 180 μ . The anal plate is surrounded by a brown chitinized horseshoe-like ring. The older the female grows, the wider the ring becomes.

DISCUSSION

The wax processes which give the body a star-like appearance distinguish the nymphal stages from the adult females. However, as may be seen from Plate 2 A & B, the newly molted female retains these processes for some time after the molt, although they are much reduced in size in proportion to the body. This probably led Bodenheimer to consider young females as 3rd stage nymphs. Externally, nymphal stages 2 and 3 are hard to distinguish from each other, and this probably led both Bodenheimer (1951) and Gothilf (1961) to consider them as one stage. The distinction by micromorphological characteristics is clear. The female has a horseshoe-like chitinized ring which is not present in any of the nymphal stages; the nymphal stages 2 and 3 may be distinguished by the number of anal setae, wax pores and marginal conus-like setae.

Like other coccids, the body of the female and the wax cover continue to grow after the last molt, but in this particular insect the appearance of the body also changes considerably.

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Table 1: Morphological differences between the stages.

	Instars of nymphs			Young female
	First	Second	Third	
Length of body (in u)	459 (396-535)	620 (535-759)	889 (722-1128)	1212 (1122-1320)
Length of anal ring's setae (in u)	52 (46- 55)	76 (69- 83)	116 (106- 124)	181 (172- 192)
Number of quinquelocular pores between spiracles and margin of body	3-4	5-8	9-12	40-50
Pairs of fringe-setae	1	2	3	4
Number of conus-like marginal spines near the spiracles	3	3	7-12	29-36

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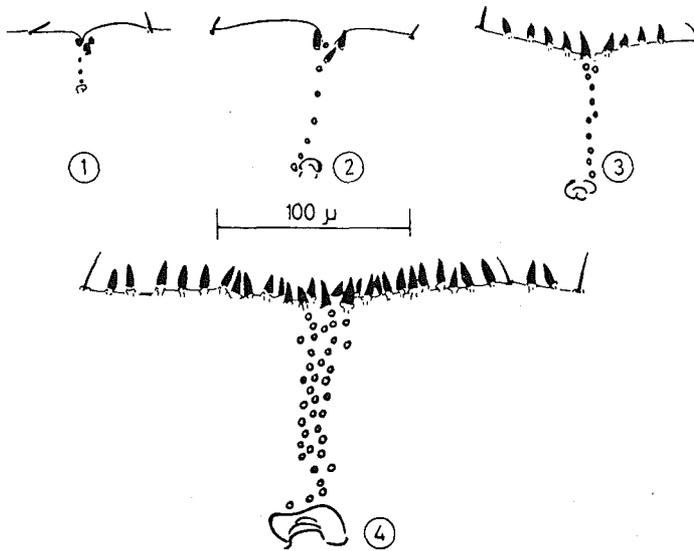


Fig. 1-4: Quinquelocular pores and conus-like marginal spiny near the spiracles; 1) first-instar nymph; 2) second-instar nymph; 3) third-instar nymph; 4) young female.

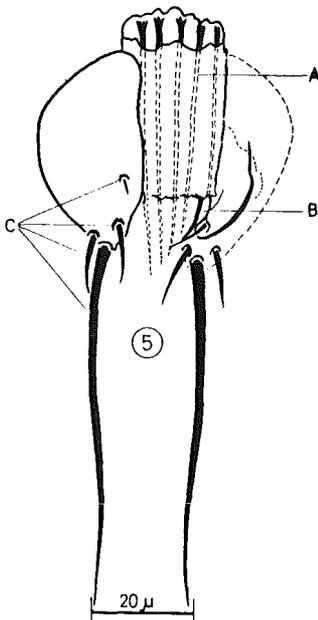


Fig. 5: Anal plates of first-instar nymph
A) anal-ring setae;
B) fringe setae;
C) apical setae.

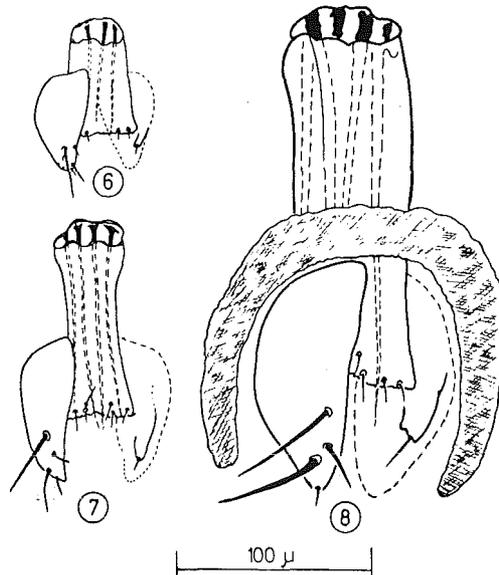


Fig. 6-8: Anal plates. 6) Second-instar nymph;
7) third-instar nymph; 8) young female.

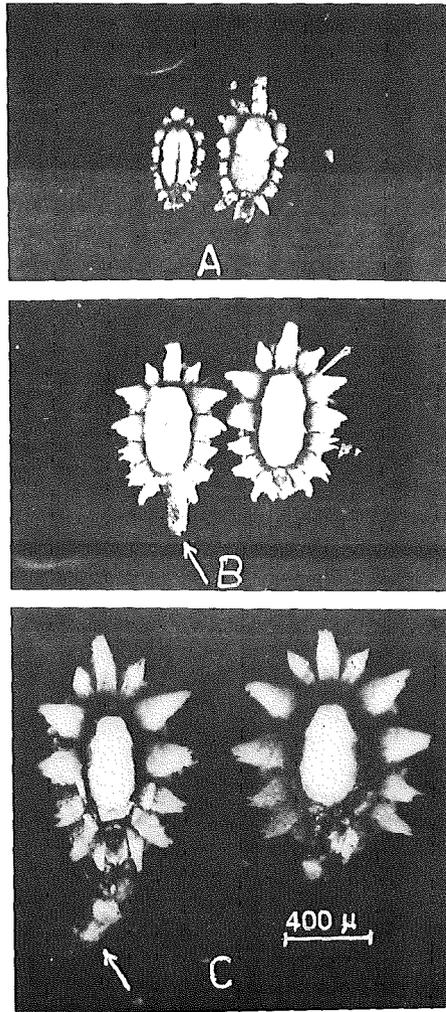


Plate 1: Instars of nymphs
A) First nymph
B) Second nymph
C) Third nymph

Arrow points to exuvium

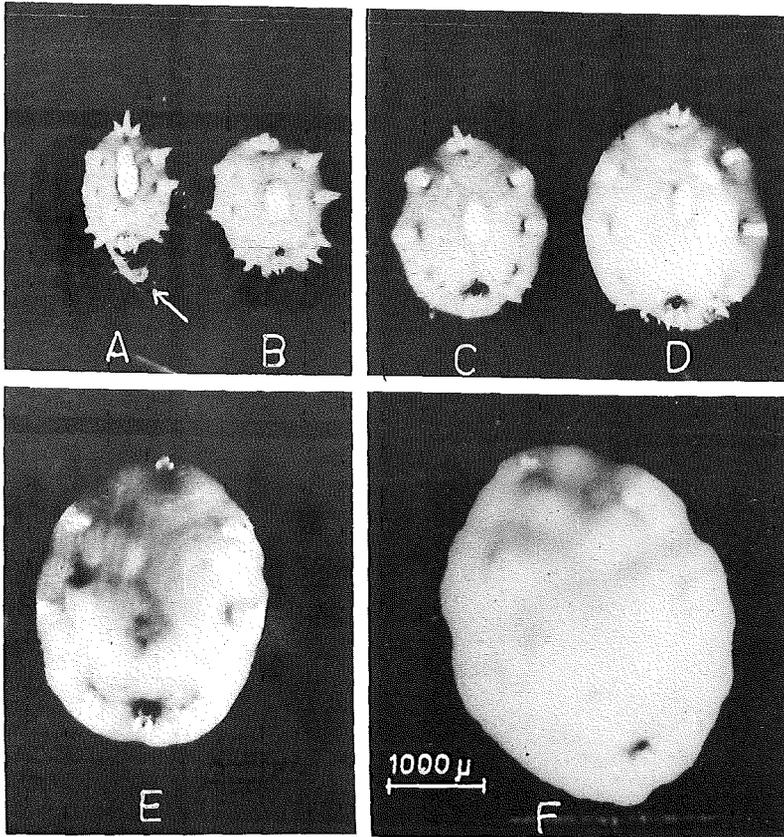


Plate 2: Females.

A, B) Young female; C, D) egg-laying female; E, F) old female.
Arrow points to exuvium.