

Descriptions and Illustrations of the First Instar of *Diaspis boisduvalli* Signoret (Hemiptera: Coccoidea: Diaspididae)¹

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Abstract The immature stages of many representatives of the Diaspididae have not been studied in detail. This work adds to the current knowledge by providing descriptions and illustrations for the male and female first-instar nymphs of *Diaspis boisduvalli* Signoret. Examination of the first instars indicated that the species followed similar patterns that were exhibited by *D. echinocacti* and *D. bromeliae*. Differences between *D. boisduvalli* and the other species included number of microducts on dorsum and differences in the pygidium.

Key Words *Diaspis boisduvalli*, first instar, pygidium

Phylogenetic relationships within the Superfamily Coccoidea have primarily been based on the morphological characteristics of the adult females. Work with the immature stages is still in its infancy with many species not having their immature stages described or illustrated. The family Diaspididae is one family within the Superfamily Coccoidea in which there has been considerable work with the first-instar nymphs. These include works by Stickney (1934), Ferris (1937, 1938, 1941, 1942), Takagi (1969), Stoetzel and Davidson (1974), Howell and Tippins (1973, 1975, 1977, 1989), Howell et al. (1984), Howell (1975, 1977, 1981, 1992, 1995). Howell and Tippins (1989) noted that the Family Diaspididae can be roughly divided into groups based on characteristics of the first instar. Group I contains the subfamilies of the Aspidiotinae, Odonospidinae and Leucaspinae. Group II containing the subfamily Diaspidinae and group III containing the genus *Comstockiella* which is often placed in the subfamily Aspidiotinae.

This study concentrated on the genus *Diaspis* in group II. The boisduval scale *Diaspis boisduvalli* Signoret is a recognized pest of orchids and bromeliads in greenhouse situations and may also be an occasional pest of cacti and palms. Closely-aligned species such as the cactus scale *D. echinocacti* (Bouche) and the bromeliad scale *D. bromeliae* (Kerner) are often times misidentified in the field as being boisduval scale. Species differentiation occurs with the adult female of *D. bromeliae* having four sets of macroducts on the pygidium; whereas, the adult females of boisduval scale and cactus scale lack these macroducts. Cactus scale and boisduval scale are differentiated easily with boisduval scale having inset cephalothoracic lobes and the cactus scale lacking inset cephalothoracic lobes. Differentiation of the first-instar nymphs of these species has not been investigated. First instars that have been

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described and illustrated from this genus include the nominal type-species, *Diaspis echinocacti* (Bouche), *D. bromeliae* (Kerner) and *D. iodinae* Boratynski. No complete descriptions or illustrations have been published on the first instar of *D. boisduvalli*. Leonardi (1920) published a rough description and outline drawings of the first instar for this species.

The measurements and illustrations in the following descriptions were made using a Nikon Optiphot phase contrast microscope. Measurements were made on eight specimens for the male and nine specimens for the female. All measurements are given in microns.

First Instar Male

Material studied. *Arecastrum romaxofalium* Gainesville, FL, 1965, A.E. Graham. *Catteleya* spp., 3 (4), Fulton Co., GA, 1968, H. Tippins; *Catteleya* spp., 2 (3), Elberton, GA. 1979, R. Beshear; *Oncidium* spp., 3 (3), Elberton, GA. 1984, R. Oetting.

General appearance. Body (1-A) elliptical, derm membranous, 212 (190-231) long, 124 (122-129) wide. Antennae and legs well developed. Small elliptical rugose areas present submarginally. Pygidium margin with three well-developed pairs of lobes, each lobule with 1-2 teeth on mesal as well as lateral margins (Fig. 1B).

Dorsum. Marginal setae 8 (6-10) long, filamentous, tapering posteriorly, distribution: 4 between eyes, 2 between eye and anterior spiracular furrow, 2 between anterior and posterior spiracular furrows, 6 on each side of body posteriorly. Dorsal body setae 2 (1-4) long, slender, distribution: 1 submedially on each abdominal segment, 3 located at posterior end of abdomen. Microducts (1-D), small, tubular, distribution: 1 mesolaterally on prothoracic segment, 1 mesolaterally on mesothoracic segment. Eight-shaped duct (Fig. 1C) 12 (11-14) long, tubular, in pit-like area, submedially on head.

Venter. Antennae (Fig. 1E) six segmented, 47 (45-49) long. Scape, 6 (5-7) long, 12 (10-17) wide. Segments II-VI; 6 (5-7), 6 (5-7), 4 (3-5), 5 (4-5), 21 (20-22) long. Scape with 2 slender setae, segment II with 2 setae and a sensory pore, segment III with 1 seta, segment IV without setae V with 1 stout seta, segment VI with no slender setae, 4 stout setae, 1 long sub-apical seta. Clypeolabral shield 33 (26-40) long, 31 (29-34) wide. Labium one segmented, 23 (19-25) long, 22 (19-24) wide with no visible setae. Legs well developed, 57 (51-62) long; mesothoracic legs slightly larger than prothoracic and metathoracic legs. Coxa with one small seta present. Trochanter often appearing two segmented, with elongate slender seta and 2 sensory pores located basally on each surface. No setae present on tibia or tarsus. Tarsus with 2 slender, slightly knobbed digitules near apex. Each tarsus with small oval shaped area containing companiform sensillum. Tarsal claw with 2 knobbed digitules. Spiracles (Fig. 1F) partially hidden by reticulations in the derm, positioned on prothorax and mesothorax. Gland spines (Fig. 1B, 1G) well developed on abdominal segments and on prothorax and mesothorax. Ventral body setae, small 1 (1-2) long, distribution: 1 seta just below level of antennal scape, 1 seta located submedially just above clypeolabral shield, 2 setae located submarginally between eye and anterior spiracle, two rows of small submedial setae on mesothorax, metathorax and each abdominal segment.

First Instar Female

Material studied. *Arecastrum romaxofalium*, Gainesville, FL, 1965, A.E. Graham; *Catteleya* spp., 2 (4), Fulton Co. GA, 1968, H. Tippins; *Catteleya* spp., 1(3), Elberton, GA. 1979, R. Beshear; *Oncidium* spp., 2(2) Elberton, GA. 1984, R. Oetting.

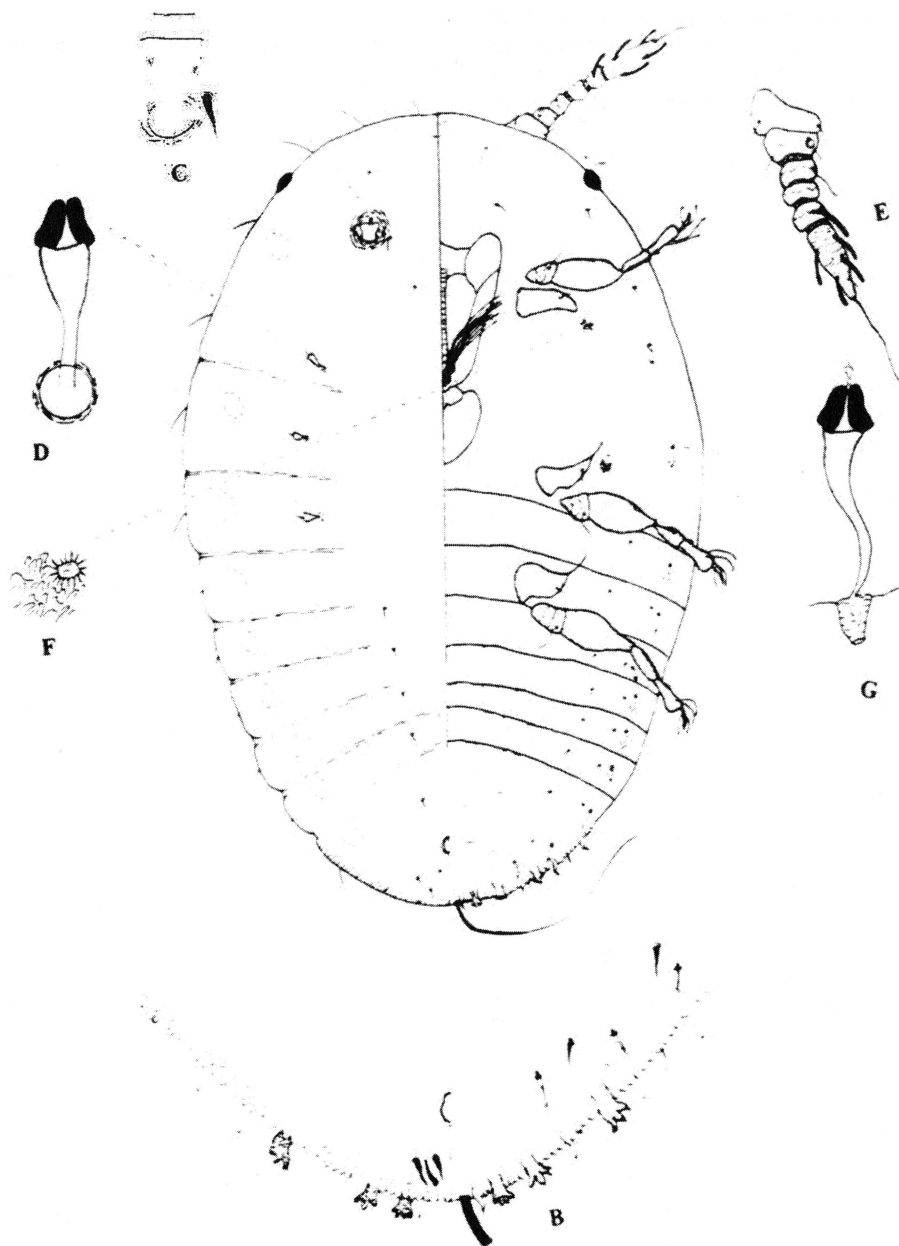


Fig. 1. First-instar male of *Diaspis boisduvalli*. A - body, B - lateral margins, C - submedial duct on head, D - microduct, E - antennae, F - spiracles, G - gland spines.

General appearance. Body (Fig. 2A) elliptical, derm membranous, 203 (182-212) long, 112 (102-121) wide. Antennae and legs well developed. Small elliptical rugose areas present submarginally. Pygidium margin with three well-developed pairs of lobes, each lobule with 1-2 teeth on mesal as well as lateral margins (Fig. 2B).

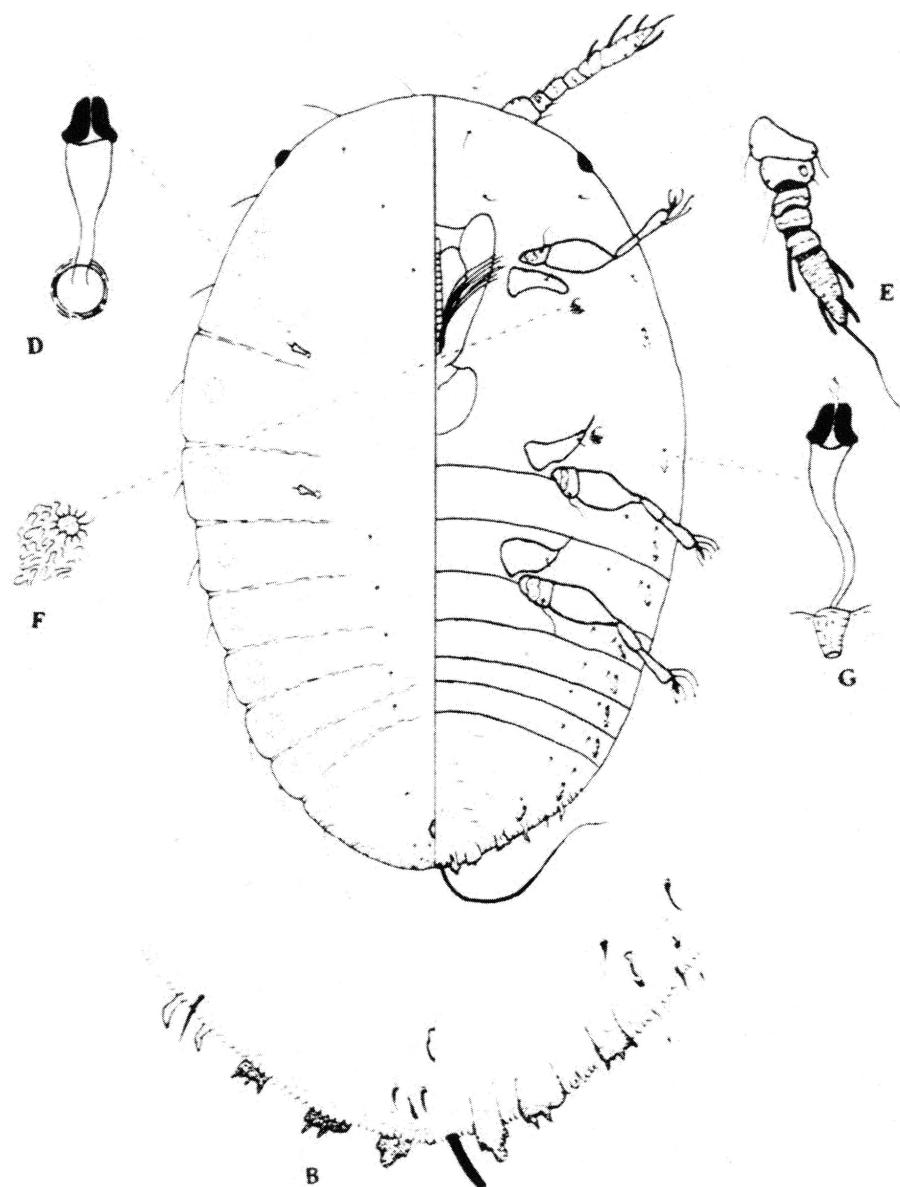


Fig. 2. First-instar female of *Diaspis boisduvalli*. A - body, B - lateral margins, D - microducts, E - antennae, F - spiracle, G - gland spines.

Dorsum. Marginal setae 8 (6-10) long, filamentous, tapering posteriorly, distribution: 4 between eyes, 2 between eye and anterior spiracular furrow, 2 between anterior and posterior spiracular furrows, 6 on each side of body posteriorly. Dorsal body setae 2 (1-4) long, slender, distribution: 1 laterad of eye, 1 submedially above level of clypeus, 1 submedially at level of clypeus, 1 submedially on each abdominal segment, 3 located at posterior end of abdomen. Microducts (Fig. 2D) small, tubular, distribution: 1 mesolaterally on prothoracic segment, 1 mesolaterally on mesothoracic segment.

Venter. Antennae (Fig. 2E) six segmented, 45 (43-46) long. Scape, 5 (4-7) long, 12 (10-17) wide. Segments II-VI: 6 (5-7), 6 (5-7), 4 (3-5), 5 (4-5), 19 (16-21) long. Scape with 2 slender setae, segment II with 2 setae and a sensory pore, segment III with 1 seta, segment IV without setae, segment V with 1 stout seta, segment VI with no slender setae, 4 stout setae, 1 long sub-apical seta. Clypeolabral shield 33 (26-40) long, 31 (29-34) wide. Labium one segmented, 23 (19-25) long, 22 (19-24) wide. No visible setae. Legs well developed, 57 (51-62) long; mesothoracic legs slightly larger than prothoracic and metathoracic legs. Coxa with one small seta present. Trochanter often appearing two segmented, with 1 elongate slender seta and 2 sensory pores located basally on each surface. No setae present on tibia or tarsus. Tarsus with two slender, slightly knobbed digitules near apex. Each tarsus with small oval shaped area containing companiform sensillum. Tarsal claw with two knobbed digitules. Spiracles (Fig. 2F) partially hidden by reticulations in the derm, positioned on prothorax and mesothorax. Gland spines (Fig. 2B, 2G) well developed on abdominal segments 6-8, reduced to small submarginal protuberances on remaining abdominal segments and on prothorax and mesothorax. Ventral body setae, small 1 (1-2) long, distribution: 1 seta just below level of antennal scape, 1 seta located submedially just above clypeolabral shield, 2 setae located submarginally between eye and anterior spiracle, two rows of small submedial setae on mesothorax, metathorax and each abdominal segment.

Discussion

Examination of the male and female first instars of *D. boisduvalli* indicate that this species follows similar patterns similar to the previously described species of *D. echinocacti* and *D. bromeliae*. The male first instar can readily be differentiated from the female first instar by the presence of an eight-shaped duct found on the anterior portion of the head and by the presence of a campaniform sensillum on each tarsus. This was also true for both *D. echinocacti* and *D. bromeliae* as reported by Howell (1975). The first instar of *D. boisduvalli* more closely resembles the nominal type species *D. echinocacti* rather than *D. bromeliae*. The first instar of *D. boisduvalli* shares a similar eight-shaped duct found on the dorsum as seen in *D. echinocacti* and the terminal antennal segment is also similar in overall shape. The first instar of *D. boisduvalli* can readily be distinguished from the first instar of *D. echinocacti* by the presence of 3 short setae (two in *D. echinocacti*) at the base of the pygidium on the dorsum and with the lobes on the pygidium being apically pointed and not blunt as seen in *D. echinocacti*. Other differences include overall number of microducts found on the dorsum, *D. boisduvalli* has 2 microducts whereas *D. echinocacti* has 4 microducts. Further investigation of first instars of the genus *Diaspis* may show that *D. bromeliae* (which strongly differs from *D. boisduvalli* and *D. echinocacti*) should be moved.

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