On the identity of the genus *Akermes* Cockerell, 1902: a study of the first-instar nymph of *A. bruneri* Cockerell (Hemiptera: Coccidae).

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ABSTRACT

The objective of the present study was to clarify the identity of *Akermes bruneri* Cockerell, 1902, the type species of the genus *Akermes* Cockerell. Only first-instar nymphs from the type material remain, however, their unique morphology differentiates them from other *Akermes* species first-instars. When they were compared to non-type first-instar nymphs from Argentina, labelled as *A. bruneri*, and deposited in the United States National Museum, no differences were seen in the first-instar nymphs of the type and non-type material suggesting that they are conspecific. The first-instar nymph of *A. bruneri* is described and illustrated. Our results confirm that the adult female described by De Lotto (1968), Granara de Willink (1999) and Hodgson (1994) is *A. bruneri*.

KEY WORDS: *Akermes* Cockerell, description, crawlers, soft scales.

INTRODUCTION

The identity of the genus *Akermes* Cockerell has remained hitherto uncertain because the original description is too poor to differentiate it from other coccid genera, and the type material includes no identifiable adult females. The genus was studied recently by Hodgson (1994), Granara de Willink (1999), and Kondo (2003) based on non-type material, and has been placed in the subfamily Myzolecaniinae (Hodgson, 1994), or in the *Toumeyella*-group (Kondo and Williams 2003, Kondo 2003). Hodgson (1994) explained that the only type slide in the USNM (labelled *Akermes bruneri* Ckll., Cotype, Paraguay, San Bernandino, on leguminous plant, Sept. 23 (Bruner) 14562) consists of numerous small pieces of adult female covered by hyphae and with many first-instar nymphs, and that the material of the adult female offers no characters by which to identify it, although it may one day be possible to reach some conclusions from the nymphs. Here we report on our examination of first-instar nymphs and our decision on the identity of *A. bruneri*, for which we describe and illustrate the first-instar nymph.

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MATERIALS AND METHODS

First-instar nymphs on a slide labeled as "*A. bruneri* Cotype" (see material studied) were remounted in order to clear and stain them. The slide was soaked in 75% ethanol for two days in order to remove the original label, next it was transferred to a covered Petri dish containing xylene for 4 days in order to dissolve the Canada balsam and free the sealed material. Specimens were slide mounted according to the method given by Williams and Granara de Willink (1992), and were dried on a hot plate at about 40°C for 2 months. The specimens were remounted onto 6 slides, most with multiple specimens on each slide. The original label was attached to one of the slides. Specimens were studied under an Olympus BX40 phase contrast compound microscope, and compared to non-type first-instar nymphs (see material studied).

The illustrations follow the typical style adopted for scale insects with the dorsal side drawn on the left, and the ventral side on the right. Measurements are taken from the non-type specimens and are presented in micrometers (μm) as a range. The first-instar nymphs remounted from the type material were all embryonic, with mostly poorly developed appendages, thus were not used for taking measurements.

RESULTS

No morphological character differences were observed among first-instar nymphs of the type material collected in Paraguay on an unidentified plant (see discussion) and non-type material from Argentina collected on *Celtis tala*. The unique morphology seen in the first-instar nymphs of the material studied, i.e., large 8-shaped dorsal microducts, their number and distribution, strongly suggest that the non-type material of *A. bruneri* deposited in the UNSM is correctly placed and identified. The first-instar nymph of *A. bruneri* is described below based largely on material from Argentina.

Akermes bruneri Cockerell, first-instar nymph.

Material studied: *Akermes bruneri* Cockerell, Paraguay, San Bernandino, 23-IX-1897, coll. L. Bruner, ex leguminous tree, No. USNM-NH-2027859, 6 slides, numerous embryonic first-instar nymphs, remounted by T. Kondo from slide labeled as "Cotype", (USNM); Argentina, Misiones, Posadas, IV-1910, coll. P. Jorgensen, ex *Celtis tala*, No. 728, 1 slide 2 specimens, (USNM).

Diagnosis: The first-instar nymph of *Akermes bruneri* Ckll. is characterized by the following combination of characters: (i) antennae 5-segmented; (ii) spiracular pores 3-5 locular; (iii) ventral submedian setae 3 pairs; (iv) claw with a denticle; (v) spiracular setae 3 in number, with median spiracular setae longest; (vi) a pair of dorsal setae present on head region; (vii) with large, invaginated, 8-shaped dorsal microducts, present in 2 submarginal rows, and in 2 submedian longitudinal parallel rows; and (viii) a simple disc pore present close to most dorsal microducts.

Description: First-instar nymph (Fig. 1)

Unmounted material: Not available in present study.

Mounted material. First-instar nymphs elongate oval, 473–535 μm long, 256–313 μm wide (n = 2).

Dorsum: Derm membranous, roughly delineated by membranous folds. One pair of dorsal setae present on head region (Fig. 2B), often broken off or undetectable. A pair of trilocular pores (Fig. 2A) present on head region. Simple disc pores (Fig. 2F) present, pore-rim about 1.8 μm wide, often hard to detect or indiscernible. Dorsal microducts (Fig. 2E) 8-shaped, large, invaginated, duct-rim of each duct about 7-10 μm wide at widest point. Anal plates each triangular, 73–80 μm long, 29–37 μm wide. Number of setae on each plate 4, including long apical seta. Anal ring (Fig. 2G) with 6 setae. Eyes present, located about same level as antennal scape.

Margin: Marginal outline smooth. Marginal setae (Fig. 2D) sharply spinose, with straight or bent tips, 9–21 μm long, becoming gradually longer at head region. Total number of marginal setae 32: 8 anteriorly between eyes, 2 between each eye and anterior spiracular setae, 2 between each anterior and posterior spiracular setae, and 8 on each side between posterior spiracular setae and abdominal apex. Spiracular setae (Fig. 2C) numbering 3, bluntly or sharply spinose, median spiracular seta longest, 9–18 μm long, lateral spiracular setae shorter, 4–9 μm long.

Venter: Derm membranous. Seven inner and outer submarginal setae (Fig. 2I) on each side of abdomen, 1 on each side between anterior and posterior spiracle, and 1 ventral cephalic seta (Fig. 2L). Antennae 5-segmented, total length 159-173 μm, 3rd antennal segment longest, fleshy setae present on last 2 segments: 1 fleshy seta on penultimate segment, and 3 on last segment. Interantennal setae 1 pair. Legs well developed,

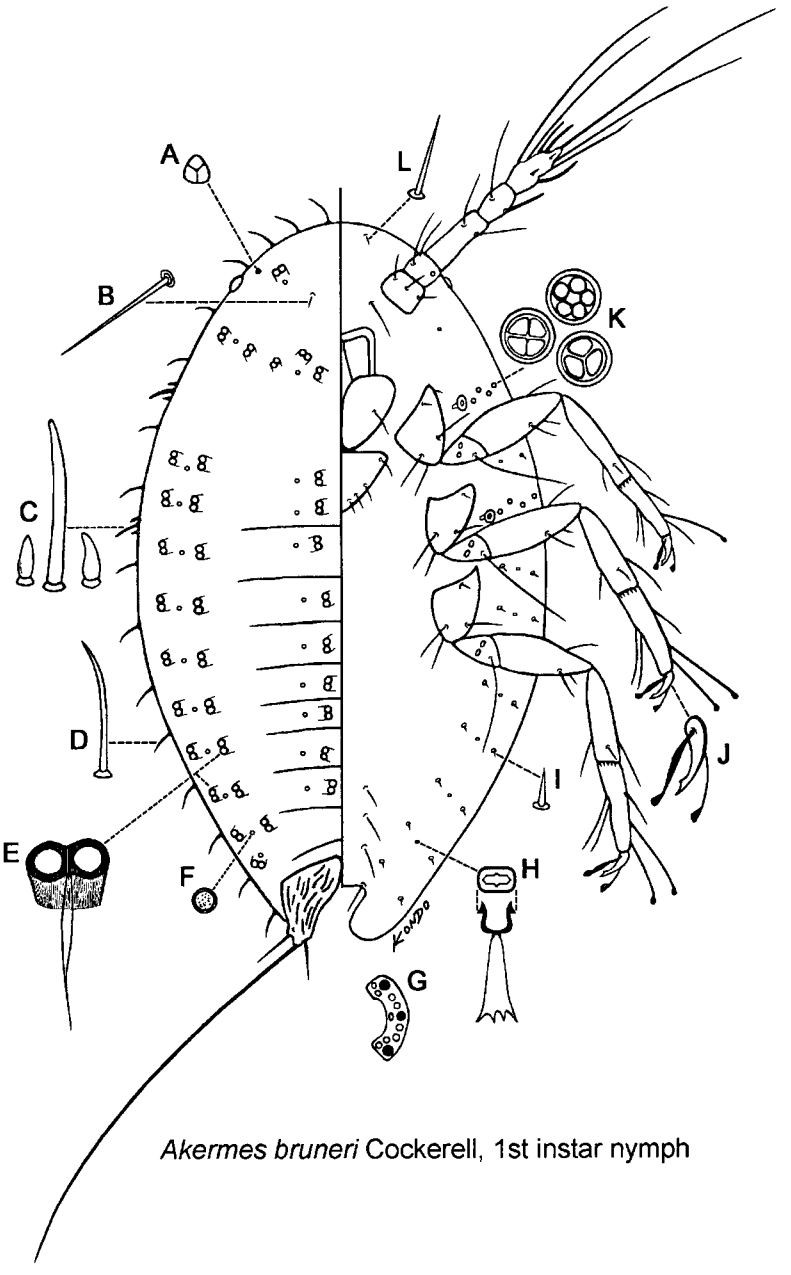

Figure 1. *Akermes bruneri* (Cockerell), first-instar nymph. A. Trilocular pore. B. Dorsal seta. C. Spiracular seta. D. Marginal seta. E. Dorsal microduct. F. Simple disc pore. G. Anal ring (right half). H. Ventral microduct. I. Ventral seta. J. Claw. K. Spiracular pores. L. Ventral cephalic seta.

trochanter + femur 102–111 μm long, tibia + tarsus (claw not included) 121–136 μm long. Microctenidia at tibial apex present. Prothoracic tarsal digitules dissimilar: 1 knobbed, 1 spiniform; mesothoracic and metathoracic tarsal digitules similar, knobbed. Claw (Fig. 2J) with a denticle, claw digitules knobbed, one thicker than other. Spiracular peritremes 9–12 μm wide. Spiracular pores (Fig. 2K) with 3–5 loculi, each 3.7–4.6 μm wide, numbering 3–4 on anterior spiracular furrow, and 4 on posterior spiracular furrow. Clypeolabral shield 91–102 μm wide. Ventral microducts (Fig. 2H) present, duct rim about 1.8–2.8 μm wide, numbering 8 on each side of body, 6 between inner and outer submarginal setae in the abdominal region, 1 between anterior and posterior spiracle, and 1 present near base of antennal scape.

Discussion: The above description of the first-instar nymph chiefly agrees with that given by Cockerell (1902). Although on the slide label of the type material of *A. bruneri* the plant host is written as "on leguminous plant", the host in the original description by Cockerell (1902) is described as follows: "Hab. – San Bernandino, Paraguay, Sept. 23, 1897, on spiny plant, probably leguminous". The material currently considered as *A. bruneri* has all been collected on *Celtis* sp. or *Celtis tala* in the plant family Ulmaceae, with the exception of a few unidentified hosts. *Celtis tala* has long spines, and probably because some leguminous plants (Fabaceae) include spiny tropical plants (e.g., *Acacia*, *Caesalpinia*), Cockerell may have thought the host of *A. bruneri* might have been a leguminous tree. Thus it is possible that the host plant of the type material was *Celtis* as for most of the rest of the non-type material.

Hodgson (1994) suggested that the material labelled *A. bruneri* that is deposited in the United States National Museum (USNM) could be divided into at least two species. One species represented by the material from Argentina collected on *Celtis* sp. and *Celtis tala* on which he based his description of *A. bruneri*, and the other species composed of the material studied by De Lotto (1968) from Uruguay collected on *Celtis tala*. He noted differences in the number of dorsal microducts, the distribution of preopercular pores, and the presence or absence of spiracular setae. The material described by Hodgson (1994) is as follows: *Akermes bruneri* Ckll., ARGENTINA, Cordoba , River III dam, on *Celtis* sp., Sept. 22, 1945, O.C. Molinari #4 (USNM (46-1756): 1/1), with details also taken from other specimens on slides labelled: ARGENTINA, Cordoba, on *Celtis tala*, June 20, 1927, Kisliuk #882, D (USNM (39-1002): 1/3); Cordoba, on *Celtis tala*, Sept. 4, 1947, O.C. Molinari (USNM (47-2268): 1/3). Kondo (2003) in a study of the subfamily

Myzolecaniinae, studied the same material that De Lotto (1968) studied and that on which Hodgson (1994) based his description, with the exception of the material collected by Kisliuk (#882), and concluded that the two lots of material conformed to a single morphological species. The material examined by Kondo (2003) is as follows: *Akermes bruneri* Ckll., Adult ♀♀, Uruguay, Salto, X-31-1940, coll. H.L. Parker, ex *Celtis tala*, No. 50, 3(5) (USNM); Argentina, Cordoba, Rio Tercero, let. 18-VII-1944, coll. O.C. Molinari, det. T. Kondo, ex *Celtis* sp. (Tala), No. 1, 1(3) (USNM); Argentina, Cordoba, River III dam, let. 22-IX-1945, coll. O.C. Molinari, ex *Celtis* sp., No. 4, USNM #46-1756, 1(1) (USNM); Argentina, Cordoba, let. 4-IX-1947, coll. O.C. Molinari, ex *Celtis tala*, No. 3, USNM #47-2268, 1(3) (USNM); Argentina, Misiones, Posadas, IV-1910, coll. P. Jorgensen, ex *Celtis tala*, mounted from USNM dry material #728, AL-304-75, 13(22) (USNM); Argentina, Misiones, Posadas, IV-1910, coll. P. Jorgensen, ex *Celtis tala*, mounted from USNM dry material #728, AL-077-86, 2(2) (USNM), Argentina, Tucuman, Tapia, I-1994, coll. Granara de Willink, AL-128-99, 1(1) (AUCC). We believe all the material listed above represents a single species because all the specimens were collected on the same host plant (*Celtis* sp.), and the variation seen among mature specimens is typical of members of the *Toumeyella*-group to which *Akermes* belongs. In particular, the density of pores on the dorsum in soft scales change depending on age and size, i.e. the microducts appear fewer in larger specimens because the derm is fully extended and the number of ducts do not change after the final moult; the number and distribution of preopercular pores slightly varies among specimens; the spiracular setae are often broken off and may appear as if they are missing (e.g. that illustrated by De Lotto, 1968). Kondo (2003) observed some plasticity in the number of spiracular setae in *A. bruneri* and reported the number as ranging from 1-3 on each spiracular area. The plasticity in the number of spiracular setae is also seen in other members of the *Toumeyella*-group, with *Toumeyella liriodendri* (Gmelin) showing the greatest variation of 0-4 spiracular setae per spiracular area in some populations (Kondo, 2003).

We conclude that the specimens described and illustrated by De Lotto (1968), Granara de Willink (1999) and Hodgson (1994) represent the genus *Akermes*, and that based on the morphology of first-instar nymphs, the species hitherto treated as *A. bruneri* is correctly identified. A taxonomic review of the genus *Akermes* is currently being prepared by Kondo, and will include redescriptions and keys for both adult female and first-instar nymphs.

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