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# Redescriptions of *Neolecanium leucaenae* Ckll., *Toumeyella cerifera* Ferris and *T. sonorensis* Ckll. and Parrott and their Transfer to *Neotoumeyella* Gen. Nov. (Hemiptera: Coccidae), with Descriptions of Two New Species from the Southeastern U.S.A. and Colombia, South America

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**Abstract:** Three species of Mexican soft scales, *Neolecanium leucaenae* Cockerell, *Toumeyella cerifera* Ferris and *T. sonorensis* Cockerell and Parrott, are redescribed based on the adult females and are transferred to *Neotoumeyella* gen. nov. as *N. leucaenae* (Cockerell) comb. nov., *N. cerifera* (Ferris) comb. nov. and *N. sonorensis* (Cockerell and Parrott) comb. nov. Two new species, *N. caliensis* Kondo and Williams sp. nov. from Colombia and *N. cephalanthi* Kondo and Williams sp. nov. from the U.S.A., are described and illustrated based on the adult female. A key to the genera of New World Myzolecaniinae based on the adult female is provided. We designate lectotypes for *N. leucaenae*, *T. cerifera* and *T. sonorensis*.

**Resumen:** Tres especies de escamas blandas mexicanas, *Neolecanium leucaenae* Cockerell, *Toumeyella cerifera* Ferris y *T. sonorensis* Cockerell and Parrott son redescritas en base a la hembra adulta y transferidas a *Neotoumeyella* gen. nov., como *N. leucaenae* (Cockerell) comb. nov., *N. cerifera* (Ferris) comb. nov. y *N. sonorensis* (Cockerell and Parrott) comb. nov. Dos nuevas especies, *N. caliensis* Kondo and Williams sp. nov. de Colombia y *N. cephalanthi* Kondo and Williams sp. nov. de EE.UU. se describen e ilustran basandose en la hembra adulta. Se provee una clave a nivel de género para la subfamilia Myzolecaniinae del Nuevo Mundo basada en la hembra adulta. Se designan lectotipos para *N. leucaenae*, *T. cerifera* y *T. sonorensis*.

**Keywords:** soft scale insects, coccids, taxonomy, new combination, new species

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The soft scales *Neolecanium leucaenae* Cockerell, *Toumeyella cerifera* Ferris and *T. sonorensis* Cockerell and Parrott fit into the *Toumeyella*-group as well as in the Myzolecaniinae, but the three species share some morphological features that differ from other taxa included in these groups (see diagnosis), thus, the new genus *Neotoumeyella* is here erected to accommodate the above three species plus two new species from the southeastern U.S.A and Colombia, South America.

The genera *Neolecanium* Parrot and *Toumeyella* Cockerell are currently included in the soft scale insect subfamily Myzolecaniinae (Hemiptera: Coccidae). The Myzolecaniinae was erected by Hodgson<sup>1</sup> to include species that lack a number of cuticular structures and have reduced appendages. Adult females of species in the subfamily are characterized by: (1) lack of dorsal tubular ducts and eyespots; (2) presence of anal plates with numerous setae on the dorsal surface; (3) particularly large spiracles, with broad bands of spiracular pores between the margin and spiracles; (4) ventral tubular ducts of one type, frequently restricted to each side of the genital opening; (5) bands of (often rather spinose) setae replacing the normal pairs of long prevulvar setae; (6) reduced legs with fine claw digitules; (7) reduced antennae; and (8) a short anal tube.<sup>1</sup> Hodgson<sup>1</sup> included 16 genera in the Myzolecaniinae: *Akermes* Cockerell, *Alecanium* Morrison, *Alecanopsis* Cockerell, *Cribrolecanium* Green, *Cryptostigma* Ferris, *Cyclolecanium* Morrison, *Halococcus* Takahashi, *Houardia* Marchal, *Megasaissetia* Cockerell, *Myzolecanium* Beccari, *Neolecanium* Parrott, *Paractenochiton* Takahashi, *Pseudophilippia* Cockerell, *Richardiella* Matile-Ferrero and Le Ruyet, *Toumeyella* Cockerell and *Xenolecanium* Takahashi. Later the Australian monotypic genus *Torarchus* Gullan and Stewart was added to the subfamily.<sup>2</sup> More recently, Kondo et al<sup>3</sup> suggested that *Xenolecanium* was a typical member of the tribe Paralecaniini of the subfamily Coccinae based on morphological features of the adult female and first-instar nymph.

Before Hodgson erected the Myzolecaniinae, Steinweden<sup>4</sup> postulated that species with reduced limbs formed a natural group, which he called the *Toumeyella*-group. Steinweden's<sup>4</sup> *Toumeyella*-group included *Toumeyella*, *Neolecanium* and *Pseudophilippia*.<sup>5</sup> The *Toumeyella*-group was defined mainly by the following features: (1) legs and antennae

greatly reduced, but retaining their parts; (2) marginal and stigmatic setae small and inconspicuous or absent; (3) anal region with hypopygial setae; and (4) presence of quinquelocular pores in the perivulvar region.<sup>5</sup> *Mesolecanium nigrofasciatum* Pergande was later added to the *Toumeyella*-group, based on a morphological analysis of adult males.<sup>6,7</sup> Hodgson<sup>1</sup> redescribed *Mesolecanium nocturnum* (Cockerell and Parrott), the type species of *Mesolecanium*, and thought that *M. nigrofasciatum* was not congeneric and that it might belong in his new subfamily Myzolecaniinae. According to Kondo and Williams,<sup>8</sup> the *Toumeyella*-group is composed of *Akermes*, *Cyclolecanium*, *Megasaissetia*, *Neolecanium*, *Pseudophilippia* and *Toumeyella*. Kondo and Williams<sup>9</sup> considered the genus *Neolecanium* to be a synonym of *Toumeyella*.

Kondo and Williams<sup>8</sup> pointed out differences between New World and Old World Myzolecaniinae and suggested that the subfamily is composed of several unrelated lineages. Members of the Myzolecaniinae are closely associated with ants that constantly tend, clean, protect and even transport them in exchange for honeydew.<sup>1</sup> The reduction and loss of many important features in the Myzolecaniinae may have resulted from multiple cases of parallel evolution in unrelated groups of coccids as a result of morphological adaptations to symbiotic associations with tending ants.<sup>10</sup>

Solving the phylogenetic relationships of the Myzolecaniinae *sensu* Hodgson<sup>1</sup> was out of the scope of this study. Here we describe two new species in a new coccid genus in the *Toumeyella*-group and have tentatively included it in the Myzolecaniinae.

## Materials and Methods

Slide-mounted specimens were examined under a compound microscope. In the descriptions, the body shape of the adult female is described both as unmounted and as mounted on a slide. "Unmounted" adult female refers to the insect's test, either alive or after preservation in alcohol. Body length and width of the adult female was measured in millimeters (mm) as mounted on the slide; other measurements are in microns (μm). Length was measured from the farthest point of the head to the posterior end of the body; width was the greatest width. The description of the adult female of the two new species is based

on multiple slide-mounted specimens. The number of specimens studied for each description is represented as (n = number of specimens studied). The slide-mounting technique of Williams and Granara de Willink<sup>11</sup> was used. The material studied is represented by the number of slides and the number of specimens on each slide, e.g. 1(2) means 1 slide with 2 adult specimens. The growth stage and sex of the specimen is listed only for non-adult females. The depository in parentheses is given for each lot of material studied (see abbreviation of depositories below). Each drawing is a generalization of several specimens and was made with the assistance of a *camera lucida* attached to a Zeiss RA phase contrast compound microscope. A taxonomic key to the adult females of the coccid genera of Myzolecaniinae that occur in the New World was built based on characters of the adult female taken from published literature. *Neolecanium* was not included in the key as this genus is considered a synonym of *Toumeyella*.<sup>9</sup>

Abbreviations for the depositories are as follows: The Auburn University Coccoidea Collection, Auburn, Alabama, U.S.A. (AUCC); the Bohart Museum of Entomology, Department of Entomology, University of California, Davis, California, USA (BME); the Natural History Museum, London, U.K. (BMNH); The National Museum of Natural History, Coccoidea Collection, Beltsville, Maryland, U.S.A. (USNM).

## Taxonomy

### Key to genera of New World

#### Myzolecaniinae based on adult females

(Characters taken from Hamon and Williams;<sup>12</sup> Hodgson;<sup>1</sup> Kondo and Williams;<sup>10</sup> Kondo et al<sup>13</sup>)

1. Anal plates located submedially; anterior spiracular pore band incomplete, not extending to margin, posterior spiracular pore band extending to margin; marginal setae cylindrical, peg-like ..... *Cyclolecanium* Morrison  
– Anal plates not located submedially, usually found at about 1/5 of body length from posterior margin; anterior spiracular pore band complete, extending to margin or extending as far as posterior spiracular pore band; marginal setae variable, not peg-like ..... 2
2. Stigmatic clefts deep; dorsal sclerotized plates associated with each spiracle ..... *Cryptostigma* Ferris  
– Stigmatic clefts shallow or absent, or rarely deep; without dorsal sclerotized plates associated with each spiracle ..... 3
3. Dorsal microducts around body margin conspicuously larger than rest of microducts on dorsum ..... *Octolecanium* Kondo  
– Dorsal microducts around body margin not conspicuously larger than rest of microducts on dorsum ..... 4
4. Large bilocular pores (probably macroducts), present in 1 or 2 small groups anterior to anal plates; marginal setae slender, sharply spinose, with tips mostly pointed, but some with lanceolate, or bifurcate apex, arranged in 1 or 2 rows, numerous (distance between each marginal seta less than half the length of a seta) ..... *Aztecalecanium* Kondo and Williams  
– Groups of large bilocular pores or macroducts absent from area anterior to anal plates; marginal setae variable, arranged in 1 row, not as numerous (distance between each marginal seta more than the length of a seta) ..... 5
5. Discoidal pores absent; dorsum with dense pattern of invaginated bilocular microducts; stigmatic setae absent ..... *Pseudophilippia* Cockerell  
– Discoidal pores present; dorsal microducts variable, generally without dense pattern of invaginated bilocular microducts; stigmatic setae present, rarely absent ..... 6
6. Ventral tubular ducts absent ..... *Akermes* Cockerell  
– Ventral tubular ducts present at least around perivulvar area ..... 7
7. Ventral tubular ducts present at least in a submarginal band on abdominal region and reaching area around posterior spiracular pore band ..... *Neotoumeyella* Kondo and Williams  
– Ventral tubular ducts not distributed as above ..... 8
8. Ventral tubular ducts located around vulva and mediolaterally on abdomen; dorsal setae lanceolate; stigmatic clefts deep ..... *Megasaissetia* Cockerell



– Ventral tubular ducts located around vulva and often also on posterior abdominal segments, but absent mediolaterally on abdomen; dorsal setae generally sharply spinose, rarely lanceolate; stigmatic clefts shallow or absent .....  
 ..... *Toumeyella* Cockerell

**Notes.** *Neolecanium* was not included in the above key since it is considered a synonym of *Toumeyella*.<sup>9</sup> According to Hodgson,<sup>1</sup> *Neolecanium* is closest to *Megasaissetia* but differs in having the median stigmatic spine distinctly longer than the two lateral spines and in having finely spiniform dorsal setae rather than lanceolate, as in *Megasaissetia*. Further, Hodgson<sup>1</sup> listed the following differences between *Neolecanium* and *Toumeyella* (features of *Toumeyella* in parentheses): (i) stigmatic spines differentiated from marginal spines (not differentiated); (ii) bilocular pores (unilocular pores); and (iii) preopercular pores although widespread, not covering most of dorsum (preopercular pores abundant and present over most of dorsum). However, many species currently included in *Toumeyella* have well-developed stigmatic spines (e.g. *T. liriodendri*, *T. pini*, *T. virginiana*,<sup>12</sup> and *T. sallei*);<sup>9</sup> many have bilocular pores (e.g. *T. liriodendri*, *T. parvicornis*, *T. pini*, *T. virginiana*<sup>12</sup> and *T. sallei*);<sup>9</sup> and many species do not have preopercular pores present over most of dorsum (e.g. *T. liriodendri*, *T. parvicornis*, *T. pini*, *T. virginiana*<sup>12</sup> and *T. sallei*).<sup>9</sup> We consider that there are no constant differences that separate the two genera.

## ***Neotoumeyella*, New Genus**

### **Type species**

*Neolecanium leucaenae* Cockerell, 1903.<sup>14</sup>

### **Generic description, adult female**

Body of adult female convex to globular, often irregular in outline, with a thin glassy test, or covered with a dull white waxy secretion. At least one species reported to produce an ovisac. **Dorsum.** Derm often becoming heavily sclerotized at maturity. Dorsal tubercles absent. Dorsal setae slender, stout, or lanceolate, with a round or pointed apex. All species with convex discoidal pores present around anal plates, often found extending over dorsum.

Dorsal microducts present, generally with well-developed septa, and a long terminal filament, distributed evenly throughout dorsum. Anal plates with 4 apical setae, with variable numbers of subapical, fringe and hypopygial setae. Anal ring variable, with 6, 8, 10 or 12 setae. **Margin.** Marginal setae slender or stout, pointed or blunt. Stigmatic setae commonly totaling 3 per stigmatic area, usually present on margin or slightly dorsad of margin. Eyes not detected. **Venter.** Ventral body setae sharply spinose, slender, straight or slightly bent; with a row of submarginal setae; interantennal setae totaling 4 or 6; long prevulvar setae, 3 pairs. Antennae and legs greatly reduced, with main segments present, occasionally indistinct or fused; without tibio-tarsal sclerotization. Antennae 3–6 segmented. Mouthparts normal, with 8 labial setae. Spiracles usually large, about same size as legs. Spiracular pores with 3–8 loculi, mostly with 5 loculi. Ventral tubular ducts of 1–3 sizes, of one size unless ducts abundant, present around vulvar area and anterior abdominal segments, always present in a submarginal band on abdomen and reaching area around posterior spiracular pore band, often found submarginally as far as anterior spiracular pore band, mouthparts and antennae. Multilocular pores (other than spiracular pores) variable, with 5–12 loculi, but pores with 5–10 loculi most common. Ventral microducts present, with a short terminal filament.

**Diagnosis.** *Neotoumeyella* gen. nov. is closest to *Toumeyella* Cockerell, and they share many morphological features. However, the two genera can be separated by the following combination of features (morphological features of *Neotoumeyella* in parentheses): (i) multilocular pores other than spiracular pores mostly quinelocular in *Toumeyella* spp.,<sup>12</sup> e.g. *Toumeyella liriodendri* (Gmelin), *T. parvicornis* (Cockerell), *T. pini* (King), and *T. virginiana* Williams and Kosztarab (multilocular pores of *Neotoumeyella* spp. have 5–12 loculi, with pores with 5–10 loculi being common); (ii) ventral tubular ducts of one type and restricted to perivulvar region in *Toumeyella* (ventral tubular ducts of 1–3 types, not restricted to perivulvar region, extending submarginally anteriorly at least up to area of posterior spiracular pore bands, and often with ventral tubular ducts present across abdominal segments, and some present on mid-thoracic region).



**Appearance in life.** Adult females of *Toumeyella* species known in life are covered by a thin layer of wax,<sup>12</sup> as are most *Neotoumeyella* species, however, one species, *N. leucaenae* is “somewhat covered with small patches of dull white waxy secretion”.<sup>14</sup> In species of *Toumeyella* and most *Neotoumeyella* the body of mature adult females becomes convex dorsally (Figs 1A and B) with a concavity below, and the eggs are held underneath the body, however, according to Ferris,<sup>15</sup> the adult female of *N. cerifera* (as *T. cerifera*) secretes a distinct ovisac, which is an unusual feature in the *Toumeyella*-group. These coccids live on the branches and stems of their hosts and often are associated with ants and are often found covered by ant constructed shelters (cartons).

**Etymology.** The new genus *Neotoumeyella* is formed by the combination of the Greek word “neo” meaning new and *Toumeyella*, indicating the close relationship of the two genera.

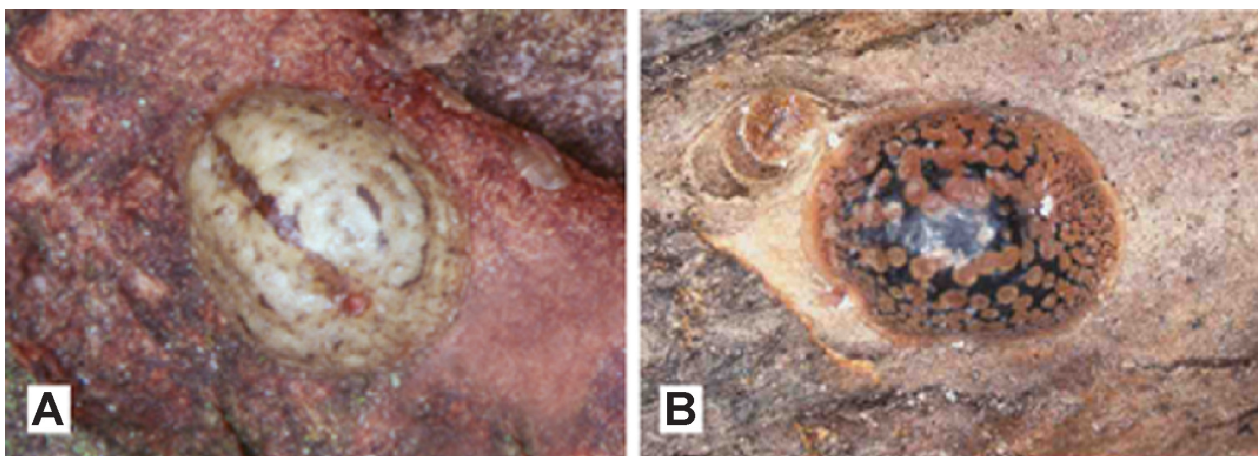
### Key to Species of Adult Females of *Neotoumeyella*, Gen. Nov.

1. Ventral tubular ducts of one type, scarce ..... 2
  - Ventral tubular ducts of more than one type, abundant ..... 4
2. Ventral tubular ducts present around mouthparts and often antennae. Spiracular pore band broadening just before stigmatic areas (up to 30 pores wide). Anal ring with 6 setae. .... *N. sonorensis*, comb. nov.

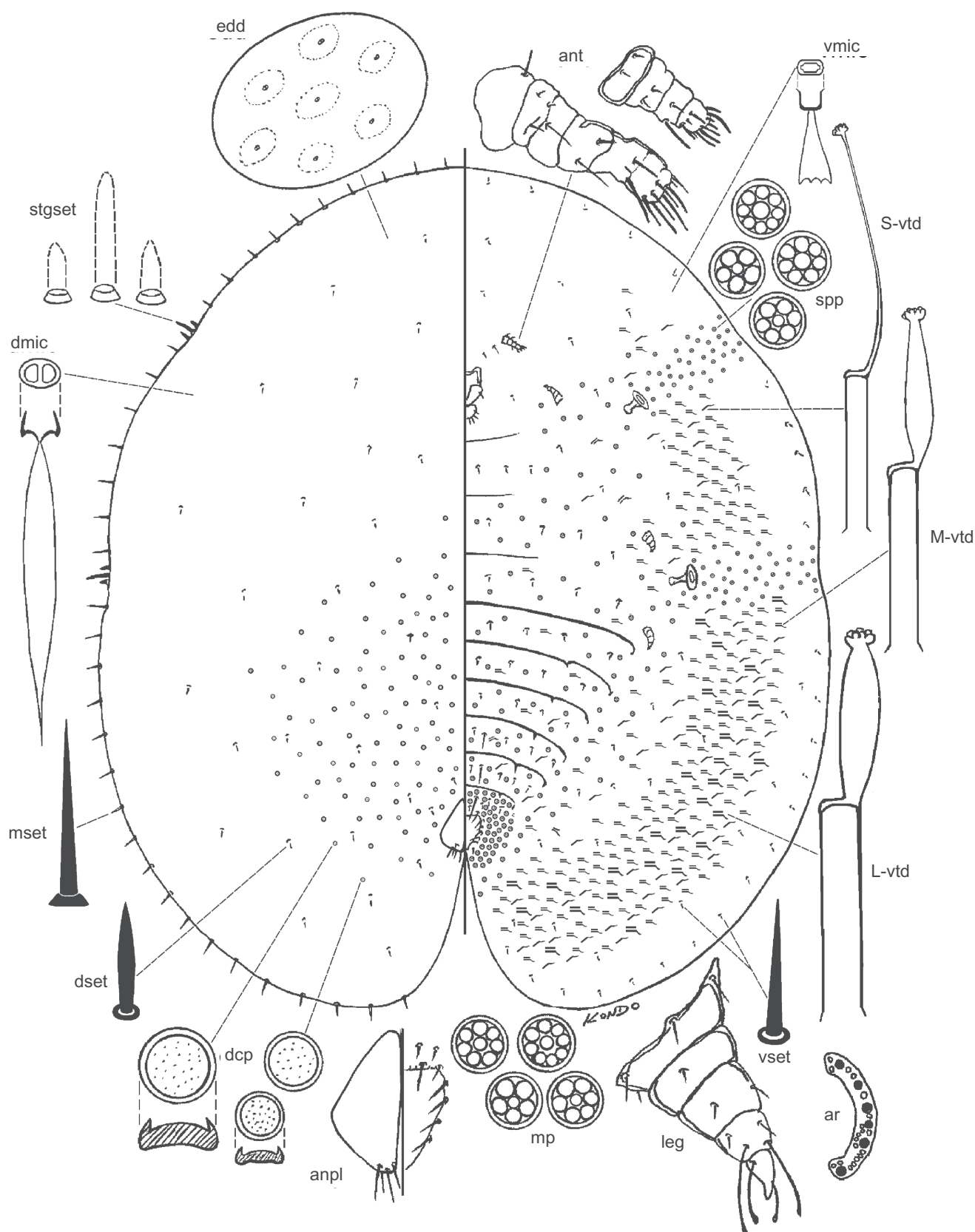
- Ventral tubular ducts not present around mouthparts and antennae. Spiracular pore band narrow throughout (2–6 pores wide) Anal ring with 10–12 setae ..... 3
- 3. Multilocular pores abundant in mid-ventral region of mesothorax. Stigmatic setae subequal in length. Multilocular pores other than spiracular pores, each with 7–12 (mostly 10) loculi ..... *N. cephalanthi*, sp. nov.
  - Multilocular pores absent from mid-ventral region of mesothorax. Stigmatic setae not subequal in length, median setae much longer than lateral setae. Multilocular pores other than spiracular pores, each with 5 or 6 (mostly 5) loculi ..... *N. caliensis*, sp. nov.
- 4. Discoidal pores widespread over entire dorsum, except for a narrow submarginal band. Ventral tubular ducts present only up to area around posterior spiracular pore band. .... *N. cerifera*, comb. nov.
  - Discoidal pores present around anal plates and extending only to mid-dorsum. Ventral tubular ducts present submarginally up to area of anterior spiracular pore band ..... *N. leucaenae*, comb. nov.

### *Neotoumeyella leucaenae* (Cockerell), new combination (Fig. 2)

*Neolecanium leucaenae* Cockerell, 1903:46.<sup>14</sup>



**Figure 1.** **A)** *Neotoumeyella caliensis* Kondo and Williams, adult female (center) and 3 nymphs (top right) in life. **B)** *Neotoumeyella cephalanthi* Kondo and Williams, adult female (center) and second-instar nymph (top left) in life. Photographs by T. Kondo.



**Figure 2.** *Neotourmeyella leucaenae* (Cockerell), adult female.

**Abbreviations:** Anplt, anal plate; ant, antenna; ar, anal ring; dmic, dorsal microduct; dcp, discoidal pore; edd, enlargement of dorsal derm; mset, marginal setae; mp, multilocular pore; sp, simple pore; spp, spiracular pore; stgsp, stigmatic spine; vmic, ventral microduct; vset, ventral setae; vtd, ventral tubular duct [S, small-sized; M, medium-sized; L, large-sized].

### Description of type species, adult female

**Unmounted material.** Insects large, highly convex, but not constricted at base; 8.5–10.0 mm long, 6.25–7.0 mm wide, 6.0–6.5 mm high. Color rather dark ferruginous, not very shiny, not tuberculate, somewhat covered with small patches of dull white waxy secretion; sides pitted.<sup>14</sup>

**Mounted material.** (n = 6). Adult female, large, elongate oval in outline, 9.0 mm long, 7.8 mm wide; anal cleft about 1/5 of body length. **Note.** The length and width was taken from the holotype, since other specimens were in poor condition and constituted of bits and pieces.

**Dorsum.** Derm membranous, becoming heavily sclerotized in old specimens. Body setae sharply spinose, with constricted base, scarce, scattered over dorsum, 9–13  $\mu\text{m}$  long. Simple pores not detected. Discoidal pores rather small, each 3.6–7.1  $\mu\text{m}$  wide, highly convex, present around anal plates, extending onto mid-dorsum. Dorsal microducts each with duct rim 2.7  $\mu\text{m}$  wide, distributed evenly throughout dorsum. Anal plates triangular in shape, located at about 1/5 of body length from posterior margin, each plate 189–199  $\mu\text{m}$  long, 80–113  $\mu\text{m}$  wide, anterolateral margin 140–162  $\mu\text{m}$  long, posterolateral margin 86–119  $\mu\text{m}$  long. Each plate with 4 dorsal apical setae, 4 ventral subapical setae, 4 fringe setae and 4 hypopygial setae. Anal ring with 12 setae, translucent pores in about 2 rows.

**Margin.** Marginal setae sharply spinose, straight or slightly bent, each 16–21  $\mu\text{m}$  long, arranged in an irregular single row around margin. Number of marginal setae between anterior and posterior stigmatic setae undetermined in studied material. Stigmatic setae broken off, but totaling 3 according to number of setal sockets, median stigmatic setae probably longest since setal socket of median stigmatic setae widest.

**Venter.** Membranous. Ventral body setae sharply spinose, each 6–9  $\mu\text{m}$  long, with 3 pairs of long prevulvar setae, each 10–25  $\mu\text{m}$  long. One row of submarginal setae, similar to rest of ventral body setae. Interantennal setae totaling 4. Antennae reduced, total length 66–149  $\mu\text{m}$  long, each 4–6 segmented. Clypeolabral shield 243  $\mu\text{m}$  wide. Legs: total length 109–175  $\mu\text{m}$  long; prothoracic legs generally shortest. Tarsus and claw each with a pair of slender digitules, with knobbed tips; claw simple.

Spiracles large, anterior peritreme each 162  $\mu\text{m}$  wide, posterior peritreme each 189  $\mu\text{m}$  wide. Spiracular pores with 4–8 loculi, mostly 5-locular, each 5.3–6.2  $\mu\text{m}$  wide, rather scarce, spiracular pore band about 4–5 pores wide, reaching margins. Tubular ducts of at least 3 different sizes: (i) large-sized ventral tubular ducts (L-vtd) with broader filaments, scarce, present within submarginal ventral tubular duct band between posterior spiracular pore band and anal cleft; (ii) medium-sized ventral tubular ducts (M-vtd) with a broad terminal filament, numerous, forming a submarginal band on abdomen and between anterior and posterior spiracles, with a few present anteriorly to anterior spiracles but lacking around apex of head; and (iii) small-sized ventral tubular ducts (S-vtd) with a slender terminal filament, more abundant than L-vtd but much less abundant than M-vtd, intermingled with medium-sized tubular ducts (M-vtd). Multilocular pores (other than spiracular pores) with 5–8 loculi, mostly 8-locular, each pore 6.2–7.1  $\mu\text{m}$  wide, abundant on perivulvar area and also present on mid ventral areas of abdominal segments and on meso- and metathorax. Microducts each with orifice 2.7  $\mu\text{m}$  wide, abundant, scattered evenly on venter.

**Distribution.** Neotropical Region: Mexico.

**Host plants.** Fabaceae: *Leucaena* sp.

**Associated ants.** None reported.

**Material studied.** In order to preserve stability of nomenclature for this species, a lectotype is designated from the syntypes. **Lectotype:** Mexico, Jalisco, Zapotlan, rec. vii.1903, coll. Townsend and Baker, Cy. 44, ex *Leucaena* (Wild shrub), No. 10522, labeled as *Neolecanium leucaenae* Cockerell, adult ♀, 1(1) (USNM). **Paralectotypes:** same data as lectotype, 3(3) (USNM); 1(2 second-instar males), 1(3 second-instar males), 1(1 embryo) (AUCC). Mexico, Zapotlan, date not given, B.M. 1931, No. 203, 2 slides, bits and pieces of about 2 adult females, material in poor condition (BMNH).

**Notes.** *Neotoumeyella leucaenae* can be separated from other members of the genus by the presence of 3 types of ventral tubular ducts; the ventral tubular ducts are abundant and extend in a submarginal band up to the area just anterior to the anterior spiracular pore band.

*Neotoumeyella leucaenae* is closest to *N. cerifera*, also collected in Mexico, but they can be easily





separated by the combination of the following features (features of *N. cerifera* in parentheses): (i) discoidal pores present around anal plates and extending only to mid-dorsum (discoidal pores widespread over entire dorsum, except for a narrow submarginal band); (ii) ventral tubular ducts of 3 types (2 types); (iii) ventral tubular ducts present submarginally up to areas of anterior spiracular pore band (ventral tubular ducts present only up to area around posterior spiracular pore band); and (iv) multilocular pores present on mid-thoracic areas (multilocular pores absent on mid-thoracic areas). Judging by the presence of second-instar males, *N. leucaenae* apparently reproduces sexually.

### *Neotoumeyella caliensis* Kondo and Williams, sp. nov. (Figs. 1A and 3)

#### Description, adult female

**Unmounted material.** Fully matured insects highly convex, light ochre, shiny, with a narrow dark brown vertical line running from head region to area anterior to anal plates, with a few irregular markings of same color on dorsum. Anal plates and area just around anal plates reddish brown.

**Mounted material.** (n = 13) Adult female, oval to elongate oval in outline, 1.8–4.3 mm long, 1.7–4.0 mm wide; anal cleft about 1/5 of body length.

**Dorsum.** Derm membranous, becoming sclerotized in old specimens. Body setae sharply spinose to lanceolate, scattered over dorsum, each 11–23  $\mu\text{m}$  long. Simple pores small, each 1.8  $\mu\text{m}$  wide. Discoidal pores oval in shape, each 6.4–11.0  $\mu\text{m}$  wide, convex, present around anal plates and extending onto mid-dorsum. Dorsal microducts each with orifice 2.7  $\mu\text{m}$  wide, distributed evenly throughout dorsum. Anal plates each triangular in shape, located at about 1/5 of body length from posterior margin, each plate 149–175  $\mu\text{m}$  long, 79–107  $\mu\text{m}$  wide, anterolateral margin 117–128  $\mu\text{m}$  long, posterolateral margin 115–128  $\mu\text{m}$  long. Each plate with 4 dorsal apical setae, about 6 ventral subapical setae, 2 fringe setae and 8 hypopygial setae. Area just anterior to anterolateral margin of anal plates showing slight sclerotization. Anal ring with 8–10 setae, translucent pores in 2 rows.

**Margin.** Marginal setae sharply spinose, straight or slightly bent, each 15–38  $\mu\text{m}$  long, arranged in

an irregular single row around body margin, with 11–22 marginal setae between anterior and posterior stigmatic setae. Stigmatic setae totaling 3, with median setae longest, each 34–64  $\mu\text{m}$  long, lateral stigmatic setae each 11–17  $\mu\text{m}$  long.

**Venter.** Ventral derm membranous. Ventral body setae sharply spinose, each 8.6–26.0  $\mu\text{m}$  long, with 3 pairs of long prevulvar setae, each 23–47  $\mu\text{m}$  long. Submarginal setae in one row, similar to rest of ventral body setae. Interantennal setae totaling 6. Antennae reduced, total length 45–94  $\mu\text{m}$  long, each 3–6 segmented. Clypeolabral shield 183–205  $\mu\text{m}$  wide. Legs: total length 70–115  $\mu\text{m}$  long; prothoracic legs generally shortest. Tarsus and claw each with a pair of spiniform digitules, claw without a denticle. Spiracles large, anterior peritreme each 66–96  $\mu\text{m}$  wide, posterior peritreme each 77–111  $\mu\text{m}$  wide. Spiracular pores with 3–6 loculi, mostly 5-locular, each 3.6–5.3  $\mu\text{m}$  wide, rather scarce, spiracular pore band about 2 pores wide, reaching margins. Tubular ducts of one type, with a slender filament, forming a submarginal band on abdomen reaching area near posterior spiracular furrow. Multilocular pores (other than spiracular pores) with 5 or 6 loculi, mostly 5-locular, each pore 3.6–5.3  $\mu\text{m}$  wide, abundant on perivulvar region, and also present on mid-ventral areas of last 3 or 4 abdominal segments. Ventral microducts each with duct rim 2.7  $\mu\text{m}$  wide, abundant, scattered throughout venter.

**Distribution.** Neotropical region. Colombia.

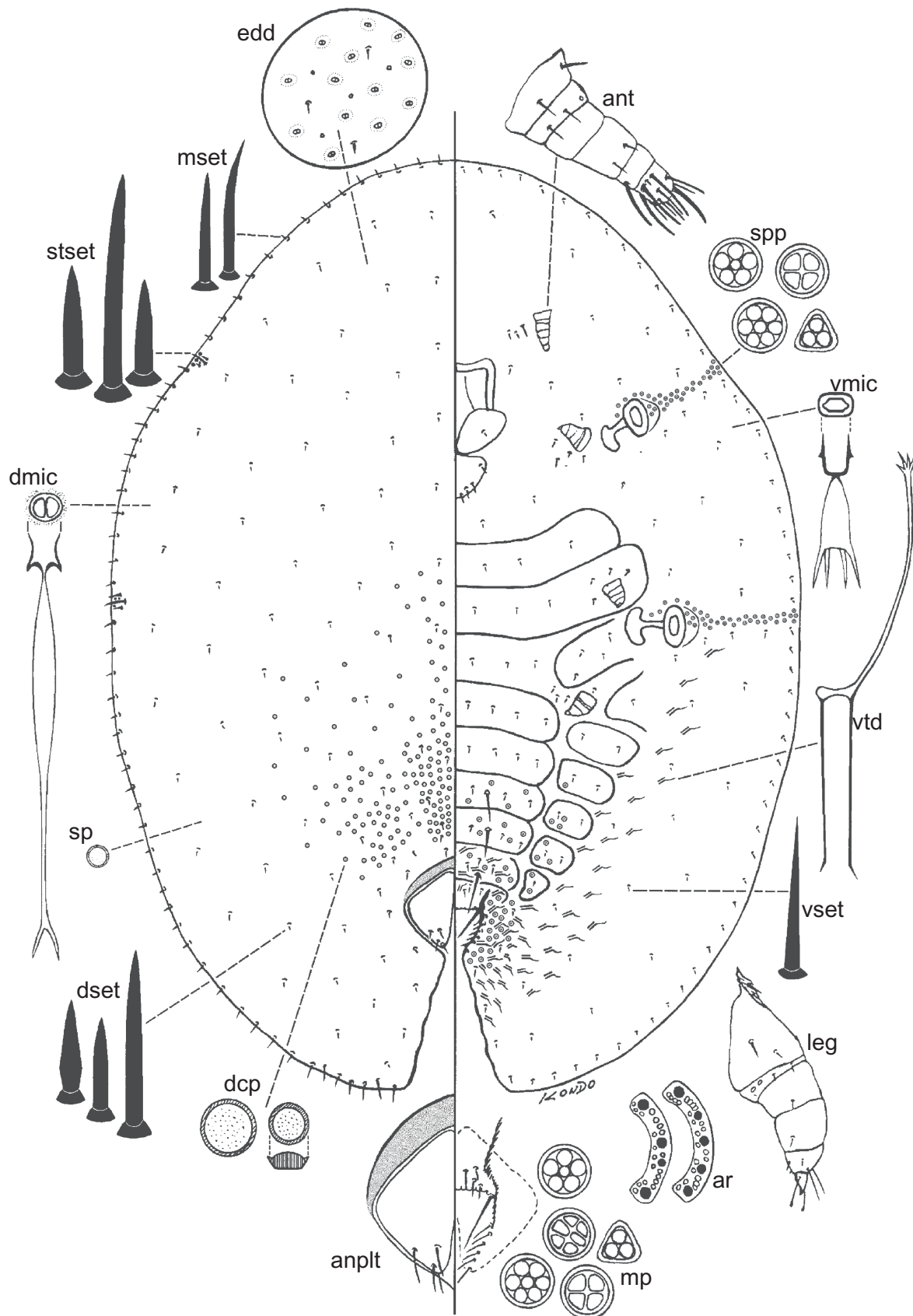
**Host plants.** Lauraceae: *Nectandra* sp., a tree locally known as “jigua amarilla”.

**Associated ants.** Dolichoderinae: *Azteca* sp.

**Material studied.** **Holotype:** Colombia, Valle, Cali, Pance, 8.i.2000, coll. T. Kondo, ex Jigua amarilla (*Nectandra* sp.), tended by *Azteca* ants, AL-103-2000, adult ♀, 1(1) (USNM). **Paratypes:** same data as holotype, 10(10) (USNM), 2(2) (AUCC).

**Notes.** *Neotoumeyella caliensis* sp. nov. is closest to *N. cephalanthi*, however, they can be easily differentiated by the presence of multilocular pores in the mid-ventral region of the thorax in *N. cephalanthi*. Other differences include the higher number of loculi in the multilocular pores, stigmatic setae subequal in length, and a more developed sclerotized crescent around the anal plates in *N. cephalanthi*.





**Figure 3.** *Neotoumeyella caliensis* Kondo and Williams, adult female.

**Abbreviations:** Anplt, anal plate; ant, antenna; ar, anal ring; dmic, dorsal microduct; dcp, discoidal pore; edd, enlargement of dorsal derm; mset, marginal setae; mp, multilocular pore; sp, simple pore; spp, spiracular pore; stgsp, stigmatic spine; vmic, ventral microduct; vset, ventral setae; vtd, ventral tubular duct.



## *Neotoumeyella cephalanthi* Kondo and Williams, sp. nov. (Figs. 1B and 4)

### Description, adult female

**Unmounted material.** Adult female oval to irregularly oval, mildly to highly convex, margins usually flattened, color of insect reddish brown, mottled with black markings; spiracular areas and anal cleft often marked with snow-white waxy secretions.

**Mounted material.** (n = 92) Body outline oval to elongate oval, 1.8–7.0 mm long, 1.4–7.0 mm wide; anal cleft extending about 1/5 of body length from posterior margin.

**Dorsum.** Derm membranous, becoming heavily sclerotized in old specimens. Body setae slender, each 6.4–15.0  $\mu$ m long, apex abruptly tapering to a point, scattered over dorsum. Simple pores circular, each 1.8–3.6  $\mu$ m wide, scattered evenly on dorsum. Discoidal pores each 4.3–11.0  $\mu$ m wide, highly convex, present on mid-dorsum anterior to anal plates, extending onto mid-dorsum. Dorsal microducts each with duct rim 2.7–3.6  $\mu$ m wide, distributed evenly throughout dorsum. Anal plates each triangular in shape, located at about 1/5 of body length from posterior margin, each 156–189  $\mu$ m long, 97–113  $\mu$ m wide, anterolateral margin 113–162  $\mu$ m long, posterolateral margin 113–135  $\mu$ m long. Each plate with 4 dorsal apical setae, about 7 ventral subapical setae, 2 fringe setae and 8 hypopygial setae. Anal ring with 10 setae and about 2 rows of translucent wax pores.

**Marginal.** Marginal setae slender, straight or slightly bent, each 11–17  $\mu$ m long, arranged in a single row around margin. Number of marginal setae between spiracular clefts totaling 6–12. With 3 stigmatic setae subequal in length, each 17–38  $\mu$ m long; shape of setae variable, mostly bluntly spinose, stout, apex rarely slightly bifid.

**Venter.** Membranous, with abdominal segmentation usually well defined. Ventral body setae slender, each 8.5–21  $\mu$ m long, those on posterior abdominal segments longest, each 21–60  $\mu$ m long. One row of submarginal setae, similar to rest of ventral body setae. Interantennal setae totaling 4. Antennae reduced, total length 34–96  $\mu$ m long, each 3–6 segmented. Clypeolabral shield 183–226  $\mu$ m wide. Legs: total length 66–119  $\mu$ m long. Tarsal digitules each

slender, knobbed; claw digitules, each slender, knobbed, one thicker than other; claw simple. Spiracles large, anterior peritreme each 68–98  $\mu$ m wide, posterior peritreme each 85–111  $\mu$ m wide. Spiracular pores with 4–8 loculi, mostly 5–7 locular, each 3.6–6.2  $\mu$ m wide, spiracular pore band about 2–6 pores wide, reaching margins. Tubular ducts of one type, rather scarce, most abundant in perivulvar region, also present on abdominal segments, and in a submarginal band on abdomen. Multilocular pores (other than spiracular pores) with 7–12 (mostly 10) loculi, each 4.4–7.1  $\mu$ m wide, abundant on perivulvar area, and also present on mid ventral areas across all abdominal segments and meso- and metathorax. Microducts each with duct rim 1.8–2.6  $\mu$ m wide, abundant, scattered evenly on venter.

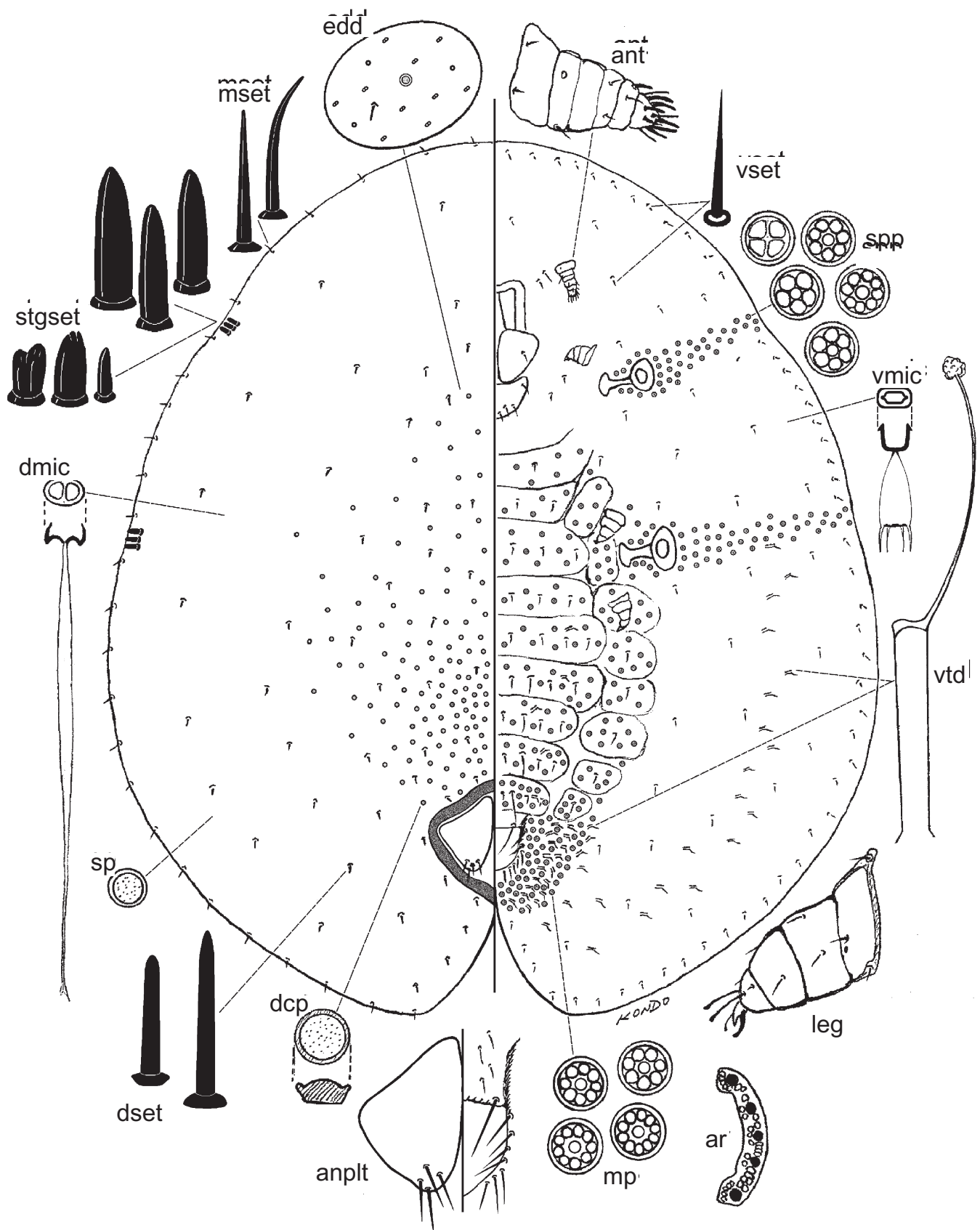
**Etymology.** The new species *N. cephalanthi* sp. nov. is named after its common host *Cephalanthus occidentalis*.

**Distribution.** Nearctic Region: USA (Alabama, Arkansas, Florida, Louisiana, North Carolina, Virginia).

**Host plants.** Rubiaceae: *Cephalanthus occidentalis* L.; Salicaceae: *Salix* sp.

**Associated ants.** Myrmicinae: *Crematogaster* sp.

**Material studied. Holotype:** USA, Virginia, Wakefield, Airport Pond, 16.viii.1969, coll. M.L. Williams, ex *Cephalanthus occidentalis*, adult ♀, 1(1) (USNM). **Paratypes:** same data as holotype, 4(4) (USNM); USA, Alabama, Macon Co., 21.iv.1976, coll. M.L. Williams, ex *C. occidentalis*, AL-707-76, 21(41) (AUCC); USA, Virginia, Arlington Farm, 13.viii.1902, coll. J.B. Gordon, ex *Cephalanthus*, AL-588-75, 8(8) (AUCC); USA, Alabama, Macon Co., 3.v.1975, coll. M.L. Williams, ex *C. occidentalis*, AL-432-75, 4(4) (AUCC); USA, Alabama, Chattahoochee State Park, 9.v.1976, coll. B.J. Muse, ex *C. occidentalis*, AL-737-76, 7(7) (AUCC); USA, Alabama, Chattahoochee State Park, 25.x.1978, coll. M.L. Williams, W. Hudson, J.D. Harper, ex *C. occidentalis*, AL-202-78, 4(4) (AUCC); USA, Florida, Wabasso Co., 23.v.1955, coll. A.M. Phillips, *C. occidentalis*, MW 444, 8(8) (AUCC); USA, Florida, McClenny, 3.iv.1952, coll. G.G. Norman, ex *C. occidentalis*, 2(6) (USNM); USA, North Carolina, 29.viii.1944, coll. Gordon, no. 926, ex *C. occidentalis*, 1(3) (USNM); USA, Florida, Wabasso, 29.viii.1955, coll. A. Burnett,



**Figure 4.** *Neotoumeyella cephalanthi* Kondo and Williams, adult female.

**Abbreviations:** Anplt, anal plate; ant, antenna; ar, anal ring; dmic, dorsal microduct; dcp, discoidal pore; edd, enlargement of dorsal derm; mset, marginal setae; mp, multilocular pore; sp, simple pore; spp, spiracular pore; stgset, stigmatic spine; vmic, ventral microduct; vset, ventral setae; vtd, ventral tubular duct.



No. 55-5, ex *C. occidentalis*, 5(5) (USNM); USA, Florida, Leon Co., 21.vii.1970, coll. Tippins, ex. Buttonbush, HHT-137-70, 1(1) (AUCC).

**Notes.** Specimens of *Neotoumeyella cephalanthi* sp. nov. have long been misidentified as *Toumeyella cerifera*. However, after studying the type material of *T. cerifera*, it became clear that the specimens recorded on *C. occidentalis* from the southeastern U.S.A represented a different species. Williams and Kosztarab<sup>5</sup> treated the populations on *Cephalanthus* as part of *T. cerifera* and considered the morphological differences to be host-induced, but also noted that the North American specimens did not produce an ovisac like the specimens from Mexico. Williams and Kosztarab,<sup>5</sup> also noted that *N. cephalanthi* (as *T. cerifera*) gives birth to live young, usually in August or September, reproduces sexually, and is often collected on plants found at 6–8 inches from water at the edge of a pond. The male of *N. cephalanthi* (as *T. cerifera*) has been described by Miller and Williams.<sup>7</sup>

### *Neotoumeyella cerifera* (Ferris), new combination (Fig. 5)

*Toumeyella cerifera* Ferris, 1921:90.<sup>15</sup>

#### Description, adult female

**Unmounted material.** Adult female secreting distinct ovisac, body highly convex, broadly oval; up to 5 mm long, 3 mm high.<sup>15</sup>

**Mounted material.** (n = 8) Adult female oval to elongate oval in outline, 1.8–4.1 mm long, 1.7–4.2 mm wide; anal cleft extending about 1/5 of body length from posterior margin.

**Dorsum.** Derm membranous, becoming heavily sclerotized in old specimens. Body setae slender, each 8.5–15.0 µm long, bases somewhat darkened, scattered over dorsum. Simple pores circular, each 2.7–3.6 µm wide, scattered evenly on dorsum. Discoidal pores each 4.4–6.2 µm wide, highly convex, present evenly on dorsum except for a small submarginal band. Dorsal microducts each with duct rim 2.7 µm wide, distributed evenly throughout dorsum. Anal plates each triangular in shape, located at about 1/5 of body length from posterior margin, each 162–199 µm long, 97–124 µm wide, anterolateral margin 162–189 µm long, posterolateral margin 108–135 µm long. Each plate with 4 dorsal apical setae, about 4 ventral

subapical setae, 2 fringe setae and 8 hypopygial setae. Anal ring with 10–12 setae, translucent pores in 1–2 rows.

**Margin.** Marginal setae slender, straight or slightly bent, each 11–15 µm long, arranged in a single row around margin. Number of marginal setae between spiracular clefts totaling 4–8. Stigmatic setae totaling 3, all subequal in length, each 11–19 µm long; bluntly spinose, stout.

**Venter.** Membranous, with abdominal segmentation usually well defined. Ventral body setae slender, each 8.5–15.0 µm long, those on posterior abdominal segments longest, each 15–36 µm long. One row of submarginal setae, similar to ventral body setae. Interantennal setae totaling 4. Antennae reduced, total length 70–119 µm long, each 4–7 segmented, mostly 5 or 6 segmented, with particularly long setae on scape and pedicel, each setae longer than segments III and IV combined. Clypeolabral shield 243–270 µm wide. Legs: total length 65–151 µm long. Tarsal and claw digitules each slender, knobbed; claw simple. Spiracles large, anterior peritreme each 86–119 µm wide, posterior peritreme each 108–140 µm wide. Spiracular pores with 3–7 (mostly 5) loculi, each 5.3–8.5 µm wide; spiracular pore band about 5–10 pores wide, reaching margins. Tubular ducts of about 3 sizes; small to medium sized tubular ducts numerous, with a thin inner ductule, widespread evenly on abdomen and mesothoracic region; large sized tubular ducts with a broad inner ductule, scarce, usually present submedially on abdomen and in area around metathoracic leg. Multilocular pores with 6–9 (mostly 7) loculi, each pore 6.2–8.5 µm wide. Microducts each with duct rim 2.7–3.6 µm wide, abundant, scattered evenly on venter.

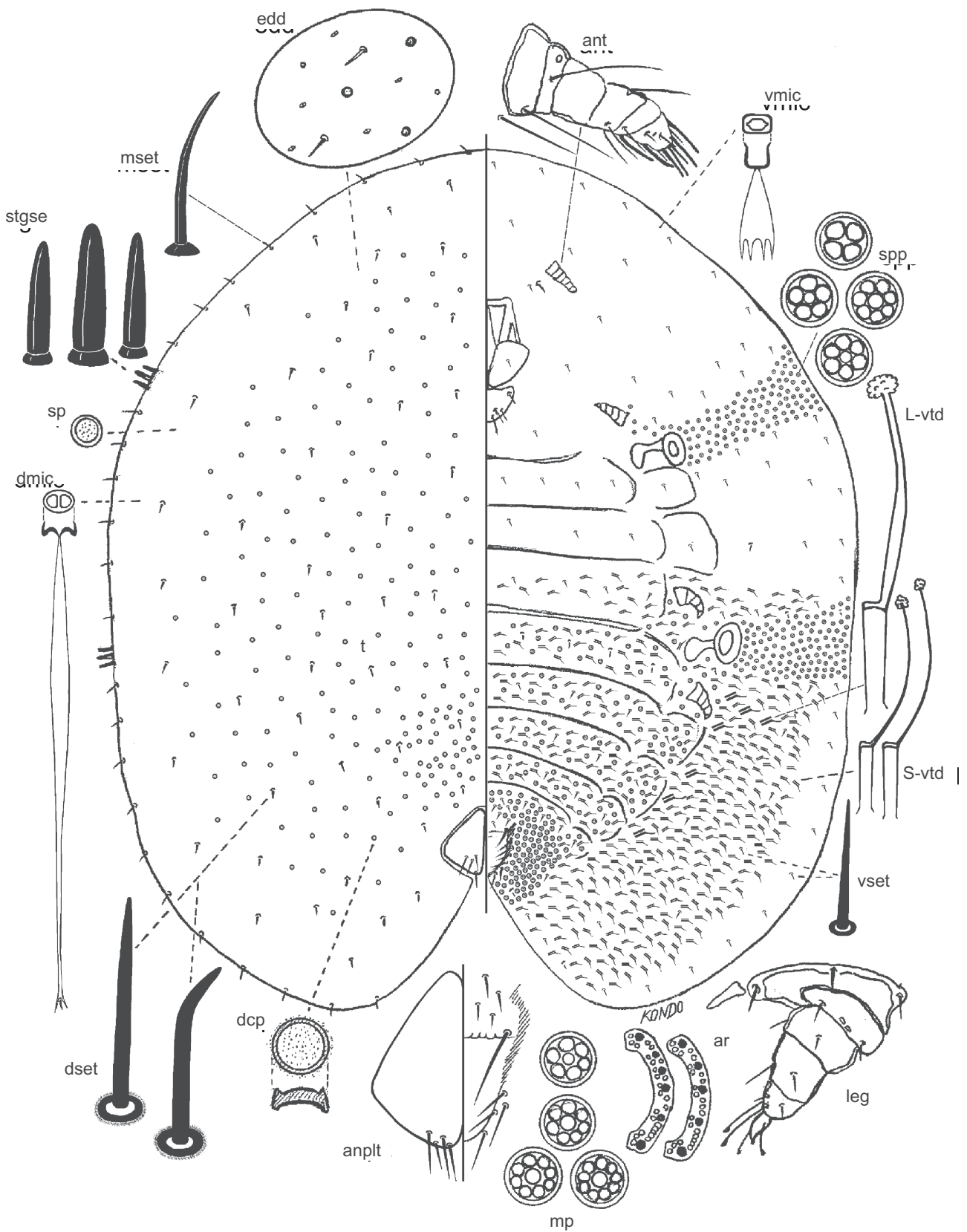
**Distribution.** Neotropical Region: Mexico (Lower California).

**Host plants.** Fabaceae: *Albizzia occidentalis* Brandegee.

**Associated ants.** Myrmicinae: *Crematogaster* sp.

**Material studied.** In order to preserve stability of nomenclature for this species, a lectotype is designated from the syntypes. **Lectotype:** Mexico, Baja California, viii.1919, coll. G.F. Ferris, ex *Albizzia occidentalis* (Fabaceae), adult ♀, 1(1) (BME). **Paralectotypes:** same data as lectotype, 4(7); 1 (7: 5 first-instar nymphs + 2 second-instar nymphs) (BME).





**Figure 5.** *Neotoumeyella cerifera* (Ferris), adult female.

**Abbreviations:** Anplt, anal plate; ant, antenna; ar, anal ring; dmic, dorsal microduct; dcp, discoidal pore; edd, enlargement of dorsal derm; mset, marginal setae; mp, multilocular pore; sp, simple pore; spp, spiracular pore; stgsp, stigmatic spine; vmic, ventral microduct; vset, ventral setae; vtd, ventral tubular duct [S, small-sized; L, large-sized].



**Notes.** *Toumeyella cerifera*, originally collected at Agua Caliente, Mexico, has long been regarded as being widely spread in the southern USA, however, after studying the type material it became clear that the species recorded on *Cephalanthus* from the southeastern USA represented a different species herein described as *N. cephalanthi* sp. nov. Williams and Kosztarab<sup>5</sup> described a North American species on *Cephalanthus* as *Toumeyella cerifera* and considered the morphological differences to be host-induced, but also noted that the North American species did not produce an ovisac as reported for the specimens from Mexico. The illustration of *T. cerifera*, given by Williams and Kosztarab<sup>5</sup> and Hamon and Williams,<sup>12</sup> apparently incorporates characters of both *T. cerifera* and *N. cephalanthi*. *Neotoumeyella cerifera* and *N. cephalanthi* sp. nov. can be easily separated by differences in the distribution of discoidal pores, abundance and types of ventral tubular ducts, and composition of multilocular pores (i.e. 7–12 in *N. cephalanthi* vs. 6–9 in *N. cerifera*). *Neotoumeyella cerifera* is only known from Mexico.

### *Neotoumeyella sonorensis* (Cockerell and Parrott), new combination (Fig. 6)

*Lecanium sonorensis* Cockerell and Parrott, 1899:161.<sup>16</sup>

*Toumeyella sonorensis* (Cockerell and Parrott), Cockerell, 1902:452.<sup>17</sup>

#### Description, adult female

**Unmounted material.** Scale 5–6 mm long, 3–4 mm broad, 2 1/2–3 mm high, Eulecanium-like, clear chestnut brown; dorsum smooth and shining; 2 longitudinal rows of deep pits on each side in subdorsal region, each row of 5 or 6 pits; sides (marginal area) broadly rugose, with small pits.<sup>16</sup>

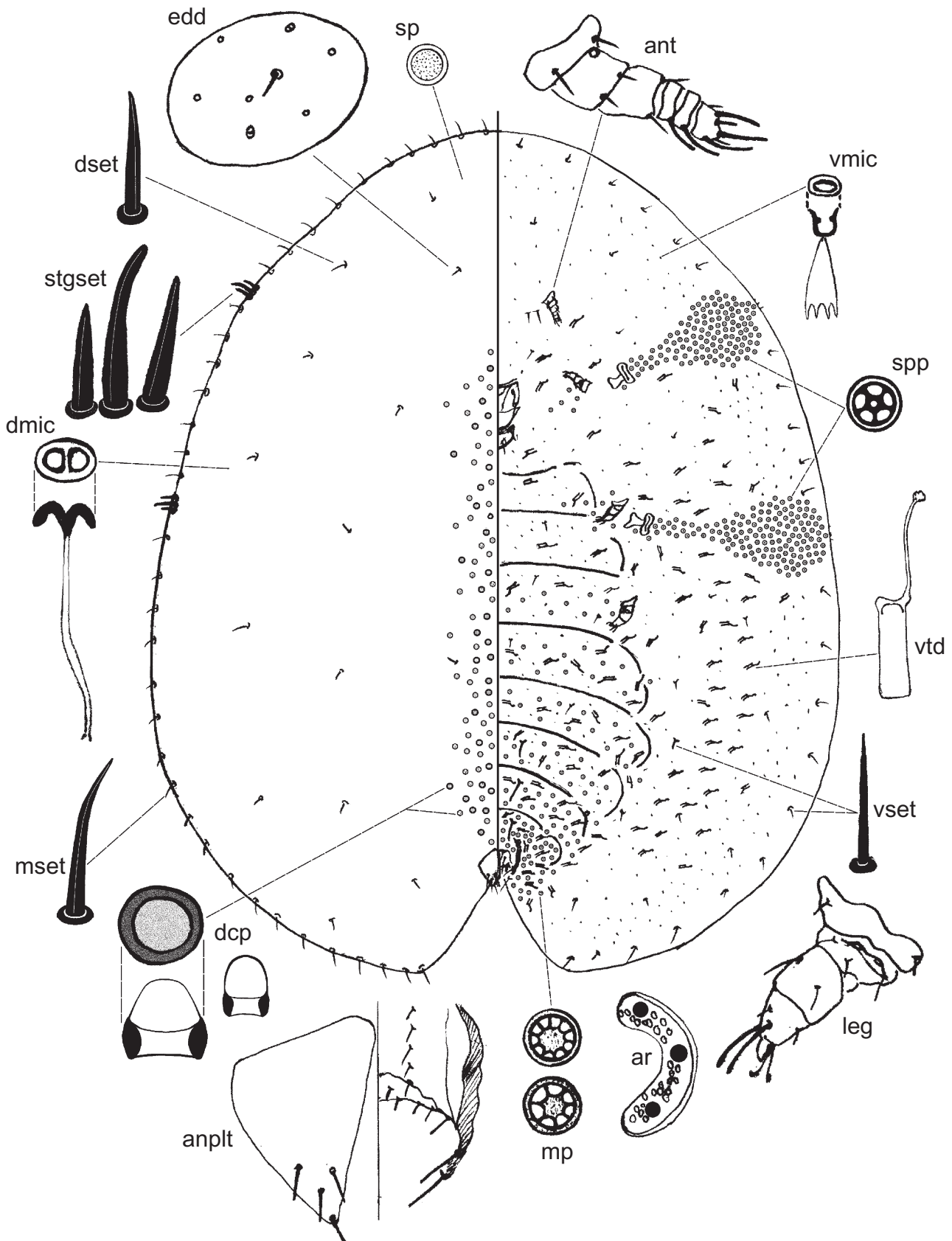
**Mounted material.** (n = 12) Adult female broadly oval to almost circular in outline, 3.5–6.5 mm long, 2.8–6.0 mm wide; anal cleft extending about 1/6 of body length from posterior margin.

**Dorsum.** Derm membranous, becoming heavily sclerotized in old specimens. Body setae slender, 11.1–12.4 µm long, scattered over dorsum. Simple pores circular, each 2.5 µm wide, scattered evenly on dorsum. Discoidal pores each 6.2–9.9 µm wide, extremely convex and dome shaped, 7.4–9.9 µm tall, present mid-dorsally in a band extending from

anal plates anteriorly to area above antennae. Dorsal microducts, bilocular, each with duct rim about 5 µm wide, abundant, scattered over entire dorsum. Anal plates each triangular in shape, located at about 1/6 of body length from posterior margin, 167–186 µm long, 105–114 µm wide, anterolateral margin 124–136 µm long, posterolateral margin 151–164 µm long. Each plate with 4 dorsal apical setae, 2 ventral subapical setae, about 8 fringe setae and 12 hypopygial setae. Anal ring with 6 setae, and 2 irregular rows of translucent pores.

**Margin.** Marginal setae slender, curved or straight, pointed, each 18.6–24.7 µm long, arranged in a single row around margin. Number of marginal setae between spiracular clefts 6–10, about 42–50 around entire body. Stigmatic setae moderately long, stout, straight or slightly curved, bluntly pointed, 3 located just on dorsum at apex of each spiracular furrow, median seta largest, each 44.5–51.9 µm long, lateral setae subequal in length, but one usually slightly longer than the other, each 25.0–44.5 µm long.

**Venter.** Derm membranous, with abdominal segmentation usually well defined. Ventral body setae slender, straight, pointed, each 12.4–14.8 µm long, with 3 pairs of long prevulvar setae. One row of submarginal setae, similar to other ventral body setae. Interantennal setae totaling 4. Antennae reduced, total length 155–179 µm long, 6 segmented. Clypeolabral shield 191–222 µm wide. Legs: total length 136–173 µm long. Tarsal and claw digitules each slender, knobbed; claw simple. Spiracles large, anterior peritreme 87–105 µm wide, posterior peritreme 105–124 µm wide. Spiracular pores with 3–7 (mostly 5) loculi, each 4.9–6.2 µm wide; spiracular pore band about 5 pores wide near spiracles, but expanding to about 30 pores wide near margin before abruptly reducing to 2–3 pores wide near spiracular setae. Tubular ducts of one type, with a thin inner ductule, widespread on abdomen and thoracic region, some occasionally occurring near antennae. Multilocular pores (other than spiracular pores) with 7–12 (mostly 10) loculi, each 6.2–9.3 µm wide, numerous in perivulvar area and on mid-ventral region of abdomen, extending up to mesothoracic legs, also some mesad of pro- and mesothoracic legs. Microducts each with duct rim 2.5 µm wide, abundant, scattered over entire venter, but more numerous in submarginal areas.



**Figure 6.** *Neotoumeyella sonorensis* (Cockerell and Parrott), adult female.

**Abbreviations:** Anplt, anal plate; ant, antenna; ar, anal ring; dmic, dorsal microduct; dcp, discoidal pore; edd, enlargement of dorsal derm; mset, marginal setae; mp, multilocular pore; sp, simple pore; spp, spiracular pore; stgsp, stigmatic spine; vmic, ventral microduct; vset, ventral setae; vtd, ventral tubular duct.



**Distribution.** Neotropical Region: Mexico.

**Host plants.** Acanthaceae: *Beloperone californica* Benth.

**Associated ants.** None reported.

**Material studied.** In order to preserve stability of nomenclature for this species, a lectotype is designated from the syntypes. **Lectotype:** Mexico, Hermosillo, Sonora, 22-IV-1897, coll. A. Koebele, ex. *Beloperone californica*, slide mounted from type material, adult ♀, AL-884-76a 1(1) (USNM). **Paralectotypes:** USDA 7928, marked TYPE, adult ♀♀, 1(3)(USNM); the following slides were mounted from dry Type Material and are labeled as such: AL-884-76, 7(7); AL-885-76, 3(3), AL-886-76, 7(7) (AUCC). Also studied were 5(5) labeled O. E. Bremmer Collection, Sonora, Mexico, No. 904, 3(3) (BME), 2(2) (USNM); and 3(4) labeled Koebele Collection Coccidae No. 1711 (BME), Type material. All of this material is considered syntypic material as it came from the original collected material.

**Notes.** *Neotoumeyella sonorensis* falls within the group of *Neotoumeyella* species with only one type of ventral tubular ducts. It differs from other species in the genus by having an anal ring with only six setae. All other species have an anal ring with 10–12 setae, which is the common number in the *Toumeyella*-group. *Neotoumeyella sonorensis* is closest to *N. caliensis* sp. nov. and *N. cephalanthi* sp. nov., but it can be easily separated from these species by the combination of the following features (features of the *N. caliensis* sp. nov. and *N. cephalanthi* sp. nov. in parentheses): (i) ventral tubular ducts present around mouthparts and often antennae (ventral tubular ducts absent from area around mouthparts and antennae); (ii) spiracular pore band broadening just before stigmatic areas, pore band expanding to up to 30 pores wide (spiracular pore band narrow throughout, 2–6 pores wide); (iii) anal ring with 6 setae (anal ring with 10–12 setae), and (iv) discoidal pores present in a more or less straight mid-dorsal line (discoidal pores not confined to a mid-dorsal line, extending laterally from midline). According to Kondo and Williams<sup>8</sup> and Sheffer and Williams,<sup>18</sup> *N. sonorensis* (as *Toumeyella sonorensis*) is the only species in the *Toumeyella*-group that has first-instar nymphs with 6-segmented antennae (all other known species in the *Toumeyella*-group have first-instar nymphs with 5-segmented antennae).

*Neotoumeyella sonorensis* is known only from the original collection from Mexico.

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## Disclosure

The authors report no conflicts of interest.

## References

- Hodgson CJ. The scale insect family Coccidae: an identification manual to genera. CAB International, Wallingford, Oxon, UK. 1994.
- Gullan PJ, Stewart AC. A new genus and species of ant-associated coccid (Hemiptera: Coccidae: Myzolecaniinae) from *Canthium* Lam. (Rubiaceae). *Mem Queensl Mus.* 1996;39:307–14.
- Kondo T, Williams ML, Gullan PJ. Taxonomic review of the genus *Xenolecanium* Takahashi and description of the new genus *Takahashilecanium* (Hemiptera: Coccidae: Coccinae, Paralecaniini). *Entomol Sci.* 2005;8:109–20.
- Steinweden JB. Bases for the generic classification of the coccoid family Coccidae. *Ann Entomol Soc Am.* 1929;22:197–245.
- Williams ML, Kosztarab M. Morphology and systematics of the Coccidae of Virginia with notes on their biology (Homoptera: Coccoidea). *Res Div Bull, Va Poly Inst and State Univ.* 1972;74:1–215.
- Miller GL. Morphology and Systematics of the male tests and adult males of the family Coccidae (Homoptera: Coccoidea) from America North of Mexico. Ph.D. thesis, 460 p. Auburn University, Auburn, USA. 1991.
- Miller GL, Williams ML. Systematic analysis of the adult males of *Toumeyella* group, including *Mesolecanium nigrofasciatum*, *Neolecanium cornuparvum*, *Pseudophilippia quaintancii* and *Toumeyella* spp. (Homoptera: Coccidae) from America north of Mexico. Contributions of the American Entomological Institute 28(4). Associated Publishers, Gainesville, FL. 1995.
- Kondo T, Williams ML. The Myzolecaniinae (Hemiptera: Coccidae): Old World vs. New World. *Boll Zool Agrar Bachic, Ser II.* 2002;33(3):125–8.
- Kondo T, Williams ML. Redescription of the soft scale insect *Toumeyella sallei* (Signoret), new combination (Hemiptera: Coccidae: Myzolecaniinae). *Ann Naturhist Mus Wien.* 2004;B 105:211–5.
- Kondo T, Williams ML. Redescription of the myrmecophilous soft scale insect: *Aztecalecanium colimae* (Cockerell), new genus and new combination (Hemiptera: Coccoidea: Coccidae). *TIP Revista Especializada en Ciencias Químico-Biológicas.* 2004;7(1):5–9.
- Williams DJ, Granara de Willink MC. Mealybugs of Central and South America. CAB International, London, England. 1992.
- Hamon AB, Williams ML. The soft scale insects of Florida (Homoptera: Coccoidea: Coccidae). Arthropods of Florida and Neighboring Land Areas. Fla Dept of Agric and Consum Serv Div Plant Ind., Gainesville. 1984.
- Kondo T, Williams ML, Gullan PJ. Redescription of *Octolecanium perconvexum* (Cockerell), New Genus and New Combination, with Description of a New Species from Guatemala (Hemiptera: Coccoidea: Coccidae). *TIP Revista Especializada en Ciencias Químico-Biológicas.* 2005;8(1):5–11.
- Cockerell TDA. Five New Coccidae from Mexico. *The Entomol.* 1903;36:45–8.
- Ferris GF. Report upon a collection of Coccidae from Lower California. *Stanford Univ Pub. Palo Alto Biol Sci.* 1921;1:61–132.





16. Cockerell TDA, Parrott PJ. Contribution to the knowledge of the Coccidae. *The Industrialist*. 1899;25:159–65, 227–37.
17. Cockerell TDA. A contribution to the knowledge of the Coccidae. Appendix. Some Brazilian Coccidae. *Ann Mag Nat Hist (Ser 7)*. 1902;9:450–6.
18. Sheffer BJ, Williams ML. Descriptions, distribution, and host-plant records of eight first instars in the genus *Toumeyella* (Homoptera: Coccidae). *Proc Entomol Soc Wash*. 1990;92(1):44–57.

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