

SYSTEMATICS, MORPHOLOGY AND PHYSIOLOGY

A New Lac Insect from Colombia, with Revised Keys to Lac Insect Genera and to Species of *Austrotachardiella* Chamberlin (Hemiptera: Coccoidea: Kerriidae)

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Nova Espécie de Inseto Laca de Colombia, com Chaves Revisadas Para os Gêneros da Família e Para as Espécies do Gênero *Austrotachardiella* Chamberlin (Hemiptera: Coccoidea: Kerriidae)

RESUMO - Uma nova espécie do inseto laca, *Austrotachardiella colombiana* Kondo & Gullan sp. n. (Kerriidae), é descrita e ilustrada com base na fêmea adulta. A espécie foi relatada causando a morte nos ramos e galhos de duas cultivares de *Psidium guajava* L. (Myrtaceae) em Santander de Quilichao, Cauca, Colômbia. Uma chave taxonômica revisada para os gêneros da família Kerriidae e uma chave atualizada para separar as espécies de *Austrotachardiella* Chamberlin são fornecidas. Não foram encontrados registros anteriores de insetos laca para a Colômbia.

PALAVRAS-CHAVE: Goiaba, Myrtaceae, *Psidium guajava*, praga, taxonomia

ABSTRACT - A new lac insect pest, *Austrotachardiella colombiana* sp. n. (Kerriidae), is described and illustrated based on the adult female. This species was reported causing dieback on the twigs and branches of two cultivars of *Psidium guajava* L. (Myrtaceae) in Santander de Quilichao, Cauca, Colombia. A revised taxonomic key to the genera of the family Kerriidae and an updated key to separate the species of *Austrotachardiella* Chamberlin is provided. No previous records of lac insects from Colombia were found.

KEY WORDS: Guava, Myrtaceae, *Psidium guajava*, pest, taxonomy

The lac insects belong to the scale insect family Kerriidae, which also has been called Lacciferidae or Tachardiidae in the past. However, the name Kerriidae is now established as the family-group name (Ben-Dov & Lit 1998). The family contains nine genera and approximately 100 described species (Ben-Dov 2002). The name "lac insect" comes from the well-known varnish called shellac, which is produced by the lac insect *Kerria lacca* (Kerr). Shellac is used in many industries, for example, as an insulating material in electrical work (Chamberlin 1923) and in paints and surface coatings (Varshney 1976). The body of *K. lacca* also contains a dye called "lake" that has been used in India (Ferris 1957). Chamberlin (1923) reported that the lac of *Tachardiella fulgens* Comstock, under the name of "jomilla", is used by the Mexicans medicinally and for repairing crockery and other utensils.

Campbell *et al.* (1994) indicated the possibility of using *Austrotachardia* sp. and *Paratachardina* sp. in the biological control of native weeds in the genus *Cassinia* in Australia. Some species, such as the yellow lac scale, *Tachardina aurantiaca* (Cockerell), are pests of crop plants in the

Maldives (Watson *et al.* 1995), and of forest plants on Christmas Island in the Indian Ocean (O'Dowd *et al.* 2003). In addition, in recent years, the lobate scale, *Paratachardina lobata* (Chamberlin), has become a serious pest in Florida, attacking numerous plants (Pemberton 2003).

In a recent visit to Colombia, the first author was given a sample of guava twigs covered by lac insects. According to its collector, Mr. Aicardo Delgado, the insects were collected in the Departamento del Cauca, Colombia, where they were causing the dieback of twigs and branches of two cultivars of *Psidium guajava* L., locally known as "guayaba pera" and "guayaba manzana". This lac insect is new to science and belongs to the genus *Austrotachardiella* Chamberlin, which now contains eight species, of which six occur in the Neotropical region (Ben-Dov 2002).

Ben-Dov (2002) lists 12 species of lac insects on the plant family Myrtaceae, and two of these occur on guava (*P. guajava*): *Afrotachardina longisetosa* (Newstead) from Uganda, and *Paratachardina theae* (Green) from India. A Mexican species, *Austrotachardiella nigra* (Townsend & Cockerell) also has been collected on guava (see Material

studied). With the current species, the number of lac insects on guava increases to four, and to 13 on the family Myrtaceae. In a compilation of published literature and personal collections, Kondo (2001) reported 174 species in 10 families of scale insects (Coccoidea) for Colombia, but included no kerriids: this is the first record of a lac insect from Colombia. Here we describe and illustrate the adult female of this new insect pest and compare it to other species in the genus *Austrotachardiella*. A revised taxonomic key to the genera of Kerriidae and an updated key to separate the species of *Austrotachardiella* are provided.

Materials and Methods

The description of the adult female of the new species is based on multiple slide-mounted specimens. Museum specimens of other species in the genus *Austrotachardiella* were examined for comparison and additional specimens were slide-mounted from dry material, because high quality mounts are essential for discerning cuticular features. The slide-mounting techniques of Williams and Granara de Willink (1992) were used except that xylene was used instead of clove oil. The collection data, number of slides with the total number of specimens, and the depository in parentheses are given for each lot of material studied. The terms used to describe the lac insect follow those of Chamberlin (1923) and Gill (1993) (Figs. 1 to 7). The term canella is used here to describe the linear group of canellar pores (multilocular disc pores) present in the area between the anterior spiracles and the mouthparts, as described by Chamberlin (1923). Measurements of the new species were made from 15 specimens using an ocular micrometer in a compound microscope. The drawing is a generalization of several specimens and was made with the assistance of a camera lucida attached to a compound microscope. The figure shows an entire female with the venter depicted on the right side of the illustration and the dorsum shown on the left. Special features of the specimen are enlarged to the side of the main illustration. However, dermal structures and enlargements are not in direct proportion to each other.

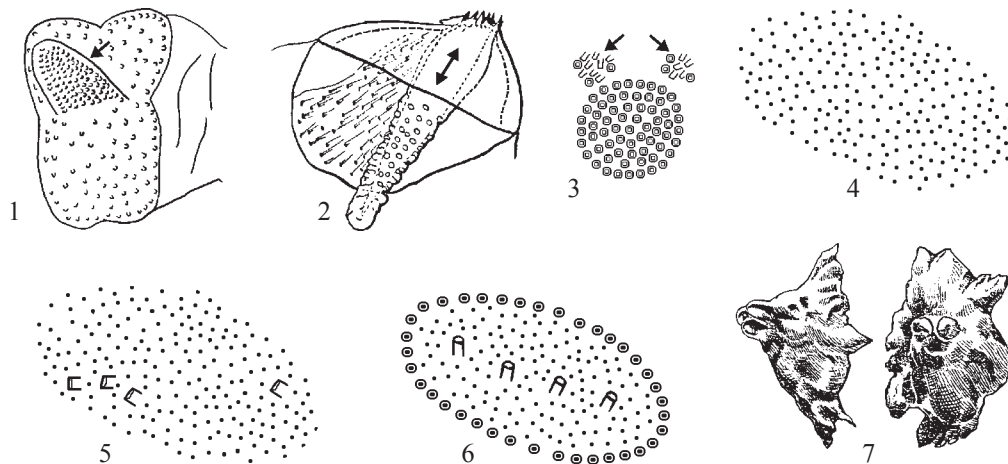
The key to the adult females of *Austrotachardiella* was updated from that of Chamberlin (1923) after examination of specimens of the included species, and by the addition of three species, *A. sexcordata* Matile-Ferrero, *A. trilobata* Mendes, and the new species herein described. The original description of Mendes (1936) was used in generating the key couplet for *A. trilobata*. Syntypes of all six species included in Chamberlin's (1923) key were available in the present study. A paratype and newly slide-mounted type material of *A. sexcordata* also was used to generate the keys (material listed below).

Abbreviations for the depositories are as follows: BME (the Bohart Museum of Entomology, Department of Entomology, University of California, Davis, California, U.S.A.); BMNH (Natural History Museum, London, UK); MNHN (Muséum National d'Histoire Naturelle, Paris, France); UNCB (Colección de Insectos, Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá D.C., Colombia); and USNM (National Museum of Natural

History Coccoidea Collection, Beltsville, Maryland, USA).

Material of Other Species Studied for Comparison and Construction of Key. Syntypes of six species of *Austrotachardiella* are in the BME, and also are deposited in the USNM. In addition, syntypes of *A. rubra* are in Brazil, at the Museu Zoológico, São Paulo University. In the present study, only material deposited in the BME was used. Specimens of *A. trilobata* were not examined and, according to the original description, are deposited at the Entomology Section of the Instituto de Biologia Vegetal, RJ, Brazil; type no. 729 730 (Mendes 1936). However, according to Ben-Dov (2002), the type material of *A. trilobata* is deposited at the Fundação Instituto Oswaldo Cruz, RJ, Brazil.

Adult ♀♀, *Austrotachardiella bodkini* (Newstead), type material, Guyana (as British Guiana), date not given, received from Green, ex *Sapium jenmani*, two slides two specimens (BME); *A. bodkini*, labeled as *Tachardia bodkini*, Guyana (as British Guiana), 1913, coll. H.W.B. Moore, "from co-type material", four slides four specimens, slide-mounted from dry material by P.J. Gullan 2004 (BME); *Austrotachardiella caerulea* Hempel (= *A. cydoniae*, synonymized by Chamberlin 1923), Brazil, São Paulo, host not given, Newstead's collection, received from Green, 1922, one slide three specimens (BME); *Austrotachardiella cydoniae* (Hempel), Brazil, São Paulo, date & coll. not given, ex rose, slide-mounted by P.J. Gullan, 2004, from dry material labeled as *A. rosae* (synonymized by Chamberlin, 1923), six slides seven specimens (BME); *Austrotachardiella gemmifera* (Cockerell), type material, Jamaica, Kingston, 1918, received from Cockerell, ex *Chrysobalanus* sp., three slides three specimens (BME); *A. gemmifera*, as *T. gemmifera*, Jamaica, Kingston, date not given, coll. M. Grabham, ex *Chrysobalanus*, six slides six specimens, slide-mounted from dry material by P.J. Gullan 2004 (BME); *Austrotachardiella nigra* (Townsend & Cockerell), labeled as *Tachardiella nigra*, Mexico, date, collector & host not given, slide labeled as "Type", one slide one specimen (poor condition), (BME); *A. nigra*, Mexico, Jalisco, Tonila, 3.viii., year & coll. not given, ex tree with guava-like leaves, one slide two specimens (poor condition) (BME); *A. nigra*, Mexico, Jalisco, Tonila, 1918, from Cockerell, ex "tree with umbrella-like leaves", two slides two specimens (BME); *A. nigra*, Mexico, Tepic Nayarit, date not given, coll. G. Ferris, ex guava, 11 slides 11 specimens, slide-mounted from dry material by P.J. Gullan 2004 (BME); *Austrotachardiella rosae* Hempel (= *A. cydoniae*, synonymized by Chamberlin, 1923), Brazil, São Paulo, 1921, received from P. Vayssiére, one slide one specimen (BME); *Austrotachardiella rotundata* (Cockerell & Cockerell), from slide labeled "Type", Mexico, Jalisco, El Platanos, date not given, coll. not given, ex "Zicna", one slide one specimen (BME); *Austrotachardiella rubra* (Hempel), labeled as *Tachardia rubra*, Brazil, type material, Cachoeira, date not given, coll. Hempel, host not given, four slides six specimens (BME); *A. rubra* (Hempel), Brazil, date not given, coll. Hempel, received from Green, 1922, host not given, three slides six specimens (BME); *A. rubra*, Brazil, date not given, coll. A. Hempel, from E.E. Green,



Figs. 1–7. Morphological features used in taxonomic key. (1) Brachial plate of *Albotachardina sinensis*, arrow pointing to accessory projection (after Zhang 1992); (2) Deep invaginated crater of *Austrotachardia angulata*, arrows pointing to crater (after Chamberlin 1923); (3) Marginal duct cluster with two associated auxiliary clusters; (4) Simplex type marginal duct cluster (composed of spermatozoid ducts only); (5) Duplex type marginal duct cluster (composed of macroducts and spermatozoid ducts); (6) Triplex type marginal duct cluster (composed of macroducts, spermatozoid ducts and a narrow outer band of microducts); (7) Test of *Austrotachardiella trilobata* in side and dorsal view (after Mendes 1936).

four slides four specimens, slide-mounted from dry material by P.J. Gullan 2004 (BME). *Austrotachardiella sexcordata* Matile-Ferrero, Paratype ♀, Peru. Loreto, Jenaro Herrera, on *Myrciaria dubia* (IIAP plantation), 15.X.1991, coll. D. Matile-Ferrero & G. Couturier, one slide one specimen (MNHN); *A. sexcordata*, same data as paratype, slide-mounted from alcohol material No.11926, donated by Matile-Ferrero, six slides six specimens (BME).

**Revised Key to Genera of the Family Kerriidae
Lindinger Based on Adult Females**
(modified from Chamberlin 1923, 1925, Varshney 1984, and Zhang 1992)

- 1. With perivulvar pore clusters (Fig. 8) 2
- Without perivulvar pore clusters 6
- 2. With more than two pairs of perivulvar pores clusters, usually with 18-50 3
- With two pairs of perivulvar pore clusters 5
- 3. Antennae long, usually four or five segmented; *brachia long, brachial plate heavily sclerotized, with a distinct terminal constriction behind crater rim *Metatachardia* Chamberlin, 1925
- Antennae short, usually one or two segmented, rarely three or four segmented; brachia either long or short, brachial plate mildly or heavily sclerotized, and without a distinct terminal constriction behind crater rim 4
- 4. Canellar pores absent near mouthparts; brachial plates and supra-anal plate subequal in area *Kerria* (*Kerria*) Targioni Tozzetti, 1884
- Canellar pores present near mouthparts; brachial plates smaller than **supra-anal plate *Kerria* (*Chamberliniella*) Varshney, 1987
- 5. Marginal duct clusters simplex (Fig. 4) or duplex (Fig. 5);

- with 3–8 setae on last antennal segment *Tachardiella* Cockerell, 1923
- Marginal duct clusters triplex (Fig. 6); with two setae on last antennal segment *Austrotachardiella* Chamberlin, 1923
- 6. Brachial plates with an accessory projection (Fig. 1) *Albotachardina* Zhang, 1992
- Brachial plates without an accessory projection 7
- 7. Brachial plate with a deep invaginated crater (Fig. 2) *Austrotachardia* Chamberlin, 1923
- Brachial plates usually flat, occasionally with a shallow crater 8
- 8. Marginal duct clusters with two closely associated auxiliary clusters of small ducts (Fig. 3), although occasionally absent from one or two marginal duct clusters per specimen *Afrotachardia* Chamberlin, 1925
- Marginal duct clusters without auxiliary clusters 9
- 9. Anal ring divided into four distinct sections *Tachardina* Cockerell, 1901
- Anal ring entire *Paratachardina* Balachowsky, 1950

*Brachial length: the length of the tubular protrusion that bears the brachial plate.
 **Supra-anal plate: the anal tubercle is usually composed of two main parts: 1) the basal part is called the pre-anal plate, and can be either present or absent, when present it is either sclerotized or membranous; and 2) the tapering part is the supra-anal plate which is always sclerotized. The anal tubercle shown in Fig. 8G, is composed of both a sclerotized pre-anal plate and a supra-anal plate; the pre-anal plate is shown at the base and bears a pair of setae on each side of its ventral surface; the supra-anal plate is the portion containing

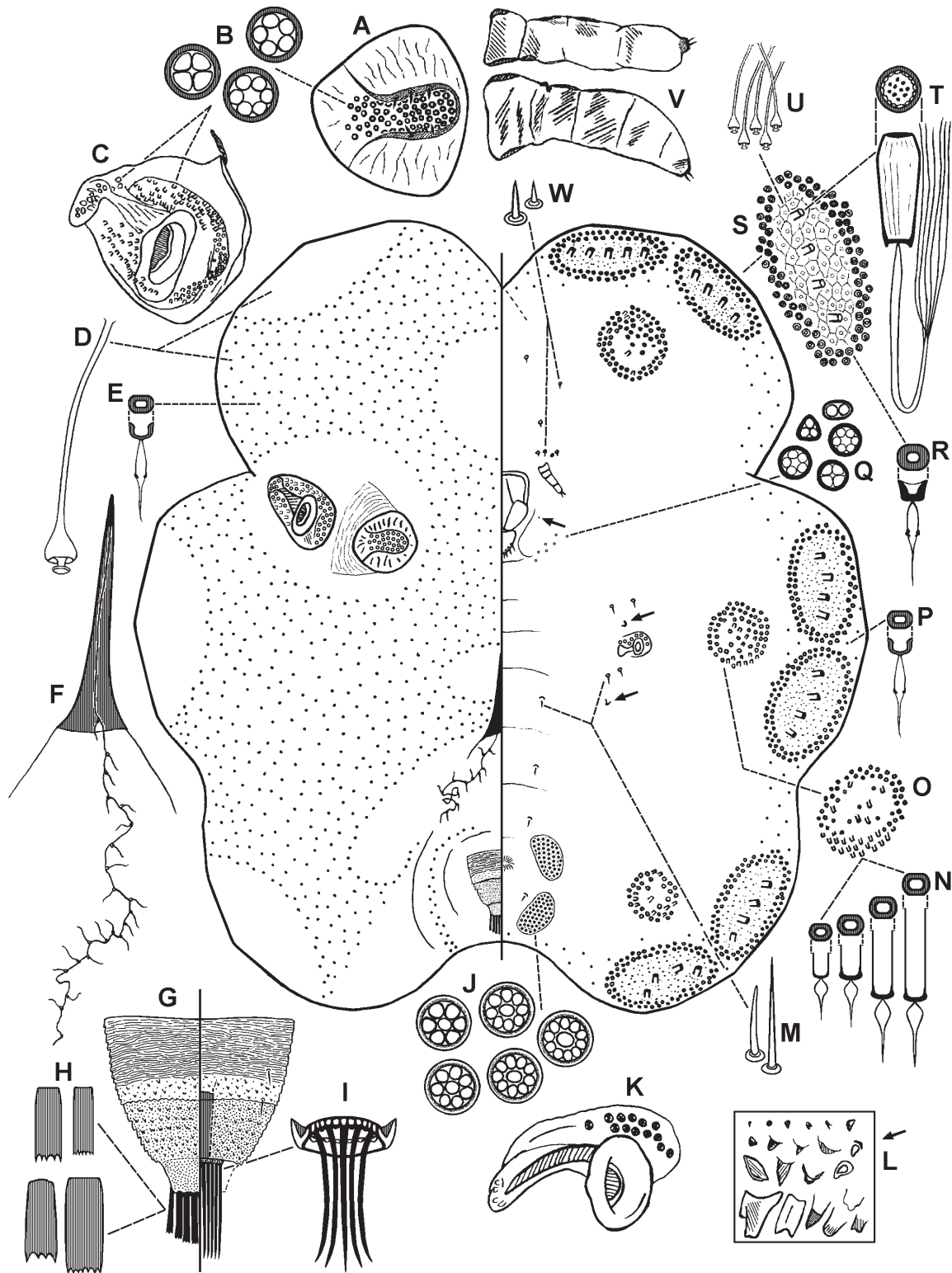


Fig. 8. *Austrotachardiella colombiana* sp. n., adult female. (A) Brachial plate; (B) Brachial and spiracular disc pores; (C) Anterior spiracle; (D) Dorsal spermatozoid duct; (E) Dorsal microduct; (F) Dorsal spine; (G) Anal tubercle; (H) Part of Anal fringe; (I) Anal ring; (J) Perivulvar pores; (K) Posterior spiracle; (L) Range of variation in leg remnants; (M) Long ventral setae; (N) Microducts on ventral duct cluster; (O) Ventral duct cluster; (P) Ventral microduct; (Q) Canellar pores; (R) Microduct on marginal pore cluster; (S) Marginal pore cluster; (T) Ventral macroduct; (U) Ventral spermatozoid ducts; (V) Antennae; (W) Short ventral setae.

most of the anal tube, and the anal ring.

Austrotachardiella Chamberlin

Tachardiella (Austrotachardiella) Chamberlin, 1923: 174.
Austrotachardiella; Kapur, 1958: 29. Change of status

Type Species. *Tachardia rotundata* Cockerell & Cockerell, by original designation.

Generic Diagnosis (modified from Chamberlin 1923). Antennae well-developed, segmentation poorly developed, four to six segmented, with two setae on apex of apical segment. Canella either well-developed or restricted to a small group of small canellar pores around mouthparts; canellar pores often only detectable in good quality specimens and at high magnification. Legs present or absent, when present, reduced to small sclerotic peg-like claws. Marginal duct clusters of triplex type (composed of macroducts, spermatozoid ducts and a narrow outer band of microducts), either entire or subdivided into two parts. Ventral duct clusters in three pairs. Perivulvar pore clusters always present and four in number. Brachial tube either short or long. Brachial plate sclerotized, with a shallow crater. Dorsal spine well-developed. Anal ring entire, with 10 setae. Anal fringe consisting of flat serrated or undulated plates; apex of plates almost reaching apex of anal ring setae.

Revised Key to Species of *Austrotachardiella* Chamberlin Based on Adult Females

- 1. Marginal duct clusters not paired (6 in total), never with a deep constriction subdividing clusters.....2
- Marginal duct clusters paired or almost paired (12 in total), completely separated or with at most a narrow isthmus of microducts connecting each cluster of a pair 4
- 2. Posterior marginal pore cluster with two macroducts *cydoniae* (Hempel)
- Posterior marginal pore cluster with 3–5 macroducts 3
- 3. Canellae well-developed, composed of 50–60 pores, each pore about the size of a spiracular pore, extending in a line from area mesad to anterior spiracles towards area near mouthparts *rubra* (Hempel)
- Canellae poorly developed, composed of a linear group of 5–10 pores, each pore much smaller than spiracular pores, present on each side of mouthparts *nigra* (Townsend & Cockerell)
- 4. Test of live insect with three elevated lobes on mid-dorsum (Fig. 7) *trilobata* (Mendes)
- Test of live insect with none or one elevated lobe on mid-dorsum 5
- 5. Always some marginal duct clusters with two macroducts, occasionally a few clusters may have more than three macroducts per cluster *rotundata* (Cockerell & Cockerell)
- Marginal duct clusters never with two macroducts, each with three or more macroducts 6
- 6. Number of microducts on anterior ventral duct clusters 35–70 (mostly <60) 7

- Number of microducts on anterior ventral duct clusters 75–150 (mostly >80) 8
- 7. Marginal duct clusters each with three or four (mostly 3) macroducts, test crimson red..... *gemmifera* (Cockerell)
- Marginal duct clusters each with four or five macroducts; test orange-red to faintly orange-ruby *bodkini* (Newstead)
- 8. Each anterior marginal duct cluster with 50–70 microducts; most marginal duct clusters with three or four (rarely specimens with marginal duct clusters with 4 or 5) macroducts; test of sticky texture *sexcordata* Matile-Ferrero
- Each anterior marginal duct cluster with 80–115 microducts; marginal duct clusters always with four or five macroducts; test of hard texture *colombiana* sp. n.

***Austrotachardiella colombiana* sp. n.**
 (Figs. 8 and 9)

Diagnosis. *A. colombiana* is characterized by the following combination of characters. Adult females orange to red brown in color, found either singly or in large numbers; resin of test often fused; tests covering infested twigs and branches of host.

Slide-Mounted Adult Female. Microducts in ventral duct clusters numerous (42–146), especially on anterior clusters (80–146); marginal pore clusters well defined, with four or five macroducts; canella short, with minute canellar pores present on both sides of mouthparts.

Adult female (Figs. 8 and 9)

Unmounted Material. Lac test orange to red brown, with six marginal lobes, each lobe tapering to a point or bifurcating, although almost completely fused in some specimens; with a small resinous horn on mid-dorsum, horn lighter in color in darker specimens. Dimensions of adult female test: 2.1–5.6 mm long, 1.8–4.3 mm wide, 0.8–2.8 mm tall. Lac texture very hard, glassy, shiny. A pair of long,

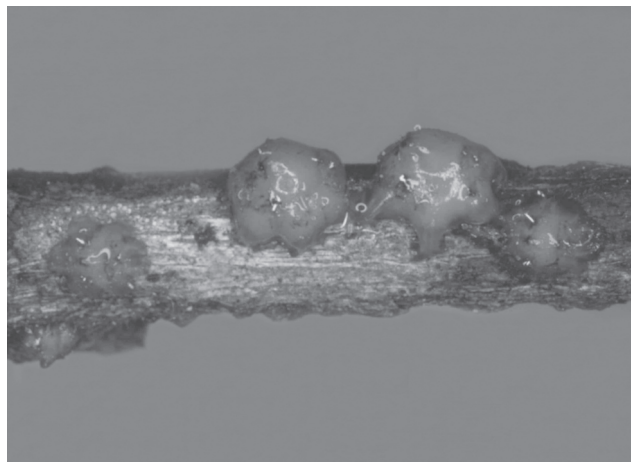


Fig. 9. Resinous tests of adult females of *Austrotachardiella colombiana* sp. n., on twig.

white, curly, filamentous waxy threads present on surface of each brachial plate (Fig. 9). Male tests often mixed with female tests, color similar to female, small, elongate, bilobed at both ends, one end broader than other, often with an open exit hole on broader end. Dimensions of male test: 1.8–2.1 mm long, 0.8–1.0 mm wide, 0.4–0.6 mm tall.

Mounted Adult Female. Insects oval to elongate oval, margin 6-lobed, with indentations between each lobe. Body 1.3–2.8 mm long, 1.1–2.4 mm wide (Fig. 8) (n = 15).

Dorsum. Derm membranous. Dorsal setae and macroducts absent. Microducts (Fig. 8E) numerous, but absent from around brachial plates and anterior spiracles, from a semicircular area on each lobe, anal tubercle, dorsal spine, and from a circular area on head region; diameter of duct rim 3–4 μm . Spermatozoid ducts (Fig. 8D) scattered throughout dorsum (distribution not illustrated), less abundant on areas devoid of microducts. Brachia short, membranous, about same length or slightly longer than widest point of brachial plates; becoming slightly sclerotized at maturity. Brachial plates (Fig. 8A) each 115–145 μm long, 120–148 μm wide; brachial crater U-shaped, with three setae on anterior margin and two setae on posterior margin, not easy to detect. Brachial pores (Fig. 8B) with 4–6 (mostly 5) loculi, each 3–5 μm wide. Anterior spiracles (Fig. 8C) present on dorsum, large, surrounded by a sclerotized area bearing multilocular disc pores; width of anterior spiracular peritremes 90–105 μm ; spiracular disc pores of similar structure to brachial pores. Anal tubercle (Fig. 8G) tapering, highly sclerotized, finely sculptured; pre-anal plate slightly shorter than supra-anal plate, with one or two pairs of setae; no setae observed on supra-anal plates. Dorsal spine (Fig. 8F) well-developed, length 200–238 μm , width at base 60–75 μm ; dorsal spine duct of dendritic type. Anal fringe entire, each anal fringe plate (Fig. 8H) serrated or undulated, 24–48 μm long. Anal ring (Fig. 8I) entire, with 10 setae, tip of setae surpassing anal fringe. Eyespots absent.

Venter. Derm membranous. Antennae (Fig. 8V) 70–105 μm long, segmentation poorly defined, four or five segmented, with a pair of setae at apex of terminal segment. Clypeolabral shield 143–175 μm long, 105–130 μm wide. Labium apparently one segmented, 48–78 μm long, 53–70 μm wide; with four pairs of setae. Legs (Fig. 8L) reduced to a remnant claw (arrowed on Fig. 8), each claw 2–40 μm long, prothoracic claw remnant smallest, often absent, metathoracic claw remnant largest. Canellae small, present in a linear group on each side of mouthparts; canellar pores (Fig. 8Q) small, each 2.5–4.0 μm wide, each with 2–6 loculi. Ventral setae slender, those on head region shortest (Fig. 8W), 2–3 μm long, those on mid-venter and near spiracles longest (Fig. 8M), 10–18 μm long, setae absent elsewhere. Posterior spiracles (Fig. 8K) much smaller than anterior spiracles, spiracular peritreme 37–43 μm wide; spiracular disc pores present within a spiracular pocket anterior to each spiracle, pores similar to those on anterior peritreme. Marginal duct clusters (Fig. 8S) distinct, elongate oval, composed of a cellular membrane surrounded by a rim of microducts; two pairs present on margins of each marginal lobe; each marginal duct cluster with four or five ventral macroducts (Fig. 8T), rim of macroducts 6–8 μm wide; microducts on marginal

duct clusters (Fig. 8R), variable in size, each 3.5–6.0 μm wide. Spermatozoid ducts similar in size and shape to those on dorsum, present around body margin, numerous on marginal duct clusters (Fig. 8U), absent from mid ventral area (distribution not illustrated). Ventral duct clusters (Fig. 8O) subcircular, present mesad to area between each pair of marginal duct clusters; anterior clusters each with 80–146 microducts, median clusters each with 70–120 microducts, posterior clusters with 42–78 microducts; microducts on ventral duct clusters (Fig. 8N) of various sizes, each rim 3.0–6.0 μm wide. Microducts outside ventral and marginal duct clusters (Fig. 8P) smallest, each 3.0–4.0 μm wide, present around body margin. Rest of ventral derm completely devoid of microducts. Perivulvar pore clusters: two pairs present around vulva, diameter of each pore cluster at widest point about same as diameter of closest ventral duct cluster, each perivulvar pore cluster with 120–250 pores, each pore with 6–11 (mostly 10) loculi (Fig. 8J) and 5–7 μm wide.

Morphological Variation. Most morphological characters appear to be stable and with little variation. However, in one specimen, the dorsal spine is only half the size (dorsal spine length: 105 μm , width at base: 25 μm) of the dorsal spine of remaining material.

Etymology. The species is named after its country of origin: Colombia.

HOLOTYPE (USNM). Adult female, Colombia, Cauca, Santander de Quilichao, 1360 m asl, 15.vii.2003, coll. Aicardo Delgado, ex on stems of *Psidium guajava*, locally known as “guayaba pera”. **PARATYPES.** Same data as Holotype, Adult females: five (BME); three (BMNH); three (UNCB); five (USNM). Males: one adult + one molting stage (pupa–adult) (BME). One small box with dry material deposited in BME.

Discussion

A. colombiana is most similar in morphology to *A. sexcordata*. However, in addition to the characters given in the taxonomic key, *A. colombiana* can be separated from *A. sexcordata* by the following: (i) brachial plates about 5 μm wider in *A. colombiana*, (ii) pre-anal plate well-developed (poorly developed in *A. sexcordata*), and (iii) a sclerotized fold/bar often present between paired marginal duct clusters in *A. sexcordata* (absent in *A. colombiana*). It should be mentioned, that *A. sexcordata* is the only species of *Austrotachardiella* that has a sticky test (Matile-Ferrero & Couturier 1993; D. Matile-Ferrero, pers. comm.), whereas all other species in the genus have a test of hard texture.

The canellae in *A. colombiana* are greatly reduced, and are composed of a small group of small multilocular disc pores with 2–6 loculi. Chamberlin (1923) describes *A. bodkini*, *A. gemmifera* and *A. rotundata* as having completely, or absolutely no canellae. However, these three species do have the same type of reduced canellae as *A. colombiana*. The canellae in these species are composed of a small linear group of 3–14 multilocular disc pores (each with 2–7 loculi), which are usually

much smaller than the spiracular disc pores on the brachial plates and spiracles. The canellae in these species are located laterad to the mouthparts, or in an area mid-way between the mouthparts and the anterior spiracles. Because of their small size, the canellar pores in these species may be confused with microducts, with their loculi usually being only visible in good quality specimens and at high magnification. A well-developed canella is composed of a band of multilocular disc pores that extends from the area laterad to the anterior spiracles and ends laterad to the mouthparts, usually near the labium. *Austrotachardiella rubra* has an intermediate distribution of canellar pores. Chamberlin (1923) described *A. rubra* as having a canella composed of a "straggling irregular band or line" of about 60 star (quinquelocular) pores. In *A. rubra* there are numerous pores near the anterior spiracles with the area mid-way between the spiracles and the mouthparts being devoid of pores, and with several (4–8) pores near the mouthparts. In *A. bodkini*, *A. colombiana*, *A. gemmifera* and *A. rotundata*, the canellar pores closer to the spiracles are completely absent, and only those near the mouthparts are present.

Acknowledgments

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