ZooKeys 3: 11-21 (2008)
doi: 10.3897/zookeys.3.21
www.pensoftonline.net/zookeys

RESEARCH ARTICLE

A peer-reviewed open-access journal
ZooKeys
Launched to accelerate biodiversity research

Redescription of *Inglisia vitrea* Cockerell (Hemiptera, Coccidae) and its transfer to the genus *Pseudokermes* Cockerell

Takumasa Kondo[1], Nate Hardy[2]

1 *Corpoica, Centro de Investigación Palmira, Valle, Colombia* **2** *Department of Entomology, University of California, Davis, U.S.A.*

Corresponding author: *Takumasa Kondo* (takumasa.kondo@gmail.com)

Academic editor: *Michael Wilson* | Received 19 August 2008 | Accepted 7 September 2008 | Published 16 September 2008

Citation: Kondo T, Hardy N (2008) Redescription of *Inglisia vitrea* Cockerell (Hemiptera, Coccidae) and its transfer to the genus *Pseudokermes* Cockerell. ZooKeys 3: 11-21. doi: 10.3897/zookeys.3.21

Abstract

The soft scale insect *Inglisia vitrea* Cockerell is transferred to the genus *Pseudokermes* as *P. vitreus* (Cockerell) **comb. nov.** The adult female is redescribed and illustrated. A lectotype is designated based on newly slide-mounted dry type material. New host-plant records and an updated geographical distribution for *P. vitreus* are given. *Pseudokermes correntinus* Granara de Willink is recognized as **syn. nov.** of *I. vitrea*.

Keywords

Coccoidea, Cardiococcinae, Cardiococcini, soft scale, new combination, new synonym

Introduction

The coccid genus *Inglisia* Maskell was originally erected for a New Zealand species, *I. patella* Maskell. As discussed by Morrison and Morrison (1922), Hodgson (1994) and Hodgson and Henderson (2000), very few if any of the species currently included in the genus *Inglisia* are likely to be congeneric. Indeed, many changes have been made in the taxonomy of this genus in recent years. Prior to 1993, there were nineteen species included in *Inglisia* (Ben-Dov 1993). Hodgson (1994) erected the genus *Vitrococcus* to accommodate *I. conchiniformis* Newstead as *V. conchiniformis* (Newstead). Ben-Dov et al. (1997) transferred *I. foraminifer major* Maskell to the genus *Cardiococcus* Cockerell as *C. major* (Maskell). Later Hodgson and Henderson (2000) distributed many New Zealand species previously included in *Inglisia* into two genera, transferring *I. fagi* Maskell, *I. leptospermi* Maskell and *I. ornata* to their newly erected genus *Crystal-*

lotesta as *C. fagi* (Maskell), *C. leptospermi* (Maskell) and *C. ornata* (Maskell), respectively, and transferred *I. inconspicua* Maskell to their newly erected genus *Aphenochiton* as *A. inconspicuus* (Maskell). Ben-Dov (1993) treated *Cryptinglisia zizyphi* (Brain) and *C. elytropappi* (Brain) as *I. zizyphi* [misspelled in Ben-Dov (1993) as *I. zizyphy*] and *I. elytropappi*. Hodgson (1994), in his identification manual to genera of Coccidae, followed De Lotto's (1978) recombination in his discussion of the genus *Cryptinglisia*, and the two species are currently treated as *C. zizyphi* and *C. elytropappi* respectively by the scale insect database, ScaleNet (Ben-Dov et al. 2006).

Currently, the genus *Inglisia* includes nine species (Ben-Dov et al. 2006): (1) *I. australis* Hempel, from Brazil, (2) *I. chelonioides* Green, from India, Sri Lanka, and China, (3) *I. grevilleae* Hall, from Zimbawe, (4) *I. malvacearum* Cockerell, from Mexico and Texas, U.S.A., (5) *I. patella* Maskell, from New Zealand, (6) *I. pluvialis* Hodgson, from Zimbabwe, (7) *I. speciosa* Takahashi, from Indonesia, (8) *I. theobromae* Newstead, from Cameroon, Uganda and Zambia, and (9) *I. vitrea* Cockerell, from Brazil, Cuba, Puerto Rico and Vieques Island, U.S.A. (Florida), and Trinidad and Tobago. Although not listed by Ben-Dov et al. (2006), *I. vitrea* has also been recorded from Colombia (Kondo 2001), and from Jamaica (Cockerell 1895a). Cockerell's (1894) original description of *I. vitrea* had no accompanying illustrations and his description of the adult female emphasized external features of the glassy test. The species was redescribed by Hamon and Williams (1984) based on both the live appearance and on cuticular morphology of slide-mounted specimens of non-type material.

The genus *Pseudokermes* Cockerell has a New World distribution. According to the scale insect database, ScaleNet (Ben-Dov et al. 2006), there are currently 8 included species: one Nearctic species plus 7 Neotropical species. These species are: *P. armatus* (Cockerell) from Mexico [Nearctic region], *P. correntinus* Granara de Willink, *P. eugenium* Granara de Willink, *P. geoffroeum* Granara de Willink, from Argentina, *P. marginatus* Newstead, from Guyana, *P. nitens* (Cockerell) from Argentina and Brazil, and *P. palmae* Hempel from Brazil.

Both *Inglisia* and *Pseudokermes* belong to the tribe Cardiococcini (Coccidae: Cardiococcinae) (Hodgson 1994). *Inglisia patella*, the type species of *Inglisia* differs from *P. nitens*, the type species of *Pseudokermes*, mainly by the following combination of features (features of *P. nitens* in parentheses): (1) Legs developed, with most segments present, although the tibia and tarsus are fused (legs reduced to small areas of sclerotization, occasionally with a claw with small digitules); (2) cribriform-like plates present on dorsum, at level of metathoracic legs (cribriform-like plates absent); (3) marginal setae of two types which alternate around margin: (i) a club-shape spine, blunt apically and narrowing abruptly at base, and (ii) a sharply spinose seta (marginal setae all spinose); (4) stigmatic spines not differentiated from marginal spines (with one large stigmatic spine, tapering to a blunt point or with a slightly flattened apex); and (5) dorsum without bi- or trilocular pores (bi- or trilocular pores frequent along mid-dorsal line and in a narrow band just dorsad to marginal spines) (character states taken from Hodgson 1994). *Inglisia vitrea* does not share any of the five characteristics listed above for *I. patella* but, on the other hand, it does share all the features listed for *P. nitens*. Clearly,

Inglisia vitrea is not congeneric with *I. patella* and would appear to be congeneric with *Pseudokermes nitens* Cockerell. Based on these morphological affinities of *I. vitrea* with *P. nitens*, we here transfer *I. vitrea* to *Pseudokermes*, as *P. vitreus* (Cockerell) comb. nov. and redescribe the species based on type and non-type material. We include additional features that were not described previously, e.g., distribution of dorsal microducts and simple pores, and the presence of vestigial legs represented by a pair of very short setae. We illustrate the adult female, designate a lectotype, and provide new host-plant and distribution data. In addition, we determine that *Pseudokermes correntinus* Granara de Willink, described from Argentina (Granara de Willink 1999), is morphologically indistinguishable from *P. vitreus* and thus it is here synonymized with the latter.

Materials and methods

Specimens were slide-mounted using the method described by Williams and Granara de Willink (1992), except that xylene was used instead of clove oil. Photographs of the dry type specimens and original labels (Figs 1A and B) were taken with a Nikon COOLPIX 3100 digital camera; Fig. 1C was taken with an Olympus OM4 camera, and were processed using the computer program Adobe Photoshop® 5.0. Afterwards, most of the dry type specimens were slide-mounted by T. Kondo. The illustration of the adult female (Fig. 2) shows the dorsum on the left and the venter on the right. The redescription of *I. vitrea* [now *P. vitreus*] is based on measurements and observations on the type material and other specimens, as listed. The terms for external morphology is taken from Cockerell's (1894) original description of the species, with some additional observations. Only specimens of *P. vitreus* were available in the present study, and material of other species of *Inglisia* and *Pseudokermes* were not seen, and so comparisons to other species mentioned in this manuscript were made using published literature.

Measurements of the lectotype are given in parentheses. The material studied is deposited at the Auburn University Coccoidea Collection, Auburn, Alabama, U.S.A. (AUCC); the National Museum of Natural History Entomological Collection, Washington, DC., U.S.A., Coccoidea collection held at USDA, Beltsville, Maryland (USNM); and the Bohart Museum of Entomology, University of California, Davis, U.S.A. (BME).

Results and discussion

Inglisia vitrea Cockerell, 1894: 308.
Pseudokermes correntinus Granara de Willink, 1999: 137. **Syn. nov.**

Common names.
English: Glassy scale (Hamon and Williams 1984). Proposed Spanish common name: Escama blanda vidriosa.

Type material studied. The type material consisted of one slide of 2 third-instar nymphs, one uncleared, with label "6409 / Inglisia / vitrea Ckll. / Acacia sp. / Port of Spain, / Trinidad / F.W. Urich #16 / TYPE", plus dry syntype coccids on two small pieces of twig, housed in a small cardboard box with two original labels inside, as follows: "Ckll. Coccidae 25. TYPE / Inglisia vitrea, Ckll / on Acacia sp. Port of Spain, Trinidad / Coll. F.W. Urich. (no. 16)" and "6049 / on / Acacia / Port of Spain / Trinidad / W.I.". These data exactly match those given in Cockerell's (1894) original description. In order to preserve stability and the nomenclatural status of this species, a lectotype is here designated from the syntypes. The examined type material is as follows: Adult female, lectotype of *Inglisia vitrea* Cockerell; paralectotypes: 4 adult females on 4 slides, 3 third-instar nymphs on 2 slides, 1 second-instar nymph on 1 slide, plus several dry specimens still in box (USNM).

Other material studied. Neotropical Region: Barbados: 10.VIII.1985, coll. K. Eng, JKF 100284, 88-04128, ex *Annona* sp. leaf, 1 slide, 4 specimens (USNM). **Brazil:** 9.VIII.1962, coll. Kunishi and Hidalgo, ex leaves of Thymelaeaceae, JFKIA, 66-495, 1 slide, 2 specimens (USNM); Sao Paulo, received 7.VI.1945, coll. H. L. Parker, 1003-61, 1 slide, 1 specimen (USNM); Sao Paulo, IX.1998, coll. T. Kondo, ex leaf of Araliaceae, 1 slide, 1 specimen (AUCC). **Colombia:** Valle del Cauca, Cali, Unicentro, 03°20'50"N, 76°34'15"W, 975 mts asl, 22.XII.2005, coll. Takumasa Kondo, ex *Pithecellobium dulce* (Roxb.) Benth. (Fabaceae), 1 slide, 1 specimen, No. TK0188 (BME). **Costa Rica:** 13.VIII.1981, coll. K. Niedzwiadek, ex orchid leaf, Miami quarantine intercept, 28981, 1 slide, 1 specimen (USNM). **Dominican Republic:** San Juan, 25.I.1974, coll. F. Rodriguez, ex leaf of undetermined tree, 5187, 1 slide, 1 specimen (USNM). **Jamaica:** Ocho Rios, 5.IX.2003, coll. Takumasa Kondo, ex undetermined tree, 1 slide, 1 specimen, No. TK0057 (BME). **U.S.A.:** Florida, Naples, 15.II.1972, coll. W. A. Padgett, ex *Calliandra* sp., 1 slide, 1 specimen (USNM). **Venezuela:** Las Delicias, Edo. Araqua, 13.X.1943, coll. Sr C. H. Ballou, Q. Vivas B, ex *Cajanus indicus*, BFQ, 1 slide, 4 specimens (USNM).

Description. Adult female (measurements based on n=21).

Unmounted material (Fig. 1). Cockerell (1894) wrote of the adult female in life: "On *Acacia* sp., Port-of-Spain (Urich). 3 mm. long, 1½ wide, oval, moderately convex. Glassy scale white, with a conspicuous median longitudinal ridge; posterior cleft large,

Fig. 1. A. Dry insects and twigs with original labels; B. Close-up of one dry adult female showing half of glassy covering removed; C. *I. vitrea* on leaf of greenhouse plant (Araliaceae), Brazil. (A and B: Type material of *I. vitrea* Cockerell, housed in USNM; photos by T. Kondo).

about one-third total length of scale. Surface of scale strongly but finely striate radiately on sides; the apparent striations, highly magnified, resolve themselves into rows of small dots (air cells?). The dorsal portion of this scale is divided into testudinoid plates; there are apparently six series of such plates, three along each side, but the two middle series are the sides of a single median row, divided only by the keel or ridge. Beyond these the broad margin is not divided into plates. The plates are concentrically striate, with a granular patch in the middle of each. The median row of plates consists of two large dorsal ones, and two smaller posterior ones. The second row consists of three plates on each side, and the third row of seven on each side. Margin with a fringe of rods at rather distant intervals. The subtransparent scale removed leaves the insect shiny red-brown, looking like a *Lecanium*. Derm with large gland pits near the margin; margin with simple spines, varying in size." The insects are commonly flat and almost round when infesting the leaves [Fig. 1C; see also round-shaped specimen (rshs), upper right of Fig. 2, small inset drawing after Hamon and Williams (1984)], but are more convex and generally longer than broad when infesting twigs (pers. obs.).

Slide-mounted material. Body 1.72-4.70 mm long, 1.28-4.84 mm wide. Lectotype damaged, 2.04 mm long, approximately 1.30 mm wide. **Note.** The lectotype and adult female paralectotypes are much smaller than the rest of the adult specimens studied (except for the Florida specimen) because the types (and the Florida specimen) are young adult females.

Dorsum. Derm membranous, becoming entirely sclerotized on older adult females. Dorsal setae completely absent. Dorsal microducts (dmic) oval, bilocular, each about 5 µm wide, with a long terminal filament; present marginally, along inner margins of anal lobes and longitudinally in a mid-dorsal line; absent elsewhere. Simple pores (sp) each 2 µm wide, closely associated with dorsal microducts and showing a similar distribution; outline of simple pores and dorsal microducts on mid-dorsal line, especially anterior to anal plates, becoming sclerotized and thus resembling preopercular pores. Dorsal tubular ducts, preopercular pores, dorsal tubercles and pocket-like sclerotizations absent. Anal plates (aplt) together quadrate, with smooth rounded outer angles, plates located at about 1/4 to 1/3 of body length from posterior margin, each plate 133-160 (155) µm long, 70-95 (90) µm wide, anterolateral margin 93-113 (113) µm long, posterolateral margin 90-113 (110) µm long, with 6-10 setae on dorsal surface, plus 1 pair of fringe setae anteriorly and about 3 ventral subapical setae; hypopygial setae not detected. Anal ring (ar) with 6 setae. A narrow sclerotic area present around anal plates, in a narrow mid-dorsal line beginning on area anterior to anal plates and extending anteriorly to level of mouthparts along mid-dorsal line of microducts; on more mature specimens, sclerotizated area on mid-dorsum may be broader but generally confined to mid-dorsal areas (as illustrated in Hamon and Williams, 1984), and in older specimens the whole dorsum may become sclerotized.

Margin. Marginal setae (mset) sharply spinose, straight, each 20-60 µm long, arranged in a single row, with 8-12 (11) on each side between anterior and posterior stigmatic areas. Stigmatic clefts very shallow or absent, each with 1 stigmatic spine (stgsp) per stigmatic area, each sharply spinose and 68-90 µm long. Eyes not detected.

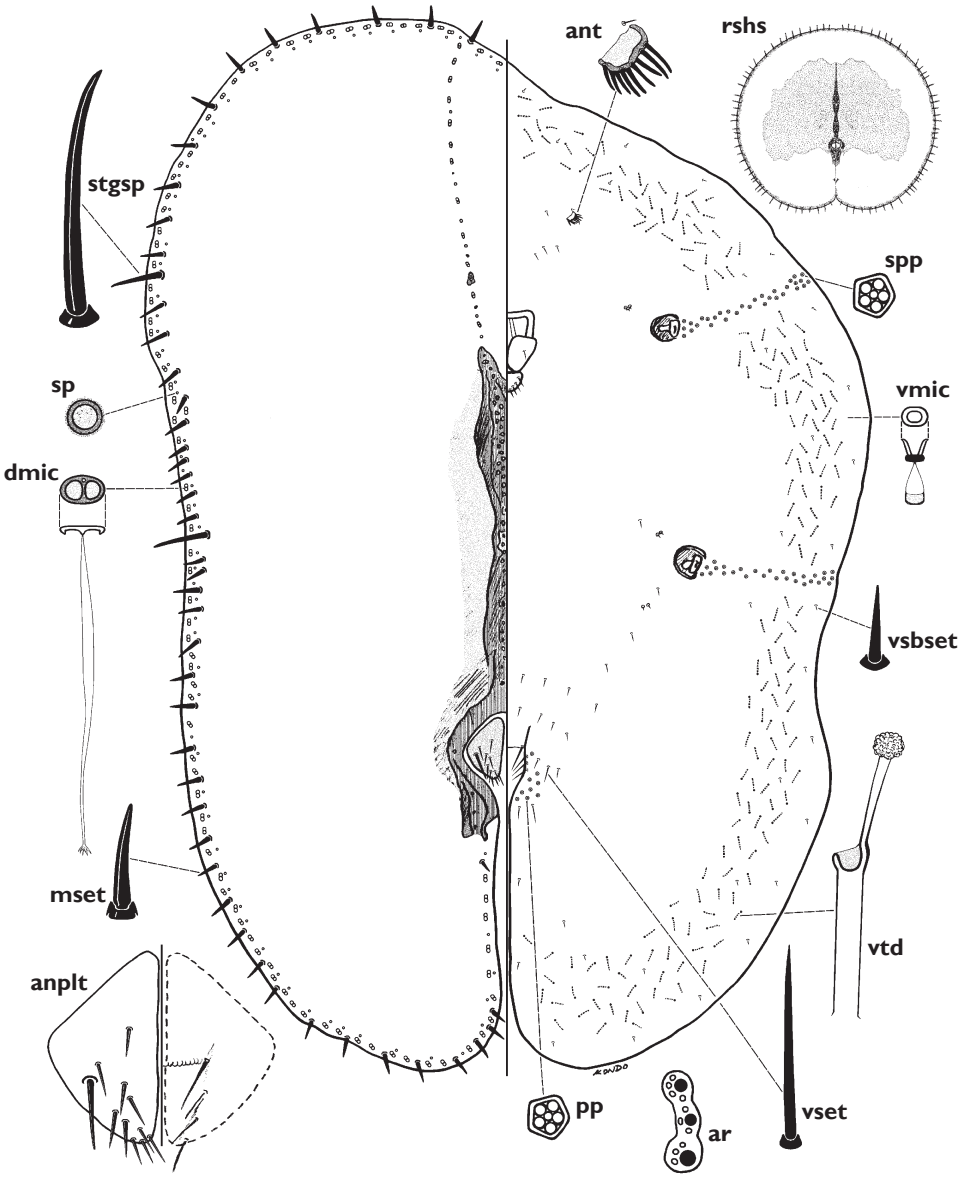

Fig. 2. *Pseudokermes vitreus* (Cockerell), adult female. Abbreviations of enlargements: anplt = anal plate; ant = antenna; ar = anal ring; dmic = dorsal microduct; mset = marginal setae; rshs = round-shaped specimen; sp = simple pore; pp = perivulvar pore; spp = spiracular pore; stgsp = stigmatic spine; vmic = ventral microduct; vset = ventral setae; vsbset = ventral submarginal setae; vtd = ventral tubular duct.

Venter. Derm entirely membranous. Perivulvar pores (pp) each 3-5 µm wide, with 5 loculi, restricted to a small area on either side of anal opening. Spiracular pores (spp) each 3-5 (4) µm wide, with 5 loculi, present in a narrow band as wide as peritreme (about 1 or 3 pores wide), extending laterally from each spiracle to body margin. Ventral microducts (vmic) scarce, scattered evenly throughout, each about 2 µm wide. Ventral tubular ducts present submarginally around body, absent elsewhere; each tubular duct with a terminal filament ending in a small flower-shaped gland. Ventral setae slender, scarce, straight or slightly bent, each 5-35 µm long, longest setae present just anterior of the vulva. Spiracles rather small, anterior spiracular peritremes each 28-43 (40) µm wide, posterior peritremes each 30-45 (45) µm wide, with a conspicuous sclerotization around each spiracle. Legs vestigial, represented by a pair of short setae, each seta about 3 µm long, hard to detect. Antennae (ant) very small, each 8-15 (13) µm long, 1 segmented, with about 9 setae. With about 6 interantennal setae, each interantennal setae 7-10 µm long. Mouthparts relatively small, clypeolabral shield 100-120 (120) µm wide; labium 1 segmented, with 4 pairs of labial setae.

Diagnosis. The adult female of *P. vitreus* can be diagnosed by the combination of the following features: (1) insect in life covered in a glassy wax cover; (2) mid-dorsal line becoming sclerotized, often with margins also becoming sclerotized; (3) dorsal setae completely absent; (4) dorsal tubercles and dorsal tubular ducts absent; (5) stigmatic setae sharply spinose, one per stigmatic cleft; (6) antennae greatly reduced, one segmented; (7) legs vestigial, represented by a pair of very short setae; (8) ventral tubular ducts in a submarginal band, absent elsewhere; (9) spiracular pores in a narrow band, present in a line from each stigmatic margin towards each spiracular peritreme; and (10) perivulvar pores present in a small group around vulva.

Morphological variation. The specimens from Costa Rica and Florida had longer marginal setae (around 55 µm on specimens from those locations versus approximately 30 µm on specimens from elsewhere). Compared to the type material, in the specimens from Barbados, Brazil, and the Dominican Republic, the spiracular pore band becomes broader near the margin. This is, no doubt, in part due to the large size of the latter specimens. On the lectotype, a tight band of ca. 30 spiracular pores extends from each spiracle to the body margin. The Florida specimen has ca. 15 spiracular pores in a band from spiracle to margin. The margins of the insect are often as sclerotic as its midline. According to Dr Chris Hodgson (pers. comm.), specimens found on the leaves are often wider than long; older specimens can be entirely sclerotized dorsally, and often have a wide submarginal band of quite large areolations. Specimens found on twigs, including, the type material, are generally longer than wide (pers. obs.).

Biology. The insects can be found on twigs and on leaves, with specimens on twigs being often associated with tending ants (T. Kondo, personal observation). Cockerell (1894) reported a specimen infested by a hymenopterous parasite.

Distribution [adapted from Ben-Dov et al. 2006; new host records indicated by an asterisk, see material studied or notes within parentheses "( )"].*Argentina (as *P. correntinus* in Granara de Willink 1999), *Barbados, *Costa Rica, Brazil, Colombia, Cuba,

Dominican Republic, *Jamaica, Panama, Puerto Rico, Trinidad, U.S.A. (Florida) and *Venezuela. Also known from the Galapagos Islands (C. Hodgson, pers. comm.).

Host plants [adapted from Ben-Dov et al. 2006; new host records indicated by double asterisk, see material studied or notes within parentheses "( )"]. **Annonaceae:** ***Annona* sp., *Rollinia mucosa*; **Lauraceae:** *Laurus nobilis*, *Persea borbonia*; **Fabaceae:** *Acacia* sp., ***Cajanus indicus*, *Calliandra* sp., ***Pithecellobium dulce*; **Myricaceae:** *Myrica cerifera*; ****Orchidaceae;* ****Thymelaeaceae; Vitaceae:** *Vitis vinifera* (for *P. correntinus* in Granara de Willink 1999). In the Galapagos Islands, the insect has been collected on *Annona cherimola* (Annonaceae), and on *Inga* sp. (Fabaceae) (C. Hodgson, personal communication).

Taxonomic notes. The specific epithet "*vitrea*" is amended to "*vitreus*" in order to match the gender of the genus "*Pseudokermes*".

In the descriptions of *Pseudokermes* spp. by Hodgson (1994) and Granara de Willink (1999), all species are described as having preopercular pores. In younger specimens of *P. vitreus*, the area anterior to the anal plates clearly shows no preopercular pores, but instead there is a mid-dorsal line of bilocular microducts associated with simple pores in the same way that they are present around the body margin. In older specimens, a linear area anterior to the anal plates becomes sclerotized up to level dorsad to mouthparts, and at this point, the structure of the bilocular microducts and simple pores become unrecognizable. Thicker areolations are formed on this sclerotized area (Fig. 2), giving the dorsal microducts and simple pores the appearance of preopercular pores. It is possible that this may be the same situation observed in other species of *Pseudokermes*. However, this will only be confirmed by observing teneral adult females, and further studies are needed to test whether this may be the case in species of *Pseudokermes* in general.

Pseudokermes vitreus appears similar to *P. nitens* (as described by Hodgson 1994), but the two differ in the following features (character states of *P. nitens* in parentheses): (1) spiracular pores present in a line extending from stigmatic areas to spiracles (spiracular pores present in a small group around stigmatic area only and not extending towards spiracle); (2) ventral tubular ducts restricted to a submarginal band (ventral tubular ducts present in a submarginal band with a few present also around mouthparts); and (3) perivulvar pores restricted to a small group around vulva (perivulvar pores present around vulva with some pores also present posteriorly on submedial areas of posterior abdominal segments).

The morphological features of *P. correntinus* Granara de Willink are almost identical to those of *P. vitreus* and thus *P. correntinus* is considered here to be junior synonym. All measurements and morphological features of *P. correntinus* agree with the description of *P. vitreus*, including the distribution of the spiracular pores, absence of ventral tubular ducts around the mouthparts, number of setae in the anal plates, and the length of marginal and stigmatic setae. Granara de Willink (1999) considered the antennae of *P. correntinus* to be composed of two segments, however, she also counted two segments in *P. eugenium* [Hodgson's (1994) *P. nitens* according to Granara de Willink (1999)] for which species Hodgson (1994) only counted one antennal segment. Furthermore,

in *P. vitreus* there exists a single seta at the base of the one-segmented antennae and, in *P. correntinus,* Granara de Willink (1999) counted this seta as part of the first segment. The apparent difference in the number of antennal segments may be due to differences in interpretation. The legs in *P. vitreus* are vestigial, and represented by a pair of very short setae (each 3 µm long) and are not easy to detect. Indeed, Hamon and Williams (1984) in their redescription of the species considered the legs to be absent, but in their illustration showed a seta at the position of each leg.

Discussion

The type species of *Pseudokermes*, *P. nitens* was redescribed by Hodgson (1994) based on non-type material from Argentina and Brazil. Hodgson (1994) considered the material he studied to be conspecific with the type material and gave the following differences between his redescription and the original description of Cockerell (1895b): (1) Cockerell (1895b) considered that the antennae and legs in *P. nitens* were absent but they were present though minute, and (2) the length of the posterior margin of the anal plates was longer than that of the anterior margin in his redescription (*vice versa* in Cockerell's description). Hodgson (1994) also indicated that the material he studied from San Paulo, Brazil, differed from the original description in having more spiracular pores.

Granara de Willink (1999) described three new species from Argentina and considered that Hodgson's (1994) redescription of *P. nitens*, based on material collected in Misiones, Argentina, corresponded to her newly described species, *P. eugenium*. Granara de Willink (1999) did not examine the type material of *P. nitens* and based her decisions entirely on the original description by Cockerell (1985b) and a redescription of the species by Hempel (1900). Granara de Willink (1999) stated that, because Cockerell and Hempel had not mentioned the presence of differentiated stigmatic spines in their descriptions of *P. nitens* which are present on the species from Argentina, she assumed that *P. nitens* does not have differentiated stigmatic spines, and thus decided that none of the Argentinean species where conspecific with *P. nitens*. Granara de Willink (1999) also indicated that *P. nitens* does not occur in Argentina because all the material she studied from Argentina has reduced antennae, traces of legs and undifferentiated stigmatic setae (antennae and legs described as absent, and stigmatic spines not mentioned by either Cockerell (1895b) or Hempel (1900)). Microscopes in the early 1900's were not as powerful as those available at present, and on many occasions reduced morphological features were not observed by earlier coccidologists, including T. D. A. Cockerell. The legs in all species studied by Granara de Willink (1999) are greatly reduced and are represented by either a small sclerotization or a tiny claw with digitules. With the microscopes available in the late 1800's and early 1900's, it would have been very difficult to see such reduced features, which may have gone undetected. For example, Cockerell (1902) describes *Akermes colimae* Cockerell [now *Aztecalecanium colimae* (Cockerell)] as having no antennae and legs; however, a

recent redescription by Kondo and Williams (2004) of this species clearly shows a pair of reduced antennae and small legs with all their segments (coxa, trochanter, femur, tibia, tarsus and claw). Thus, it is critical to compare the type material of *P. nitens* and *P. eugenium* in order to determine if they are conspecific.

As a result of this study, the composition of the genus *Pseudokermes* is changed to include 8 species: *P. armatus*, *P cooleyi*, *P. eugenium*, *P. geoffroeum*, *P. marginatus*, *P. nitens*, *P. palmae* and *P. vitreus*. *Pseudokermes* may include more synonyms because of the lack of studies based on type material. Furthermore, it is doubtful whether all species currently included in *Pseudokermes* are congeneric with the type species of the genus, *P. nitens*, and further studies are needed in order to elucidate their relationships.

Acknowledgements

The authors thank Dr Douglass R. Miller for the loan of specimens. Thanks also to Dr Penny Gullan and Dr Chris Hodgson for reviewing this manuscript. Special thanks to Dr Lyubomir Penev for making possible the publication of this study. This work was supported in part by grant DEB-0118718 from the National Science Foundation (Partnerships in Enhancing Expertise in Taxonomy program) to Penny Gullan.

References

Ben-Dov Y (1993) A systematic catalogue of the soft scale insects of the world (Homoptera: Coccoidea: Coccidae) with data on geographical distribution, host plants, biology and economic importance. Flora & Fauna Handbook, No. 9. Sandhill Crane Press, Gainesville, 536 pp.

Ben-Dov Y, Hodgson CJ, Miller DR (1997) Changes and comments on the taxonomy and nomenclature of some taxa in the families Coccidae, Eriococcidae and Pseudococcidae (Homoptera: Coccoidea). Phytoparasitica 25: 199-206.

Ben-Dov Y, Miller DR, Gibson GAP (2006) ScaleNet: a database of the scale insects of the world. http://www.sel.barc.usda.gov/scalenet/scalenet.htm [accessed 18.VIII.2008]

Cockerell TDA (1894) Notes on some Trinidad Coccidae. Journal of the Trinidad Field Naturalists' Club 1: 306-310.

Cockerell TDA (1895a) Coccidae or scale insects. VII. Bulletin of the Botanical Department, Jamaica (Ser. 2) 2: 100-102.

Cockerell TDA (1895b) On the subglobular species of *Lecanium*. Canadian Entomologist 27: 201-204.

Cockerell TDA (1899) Rhynchota, Hemiptera - Homoptera. [Aleurodidae and Coccidae]. Biologia Centrali-Americana 2: 1-37.

Cockerell TDA (1902) A catalogue of the Coccidae of South America. Revista Chilena de Historia Natural 6: 250-257.

De Lotto G (1978) The soft scales (Homoptera: Coccidae) of South Africa, III. Journal of the Entomological Society of southern Africa 41: 135-147.

Granara de Willink MC (1999) Las cochinillas blandas de la República Argentina (Homoptera: Coccoidea: Coccidae). [Soft scale insects of Argentina (Homoptera: Coccoidea: Coccidae)]. Contributions on Entomology, International 3(1): 1-183.

Hamon AB, Williams ML (1984) The soft scale insects of Florida (Homoptera: Coccoidea: Coccidae). Arthropods of Florida and Neighboring Land Areas. Florida Department of Agriculture & Consumer Services, Division of Plant Industries, Gainesville. 194 pp.

Hempel A (1900) As coccidas Brasileiras. [Brazilian coccids.] Revista do Museu Paulista. São Paulo 4: 365-537.

Hodgson CJ (1969) Notes on Rhodesian Coccidae (Homoptera: Coccoidea): Part III. Arnoldia (Rhodesia) 4: 1-42.

Hodgson CJ (1994) The scale insect family Coccidae: an identification manual to genera. CAB International, Wallingford, Oxon, 639 pp.

Hodgson CJ, Henderson RC (2000) Coccidae (Insecta: Hemiptera: Coccoidea). Manaaki Whenua Press, Lincoln, Canterbury, 259 pp.

Kondo T (2001) Las cochinillas de Colombia (Hemiptera: Coccoidea). [The scale insects of Colombia (Hemiptera: Coccoidea]. Biota Colombiana 2: 31-48.

Kondo T, Williams ML (2004) 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 7: 5-9.

Maskell WM 1879 (1878) On some Coccidae in New Zealand. Transactions and Proceedings of the New Zealand Institute 11: 187-228.

Morrison H, Morrison ER (1922) A redescription of the type species of the genera of Coccidae based on species originally described by Maskell. Proceedings of the United States National Museum (Washington) 60: 1-120.

Williams DJ, Granara de Willink MC (1992) Mealybugs of Central and South America. CAB International, London, 635 pp.