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A new record of a mealybug species (Hemiptera: Coccoidea: Pseudococcidae) from Tristan da Cunha and a new description of the species

Abstract - The rhizoecine mealybug *Rhizoecus bolacis* Williams is here recorded from Tristan da Cunha, bringing the total number of scale insect species known from this archipelago to two! The adult female is redescribed and what is probably the 2nd-instar female is described. The generic placement of this species is discussed.

Riassunto - È segnalata la presenza dello pseudococcide *Rhizoecus bolacis* Williams per Tristan da Cunha, portando così il numero di cocciniglie note per l'arcipelago a due. Viene ridescritta la femmina adulta e descritto uno stadio giovanile, probabilmente corrispondente a una neanide femminile di 2ª età. La posizione generica della specie viene brevemente discussa.

Key words: hypogeal mealybugs, Rhizoecinae, *Rhizoecus bolacis*.

The Tristan da Cunha Archipelago comprises a group of small volcanic islands lying about 2800 km west of South Africa and about 3500 km from South America. The main island of Tristan da Cunha is only slightly less than 100 km^2 in area. Other islands in the group include Inaccessable Island and Nightingale Island, the nearest islands, and Gough Island, lying almost 400 km south of the main island. The whole territory is a Dependency of St Helena. Tristan da Cunha is one of the United Kingdom's Overseas Territories (see Jones, 2006 for insects). It is represented in the UK by the Governor of St Helena and the islands have an Administrator to represent the Governor. The main Island ofTristan da Cunha has a population of fewer than 300 people and is regarded as the remotest populated island in the world. Agriculture is controlled by the Agriculture and Resources Department on the island

The only previously known scale insect from the archipelago was the armoured scale *Hemiberlesia rapax* (Comstock) (Diaspididae), recorded by Reyne (1954) from the main island of Tristan da Cunha, Stony Beach, Station 1027, 8.iii.1938, on *Empetrum rubrum* [Empetraceae] and from Inaccessable Island, Blendon Hall, 23.ii.1938, on *Phylica arborea* [Rhamnaceae]. *H. rapax* has also been collected recently from the main island at Edinburgh Settlement, 18.ii.2005, on the nodes of *Pyrus communis* [Rosaceae], (C.

Hänel). Ryan (2007) has listed this species in a field guide to the animals and plants of Tristan da Cunha, and Williams & Mendel (2007) mentioned it briefly when discussing the scale insects of Ascension Island.

Hemiberlesia rapax is polyphagous and mainly tropicopolitan in distribution with some extensions into temperate regions. It occurs on leaves and bark and is often a pest of agricultural and horticultural plants. For a full listing of the systematics, host plant range, distribution and natural enemies of this species see Ben-Dov & German (2003) and Ben-Dov *et al.* (2008).

The hypogeal mealybug, *Rhizoecus bolacis* Williams, was found recently on Tristan da Cunha. This species was described originally from the Falkland Islands by Williams (2004b) and it was incorporated in a revision of the subfamily Rhizoecinae by Kozár & Konczné Benedicty (2007). Further examination of specimens collected in the Falkland Islands and from Tristan da Cunha show some differences in characters from those described originally and the species is redescribed herein.

MATERIALS AND METHODS

The specimens were prepared on microscope slides using the techniques described by Williams & Granara de Willink (1992). Each illustration shows the outline of the body with a dividing line in the middle to separate the dorsum on the left and the venter on the right, with enlargements of important characters around the margin of the main drawing. Morphological terms are the same as those used in Williams & Granara de Willink (1992) and Kozár & Konczné Benedicty (2007). Measurements of the body are given in millimetres (mm) and all other measurements are in micrometres (μm).

TAXONOMY

The subfamily Rhizoecinae is presently divided into two tribes, Rhizoecini and Xenococcini. According to Bünzli (1935) and Schmutterer (1952), species in the tribe Rhizoecini (based on the genus *Rhizoecus* Künckel d'Herculais) have four female instars. Adult males have two feeding instars (the first- and second-nymphal instars), followed by a normal prepupa and pupa (Williams, 2004a) as in most Pseudococcidae, thus there are the usual five instars altogether. Species in the tribe Xenococcini are unique among the Pseudococcidae in possessing a female pupal instar (Williams, 1998). Work by Kishimoto-Yamada *et al.*, 2005) has shown that, in the Xenococcini (based on *Eumyrmococcus smithii* Silvestri), the first-nymphal instar is followed by the female pupal instar or the male prepupal instar so that there are only three female instars and four male instars. In the absence of other female instars in the present study, we cannot be sure whether the immature specimens we describe for *Rhizoecus bolacis* represent the second- or third-instar nymphs but we suspect they are second instars.

Rhizoecus bolacis belongs to a small group of elongate species in the genus *Rhizoecus*

in possessing abundant setae, a single circulus, few tritubular cerores on the dorsum and venter, and in lacking multilocular disc pores. It is similar to *R. albidus* Goux but the circulus of *R. bolacis* is more squat and not so conical. *Rhizoecus atlanticus* Hambleton is also very similar but differs in possessing a few more tritubular cerores on the midline of the dorsum and a more developed cephalic plate. Other similar species are *R. cacticans* (Hambleton), a species with a much longer circulus, *R. elongates* Green, a species without tritubular cerores on the midline, and *R. maritimus* Ferris, a species with short setose digitules instead of knobbed digitules in *R. bolacis*.

Description

RHIZOECUS BOLACIS Williams

Rhizoecus bolacis Williams, 2004: 2.
Ripersiella bolacis (Williams): Kozár & Konczné Benedicty, 2007: 406.

Material studied: Holotype and paratype ♀♀: Falkland Islands, Cusby's Hill, roots of *Bolax gummifera* [Umbelliferae], 7.xi.2002, A. Jones (The Natural History Museum, London) (BMNH): 1/3ad♀♀ + 3 immatures, probably 2nd-instar ♀♀, all in good condition. **Tristan da Cunha,** Down-by-the-Pot, penguin colony, on farm grass, 10.iii.2005, C. Hänel (BMNH): 24 ad♀♀, in fair to good condition on three slides (BMNH).

Adult female (Fig. 1)

Main description from 3 type specimens of *R. bolacis*, but with data from Tristan da Cunha material in brackets.

Unmounted material. Not seen.

Mounted material. Elongate oval, 1.12-2.03 (1.0-1.25) mm long, 425-950 (375-500) μm wide; circulus convex, nipple-like, round; oral collar ducts few; quinquelocular and multilocular pores absent; tritubular cerores present on both dorsum and venter; dorsal and ventral setae all setose; cephalic plate present; anal lobes rounded; antennae 6 segmented; legs well developed; claw digitules capitate; claw without a denticle.

Dorsum. Derm membranous. Dorsal setae mostly 18-36 (20-30) μm long but a few up to 35 (38) μm; abundant throughout but mainly in transverse bands. Trilocular pores each with a central loculus and about 3 μm wide; abundant throughout, mainly in segmental bands. Simple (discoidal) pores and preantennal pores absent. Tritubular cerores present, distribution slightly variable but essentially in a medial line, two submedial lines and a marginal line; each about 3 μm wide. Ostioles rather large and fleshy but apparently with lips mainly hidden below cuticle; anterior ostioles perhaps without setae or trilocular pores on lips, but posterior pair with 1 or 2 trilocular pores and a seta on each posterior lip. Oral collar ducts small, each about 2 μm wide, sparsely distributed throughout. Anal

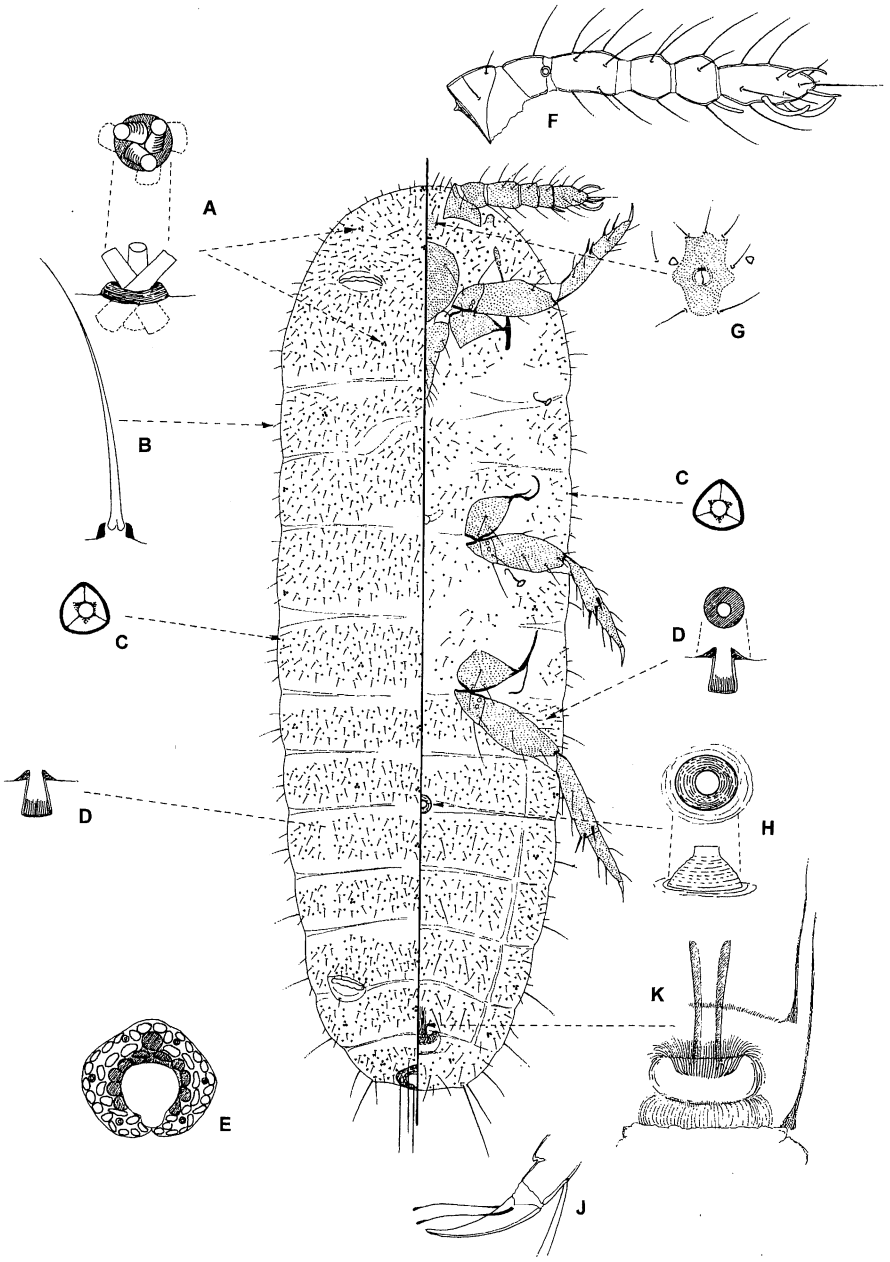

Fig. 1 - *Rhizoecus bolacis* Williams. Adult female, A = tritubular cerore, B = dermal seta, C = trilocular pore; D = oral collar duct; E = anal ring; F = antenna, G = cephalic plate; H = circulus J = claw, and K = area of vulva with oviduct.

ring complex, about 71-76 (66-73) μm wide, with two rings of "open" pores and an inner ring of "closed" pores; pores without spiculae; anal ring with 3 pairs of setae, each about 90-96 (65-85) μm long. Anal lobes rounded, each with a long seta, 75-90 (85-90 μm long) plus two shorter setae, each 53-70 (60-70) μm long. Margin not differentiated but most segments with a longer lateral seta, longest up to about 55 (50) μm long.

Venter. Derm membranous. Ventral setae similar to those on dorsum, and also arranged mainly in segmental bands; interantennal setae and cisanal setae not apparently differentiated. Trilocular pores as on dorsum but less frequent medially on thorax. Simple (discoidal) pores absent. Oral collar ducts similar to those on dorsum, absent or very sparse medially on head and thorax, otherwise sparsely present throughout. Tritubular cerores similar to those on dorsum present submarginally on most segments. Circulus cone-shaped, with a nipple-like centre; more or less round, 25-30 (22-25) μm wide, present between segments III and IV. Eyespots absent on two specimens but small and only slightly convex on 3rd, about 8 μm wide (highly convex, about as tall as wide, each 11-13 μm wide), about 1 eye-width laterad to each scape.

Antennae 6 segmented; each antenna from segment II to apex 179-190 (150-170) μm long; scape each with 3 setae, pedicel with 3 setae + campaniform pore (this placed very close to or even in intersegmental membrane between segments II and III); segment III with two rings of 5 setae, IV with a ring of 5 setae, V with a ring of 5 setae + a fleshy (falcate sensory) seta; apical segment with about 16-18 hair-like setae + 4 fleshy setae; apical seta about 30-35 μm long. Cephalic plate present just anterior to clypeolabral shield, of rather variable shape but with a circular area in the middle with a more or less longitudinal line across it; circular area about 15-17 μm wide. Clypeolabral shield about 104-125 (80-85) μm long; labium about 115-123 (95-110) μm long, with 11 pairs of setae. Spiracles small: width of peritremes 13-16 (13-15) μm. Metathoracic legs: lengths (μm): coxa 90-100 (84-88); trochanter + femur 160-165 (140-150); tibia 120-133 (90-108); tarsus 68-72 (60-65); claw 25-27 (23-25); number of setae: coxa 10 (7 or 8); trochanter 4; femur 8 (6); tibia 9-10 (9-11), meso- and metatibia each with three spurs 19-24 (18-22) μm long; each protibia with only 2 spurs; tarsus 5 or 6; minute translucent pores absent. Tarsal digitules both short and setose; claw digitules slightly longer than claw and both capitate; claw without a denticle. Vulva distinct, located between segments VII and VIII, oviduct (internal genital organ) clear, tubular, about 75-88 (70) μm long and 18-20 μm wide, apparently opening into a cavity. With 2 pairs of long membranous tubes on each side of vulva, one pair anterior to vulva and other pair posterior.

Discussion: *R. bolacis* was recently transferred from *Rhizoecus* to *Ripersiella* (Kozár & Konczné Benedicty, 2007) because *R. bolacis* was originally thought to have bitubular cerores rather than tritubular. However, the present study found that the cerores are clearly tritubular and therefore the correct generic placement is *Rhizoecus*.

These two lots of material (the type series and that from Tristan da Cunha) differ mainly in the presence or absence of simple eyes. The holotype specimen of *R. bolacis* and one of the paratypes have no eyes at all but the third specimen (at the bottom of the slide) does have small, rather inconspicuous, eyes. All specimens from Tristan da Cunha have well developed, highly convex eyes, which are conspicuous. The only other difference between

the two lots of material is that the measurements for the material from Tristan da Cunha tend to be about 10% smaller. It is here considered that these differences are not sufficient to justify raising a new species for the latter material.

Immature stage (Fig. 2)

Also on the type slide of *R. bolacis* are 3 non-adult specimens. Whilst the layout of the pores, cerores and setae appear to be similar on the three specimens, their limbs differ considerably in size. It is not known whether this means there is more than one instar present (none are believed to be 1st-instar) or whether they represent a highly variable stage. In the following description, the measurements given are for the medium-sized specimen and the data for the other two specimens are given as ranges in brackets afterwards.

Unmounted material. Not seen.

Mounted material. Elongate oval, 0.75 (0.68-1.21) mm long, 285 (265-500) μm wide; circulus convex, nipple-like, round; oral collar ducts absent; quinquelocular and multilocular pores absent; tritubular cerores present on dorsum only; dorsal and ventral setae all setose; cephalic plate absent; anal lobes rounded; antennae 6 segmented; legs well developed; claw digitules capitate; claw without a denticle.

Dorsum. Derm membranous. Dorsal setae mostly 8-25 μm long but a few up to 33 (33-41) μm; frequent throughout but mainly in transverse bands. Trilocular pores each with a central loculus and about 3 μm wide; frequent throughout, mainly in segmental bands. Simple (discoidal) pores and preantennal pores absent. Tritubular cerores present, distribution slightly variable but essentially in a medial line and a marginal line but with 1 submedially on head; each about 3 μm wide. Ostioles rather large and fleshy but apparently with lips mainly hidden below cuticle; anterior ostioles perhaps without setae or trilocular pores on lips, but posterior pair with 3 or 4 trilocular pores and 6 or 7 setae on each posterior lip. Oral collar ducts absent. Anal ring complex but thought to be similar to that on adult female; about 50 (40-50) μm wide, with 3 pairs of setae, each about 63 (60-75) μm long. Anal lobes rounded, each with a long seta, 60 (65-78) μm long, plus two shorter setae, each 54 (50-60) μm long. Margin not differentiated but most segments with a longer lateral seta, longest up to about 40 (33-50) μm long.

Venter. Derm membranous. Ventral setae similar to those on dorsum, and also arranged mainly in segmental bands; interantennal setae and cisanal setae not apparently differentiated. Trilocular pores as on dorsum but less frequent medially on thorax. Simple (discoidal) pores absent. Oral collar ducts and tritubular cerores absent. Circulus cone-shaped, with a nipple-like centre; more or less round, 20 (15-20) μm wide, present between segments III and IV. Eyespots absent.

Antennae 6 segmented; each antenna from segment II to apex 125 (96-135) μm long; scape each with 3 or 4 setae, pedicel with 3 setae + campaniform pore; segment III with one ring of 5 setae, IV with a ring of 5 setae, V with a ring of 5 setae + a fleshy (falcate sensory) seta; apical segment with about 16-18 hair-like setae + 4 fleshy setae; apical seta

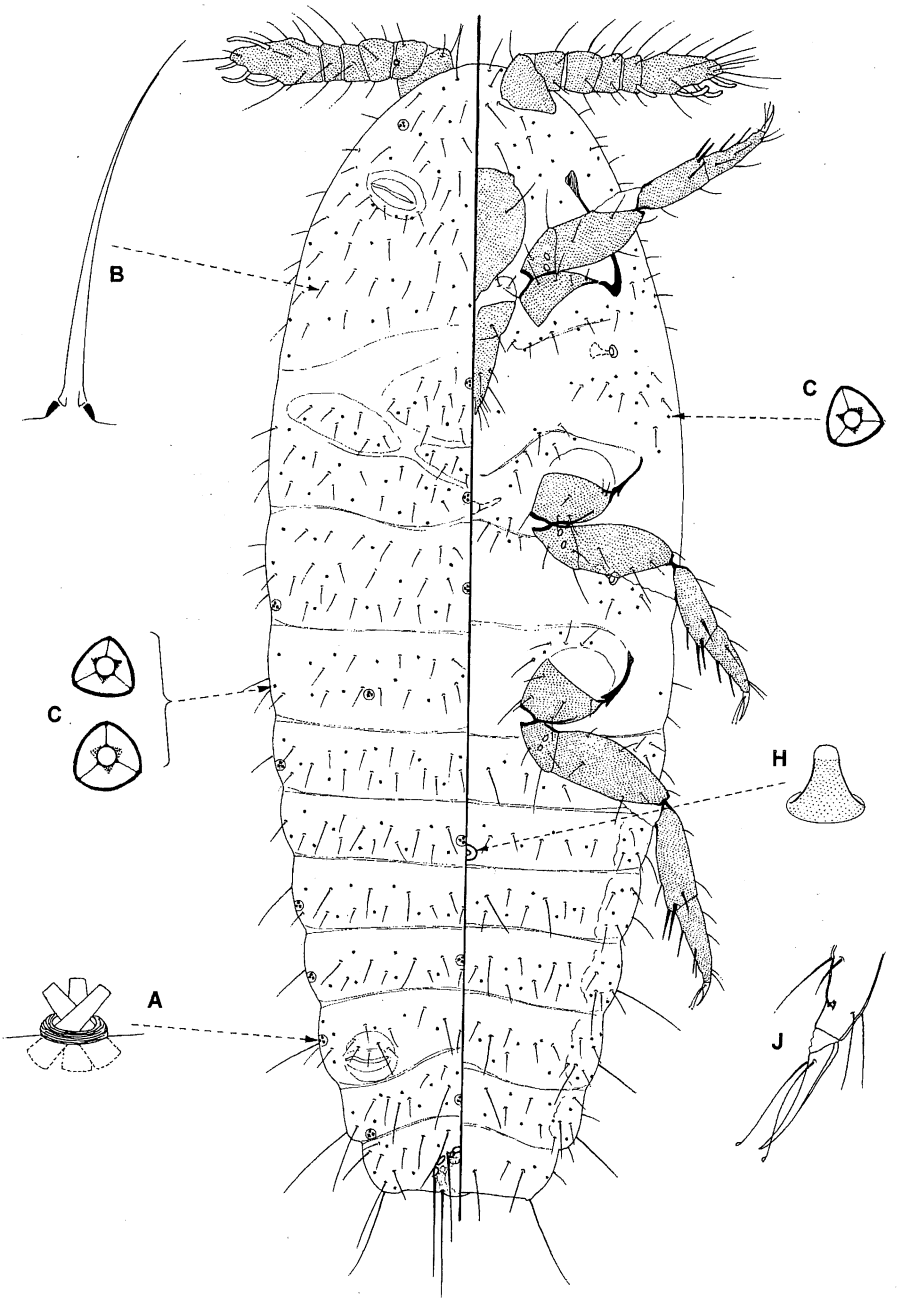

Fig. 2 - Immature *Rhizoecus bolacis* Williams (probably 2nd-instar female). For letters, see Fig. 1.

about 25 (25) μm long. Cephalic plate absent. Clypeolabral shield about 83 (75-95) μm long; labium about 88 (65-90) μm long, with 11 pairs of setae. Spiracles small: width of peritremes 10 (9-11) μm. Metathoracic legs: lengths (μm): coxa 66 (50-75); trochanter + femur 115 (88-130); tibia 75 (53-90); tarsus 58 (45-61); claw 21-23; number of setae: coxa 10 (8); trochanter 4; femur 5; tibia 7 (9), meso- and metatibia with three spurs, each 13-17 μm long; each protibia with only 2 spurs; tarsus with 5 or 6 setae; minute translucent pores absent. Tarsal digitules both short and setose; claw digitules slightly longer than claw and both capitate; claw without a denticle.

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REFERENCES

Ben-Dov, Y. & German, V. 2003 - *A Systematic Catalogue of the Diaspididae (Armoured Scale Insects) of the World, subfamilies Aspidiotinae: Comstockiellinae and Odonaspidinae*. Intercept Ltd, Andover, UK, 1111 pp.

Ben-Dov, Y., Miller, D.R. & Gibbson, G.A.P. 2008 - *Hemiberlesia rapax* (Comstock). ScaleNet: a Database of the Scale Insects of the World. Scales in a Family/Genus Query Results. Available from http://www.sel.barc.usda.gov/SCALENET/SCALENET.HTM (accessed 11 July 2008).

Bünzli, G.H. 1935 - Untersuchungen über coccidophile Amaisen aus den Kafeefeldern von Surinam. Mitteilungen Scweitzerischen Entomologischen Gesellschaft, 16: 455-493.

Jones, A.G. 2006 - Insects in the UK Overseas Territories, a short review of endemism with an introduction to the 'Falklands Islands Invertebrates Conservation Project'. *Antenna*, 30: 14-29.

Kishimoto-Yamada, Itioka, T. & Kawai, S. 2005 - Biological characterization of the obligate symbiosis between *Acropyga sautori* Forel (Hymenoptera: Formicidae) and *Eumyrmococcus smithii* Silvestri (Hemiptera: Pseudococcidae: Rhizoecinae) on Okinawa Island, southern Japan. Journal of Natural History, 39: 3501-3524.

Kozár, F. & Konczné Benedicty, S. 2007 - *Rhizoecinae of the World*. Plant Protection Institute, Hungarian Academy of Sciences, Budapest, 617 pp.

Reyne, A. 1954 - Scale insects (Coccoidea), No. 31, pp 3-4. Results of the Norwegian Expedition to Tristan da Cunha 1937-1938. No 32-38, Det Norske vetenskaps-Akademi, Oslo.

Ryan, P. 2007 (Ed.) - Field Guide to the Animals and Plants of Tristan da Cunha and Gough Island. Pisces Publications, Newbery, for the Tristan Island Government, 162 pp.

Schmutterer, H. 1952 - Die Ökologie der Cocciden (Homoptera, Coccoidea) Frankens I. Zeitschrift für Angevandte Entomologie, 33: 369-420.

WILLIAMS, D.J. 1998 - Mealybugs of the genera *Eumyrmococcus* Silvestri and *Xenococcus* Silvestri associated with the ant genus *Acropyga* Roger and a revision of the subfamily Rhizoecinae (Hemiptera, Coccoidea, Pseudococcidae). Bulletin of The Natural History Museum, London (Entomology), 67: 1-64.

WILLIAMS, D.J. 2004a - *Mealybugs of southern Asia*. The Natural History Museum, London, UK, and Southdene SDN. BHD., Kuala Lumpur, Malaysia, 896 pp.

WILLIAMS, D.J. 2004b - Two new mealybug species from the Falkland Islands (Hemiptera: Sternorrhyncha: Coccoidea: Pseudococcidae). Zootaxa, 659: 1-8.

WILLIAMS, D.J. & GRANARA DE WILLINK, M.C. 1992 - *Mealybugs of Central and South America*. C.A.B. International, Wallingford, UK, 635 pp.

WILLIAMS, D.J. & MENDEL, H. 2007 - Stermorrhyncha (Hemiptera) of Ascension Island. Entomologist's Monthly Magazine, 143: 131-135.

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