



## A new species of *Acanthococcus* (Hemiptera, Coccoidea, Eriococcidae) on *Leptospermum scoparium* (Myrtaceae) from Italy and France

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### Abstract

The adult female, 1<sup>st</sup>-instar nymph, 2<sup>nd</sup>-instar male and 2<sup>nd</sup>-instar female nymphs of a new species of felt scale, *Acanthococcus mariannae* Pellizzari, are described and illustrated. The new species was collected off *Leptospermum scoparium* (Myrtaceae) in Italy and France. An identification key of *Eriococcid* species known to occur on *Leptospermum* spp is also provided.

**Key words:** *Acanthococcus mariannae*, felt scales, Italy, France, identification key

### Introduction

In August 2004, an Eriococcid was collected off potted *Leptospermum scoparium* (Fam. Myrtaceae) in Genova (Italy). The potted plants were heavily infested and one of them was covered with sooty mould and was dead (Plate 2, fig. c). Two years later the same eriococcid species was recorded off the same host plant in Corsica (France), in two localities (Ajaccio and Olmeto). Thus this Eriococcid would appear to be linked to *Leptospermum scoparium*.

The genus *Leptospermum* comprises more than 80 species of plants native to the Australasian region. Among them, *Leptospermum scoparium* is a shrub, native to New Zealand and southeast Australia. It is largely cultivated as an ornamental plant and several cultivars have become established in the trade. It is well known that myrtaceous plants are host to a large number of eriococcid species mainly in the Australasian Region and South America: according to Ben-Dov *et al.* (2010) there are 157 species in 28 genera. Seven species belonging to the genus *Eriococcus* have been recorded so far on *Leptospermum* sp., all from Australia. They are *E. campbelli* Hoy, *E. cultellus* Hoy, *E. gibbus* Hoy, *E. milleri* Hoy, *E. spiniger* Maskell, *E. leptospermi* Maskell and *E. orariensis* Hoy. The latter two species have also been introduced into New Zealand (Hoy, 1953; 1954; 1959) where they are considered pests of ornamental *Leptospermum*. Their accidental introduction into New Zealand caused the death of *Leptospermum* trees over large areas between the 1940s and 1960s (Epenhuijsen *et al.*, 2000). However, the species recently discovered on *Leptospermum* in Italy and France appears to be none of these species.

A comparison with the known *Eriococcus* and *Acanthococcus* species living on Myrtaceae (37 species, of which 4 are from Brazil, the others from Australasia) (Ben-Dov *et al.*, 2010) did not lead to any identification. Mounted specimens were sent to Dr. Douglass Miller (USDA) and he concluded that this apparently new eriococcid was not from the Australasian area (2004, personal communication). In addition, Rosa Henderson (Landcare Research, Auckland, New Zealand) was sent specimens and she also concluded that it was not a known Australian or New Zealand species (2006, personal communication). They both pointed out the presence of large dorsal and ventral macrotubular ducts, a morphological character not present in any Australasian eriococcids.

According to the keys to genera by Hodgson *et al.* (2004) and Henderson (2007), this new species falls in the genus *Eriococcus* whereas, according to more recent keys (Kozár and Konczné Benedicty, 2008; Hodgson and Miller, 2010) it is an *Acanthococcus* species. Accordingly to the most recent papers, this new species is placed in the genus *Acanthococcus*, even though it is possible that, based on molecular analysis, this position could change in the future.

We are aware that the generic position of many Eriococcids is still currently controversial (Foldi & Kozár, 2007), mainly with regard to the morphological features which separate the genera *Acanthococcus* and *Eriococcus*. The present taxonomic situation and status of our knowledge of the Family Eriococcidae are clearly summarized by Kozár and Konczné Benedicty (2008), Kozár (2009), Kozár *et al.* (2009) and Hodgson and Miller (2010).

## Material and methods

Specimens were slide mounted according to the procedures of Ben-Dov and Hodgson (1997). Measurements and frequencies are given as mean, followed by the ranges in parentheses. Terminology follows that of Williams (1985), Miller and Miller (1992), Hodgson and Trencheva, (2008) and Kozár *et al.* (2009).

Specimen depositories: The Scientific Museums of the University of Padua (Italy), Department of Environmental Agronomy & Crop Production - Entomology (DEAE); Museum National d'Histoire Naturelle, Paris, France (MNHN); Laboratoire National de la Protection des Végétaux-CBGP, Montferrier-sur-Lez, France (LNPV).

## Key to the 7 eriococcid species known to occur on *Leptospermum* spp.

The key is based on adult females morphology and is taken from Hoy (1959), with modifications to insert the new species and to update terminology.

- |   |  |  |
|---|--|--|
| 1 | Antennae 6 segmented.....  | 2  |
| - | Antennae 7 segmented.....  | 6  |
| 2 | Cup-shaped invagination of macrotubular ducts markedly asymmetrical.....                             | <i>E. orariensis</i>                         |
| - | Cup-shaped invagination of macrotubular ducts more or less symmetrical.....                          | 3  |
| 3 | Mesal margin of anal lobes beset with teeth.....   | <i>E. spiniger</i>                           |
| - | Mesal margin of anal lobes without teeth.....  | 4  |
| 4 | Some dorsal enlarged setae equal in size to marginal setae.....                                      | <i>E. leptospermi</i>                        |
| - | All dorsal enlarged setae markedly smaller than marginal setae.....                                  | 5  |
| 5 | Marginal enlarged setae of penultimate abdominal segment almost as long as anal lobes.....           | <i>E. cultellus</i>                          |
| - | Marginal enlarged setae of penultimate abdominal segment much shorter than anal lobes.....           | <i>E. campbelli</i>                          |
| 6 | Marginal enlarged setae much longer than dorsal setae.....   | <i>A. mariannae</i> Pellizzari <b>sp. n.</b> |
| - | Marginal setae not obviously longer than dorsal setae.....   | 7  |
| 7 | Dorsal enlarged setae each with almost parallel sides and a blunt tip; hind coxa with few pores..... | <i>E. gibbus</i>                             |
| - | Dorsal enlarged setae sharply conical; hind coxa without pores.....                                  | <i>E. milleri</i>                            |

## *Acanthococcus mariannae* Pellizzari **sp. n.**

**Living specimens.** Adult female elongate, oval, grey-brown; abdomen with distinct segmentation. Females settled on upper surface of leaves or on twigs of host plant. Before egg-laying, the adult females become enclosed in a felted, white, lightly convex eggsac, open only at anal end. Male test oval, white, on under surface of leaves (plate 2). Adult males winged.

**Material studied: Holotype:** adult female, **Italy**, Genova, 14 August 2004, on *Leptospermum scoparium* (Myrtaceae), DEAE, slide n.1128/1.

**Paratypes: Italy:** same data as holotype: 12 adult females, 4 first-instar nymphs, 5 second-instar females, 5 second-instar males. Also prepupae, pupae and 2 adult males, not described in this paper, DEAE, 27 slides n.1128/2–1128/28. Also: **France**, Corsica, Ajaccio, 5 May 2006, on *Leptospermum* sp., LNPV, 16 adult females on 5 slides n. 0600432/1–0600432/5; France, Corsica, Olmeto, 29 September 2006, on *Leptospermum* sp., LNPV, 8 adult females on 2 slides n. 0602207/1–0602207/2; **France**, Corsica, Ajaccio, 19 February 2006 on *Leptospermum*, MNHN, 4 females on slide n. 14568.

**ADULT FEMALE (Fig. 1).** Described from 9 young females in good condition. Details checked on remaining specimens. Length and width also from 4 post-reproductive females.

**Mounted specimen.** Body elongate oval, 1.60 (1.44–1.96) mm long, 0.76 (0.48–0.96) mm wide (Plate 1, fig. a). Post-reproductive female 2.16 (2.0–2.35) mm long and 1.14 (1.12–1.2) mm wide.

**Margin.** Marginal enlarged setae conical, with straight sides and blunt apex, each 18 (16–22)  $\mu\text{m}$  long and 6  $\mu\text{m}$  wide at base, distributed along body margin, totalling 42–43 on each side; with 2 setae on margin of each abdominal segment, 4–5 setae on margin of each thoracic segment, and with row becoming double on dorsal apex of head.

**Dorsum.** Enlarged setae small, 5.0–6.5  $\mu\text{m}$  long and 3–4  $\mu\text{m}$  wide at base, distributed in an irregular row of 7–12 setae across each abdominal segment; also sparse on thorax and head. Dorsal macrotubular ducts large, each about 20  $\mu\text{m}$  long and 10  $\mu\text{m}$  wide, with a well-developed sclerotised rim and inner ductule; numbering 10–20 across each abdominal segment, becoming less abundant posteriorly, and sparse on head and thorax (Plate 1, fig.b). Microducts numerous, scattered, each 6.5  $\mu\text{m}$  long. Anal lobes protruding, slightly sclerotised, each 67 (60–74)  $\mu\text{m}$  long, each lobe dorsally with 3 enlarged setae and 3 or 4 microtubular ducts; ventrally with 2 hairlike setae. Apical seta 120  $\mu\text{m}$  (110–136) long (Plate 1, fig.d). Anal ring with 4 pairs of setae and with an outer row of cone-shaped pores. Cauda present, triangular in shape, with an irregular margin.

**Venter.** Labium 3-segmented, with 2 pairs of setae on unsclerotised basal segment, one pair on middle segment and 5 pairs on apical segment. Stylet loop slightly exceeding level of second coxae. Antennae 7-segmented; each antenna with a frontal lobe. Total length of each antenna 150 (140–160)  $\mu\text{m}$ . Scape with 3 setae, 2<sup>nd</sup> segment with 2 setae and 1 sensory pore, 3<sup>rd</sup> segment without setae, 4<sup>th</sup> segment with 2 setae, 5<sup>th</sup> segment with 1 fleshy seta, 6<sup>th</sup> segment with 1 fleshy seta + 2 setose setae, 7<sup>th</sup> segment with 3 fleshy setae + 7 flagellate or hair-like setae. Eyes near margin. Legs well developed; hind coxa with translucent pores and spinulae; trochanter with 2 campaniform pores; claw with small denticle. Tarsal digitules knobbed; claw digitules longer than claw, knobbed. Measurements of metathoracic leg: coxa 41 (40–46)  $\mu\text{m}$ ; trochanter + femur 123 (106–136)  $\mu\text{m}$ ; tibia 59 (50–68)  $\mu\text{m}$ ; tarsus 89 (84–96)  $\mu\text{m}$ ; claw 18  $\mu\text{m}$ . Body setae: ventral setae hair-like, with 2 on median part of each abdominal segment, more numerous near coxae on thorax and on head. Minute hair-like setae sparse on abdominal segments. Loculate pores each quinquelocular and 3–4  $\mu\text{m}$  wide, numerous, forming transverse bands on posterior abdominal segments, becoming less abundant anteriorly and sparse on head and on medial and submarginal parts of thorax; also with 2–6 laterad to each spiracle opening. Cruciform pores few, each 3–4  $\mu\text{m}$  long, present on submargin of thorax and head. Macrotubular ducts smaller than dorsal ducts, each 18  $\mu\text{m}$  long, 6  $\mu\text{m}$  wide, mainly distributed along body margin and submarginally (Plate 1, fig.c). A few very small macrotubular ducts, each 11–16  $\mu\text{m}$  long and 2.5  $\mu\text{m}$  wide, with a sclerotised ring 4  $\mu\text{m}$  in diameter and a very long inner filament, intermingled with quinquelocular pores on posterior abdominal segments. Spinules present on abdominal segments.

**Comment.** This new species differs from the other *Eriococcus* species living on *Leptospermum* by having the following combination of characters: 7-segmented antennae; dorsal enlarged setae markedly smaller than marginal setae; large dorsal macrotubular ducts with markedly symmetrical cups; and two sizes of ventral tubular ducts. The large dorsal macrotubular ducts are also clearly visible in the living adult female under a stereo microscope magnification (Plate 2, fig. f). According to the descriptions and drawings by Hoy (1954; 1959), both *E. cultellus* and *E. campbelli* have dorsal enlarged setae markedly smaller than the marginal setae, but the marginal setae are long and slender, and they have 6-segmented antennae. *E. gibbus* and *E. milleri* have 7-segmented antennae but the dorsal enlarged setae are as long as the marginal setae. Moreover, *E. gibbus* has the enlarged setae on the last abdominal segments with almost parallel sides and a blunt tip. *E.*

*leptospermi* has 6-segmented antennae and enlarged dorsal setae as long as the marginal setae. *E. orariensis* is clearly separated from the others by having the marginal setae only on the abdominal segments; in addition, the enlarged seta on the margin of the penultimate abdominal segment is stout, “peg-like”, with a blunt tip. *E. spiniger* is also clearly distinct due to the presence of about 70 enlarged marginal setae, on each body side, each with a blunt apex.

**FIRST- INSTAR NYMPH** (Fig. 2). Described from 4 specimens in good condition.

**Mounted material:** oval, 0.4 mm long and 0.18 mm wide.

**Margin.** Marginal enlarged setae conical, with straight sides and a blunt apex, with 1 seta on each abdominal segment and a total of 22 or 23 on each body side, and with row becoming double dorsally on apex of head; each spine 9.5  $\mu\text{m}$  long and 2.5  $\mu\text{m}$  wide.

**Dorsum.** Dorsal spinose setae very small, about 2.5–3.0  $\mu\text{m}$  long, in four longitudinal rows on thorax and abdomen. Microducts present submedially on abdomen, with one pair per segment, and with a few on thorax and head. Anal lobes moderately protruding, lightly sclerotised, each 21  $\mu\text{m}$  long, with 2 enlarged setae dorsally and 2 hair-like setae ventrally; each apical seta 108  $\mu\text{m}$  long. Anal ring with 6 setae. Cauda not located.

**Venter.** Labium 43–45  $\mu\text{m}$  long, 3-segmented, with 2 pairs of setae on basal segment, 1 pair of setae on second segment and 5 pairs on apical segment; stylet loop reaching coxae of third legs. Antennae 6-segmented, each 83 (77–90)  $\mu\text{m}$  long, scape with 3 setae, 2<sup>nd</sup> segment with 3 setae and one sensory pore; 3<sup>rd</sup> segment with 2 setae; 4<sup>th</sup> segment with 1 fleshy seta; 5<sup>th</sup> segment with 1 fleshy + 2 flagellate setae; 6<sup>th</sup> with 3 fleshy + 5 flagellate setae. Legs well developed, 136–147  $\mu\text{m}$  long. Claw 13  $\mu\text{m}$  long, with a small denticle; tarsal and claw digitules slightly capitate and longer than claw. Body setae: with one pair of interantennal setae and two other pairs of setae between antennae and clypeolabral shield. Very short setae forming a longitudinal submarginal and a submedian row on each side of abdomen; with submarginal short setae present on thorax; with 1 pair of suranal setae plus 1 pair of ventral setae medially on each abdominal segment; other setae few on thorax. Loculate pores, each with 3 loculi, few, present on head and thorax plus 2 submedially across each abdominal segment. Cruciform pores: with 3 on each submargin of thorax. One preantennal pore present anterior of each scape.

**SECOND-INSTAR FEMALE NYMPH** (Fig. 3). Described from 5 specimens in good condition.

**Mounted material:** body membranous, oval, 0.70 (0.88–0.64) mm long, 0.34 (0.30–0.40) mm wide.

**Margin.** Enlarged setae conical, each about 13  $\mu\text{m}$  long and 5  $\mu\text{m}$  wide, with straight sides and a blunt apex, totalling 34–35 on each side; with 2 setae on margin of each abdominal segment, 3 or 4 on each thoracic segment and with row becoming double on apex of head.

**Dorsum.** Dorsal conical setae very short, each 5  $\mu\text{m}$  long and 1.5  $\mu\text{m}$  wide, distributed in four longitudinal rows on thorax and abdomen, plus two spinose setae anteriorly on head. Microducts, each about 5  $\mu\text{m}$  long, present submarginally and also sparsely throughout dorsum. Cauda observed in 2 specimens, subrectangular, with an irregular margin. Anal lobes lightly sclerotised, each 44 (42–48)  $\mu\text{m}$  long, with 3 enlarged setae and 2 microducts on dorsal surface, plus 2 hair-like setae on ventral surface. Apical seta each 104 (110–102)  $\mu\text{m}$  long. Anal ring with 6 setae.

**Venter.** Labium 3-segmented, with 2 pairs of short setae on unsclerotised basal segment, 1 pair on middle segment and 5 pairs on apical segment. Antennae 6 segmented, each 100 (97–106)  $\mu\text{m}$  long, each antenna with a frontal lobe; scape with 4 setae; 2<sup>nd</sup> segment with 3 setae + 1 pore; 3<sup>rd</sup> segment with 2 setae; 4<sup>th</sup> segment with 1 fleshy seta; 5<sup>th</sup> segment with 1 fleshy seta + 2 flagellate setae; 6<sup>th</sup> with 3 fleshy setae + 6–7 flagellate setae. Legs well developed. Length of metathoracic leg: coxa 28 (24–30)  $\mu\text{m}$ ; trochanter + femur 63 (52–70)  $\mu\text{m}$ ; tibia 31 (28–36)  $\mu\text{m}$ ; tarsus 59 (56–64)  $\mu\text{m}$ ; claw with a small denticle, each 15  $\mu\text{m}$  long; tarsal and claw digitules slightly capitate and longer than claw. Trochanter with 2 pores. Body setae: with 5 pairs of setae on head between antennae and clypeolabial shield; with 1 pair of suranal setae and 1 pair of setae medially on each abdominal segment, plus submedial and submarginal rows of short setae on abdominal and thoracic segments. Quinquelocular pores mainly present submarginally on thorax and abdomen, with 1 pore on submargin of each abdominal segment, 1–3 pores near each stigmatic opening and 2 pores on head between antennae. A few cruciform pores present on margin of thorax. One preantennal pore present anterior to each scape. Spinules present on abdominal segments.

**SECOND INSTAR MALE NYMPH** (Fig. 4). Described from 5 specimens in good condition.

**Mounted material.** Body membranous, oval, 0.57 (0.56–0.60) mm long, 0.26 (0.25–0.28) mm wide

**Margin.** With enlarged conical setae each 13  $\mu\text{m}$  long and 5  $\mu\text{m}$  wide, with straight sides and a blunt apex, totalling 34–36 on each side; with 2 setae on margin of each abdominal segment, 3–4 on each thoracic segment, and with row becoming double on apex of head.

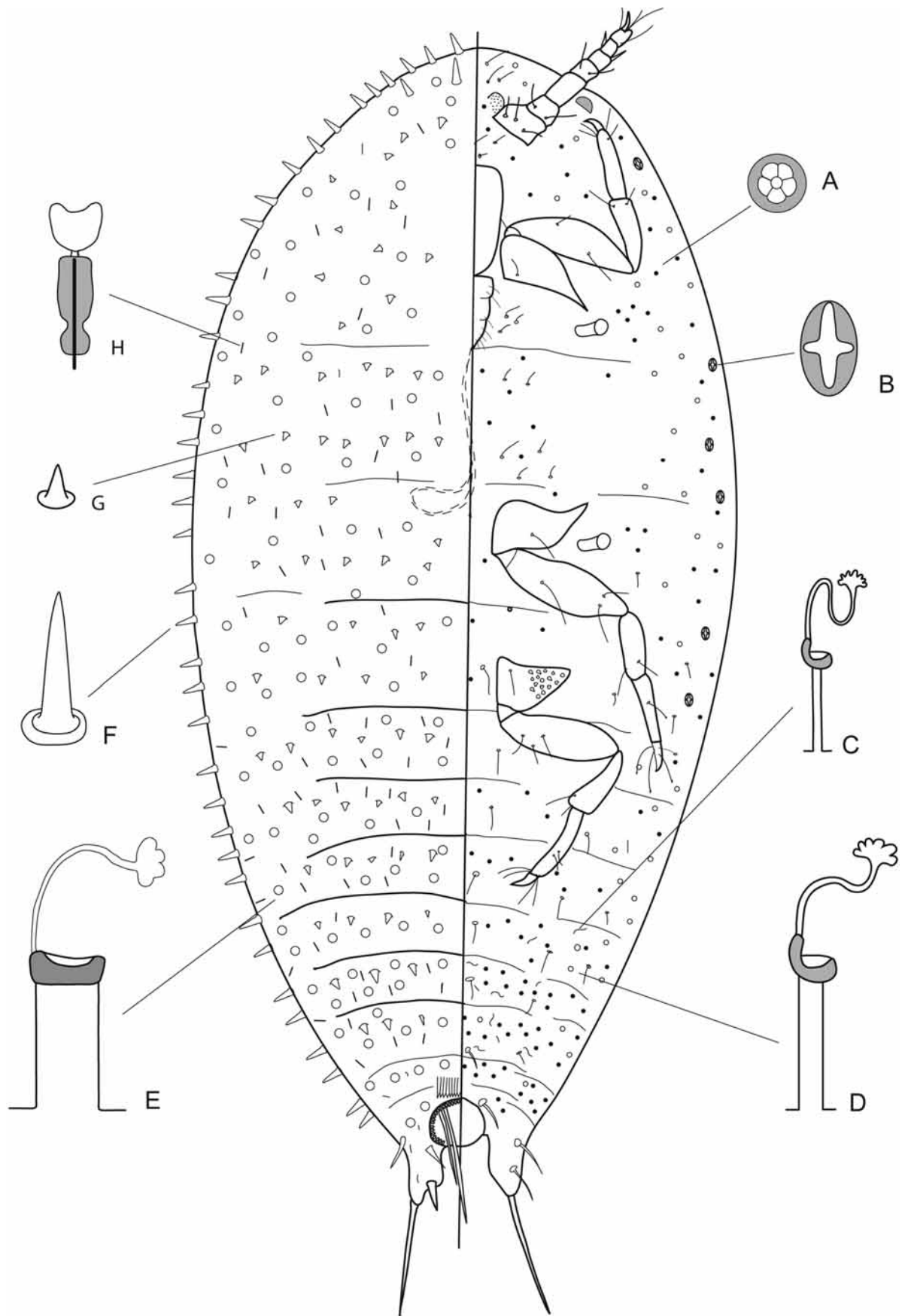
**Dorsum.** Dorsal conical setae very short, each 3  $\mu\text{m}$  long and 1.5  $\mu\text{m}$  wide, distributed in four longitudinal rows on abdomen and thorax, plus 2 spinose setae anteriorly on head. Macrotubular ducts each with a well-developed cup-shaped invagination, diameter 8  $\mu\text{m}$ , sparse over dorsum. Microducts each about 5  $\mu\text{m}$  long, present submarginally and also sparsely throughout dorsum. Cauda observed in 3 specimens, subrectangular, with an irregular margin. Anal lobes lightly sclerotised, each 41 (35–44)  $\mu\text{m}$  long, with 3 spinose setae and 2 microducts on dorsal surface, plus 2 hair-like setae on ventral surface. Apical setae each 93 (83–102)  $\mu\text{m}$  long. Anal ring with 6 setae.

**Venter.** Labium 3-segmented, with 2 pairs of setae on unsclerotised basal segment, 1 pair of setae on middle segment and 5 pairs of setae on apical segment. Antennae 7 segmented, each 99 (96–102)  $\mu\text{m}$  long, each antenna with a frontal lobe; scape with 4 setae; 2<sup>nd</sup> segment with 3 setae + 1 pore; 3<sup>rd</sup> segment without setae; 4<sup>th</sup> segment with 2 setae; 5<sup>th</sup> segment with 1 fleshy seta; 6<sup>th</sup> with 1 fleshy + 2 hair-like setae; 7<sup>th</sup> with 3 fleshy + 7 flagellate setae. Macrotubular ducts with a well-developed cup-shaped invagination and long inner ductule, smaller (diameter 5  $\mu\text{m}$ ) than dorsal ducts, mainly distributed on head and submargin of abdomen, these ducts intermingled with macrotubular ducts similar in size to those on dorsum (diameter 8  $\mu\text{m}$ ). Legs well developed. Lengths of metathoracic legs: coxa 26 (24–28)  $\mu\text{m}$ ; trochanter + femur 68 (64–70)  $\mu\text{m}$ ; tibia 31 (28–36)  $\mu\text{m}$ ; tarsus 53 (50–56)  $\mu\text{m}$ ; claw 14  $\mu\text{m}$ , with a small denticle, tarsal and claw digitules slightly capitate and longer than claw. Trochanter with 2 pores. Body setae: with 4 pairs of hair-like setae between antennae and clypeolabral shield. With 1 pair of suranal setae and 1 pair of flagellate setae medially on each abdominal segment, plus submedial and submarginal rows of shorter setae on abdominal and thoracic segments. Other short setae few on head and thorax. Quinquelocular pores numbering 4 across each abdominal segment; also with a few on head (2 between antennae) and thorax, plus 2–4 pores near each stigmatic opening. A few cruciform pores present on margin of thorax. Spinules present on abdominal segments.

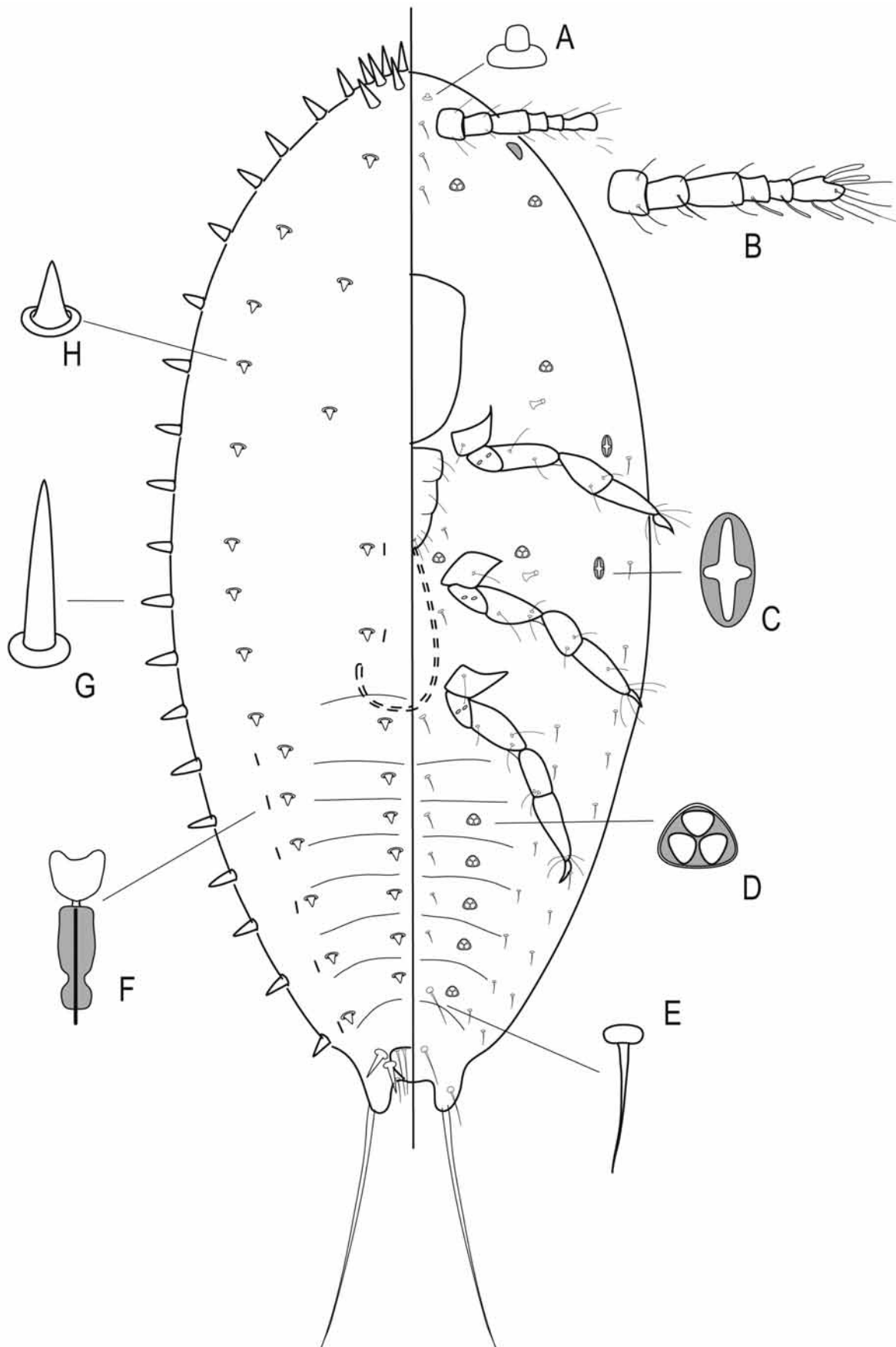
**Comments on morphology of nymphal instars.** The only description of nymphal stages of *Eriococcus* species living on Myrtaceae or on *Leptospermum* are those of Hoy on *E. orariensis* (1954, 1958). He described and illustrated the first instar (Hoy, 1954) showing that, like the adult female, the marginal spines are only present on the abdominal segments. A subsequent paper, devoted to the immature stages of *E. orariensis* (Hoy, 1958), presents instar descriptions (somewhat unclear), with measurements and statistics, but without drawings. Instead, there is a plate with photos of all instars at different growing periods and a plate with photos of pores and tubular ducts. With regard to first instar morphology, the author points out the presence of trilocular pores, noticed also on the first instar of *E. leptospermi* but not observed “in the first nymphal stage of any other species of *Eriococcus* examined to date in New Zealand” (Hoy, 1958). Trilocular pores are present also on the first instar of *A. mariannae* but are 5 locular on other Palaearctic *Eriococcus* first instars (i.e. *E. roboris* Goux, *E. melnikensis* Hodgson & Trencheva, *E. aceris* (Signoret) (Hodgson & Trencheva, 2008).

With regard to second-instar female (“intermediate female”, according to Hoy, 1958), *E. orariensis* again has marginal setae only on the abdominal segments. In addition, it has the stout, dorsal “peg-like” seta with blunt tip each on each margin of the penultimate abdominal segment, as in the adult female. Although the distribution of ventral 5-locular pores is similar in *E. orariensis* and *A. mariannae*, the second-instar female of *A. mariannae* is clearly different in having enlarged marginal setae along the whole body margin.

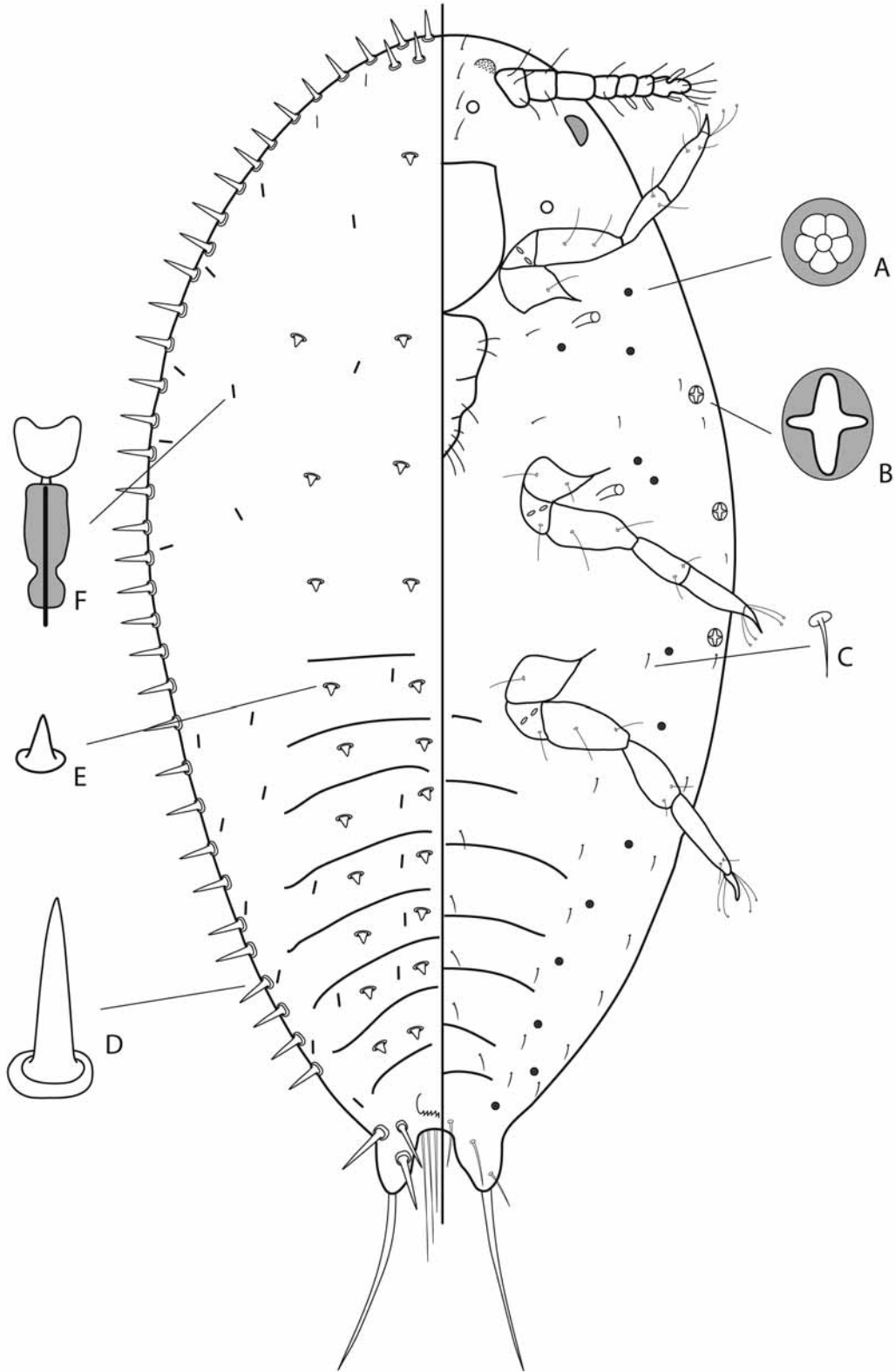
The second-instar male of *E. orariensis* is characterised by a moderate number of dorsal tubular ducts whereas, on the venter, they are almost entirely 5-locular pores, whereas the macrotubular ducts are numerous on the dorsum of *A. mariannae* and are also present on the ventral margin and submargin of the body, mixed with smaller tubular ducts.



**FIGURE 1.** *Acanthococcus mariannae* Pellizzari, sp. n., adult female, where A: 5-locular pore; B: cruciform pore; C: ventral tubular duct; D: ventral tubular duct; E: dorsal tubular duct; F: marginal enlarged seta; G: dorsal conical seta; H: microduct.

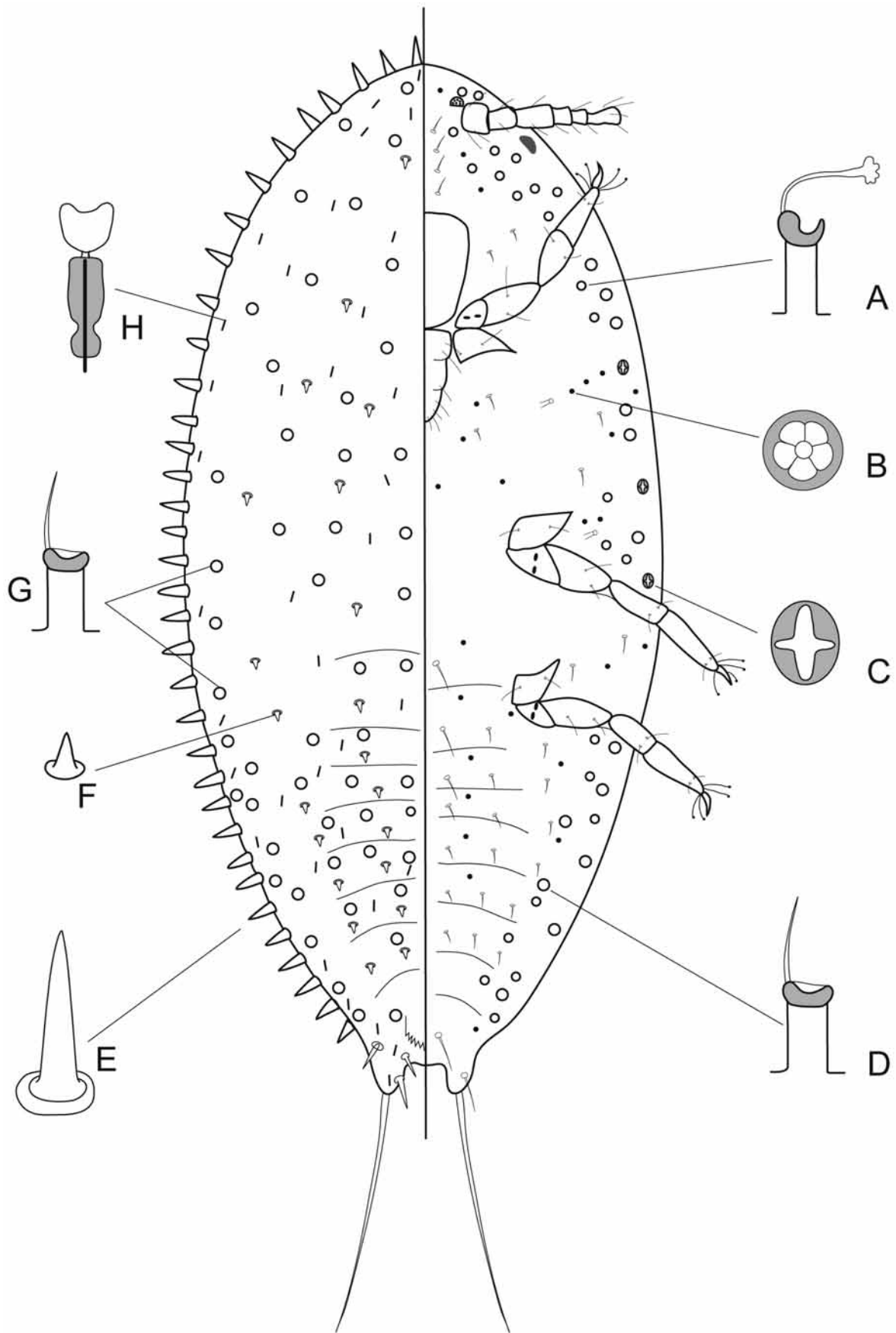


**FIGURE 2.** *Acanthococcus mariannae* Pellizzari, first instar nymph, where A: preantennal pore; B: antenna; C: cruciform pore; D: trilocular pore; E: ventral seta; F: microduct; G: marginal enlarged seta; H: dorsal conical seta.

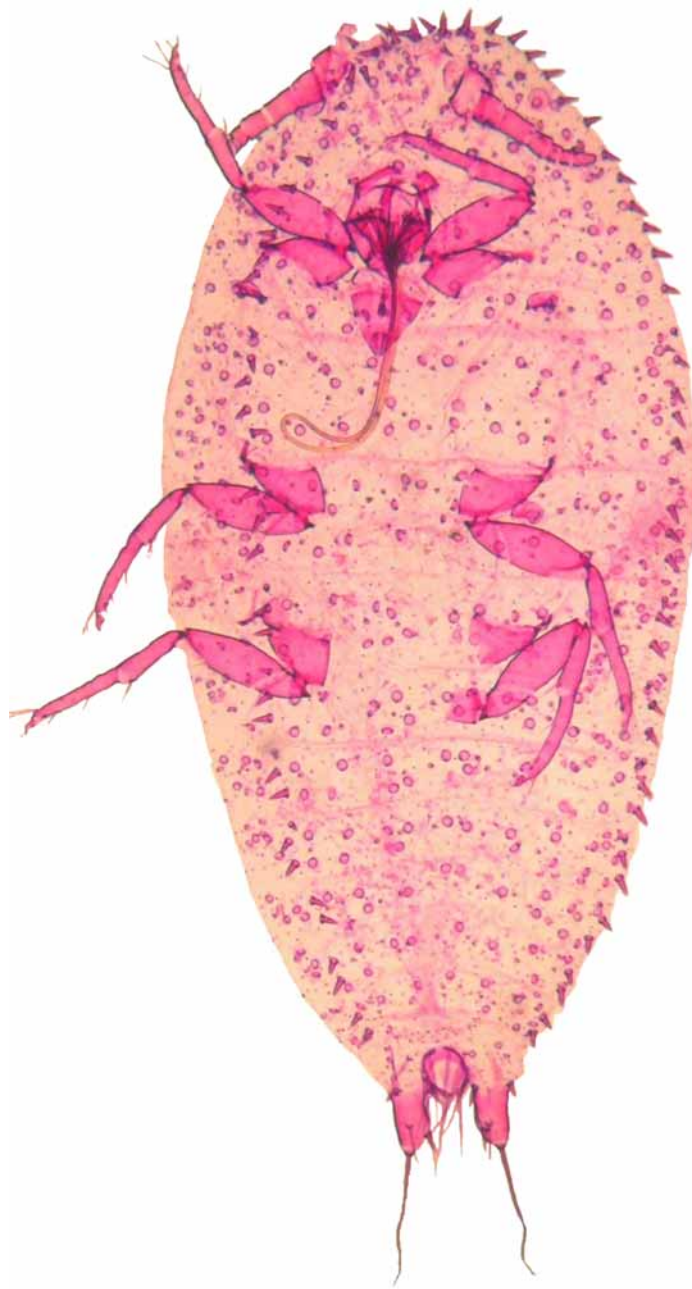


**FIGURE 3.** *Acanthococcus mariannae* Pellizzari, second-instar female nymph, where A: 5-locular pore; B: cruciform pore; C: ventral seta; D: marginal enlarged seta; E: dorsal conical seta; F: microduct.





**FIGURE 4.** *Acanthococcus mariannae* Pellizzari, second-instar male nymph, where A: tubular duct; B: 5-locular pore; C: cruciform pore; D: ventral tubular duct; E: marginal enlarged seta; F: dorsal conical seta; G: dorsal tubular duct; H: microduct.



a



b



c



d

**PLATE 1.** a: microphoto of adult female of *A. mariannae* Pellizzari; b: dorsal macrotubular ducts; c: ventral tubular ducts; d: adult female anal lobes.

**Derivatio nominis.** The species is named after my elder daughter Marianna, who came with me on several collecting trips.



a



b



c



d



e



f

**PLATE 2.** a: adult females of *A. mariannae* Pellizzari enclosed in a felt eggsac; b: male tests; c: infested *Leptospermum scoparium*; d: nymphs on a *Leptospermum* twig; e: egg-laying female (ventral view); f: young adult female.

**Biological notes.** The young adult females and the ovipositing females, enclosed in their white felted eggsac, settle on the under surface of leaves, on the axil of leaves and twigs, and along the thin twigs of *Leptospermum scoparium* (Plate 2, fig. a). The oval, white, felted tests of the males are secreted on the underside of leaves or along the thin twigs (Plate 2, fig. b). In Italy, all instars (eggs, nymphal instars, adult males and females) were recorded on the host plant at the time of collection (Aug. 14, 2004) (Plate 2, fig. d). In France, adult females and males have been collected in May and again in September.

Despite the large number of known *Acanthococcus* or *Eriococcus* species, relatively few papers mention their biology or discuss how the number of annual generations varies depending also on the meteorological conditions. For instance, according to Gill (1993), *E. araucariae* develops 2 generations/year in California, whereas in South Italy it has 6 or 7 generations/year and overwinters as the egg stage (Marotta *et al.*, 2001). With regard to *Eriococcus* species living on *Leptospermum*, very little information is available. According to Zondag (1977), *E. orariensis* develops three and a partial fourth generations on *Leptospermum scoparium* in New Zealand. Although sparse, the collection data for *A. mariannae* suggest that this species could develop several overlapping generations throughout the year.

## Conclusion

It seems almost certain that *A. mariannae* has been accidentally introduced to Europe on *Leptospermum* species, probably *L. scoparium*. A comparison of some morphological characters of this new species (shape of dorsal microtubular ducts, shape of ventral cruciform pores, presence of large, dorsal macrotubular ducts, antennae 7 segmented) with other *Eriococcus* species recorded on Myrtaceae in Australasia or South America (Hoy, 1959; 1962; Gullan & Vranjic, 1991; Foldi & Kozár, 2007), whose Eriococcid fauna is zoogeographically related (Miller & Gonzalez, 1975), did not highlight any clear affinities and so the native land of this new species still remains unknown.

## Aknowledgements

We are grateful to Ferenc Kozár for kindly reading the manuscript and for his valuable suggestions. Many thanks also to Rosa Henderson, Douglas Miller and Danièle Matile Ferrero for studying the slides of this species and for their comments and to Chris Hodgson, Rosa Henderson and an anonymous reviewer whose comments helped to improve the manuscript.

## References

- Ben-Dov, Y. & Hodgson, C.J. (1997) Collecting and mounting. In: Ben-Dov, Y. & Hodgson, C.J. (Eds.), *World Crop Pests. Soft Scale Insects, Their Biology, Natural Enemies and Control*, vol.7A. Elsevier, Amsterdam, pp. 389–395.
- Ben-Dov, Y., Miller, D.R. & Gibson, G.A.P. (2010) *ScaleNet: a database of the scale insects of the world*. Available from <http://www.sel.barc.usda.gov/scalenet/scalenet.htm> (accessed February 2010).
- Epenhuijsen, K. van., Henderson, R.C., Carpenter, A. & Burge, G.K. (2000) The rise and fall of manuka blight scale: a review of the distribution of *Eriococcus orariensis* (Hemiptera: Eriococcidae) in New Zealand. *New Zealand Entomologist*, 23, 67–70.
- Foldi, I. & Kozár, F. (2007) New species and new records of *Eriococcus* (Hemiptera, Coccoidea, Eriococcidae) from South America. *Zootaxa*, 1573, 51–74.
- Gill, R.J. (1993) *The scale insects of California, part 2. The minor families (Homoptera: Coccoidea. California Dept. of Food and Agriculture. Technical series in Agricultural Biosystematics and Plant Pathology*, 2, 241pp.
- Gullan, P.J. & Vranjic, J.A. (1991) The taxonomy of the gum tree scales *Eriococcus confusus* Maskell and *E. coriaceus* Maskell (Hemiptera: Coccoidea: Eriococcidae). *General and Applied Entomology*, 23, 21–40.
- Henderson, R.C. (2007) Three new genera and six new species of felt scales (Hemiptera: Coccoidea: Eriococcidae) from mountain habitats in New Zealand. *Zootaxa*, 1449, 1–29.
- Hodgson, C.J. & Miller, D.R. (2010) A Review of the Eriococcid Genera (Hemiptera: Sternorrhyncha: Coccoidea) of South America *Zootaxa*, 2459, 1–101.

- Hodgson, C.J. & Trencheva, K. (2008) A new species of *Eriococcus* (Hemiptera: Sternorrhyncha: Coccoidea: Eriococcidae) and redescriptions of *Eriococcus roboris* Goux and *E. thymelaeae* Newstead, with a key to the *Eriococcus* species on *Quercus* in the western Palaearctic. *Zootaxa*, 1959, 1–38.
- Hodgson, C.J., Gonçalves, S.J.M.R., Miller, D.R. & Isaias, R.M.S. (2004) A key to genera of Eriococcidae (Hemiptera: Coccoidea) from the Neotropical region and a revision of *Pseudotectococcus* Hempel (Eriococcidae), a gall inducing scale insect genus from Brazil, with a description of a new species. *Lundiana*, 5, 51–72.
- Hoy, J.M. (1953) First record of the occurrence of *Eriococcus leptospermi* Mask. in New Zealand. *New Zealand Entomologist*, 1, 1.
- Hoy, J.M. (1954) A new species of *Eriococcus* Targ. (Hemiptera, Coccidae) attacking *Leptospermum* in New Zealand. *Transactions of the Royal Society of New Zealand*, 82, 465–474.
- Hoy, J.M. (1958) The immature stages of *Eriococcus orariensis* Hoy (Homoptera, Coccoidea). *New Zealand Journal of Science*, 1, 258–280.
- Hoy, J.M. (1959) Species of *Eriococcus* Targ. (Homoptera, Coccoidea) associated with the genus *Leptospermum* Forst. in south-eastern Australia and Tasmania. *New Zealand Journal of Science*, 2, 1–34.
- Hoy, J.M. (1962) *Eriococcidae (Homoptera: Coccoidea) of New Zealand*. New Zealand Department of Scientific and Industrial Research Bulletin 146, 1–219.
- Kozár, F. (2009) Zoogeographical analysis and status of knowledge of the Eriococcidae (Hemiptera) with a World list of species. *Bollettino di Zoologia Agraria e di Bachicoltura* (Ser. II), 41 (2), 87–121.
- Kozár, F. & Konczné Benedicty, Z. (2008) Description of three new genera, five new species and some additional data on the taxonomy and distribution of Neotropic Eriococcidae (Homoptera Coccoidea Eriococcidae). *Bollettino di Zoologia Agraria e di Bachicoltura* (Ser. II), 40(2), 1–8.
- Kozár, F., Williams, D.J. & Konczné Benedicty, Z. (2009) A new genus and four new species of the scale insect family Eriococcidae (Hemiptera: Coccoidea) from the Austro-Oriental Region. *Zootaxa*, 1979, 1–15.
- Marotta, S., Priore, R. & Lopez, C. (2001) Note morfologiche e bio-etologiche su *Acanthococcus araucariae* (Maskell, 1897) (Sternorrhyncha Coccoidea Eriococcidae). [Morphological and bioethological observation on *Acanthococcus araucariae* (Maskell, 1897) (Sternorrhyncha Coccoidea Eriococcidae)]. *Bollettino del Laboratorio di Entomologia Agraria 'Filippo Silvestri'*. Portici, 56, 69–79.
- Miller, D.R. & González, R.H. (1975) A taxonomic analysis of the Eriococcidae of Chile. *Revista Chilena de Entomología*, 9, 131–163.
- Miller, D.R. & Miller, G.L. (1992) Systematic analysis of *Acanthococcus* (Homoptera: Coccoidea: Eriococcidae) in the western United States. *Transactions of the American Entomological Society*, 118(1), 1–106.
- Williams, D.J. (1985) The British and some other European Eriococcidae (Homoptera: Coccoidea). *Bulletin of the British Museum (Natural History) Entomology Ser.*, 51, 347–393.
- Zondag, R. (1977) *Eriococcus orariensis* Hoy (Hemiptera: Coccoidea: Eriococcidae), causal agent of Mauka blight. Forest and Timber Insects in New Zealand, *New Zealand Forest Service No. 23*, 1–7.