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Revision of the family Asterolecaniidae  
(Hemiptera: Coccoomorpha) in Argentina

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## Revision of the family Asterolecaniidae (Hemiptera: Coccomorpha) in Argentina

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**Abstract.** The Asterolecaniidae (Hemiptera: Coccomorpha), known as pit scales, are currently represented by 11 genera and 52 species in the Neotropical region, and by five species in Argentina. The goal of this study is to review and update the information currently known about the biodiversity of Asterolecaniidae in Argentina. We describe *Argenta* Granara de Willink **new genus**, *Argenta eduardoi* Granara de Willink **new species**, *Mycetococcus ligae* Granara de Willink **new species**, and *Sclerosococcus williamsi* Granara de Willink **new species**; an illustration of *Pollinia pollini* (Costa) is also included; the species *Asterolecanium puteanum* Russell and *Russellaspis pustulans* (Cockerell) are noted for the first time in Argentina. Dichotomous keys to the genera of Asterolecaniidae and the species of *Asterolecanium* Targioni-Tozzetti, *Mycetococcus* Ferris, and *Sclerosococcus* McKenzie in Argentina are presented. This work increases the number of known species in Argentina to ten.

**Key words.** Pit scales, neotropics.

**Resumen.** Asterolecaniidae (Hemiptera: Coccomorpha), conocidas como “pit scales” están representadas por 11 géneros y 52 especies en la región Neotropical y cinco especies en la Argentina. El objetivo de este estudio es revisar y actualizar la información conocida acerca de la biodiversidad de Asterolecaniidae en Argentina. Se describe *Argenta* Granara de Willink **nuevo género**, *Argenta eduardoi* Granara de Willink **nueva especie**, *Mycetococcus ligae* Granara de Willink **nueva especie** y *Sclerosococcus williamsi* Granara de Willink **nueva especie**; se incluye también una ilustración de *Pollinia pollini* (Costa) y se cita por primera vez para el país a *Asterolecanium puteanum* Russell y *Russellaspis pustulans* (Cockerell). Se presenta una clave de los géneros de Asterolecaniidae y claves de las especies de *Asterolecanium* Targioni-Tozzetti, *Mycetococcus* Ferris y *Sclerosococcus* McKenzie registrados en la Argentina. Este trabajo eleva a diez el número de especies conocidas en la Argentina.

**Palabras clave.** “Pit scales”, neotropicales.

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### Introduction

The families Asterolecaniidae Cockerell, Cerococcidae Balachowsky, and Lecanodiaspididae Targioni-Tozzetti are known as “scale insects that produce galls or depressions”, i.e., pit scales (Lambdin and Kosztarab 1977). However, it should be noted that a pit is a depression in the gall itself, and not a depression in the plant. Pit scales share eight-shaped pores on one or both surfaces of the body, reduced antennae, and the absence of legs. The family Asterolecaniidae currently includes 25 genera and 247 species world-wide (García Morales et al. 2016), which affect a large number of plant species, mainly trees and shrubs, and rarely herbaceous plants. Some pit scales are capable of causing economic damage, such as *Bambusaspis bambusae* (Boisduval), which affects various Poaceae from South America, and *Pollinia pollini* (Costa) whose sole host is *Olea europaea* L. (Stumpf and Lambdin 2006).

In the Neotropical region, 11 genera and 52 species have been recorded, and *Asterodiaspis variolosa* (Ratzeburg), *Asterolecanium quaesitum* Russell, *Asterolecanium viridulum* Cockerell, *Bambusaspis bambusae*, and *Pollinia pollini* have been reported from Argentina (Granara de Willink and Claps 2003; Granara de Willink 2004; Stumpf and Lambdin 2006). This family has been studied by several researchers including Russell (1941), who dealt in depth with the genus *Asterolecanium*; Ferris (1955) studied the Asterolecaniidae of North America among other coccomorphan families; Nakahara (1981) listed the species present in Hawaii; Gill (1993) worked on those in California and described 10 species in four genera; Kosztarab (1996) included them in his work on scale insects of the northeastern United States; Kondo (2001) listed eight species in six genera for Colombia; Stumpf and Lambdin (2006) provided a comprehensive review of the species of North and South America; Giliomee and Kozar (2008) reviewed the family in South Africa; and Gavrilo-Zimin (2019) described a genus and four new species from different regions of the world. In Argentina, Granara de Willink (2004) listed three species of Asterolecaniidae on native and ornamental hosts.

The objective of this work is to extend that last work and update our view of the biodiversity of Asterolecaniidae in Argentina.

## Materials and Methods

Specimens were prepared using the techniques listed by Granara de Willink (1990). The material studied is deposited in the collection of the Instituto Fundación Miguel Lillo (IFML), Tucumán, Argentina.

Measurements are expressed in mm and  $\mu\text{m}$  showing the values for the holotype followed by the range of values for paratypes in parentheses. Body width is measured at the spiracular level where the body is the widest. This could be at the anterior or the posterior spiracle, or in between.

Structures around the central illustration are presented in different magnifications. Measurements are given in the corresponding descriptions.

The material examined is shown with the number of slides first, followed by the number of adult females, and numbers of first (N1), second (N2), and third (N3) instars, respectively, in parentheses. Example: 2 (13, 6N1, 3N2, 1N3).

All illustrations were provided by Cristina Granara de Willink.

## Results

### Family Asterolecaniidae

This family includes diverse taxa on a variety of hosts. They are sapsuckers exclusively found on angiosperms, most frequently on species of Fagaceae, Oleaceae, and Poaceae (Bambuseae) (Gavrilo-Zimin 2019). However, the species studied in this work were found on other host plant families: Anacardiaceae, Bromeliaceae, and Santalaceae.

The phylogenetic position of some genera is still controversial. Based on the characteristics of the anal area, Stumpf and Lambdin (2006) recovered the genera *Mycetococcus* Ferris, *Pollinia* Targioni-Tozzetti, and *Sclerosococcus* McKenzie as sister to the rest of the extant pit scale lineages. The Asterolecaniidae are thought to be most closely related to the Cerococcidae and the Lecanodiaspididae:

### Key to the genera of Asterolecaniidae in Argentina (adult females)

- |       |   |                               |
|-------|---|-------------------------------|
| 1.    | Eight-shaped pores restricted to distinct marginal bands, on dermal surface                               | 2                             |
| —     | Eight-shaped pores not restricted to distinct marginal bands, each at base of a duct opening onto surface | 5                             |
| 2(1). | With caudal tubes; in many species with arch-like tentorial sclerotization                                | <i>Bambusaspis</i> Cockerell  |
| —     | Without caudal tubes; without arch-like tentorial sclerotization  | 3                             |
| 3(2). | Dorsum with marginal bands of flat eight-shaped pores   | <i>Asterodiaspis</i> Signoret |
| —     | Dorsum with marginal bands of bent eight-shaped pores   | 4                             |

- 4(3). Six pairs of apical setae present or absent; if 6 pairs of apical setae present, then always with marginal band of 8-shaped pores; most species without simple disk pores on venter; if disk pores present on venter, then specimens either with bands of marginal or submarginal 8-shaped pores on dorsum and venter, or clypeolabral shield without tentorial sclerotization . . . *Asterolecanium* **Targioni-Tozzetti**  
 — With 6 pairs of apical setae and single row of marginal 8-shaped pores; with submarginal row of simple disk pores on venter; with tentorial sclerotization on clypeolabral shield . . . . . *Russellaspis* **Bodenheimer**
- 5(1). Circular in appearance; anal lobes membranous; without tubular ducts . . . . *Pollinia* **Targioni-Tozzetti**  
 — Elongate or pyriform in appearance; anal lobes partially or completely sclerotized; with tubular ducts . . . . . **6**
- 6(5). Without caudal process; anal ring horseshoe-shaped; last abdominal segment with thick, bulbous setae . . . . . *Sclerosococcus* **McKenzie**  
 — With caudal process; anal ring circular; last abdominal segment without bulbous setae . . . . . **7**
- 7(6). Caudal process strongly sclerotized; with numerous thick setae on dorsum and venter . . . . . *Mycetococcus* **Ferris**  
 — Caudal process slightly sclerotized; with few thin marginal setae . . . . . *Argenta* **Granara de Willink, gen. nov.**

### *Argenta* Granara de Willink, new genus

**Description.** Pyriform. Antennae unsegmented; legs absent. Marginal bands of eight-shaped pores missing. Dermis membranous, but segments posterior to vulva slightly sclerotized on venter and dorsum, forming a caudal process. Dorsum with scattered eight-shaped pores, with tubular ducts; anal lobes absent; anal ring without setae or pores. Venter with submarginal eight-shaped pores; spiracles surrounded by quinquelocular pores; with few short setae.

**Comments.** Among the recorded genera of Asterolecaniidae in North and South America, none resemble *Argenta*. This genus shares the presence of eight-shaped pores at the base of a duct with the genera *Sclerosococcus*, *Mycetococcus*, and *Pollinia*. *Argenta* has tubular ducts with short arms which are absent in the other three genera. It resembles *Mycetococcus* through the presence of a sclerotized caudal process. *Mycetococcus* differs from *Argenta* by possessing a strongly sclerotized caudal process with numerous thick setae on both dorsum and venter, while *Argenta* possesses a slightly sclerotized caudal process with few thin setae. Although the genera *Asterolecanium* Targioni-Tozzetti, *Palmaspis* Bodenheimer, and *Planchonia* Signoret also have tubular ducts with short arms, they differ from *Argenta* through the lack of eight-shaped pores at the base of a duct. In the Oriental region, the monotypic genus *Amorphococcus* Green presents characters similar to *Argenta*. Both genera form galls on host plants; with a pyriform body shape; antennae one-segmented; with tubular ducts; multilocular pores present near spiracles and absent on ventral abdomen. Differences include: (*Amorphococcus* characters in parentheses, taken from Lambdin and Kosztarab 1975): i) anal tube with anal plates with one seta each, absent (present); ii) group of setae close to vulva absent (present); iii) eight-shaped pores at the base of a wide duct, present (absent); iv) spiracles with quinquelocular pores only.

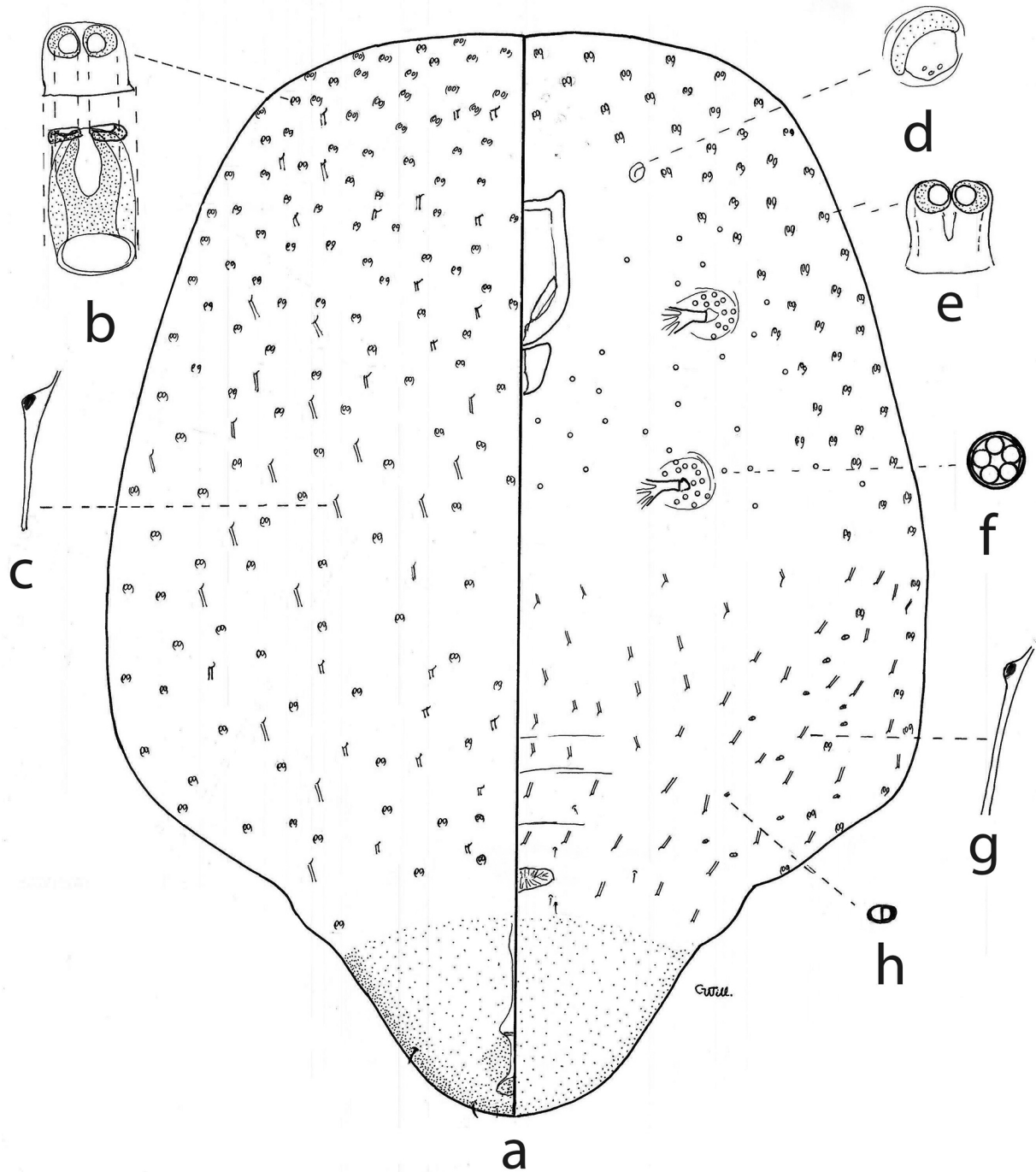
**Etymology.** The generic name alludes to the silvery color of the wax that covers the insect in the gallery under the bark of the host. It is considered to be of feminine grammatical gender.

### *Argenta eduardoi* Granara de Willink, new species

(Fig. 1)

**Type material. Holotype.** Female marked with a black circle. Argentina, Tucumán, Río Marapa, 20/ii/1993, on *Schinus* sp. (Anacardiaceae), MCG Willink col. 1(2) IFML. **Paratypes.** 6 (8, 5 N2, 4N1); same data as holotype. IFML.

**Diagnosis.** Marginal and submarginal ducts with eight-shaped pores numerous on ventral cephalothorax; ventral quinquelocular pores numerous in spiracular atrium and in the prothoracic and mesothoracic areas.



**Figure 1.** *Argenta eduardoi* sp. nov., adult female. **a)** Dorsal (left), ventral (right) view. **b, e)** Eight-shaped pore duct. **c, g)** Tubular duct. **d)** Antenna. **f)** Quinquelocular pore. **h)** Bilocular pore.

**Habitus.** This species forms a closed, slightly protruding gall with a small dorsal hole in the host's bark. The individuals, protected by a serous cover, form depressions and are arranged side by side in galleries under the bark, probably produced by other insects.

**Microscopic description.** Adult female. Pyriform, 816 (567–838)  $\mu\text{m}$  long and 648 (372–666)  $\mu\text{m}$  wide. Dermis membranous, with the last abdominal segments (VIII–IX) posterior to the vulva slightly sclerotized, forming a caudal process with a rounded end, with 1–2 setae on each side.

**Dorsum.** Eight-shaped pore ducts, approximately 5–7.35  $\mu\text{m}$  in diameter, scattered on the surface, more numerous in the cephalic area, considerably decreasing in number toward the abdomen, absent on the caudal process. Tubular ducts 14–21  $\mu\text{m}$  long and 1  $\mu\text{m}$  wide, with a short arm, numerous on the thorax and scattered on the abdomen. Caudal process without pores or ducts, with 2–3 pairs of very short spiniform marginal setae, 3.5–5  $\mu\text{m}$  long. Simple, non-terminal anal opening, at the end of an anal tube. Anal ring 12 (10–12)  $\mu\text{m}$  in diameter, without pores and setae.

**Venter.** Very small antennae, apparently one-segmented with short setae. Spiracles with thin arms and small atria, approximately 22  $\mu\text{m}$  long and 8  $\mu\text{m}$  in diameter. Similar-sized anterior and posterior spiracles open into a circular peritreme, 35 (35–49)  $\mu\text{m}$  in diameter, with 10–12 quinquelocular pores, 4.2  $\mu\text{m}$  in diameter. Quinquelocular pores are also found on the thorax in between the anterior and posterior spiracles, reaching the body margin and close to the mouthparts, but are rare on abdominal segments. The labium is unsegmented. Eight-shaped pore ducts in marginal and submarginal bands throughout the length of the body, numerous on the cephalothorax and rare on the abdomen. Vulva on first abdominal segment anterior to sclerotized area. Scattered submarginal bilocular pores on the abdomen. Up to six small, spiniform setae per segment, 3–5 (3.5)  $\mu\text{m}$  in length, in the membranous part of the abdomen. Legs absent.

**First instar nymph (Fig. 2).** The description is based on a single individual. The other three available specimens are not in good condition.

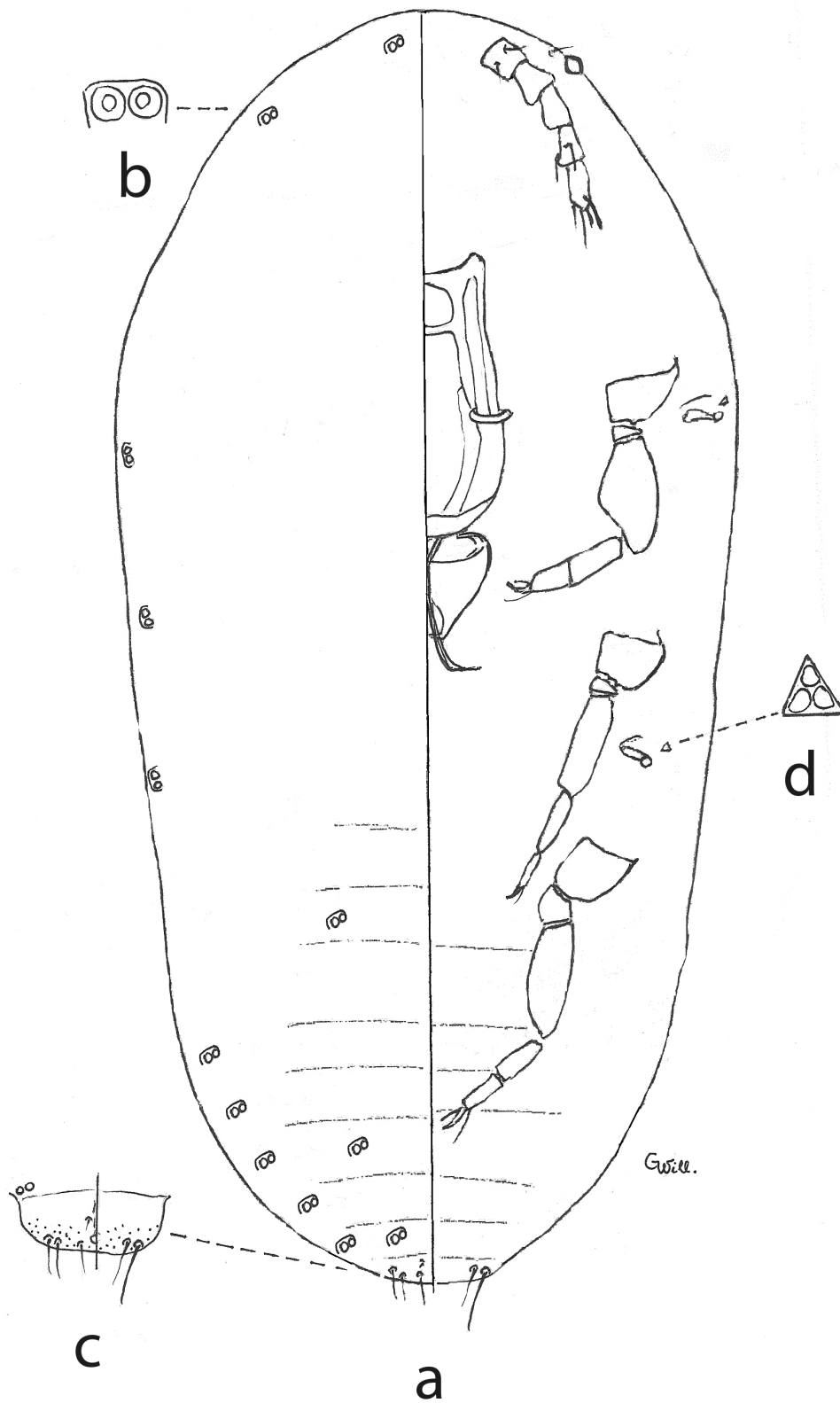
Oval body shape, 280  $\mu\text{m}$  long and 100  $\mu\text{m}$  wide, with membranous dermis. With small, rounded anal lobes, not separated, carrying three dorsal setae of similar lengths and two ventral setae, one 3.5  $\mu\text{m}$  long, and the apical one longer.

**Dorsum.** With marginal eight-shaped pore ducts, one per abdominal segment, one on the prothorax, one on the mesothorax, one on the metathorax, one in the anterior region, and one posterior to the eye, on each side of the body, also in submedial rows on abdominal segments I, V, and VII. With spiniform marginal setae, very thin, 5.6  $\mu\text{m}$  long, one behind each antenna.

**Venter.** Antennae 45  $\mu\text{m}$  long, with five segments. The base segment is 10  $\mu\text{m}$  long, II 10  $\mu\text{m}$ , III 8  $\mu\text{m}$ , IV 6  $\mu\text{m}$ , and V 9  $\mu\text{m}$ ; with 3–4 setae at the tip, one fleshy seta in the middle of the distal segment, and two setae on the base segment. Eyes present, on the margins. Clypeolabral shield 42  $\mu\text{m}$  long and 25  $\mu\text{m}$  wide, labium 23  $\mu\text{m}$  long and 25  $\mu\text{m}$  wide. Anterior and posterior spiracles of similar size, 8  $\mu\text{m}$  in length, with a trilocular pore close to the peritreme. Well-developed legs, coxae of the metathoracic legs 12  $\mu\text{m}$  long and 14  $\mu\text{m}$  wide, trochanter plus femur 27  $\mu\text{m}$  long, and tibia plus tarsus plus claw 31  $\mu\text{m}$  long.

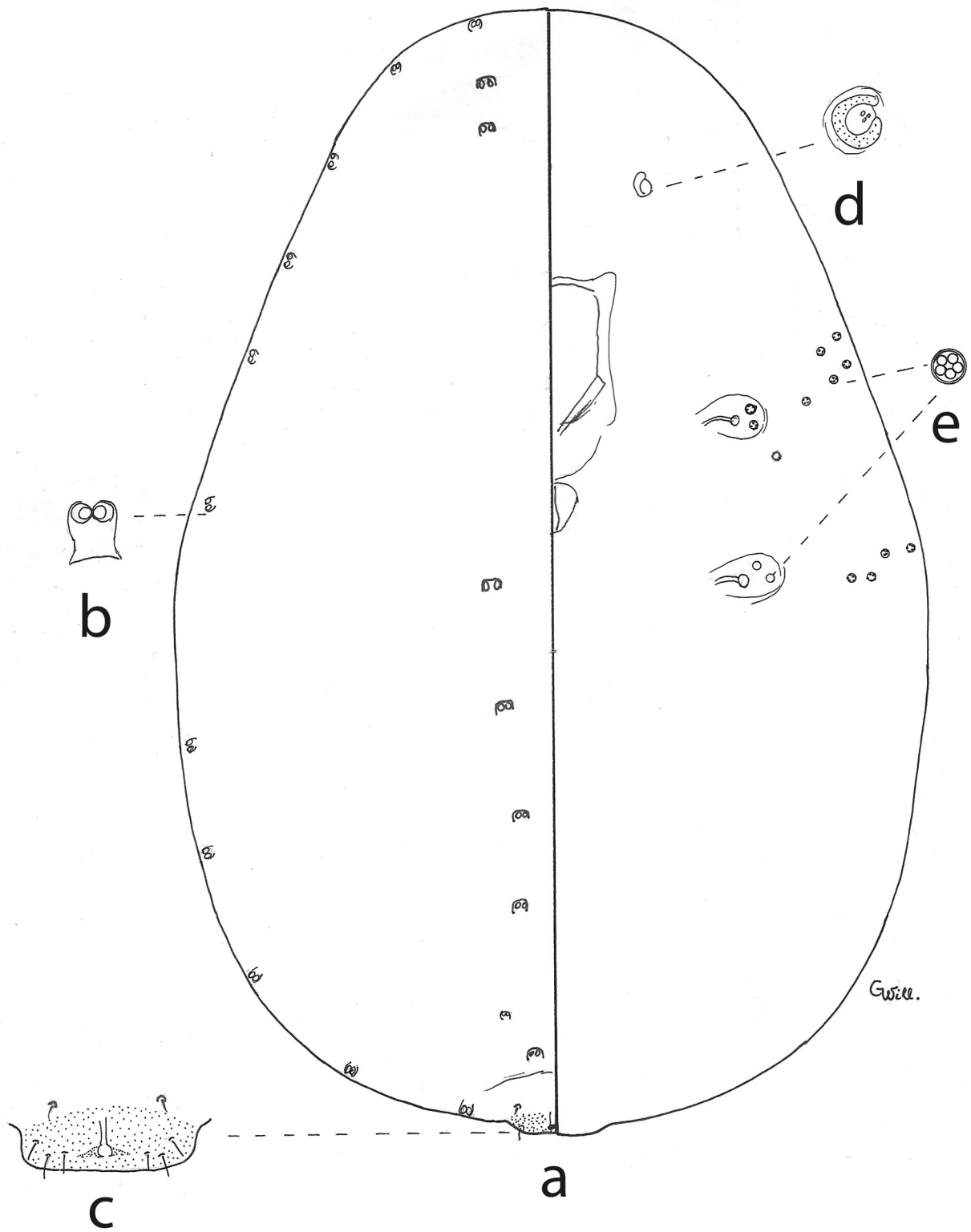
**Second instar nymph (Fig. 3).** Oval body shape, 444  $\mu\text{m}$  long and 288  $\mu\text{m}$  wide, with membranous dermis. Anal lobes with three dorsal setae, slightly sclerotized, with a gap, and one anal tube. **Dorsum:** With short eight-shaped pore ducts along the margin, 5  $\mu\text{m}$  long and 4.2  $\mu\text{m}$  wide. With 10–12 eight-shaped pore ducts along the margin on each side of the body, one duct in front of the mouthparts, one submedial on the prothorax, and four ducts on the dorsal midline of the abdomen. Posterior sclerotized area without pores, with three pairs of short, spiniform, marginal setae. Anal ring without setae and pores. **Venter:** Antennae strongly reduced, invaginated, with 3–4 short setae. With similar-sized anterior and posterior spiracles, 15.4  $\mu\text{m}$  in length, peritreme diameter 6.3  $\mu\text{m}$ ; spiracles open into a circular depression approximately 21  $\mu\text{m}$  in diameter, with 2–3 quinquelocular pores, 3.5  $\mu\text{m}$  in diameter, with 4–5 quinquelocular pores also found in the spiracular furrows. Mouthparts 56  $\mu\text{m}$  long, with unsegmented labium. Legs absent.

**Etymology.** The specific epithet was designated in honor of Eduardo Willink for the strong support throughout the career of the author of the species.



**Figure 2.** *Argenta eduardoi* sp. nov., first instar nymph. **a)** Dorsal (left), ventral (right) view. **b)** Eight-shaped pore duct. **c)** Anal lobe. **d)** Trilocular pore.





**Figure 3.** *Argenta eduardoi* sp. nov., second instar nymph. **a)** Dorsal (left), ventral (right) view. **b)** Eight-shaped pore duct. **c)** Anal lobe. **d)** Antenna. **e)** Quinquelocular pores.

***Asterodiaspis* Signoret, 1877**

**Type species.** *Aonidia ilicicola* Targioni-Tozzetti, 1888

**Diagnosis.** Flat marginal eight-shaped pores on margins (Stumpf and Lambdin 2006).

***Asterodiaspis variolosa* (Ratzeburg, 1870)**

**Material examined.** Jujuy, 12/1993, on oak (*Quercus* sp.), Muruaga col., 1 (1) IFML.

**Diagnosis.** Apical setae 23–37 µm long, on fused anal lobes; with 32–80 quinquelocular pores in each spiracular furrow (Stumpf and Lambdin 2006).

**Comments.** Its common name is golden oak scale. Found on all species of *Quercus* L. (Fagaceae) (Stumpf and Lambdin 2006).

***Asterolecanium* Targioni-Tozzetti, 1868**

**Type species.** *Coccus aureus* Boisduval, 1868

**Diagnosis.** Eight-shaped pores in marginal band and dispersed and/or grouped on the dorsum. Small 8-shaped pores present or absent. Tubular ducts present. Anal ring with pores and six setae; with arched plates. Antennae one-segmented. Simple disk pores may form ventral submarginal band. 5–7 locular pores in spiracular furrows, quinquelocular pores sometimes in ventral submarginal bands. Multilocular pores on the abdomen.

**Comments.** According to Stumpf and Lambdin (2006), *Asterolecanium* is a paraphyletic genus without defining characters.

**Key to the species of *Asterolecanium* in Argentina (adult females)**

1. Eight-shaped pores in single marginal row and in dorsal medial and transverse bands ..... *A. puteanum* Russell
- Eight-shaped pores in double or triple marginal rows; not arranged in dorsal bands ..... 2
- 2(1). Oval body shape; eight-shaped pores in three sizes in marginal rows, most reaching the last abdominal segment; Eight-shaped pores similar to marginal ones absent on dorsum; antennae with 3–4 long fleshy setae and 2–3 short, thin, pointed setae ..... *A. quaesitum* Russell
- Circular body shape; marginal eight-shaped pores in three rows from head to prothoracic spiracles, continuing in double rows to the sixth abdominal segment and in a single row to the anal area; dorsum with scattered eight-shaped pores of different sizes; antennae with two fleshy and two thin setae with rounded ends ..... *A. viridulum* Cockerell

***Asterolecanium puteanum* Russell, 1941**

**Material examined.** Argentina, La Pampa, PN Lihuel Calel, xi/ 1997, on *Lycium* sp. (Solanaceae), MCG de Willink col., 2(9) 1020 y 1021 IFML.

**Diagnosis.** Eight-shaped pores in transverse dorsal bands, size similar to marginal pores (Stumpf and Lambdin 2006).

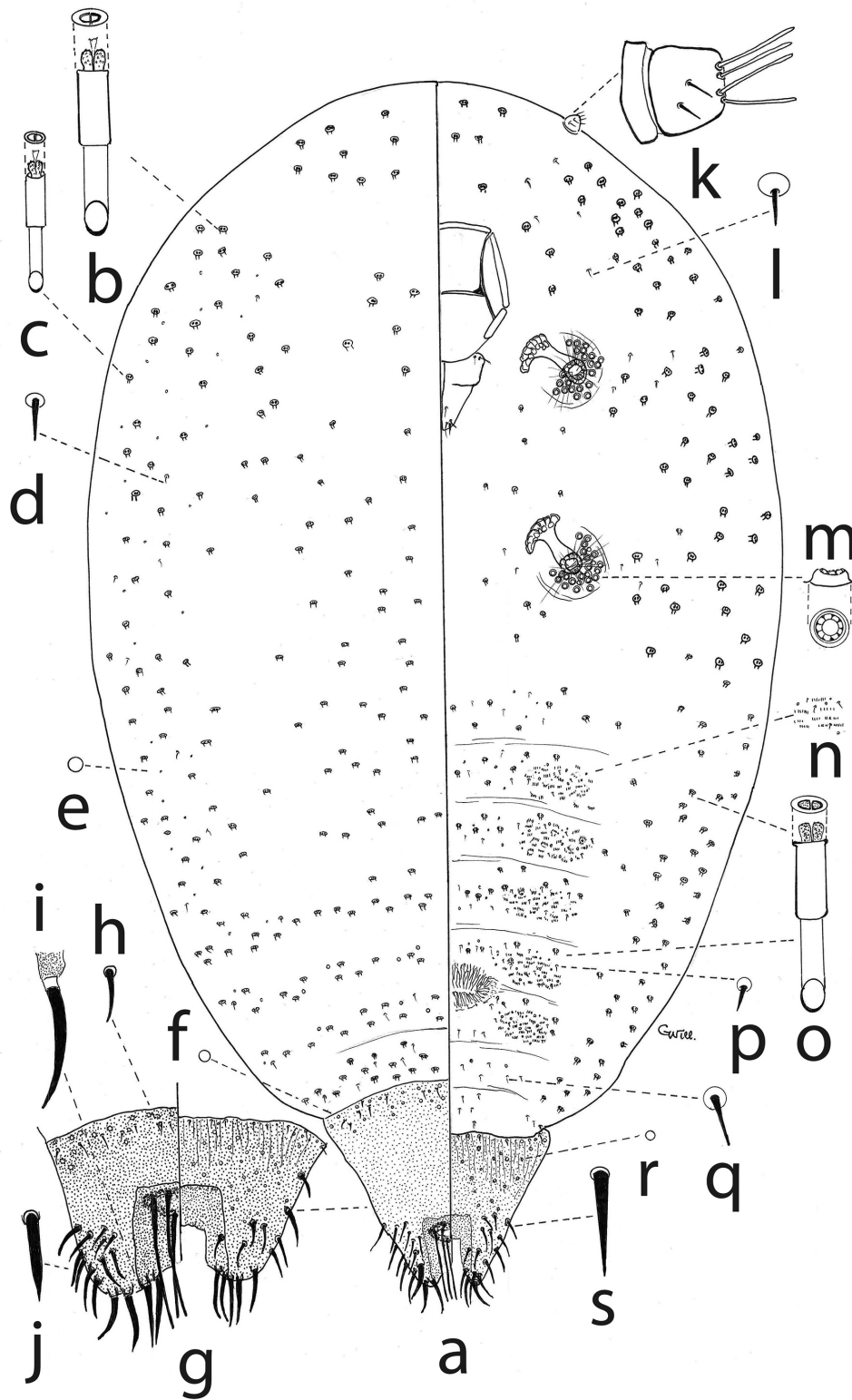
**Comments.** The common name is holly pit scale. This is the first record of *A. puteanum* in Argentina. *Lycium* L. is added as a new host to the list of five genera and eight species cited for this species (García Morales et al. 2016).

***Asterolecanium quaesitum* Russell, 1941**

**Diagnosis.** Eight-shaped pores bent, with different sizes in dorsal marginal bands and ventral submarginal band; apical setae 25–35 µm long (Stumpf and Lambdin 2006).

**Comments.** The common name is tusca pit scale. Found on tusca, *Acacia* sp. (Fabaceae). Cited from Córdoba, Argentina (Stumpf and Lambdin 2006).





**Figure 4.** *Mycetococcus ligae* sp. nov., adult female. **a)** Dorsal (left), ventral (right) view. **b, c, o)** Tubular ducts. **d, l, p, q)** Setae. **e)** Small disk pore. **f)** Large disk pore. **g)** Caudal process. **h, i, j, s)** Different types of setae on caudal process. **k)** Antenna. **m)** Multilocular pore. **n)** Microspicules. **r)** Disk pores on caudal process.

**Habitus.** Body of the adult female completely covered by a felt-like structure with a cottony appearance. These asterolecaniids do not produce a pit; they were found on the leaves of their hosts.

**Microscopic description.** Body oval, elongated, length 1.2 (1.4–1.6) mm and width 0.9 (0.7–1.0) mm. Dermis membranous, except in the caudal process area formed by the last two strongly sclerotized abdominal segments on dorsum and venter. Legs absent.

Dorsum. Tubular ducts abundant, with internal eight-shaped ends formed by two rounded protrusions, each with one medium filament and one simple external opening, 14–21  $\mu\text{m}$  long and 2–3.5  $\mu\text{m}$  wide, forming transverse bands on the abdomen. Dorsal setae very small, like spicules, 4–5  $\mu\text{m}$  long, basal diameter 3–3.5  $\mu\text{m}$ , similarly distributed like disk pores. Small disk pores, 1–2  $\mu\text{m}$  long, in submarginal longitudinal bands on thorax and abdomen. Large disk pores, 4  $\mu\text{m}$  long, in transverse rows on the last 2–3 segments anteriorly to and at the base of the caudal process.

Venter. Antennae 27 (24–31)  $\mu\text{m}$  long, bisegmented, the basal segment without setae and the distal segment with four fleshy setae at the apex and two long spiniform setae. Clypeolabral shield 174 (160–184)  $\mu\text{m}$  long and 140 (128–142)  $\mu\text{m}$  wide. Labium bisegmented, 97 (97–98)  $\mu\text{m}$  long and 117 (97–98)  $\mu\text{m}$  wide, basal segment with two pairs of setae on the anterolateral corners, apical segment with three pairs of thin setae at the tip, and a mid-segment pair. With two pairs of spiracles of equal size, 58  $\mu\text{m}$  long and 22  $\mu\text{m}$  wide at the peritreme, located in a dermal depression; multilocular pores with 9–10 locules, 10  $\mu\text{m}$  in diameter, only around the spiracular opening, with 18–22 pores around the anterior pair and 26–30 around the posterior pair. They are usually found in radial dermal striations around the peritreme. Tubular ducts similar to the dorsal ones, the smallest in the middle and the largest in the lateral and submarginal areas from the head to segment VIII. Quinquelocular pores absent. Disk pores only in the middle of the abdomen. Submedial areas covered with large numbers of microspicules, small setae, and disk pores, wider in lateral areas of abdominal segments III–VII.

**Caudal process.** Formed by abdominal segments X–XI, strongly sclerotized dorsally and ventrally, 200 (202–206)  $\mu\text{m}$  long and 366 (312–316)  $\mu\text{m}$  wide. Tip rounded with approximately 20 thick setae, 46–54  $\mu\text{m}$  long, with pointed tips and thick, tall, protruding bases; remaining setae with rounded tips, thinner, but of same length as the other setae; 14–15 dorsal and 13–15 ventral setae. On the anterior part of the caudal process there is a band of 7–8 dorsal setae, approximately 10  $\mu\text{m}$  long, and disk pores; ventrally they are distributed on the surface of the lobe. Anal ring 105 (97–100)  $\mu\text{m}$  wide, dorsal, located at the bottom of a strongly sclerotized depression and surrounded by the anal lobes; with 2–3 pore circles and three pairs of long setae, 136 (125–140)  $\mu\text{m}$  long. The anal plates and the arched plate which surround the anal opening and are in turn surrounded by the strong anal ring are difficult to see.

**Systematic considerations.** *Mycetococcus ligae* shares with *M. ehrhorni* eight-shaped ducts and a caudal process. They are differentiated by (*M. ehrhorni* characters in parentheses, taken from Ferris 1955): 1) anal lobes with numerous long and stout dorsal and ventral setae (with short setae, two dorsally and three ventrally); 2) anal lobes strongly sclerotized forming part of the caudal process (forming two cones, one for each lobe, separated by an indentation); 3) with multilocular pores (9–10 locules) close to spiracles (with quinquelocular pores); and 4) areas formed by concentration of microspicules, small setae, and disk pores (areas absent).

*Mycetococcus ligae* resembles *M. corticis* because both have a caudal process, multilocular pores close to the spiracles, and radial dermal striations around the peritreme. They are differentiated by (*M. corticis* characters in parentheses, taken from Ferris 1955): 1) antennae bisegmented (one-segmented); 2) areas formed by concentration of microspicules, small setae, and disk pores (areas absent); 3) tubular ducts with internal ends eight-shaped (internal ends truncated); and 4) eight-shaped pores absent (present).

*Mycetococcus ligae* differs from *M. sinensis* by (*M. sinensis* characters in parentheses, taken from Gavrilov-Zimin 2018): 1) antennae bisegmented, with four fleshy and two spiny setae (antennae vestigial, non-segmented, with one seta); 2) quinquelocular pores absent (present in groups between spiracles and body margin); 3) multilocular pores around spiracular peritremes (multilocular pores absent); 4) areas formed by concentration of microspicules, small setae, and disk pores (areas absent), and 5) legs absent (legs vestigial).

Unlike the known species in this genus, whose hosts belong to the Fagaceae, the new species described here was found on a species of Santalaceae.

**First instar nymph (Fig. 5).** Oval body shape, 0.5 mm long and 0.3 mm wide. **Dorsum:** With trilocular pores, 4  $\mu\text{m}$  diameter, forming longitudinal marginal, submarginal, lateral, and medial rows, present on abdomen and metathorax; toward the front of the body they become rare; with three pores near the base of the antennae. Spiniform setae very slender, arranged in longitudinal submarginal and median rows; abdominal segment VII with 8 setae, each 7  $\mu\text{m}$  long. Anal ring 24.5  $\mu\text{m}$  in diameter, exposed, with six setae, each 63  $\mu\text{m}$  long, and 1–2 rows of pores. Undifferentiated anal lobes, represented by two dorsal setae and two trilocular pores. With a sclerotization of the last segment, 75–90  $\mu\text{m}$  in diameter, which surrounds the anal ring and the anal lobes; with four setae and two trilocular pores. **Venter:** Antennae 70  $\mu\text{m}$  long, with six segments; basal segment with two short setae, segment V with one fleshy seta, and apical segment with five slender setae and one fleshy seta. Eyes present. Clypeolabral shield 65  $\mu\text{m}$  long. Labium 45  $\mu\text{m}$  long, without visible segmentation. With trilocular pores, 3  $\mu\text{m}$  long, smaller than the dorsal ones, on the pro-, meso-, and metathorax. Setae in marginal, lateral, and medial rows, on abdomen and anterior region, about 7  $\mu\text{m}$  long. Last segment sclerotized, with four setae and one trilocular pore. Legs developed, coxae of hind legs 14  $\mu\text{m}$  long and 22  $\mu\text{m}$  wide, trochanter plus femur 47  $\mu\text{m}$  long, tibia plus tarsus 56  $\mu\text{m}$  long, claw 10.5  $\mu\text{m}$  long.

**Second instar female nymph.** With oval and rounded body. Antennae bisegmented. Legs missing. With bisegmented labium. Short eight-shaped pore ducts rare on both surfaces. With three multilocular pores close to anterior spiracles and four close to posterior spiracles, respectively. Anal ring with six setae, pores arranged in two bands. Caudal process with three short spiniform dorsal setae. With an anal plate inside the anal tube.

**Third instar female nymph.** Oval body. Bisegmented antennae. Without legs. Multilocular pores restricted to the spiracular peritreme, with 6–7 in the anterior ones and 10–11 in the posterior ones. Eight-shaped pores at the bases of tubular ducts, formed by two rounded protuberances, numerous on both surfaces. Anal ring sclerotized, with six setae. Anal tube sclerotized, with two lateral internal setae. Caudal process with three setae on external surface and seven lateral and marginal setae. With sporadic and very small setae, on three segments anterior to caudal process. With spicule-like setae on abdominal segments.

**Second instar male nymph.** With oval and rounded body. Antennae with six segments. Eyes present. Legs developed, tibiae longer than tarsi. Slightly sclerotized circular pores scattered on both surfaces. Very small invaginated eight-shaped pores scattered over both surfaces. One to three multilocular pores close to anterior spiracles, four to five close to posterior ones, respectively. Exposed anal ring with six setae, and pores arranged in two bands. Anal process not protruding, with three dorsal setae near the anal ring and four ventral setae, one larger than the others.

**Etymology.** The specific epithet of this species alludes to the specific epithet and common name (liga) of the host plant.

### ***Pollinia Targioni-Tozzetti, 1868***

**Type species.** *Coccus pollini* Costa, 1857

**Diagnosis.** Eight-shaped pores at the base of a duct, small, with a dark edge. Few setae present, small, on both surfaces. Membranous anal lobes with setae. Tubular ducts absent.

### ***Pollinia pollini* (Costa, 1857)**

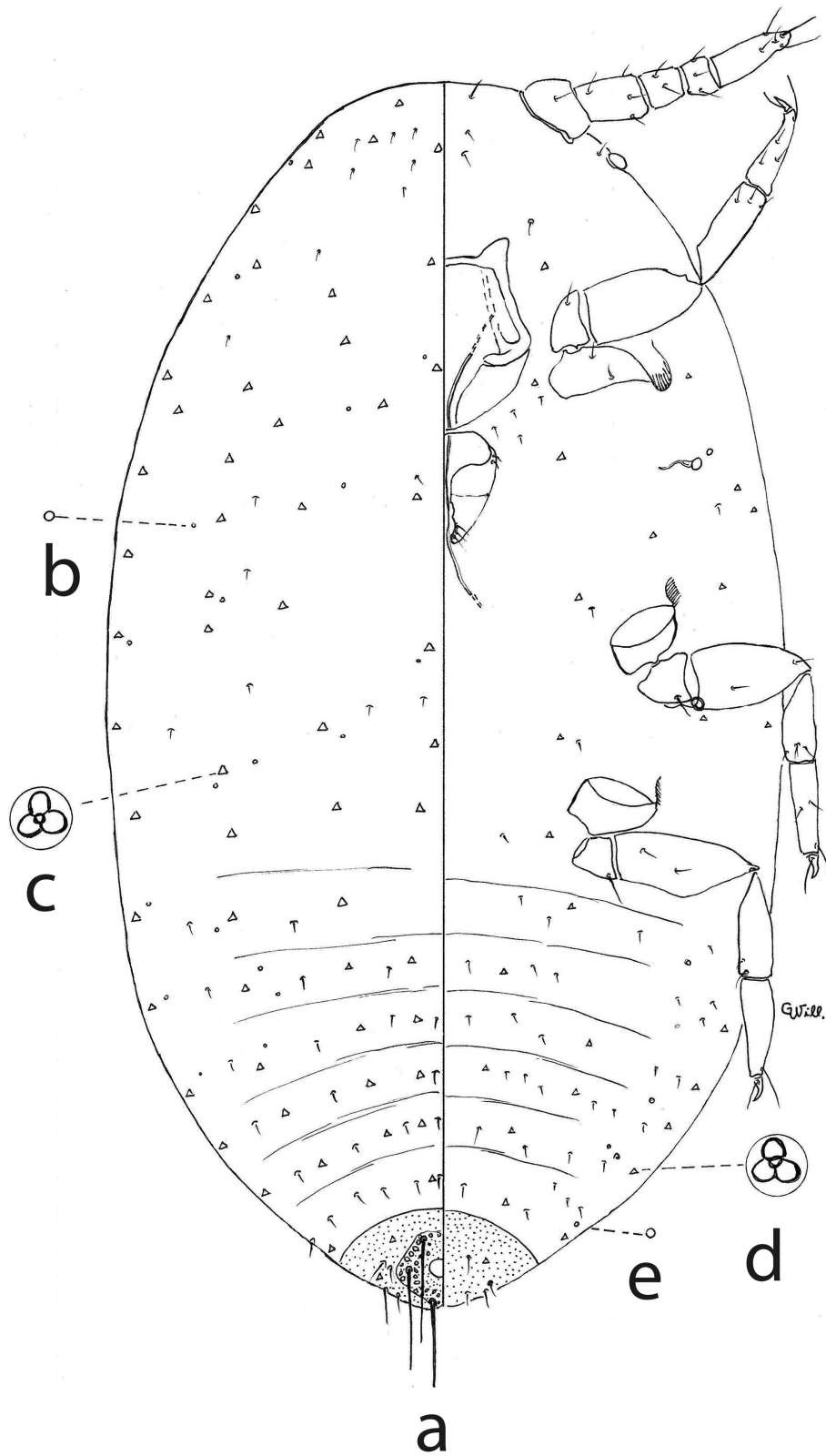
(Fig. 6)

**Material examined.** Argentina, Mendoza, iii/1997, on *Olea europaea*, García col., 5 (9) 1023, 1024, 1025, 1026, 1027, 1028 IFML; Córdoba, Cruz del Eje, iii/2006, on *Olea europaea*, Mazzuferi col., 3 (18) 1029, 1030, 1031 IFML.

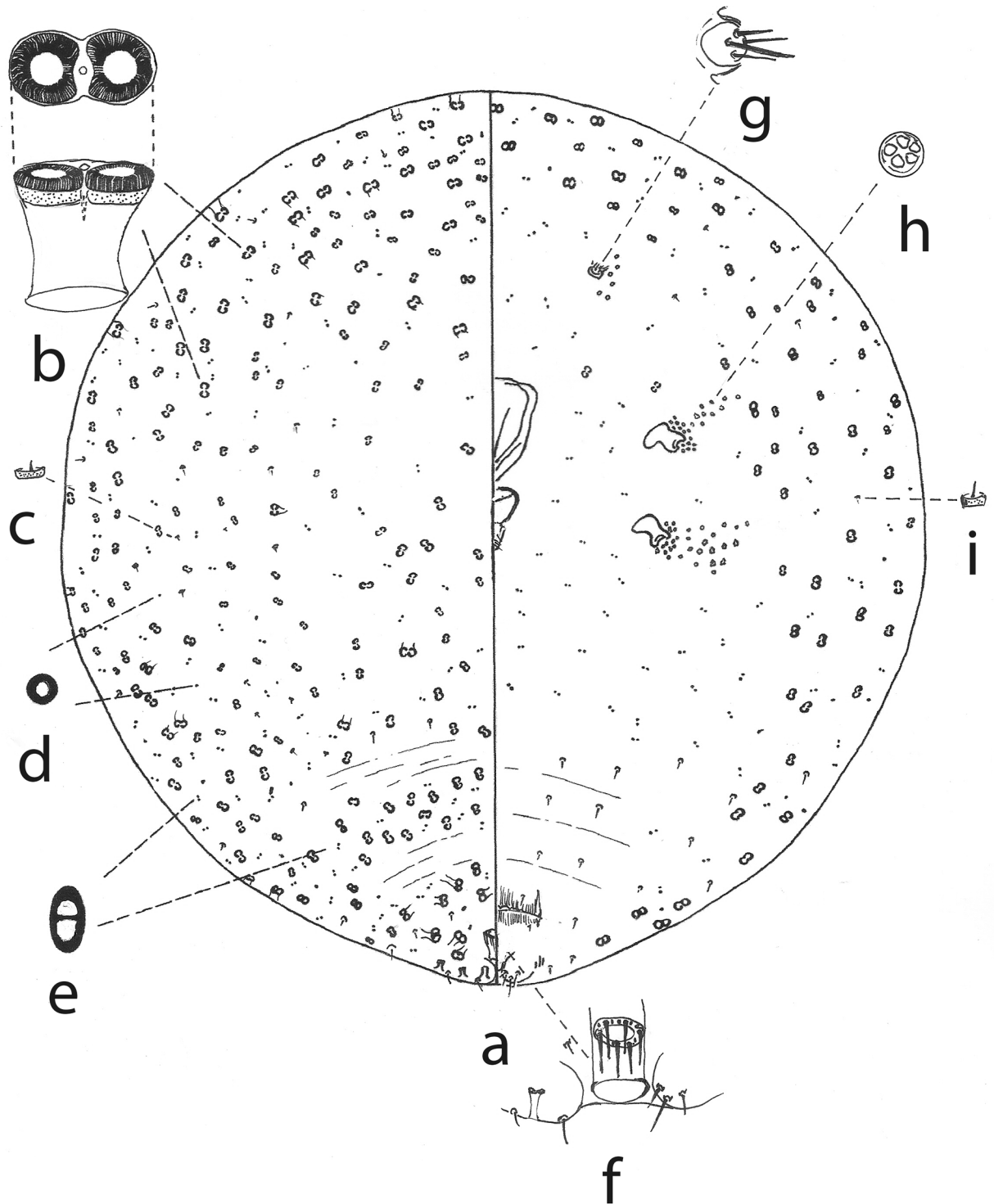
**Diagnosis.** Spiniform setae rare, with a large base. Rounded anal lobes cover the anal area.

**Biological data.** *Pollinia pollini* does not produce pits on the host plant. Found under dead specimens of *Saissetia oleae* (Olivier) (Hemiptera: Coccidae). Cucchi and Becerra (2015) speculate that this could be for protection against parasitoids.

**Comments.** The common name is ornate olive scale. It mainly affects olive, *Olea europaea* L. (Oleaceae) but was



**Figure 5.** *Mycetococcus ligae* sp. nov., first instar nymph. **a)** Dorsal (left), ventral (right) view. **b, e)** Disk pores. **c, d)** Trilocular pores.



**Figure 6.** *Pollinia pollini* (Costa), adult female. Modified after Gill (1993). **a)** Dorsal (left), ventral (right) view. **b)** Eight-shaped pore ducts. **c, i)** Setae. **d)** Disk pores. **e)** Bilocular pore. **f)** Anal lobe. **g)** Antenna. **h)** Quinquelocular pore.



also found on fig, *Ficus carica* L. (Moraceae) (García Morales et al. 2016). In Argentina, it is found in Córdoba, La Rioja, Mendoza, and San Juan (Cucchi and Becerra 2015).

### ***Russellaspis* Bodenheimer, 1951**

**Type species.** *Asterodiaspis pustulans* Cockerell, 1892

**Diagnosis.** With tentorial sclerotization on the clypeolabral shield. Based on cladistic analysis, it is part of the Asterolecaniinae subfamily, as a group within *Asterolecanium* (Stumpf and Lambdin 2006).

### ***Russellaspis pustulans* (Cockerell, 1892)**

**Material examined.** Argentina, Santiago del Estero, near Lavalle, 17/v/1998, host unknown, MCG de Willink col., 1(5) 1022 IFML.

**Diagnosis.** With submarginal row of simple disk pores on venter. With tentorial sclerotization on the clypeolabral shield (Stumpf and Lambdin 2006).

**Comments.** The common name is oleander pit scale. Polyphagous, known to feed on plants in 69 families (García Morales et al. 2016). This is the first record of this species in Argentina.

### ***Sclerosococcus* McKenzie, 1958**

**Type species.** *Sclerosococcus ferrisi* McKenzie, 1958

**Diagnosis.** Adult female with membranous dermis, except partial sclerotization of the last three or four abdominal segments. With eight-shaped pore ducts on dorsum and venter. Anal lobes not protuberant, with robust apical setae and 5–6 acute spiniform setae. Abdominal quinquelocular pores in transverse bands either present or absent. Antennae and labium one-segmented. Groups of multilocular pores with 7–9 locules lateral of spiracles. Multilocular pores with 5–8 locules on dorsum or dorsum and venter of cephalothorax, either present or absent. Without legs, anal ring setae, bilocular pores, simple disk pores, and tubular ducts (modified from McKenzie 1958 and Lambdin 1980).

**Comments.** To date, four species have been described: *S. bromeliae* McKenzie, 1963, on undetermined Bromeliaceae from Florida, Mexico, and Peru, *S. chilensis* Lambdin, 1980, on Bromeliaceae from Chile, *S. ferrisi* McKenzie, 1958, on a “succulent” from Mexico, and *S. tillandsiae* Lambdin, 1980, on *Tillandsia* sp. (Bromeliaceae) from Ecuador; the last two were found in quarantine in San Francisco and Los Angeles, California, USA, respectively (Lambdin 1980).

### **Key to the species of *Sclerosococcus* (adult females)**

1. With two groups of 3–6 tack-shaped setae (Fig. 7, 8) between the antennae and the first spiracle . . . . . ***S. bromeliae* McKenzie**
- No groups of setae in that location . . . . . **2**
- 2(1). Last abdominal segments partially sclerotized . . . . . **3**
- Last abdominal segments membranous . . . . . **4**
- 3(2). Cephalothorax with groups of multilocular pores with 6 locules forming dorsal and ventral marginal bands; quinquelocular pores in two entirely or partially transverse bands on ventral segments VI and VII and on dorsal segments VI–VIII . . . . . ***S. ferrisi* McKenzie**
- Cephalothorax with multilocular pores with 7 locules in partial or complete bands on dorsal and ventral margins; abdominal quinquelocular pores absent . . . . . ***S. williamsi* Granara de Willink, sp. nov.**
- 4(2). With groups of multilocular pores with 7 locules forming bands from the cephalothoracic margin to the area behind the first pair of spiracles; quinquelocular pores in dorsal and ventral transverse bands, not found on abdominal margin . . . . . ***S. tillandsiae* Lambdin**
- With groups of multilocular pores with 7 locules forming wide dorsal and ventral cephalothoracic bands; quinquelocular pores in dorsal and ventral transverse rows, present on abdominal margin . . . . . ***S. chilensis* Lambdin**

***Sclerosococcus williamsi* Granara de Willink, new species**

(Fig. 7, 8)

**Type material. Holotype.** Female marked by a black circle. Argentina, Salta, Alemania, v/1991, on Bromeliaceae, possibly *Deuterocohnia longipetala* (Baker) Mez in Mart, Granara de Willink col. 1(2). **Paratypes.** 6 (13, 2 N2); same data as holotype. IFML.

**Material examined.** Argentina, Salta, Alemania, iii/1993, 4 (16, 4 N1, 1 N2); vii/1990, 1(3); Salta, Cafayate, iv/1997, 5 (4, 7 N2, 1 male); Salta, El Anfiteatro, near Cafayate, 22/v/2009, 10 (31, 17 N1, 4 N2), all collected on *Deuterocohnia* Mez, possibly *D. longipetala* (Baker) Mez (Bromeliaceae) by Granara de Willink. IFML.

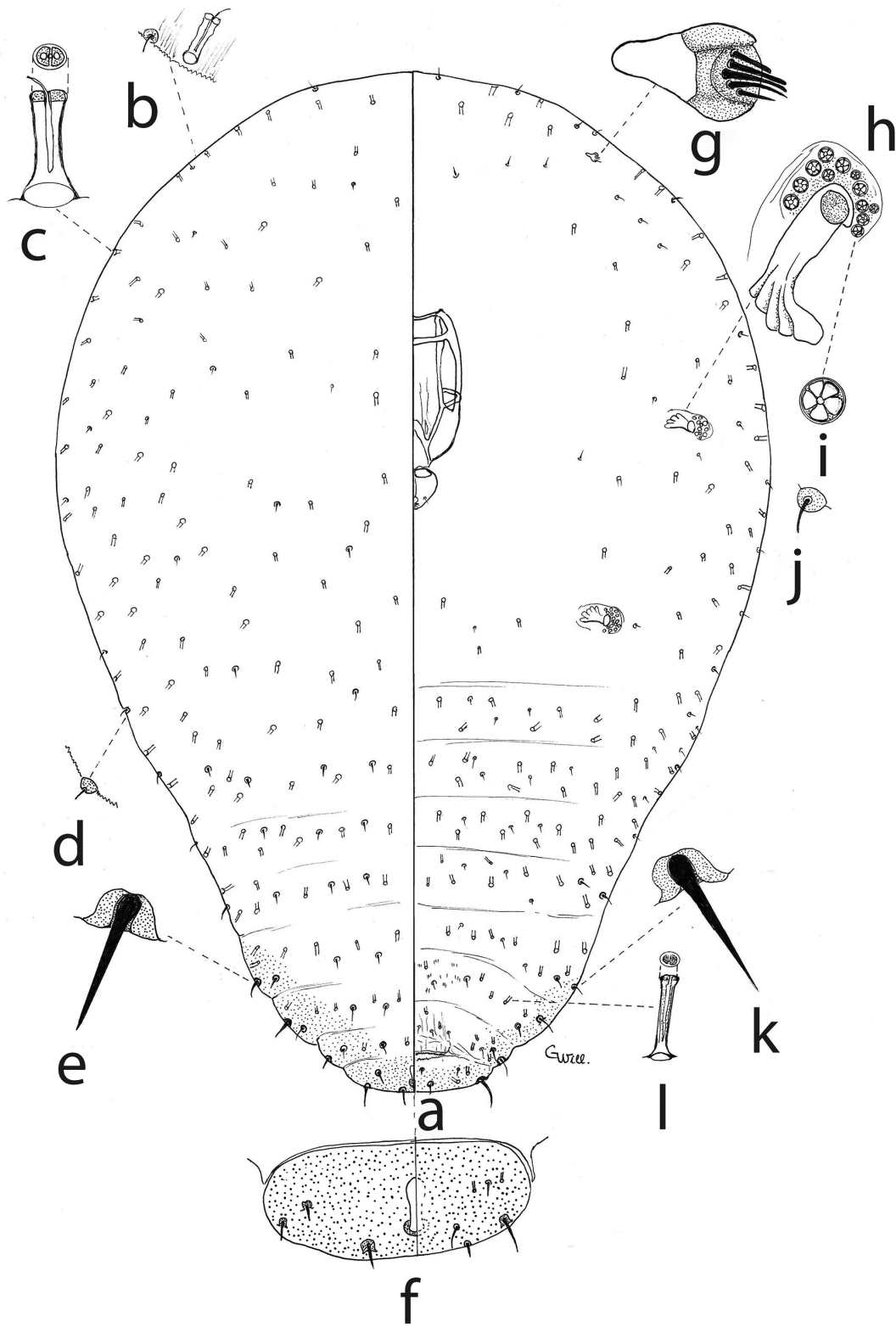
**Diagnosis.** Multilocular pores with 5–9 locules present in spiracular atrium. Multilocular pores absent or present on marginal and submarginal cephalothorax. Multilocular pores absent on dorsal and ventral abdomen. Numerous eight-shaped pore ducts of varying sizes on dorsum and venter. Marginal setae of the last four abdominal segments and of the anal lobe strong, with a bulbous base, inserted into a sclerotized depression.

**Habitus.** This species was found in flower calices. Apparently, it does not make pits. Each female forms a network of thin and long wax filaments that surround and protect it, leaving the posterior part of the body free. Without filaments, it shows little powdery wax and a yellowish color.

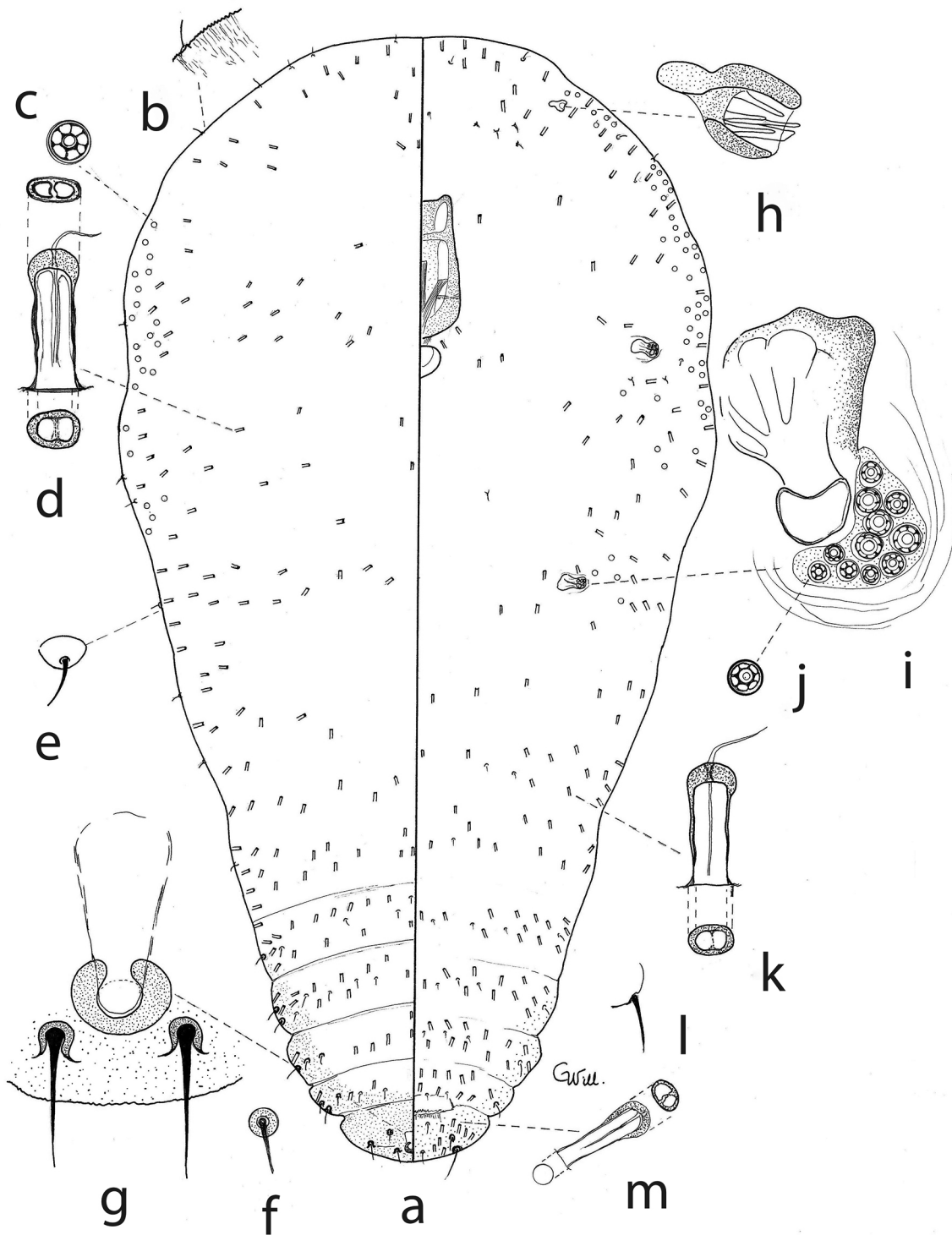
**Microscopic description.** Body elongated oval or pyriform; length 1.62 (0.94–1.86) mm, width 0.66 (0.51–1.22) mm. Without legs. Dermis membranous, striated (easily seen at body margin); last abdominal segment sclerotized, segments V–VIII submarginally sclerotized.

**Dorsum.** With thick setae with a wide and tall sclerotized base; setae with different sizes; with one or two marginal setae on abdominal segments IV–VII, 19–29 (24–33)  $\mu\text{m}$  long and 2.5–5  $\mu\text{m}$  at the base. Setae rarely present on thorax and anterior abdominal segments; if present, then shorter and thinner than other setae, short and stout, 2.5  $\mu\text{m}$  wide at the base and 2.5 (2.5–7)  $\mu\text{m}$  long; six setae on abdominal segment V, 10 setae on VI, eight setae on VII; four setae in anterior region, 10  $\mu\text{m}$  long. Marginal and submarginal multilocular pores occasionally occur on the cephalothorax. Numerous eight-shaped pore ducts on the internal end, with a simple wide aperture, and a short and thin filament, 10–15  $\mu\text{m}$  long, scattered; ducts arranged in transverse rows on abdominal segments, anterior segments with a double row of ducts, segment VI with 11 ducts, VII with four ducts, and VIII with six ducts. Horseshoe-shaped anal ring, 15 (14–17)  $\mu\text{m}$  wide, without pores or setae, anal opening 10 (7–12)  $\mu\text{m}$  wide. With sclerotized anal tube.

**Venter.** Antennae 22 (17–26)  $\mu\text{m}$  long and 12 (12–17)  $\mu\text{m}$  wide, with two segments and fleshy setae. Anterior and posterior spiracles of same size, 32 (46–57)  $\mu\text{m}$  long and 11 (21–33)  $\mu\text{m}$  wide, peritreme diameter 11 (24–27)  $\mu\text{m}$ . Clypeolabral shield 290 (216–288)  $\mu\text{m}$  long and 165 (127–149)  $\mu\text{m}$  wide. Labium one-segmented, 75 (45–96)  $\mu\text{m}$  long, 85 (55–108)  $\mu\text{m}$  wide, with four setae. With few short, slender, and tack-shaped marginal and submarginal setae, 5–7  $\mu\text{m}$  long and 5–6  $\mu\text{m}$  wide at the base, up to segment III; setae absent in middle of meso- and metathorax; 4–5 setae in transverse rows in the middle of segments IV–VIII. With one broad-based seta, similar to dorsal ones, 24  $\mu\text{m}$  long, on the margin of each of the segments IV–VIII. With microspicules in the middle of segment VI. With multilocular pores with 5–9 locules, approximately 5  $\mu\text{m}$  in diameter, in spiracular atria; with 5–12 pores in anterior and 5–16 pores in posterior atria, respectively. Multilocular pores with 7–9 locules found on margin and submargin of thorax. These are either absent or very numerous (up to 400) and are distributed either between the anterior and posterior spiracles, between the posterior spiracles and antennae, or, forming a continuous row including the cephalic area, from the posterior spiracle of one side to the posterior spiracle of the opposite side. Multilocular pores are absent on abdominal segments. With eight-shaped pore ducts, similar to the dorsal ones, 17–21 (15–24)  $\mu\text{m}$  long and 5  $\mu\text{m}$  wide, numerous in marginal and submarginal areas on cephalothorax, but also in the medial area, and arranged in transverse rows on abdomen, smaller in posterior than in anterior segments. Vulva between segments VII–VIII, apparently covered by a plate-like structure, with 4 (4–6) ducts and 4 (4) setae. With a pair of setae posterior to the vulva on segment VIII, 6  $\mu\text{m}$  in diameter at the base and 10–14  $\mu\text{m}$  long; laterally a seta and seven ducts on each side; marginal seta 48 (30–61)  $\mu\text{m}$  long, with a deep and broad base, 20  $\mu\text{m}$  in diameter and 8  $\mu\text{m}$  deep.



**Figure 7.** *Sclerosococcus williamsi* sp. nov., adult female without cephalothoracic pores. **a)** Dorsal (left), ventral (right) view. **b, d)** Setae. **c, l)** Eight-shaped pore ducts. **e, k)** Broad-based setae. **f)** Anal lobe. **g)** Antenna. **h)** Spiracle. **i)** Multilocular pore inside spiracular peritreme. **j)** Tack-shaped seta.



**Figure 8.** *Sclerosococcus williamsi* sp. nov., adult female with cephalothoracic pores. **a)** Dorsal (left), ventral (right) view. **b, e, l)** Setae. **c, j)** Multilocular pores. **d, k, m)** Eight-shaped pore ducts. **f)** Tack-shaped seta. **g)** Anal lobe. **h)** Antenna. **i)** Spiracle.

**Observations.** Apparently, there are two types of females; one with multilocular pores on the cephalothorax and the second one without pores in that position. Unborn nymphs were observed in both types of females, indicating viviparity.

**First instar nymph (Fig. 9).** Oval body shape, 366  $\mu\text{m}$  long and 148  $\mu\text{m}$  wide. **Dorsum:** Eight-shaped pore ducts, short and wide, 7–12  $\mu\text{m}$  long and 2.5–5  $\mu\text{m}$  wide, marginal, one in the cephalic region, two on the thorax, and three on the abdomen. Anal lobes not developed, represented by a ventral seta, 36  $\mu\text{m}$  long, an apical seta, 60  $\mu\text{m}$  long, and three dorsal setae on each side of the anal ring. **Venter:** Antennae 60–67  $\mu\text{m}$  long and 10  $\mu\text{m}$  wide, with six segments. Eyes poorly developed. Labrum 67–79  $\mu\text{m}$  long and 42–45  $\mu\text{m}$  wide. Labium 31–36  $\mu\text{m}$  long and 24–26  $\mu\text{m}$  wide. Legs developed, metathoracic coxa 12–17  $\mu\text{m}$  long, trochanter plus femur 33–56  $\mu\text{m}$  long, tibia 12–14  $\mu\text{m}$  long, tarsus 10–17  $\mu\text{m}$  long, and claw 7  $\mu\text{m}$  long. With thin setae with circular bases, submarginal and medial on abdominal segments, and four pairs between the antennae. With a quinquelocular pore close to each spiracle.

**Second instar female nymph (Fig. 10).** Oval body shape, 510–660  $\mu\text{m}$  long and 346–420  $\mu\text{m}$  wide, without legs. **Dorsum:** Small dorsal setae with a conical base, 2.5  $\mu\text{m}$  wide at base and 7–10  $\mu\text{m}$  long, on thorax, scattered between ducts. Marginal setae 12  $\mu\text{m}$  long. With eight-shaped pore ducts, similar to those of the adult, 9–12  $\mu\text{m}$  long and 5  $\mu\text{m}$  wide, submarginal and lateral along body. Horseshoe-shaped anal ring, without setae. Undifferentiated anal lobes, represented by two setae, 5  $\mu\text{m}$  and 10  $\mu\text{m}$  long, respectively. Last abdominal segment slightly sclerotized. Anal opening 9.6–12  $\mu\text{m}$  long. **Venter:** Antennae one-segmented, 12–16  $\mu\text{m}$  long and 10–12  $\mu\text{m}$  wide, with five fleshy setae. Spiracles 26–31  $\mu\text{m}$  long and 9–12  $\mu\text{m}$  wide. Clypeolabral shield 160–170  $\mu\text{m}$  long and 84–86  $\mu\text{m}$  wide. Labium 41–45  $\mu\text{m}$  long and 57–60  $\mu\text{m}$  wide. Setae rare, similar to dorsal ones. With 3–4 quinquelocular pores in anterior spiracles and 2–3 in posterior spiracles, respectively. Eight-shaped pore ducts rare, similar in length to the dorsal ones, scattered in submarginal area.

**Comments.** *Sclerosococcus williamsi* differs from the other four species in this genus by: 1) it lacks abdominal multilocular pores, 2) if the multilocular pores form a marginal band on both surfaces of the cephalothorax up to the metathoracic spiracles, then they are not arranged in groups. The host plant, *D. longipetala*, occurs in arid areas of Peru, Bolivia, and Argentina (Tropicos 2023).

**Etymology.** The specific epithet was designated in honor of Dr. D.J. Williams of the Commonwealth Institute, for his great contribution to coccidology and for the trust he placed in the author of this species.

## Conclusions

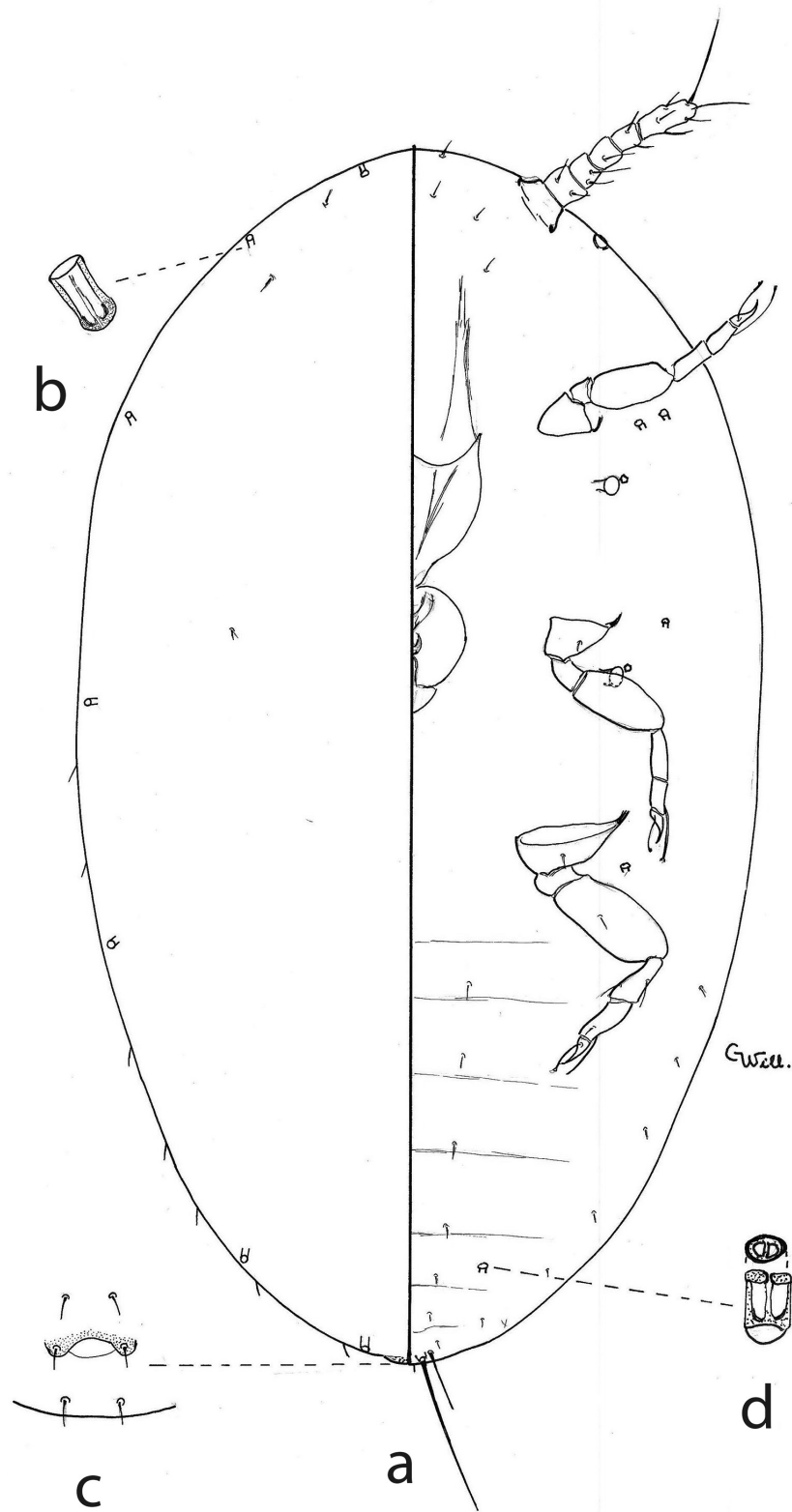
In a review of the pit scales of Argentina, we describe three species and one genus new to science, provide brief diagnoses for all species new to and genera and species already known from Argentina, and present dichotomous keys to the genera of Asterolecaniidae and the species of *Asterolecanium*, *Mycetococcus*, and *Sclerosococcus* in Argentina.

## Acknowledgments

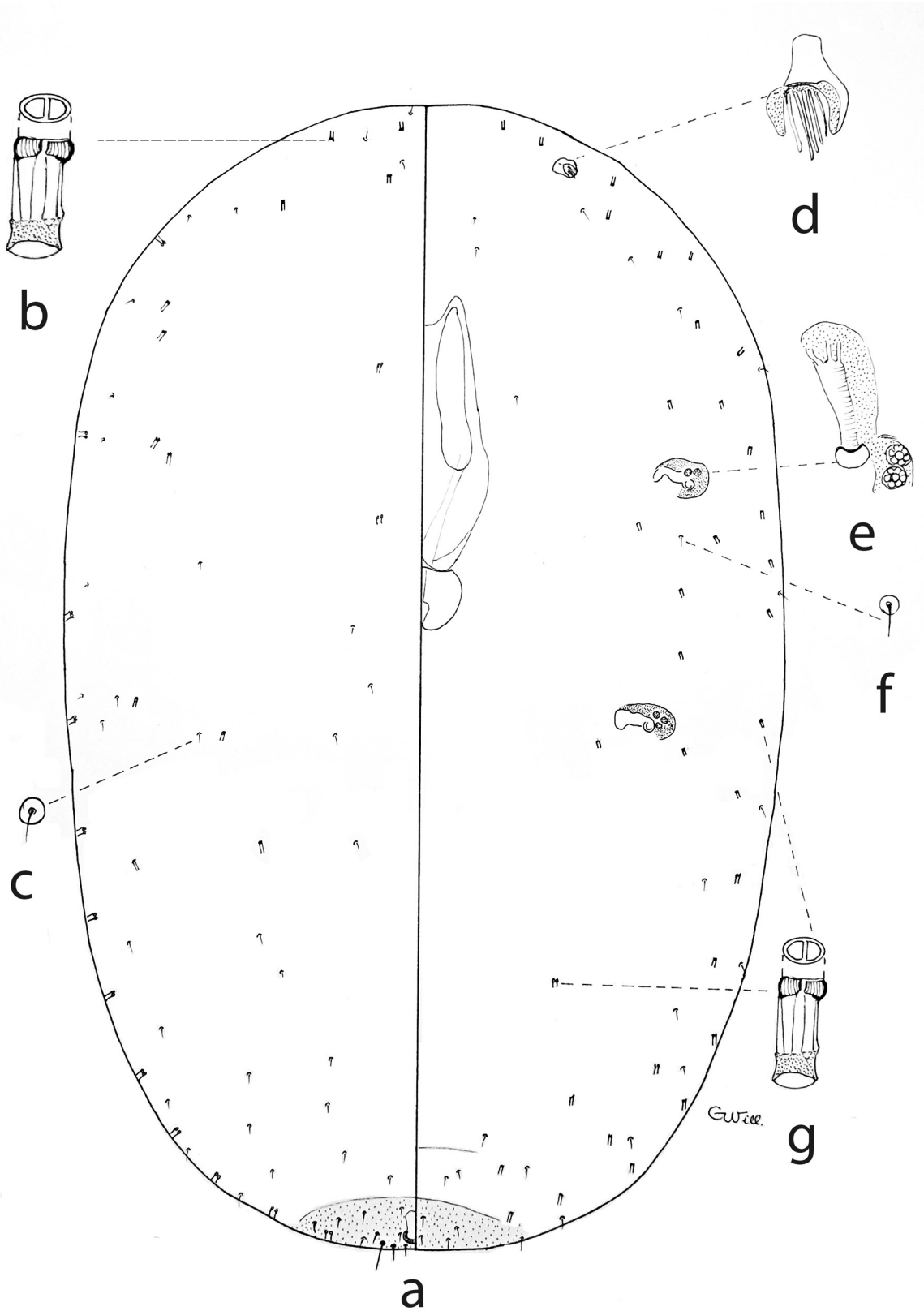
We would like to thank Hernan Willink for his help in digitizing the figures, Julieta Carrizo and Lucía Claps, professors of the Facultad de Ciencias Naturales e Instituto Miguel Lillo, UNT, for providing access to parts of the material, the Instituto Superior de Entomología “Dr. Abraham Willink” (INSUE), and Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) for their generous support to carry out this work. We also thank the two reviewers, Nate Hardy, Auburn University, and Erin Powell, Florida Department of Agriculture and Consumer Services, whose profound subject knowledge helped us in getting the manuscript in the best shape possible.

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**Figure 9.** *Sclerosococcus williamsi* sp. nov., first instar nymph. **a)** Dorsal (left), ventral (right) view. **b, d)** Eight-shaped pore ducts. **c)** Anal lobe.



**Figure 10.** *Sclerosococcus williamsi* sp. nov., second instar female nymph. **a)** Dorsal (left), ventral (right) view. **b,** **g)** Eight-shaped pore ducts. **c, f)** Setae. **d)** Antenna. **e)** Spiracle.

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