

Research Article

Description of Plum Scale Immatures Stages (*Sphaerolecanium prunastri* (Boyer de Fonscolombe) (Hemiptera: Coccidae)

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Abstract: Species identification of scale insects is usually made during the adult female period. However, early nymphal stages are targeted in the control of these pests. Plum Lecanium, *Sphaerolecanium prunastri* (Boyer de Fonscolombe) (Hemiptera: Coccidae) is an economically important pest of stone fruits, almonds, and ornamental *Prunus* species in Turkey as well as worldwide. The first-instar, second-instar male and female, and third-instar female of plum scale are redescribed and illustrated. We present diameters, position, distribution, and number of pores (simple, bilocular, trilocular pores, micro-ducts, tubular ducts, spiracular disc-pores), and marginal setae in all immature stages of Plum Lecanium that have not been given descriptions from different authors previously. We recorded the presence of heavy rimmed pores in second-instar males and females. An identification key is provided for all instars and adult females.

Erik Koşnili (*Sphaerolecanium prunastri* (Boyer de Fonscolombe) (Hemiptera: Coccidae)'nin Biyolojik Dönemlerinin Tanımlanması

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Anahtar kelimeler

Gelişme dönemi,
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Prunus sp.,
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Öz: Kabuklubitlerde tür teşhisi genellikle ergin dişi döneminde yapılmaktadır. Oysa bu zararlıların mücadelesinde genç nimf dönemleri hedef alınmaktadır. Erik Koşnili, *Sphaerolecanium prunastri* (Boyer de Fonscolombe) (Hemiptera: Coccidae) Türkiye'de olduğu gibi dünyada da taş çekirdekli meyve ağaçları, badem ve süs eriklerinin önemli bir zararlısıdır. Bu çalışmada erik koşnlinin birinci, ikinci dönem (♂, ♀) ve üçüncü dönem nimfleri tanımlanmış, ve çizimleri yapılmıştır. Her dönemin sahip olduğu karakterlerin büyüklüğü, pozisyonu, dağılımı, salgı bezleri (basit, bilocular, trilocular porlar, tüp şeklindeki porlar, stigma disk porları), vücut kenar kıllarının boyutu ile sayısı tespit edilmiştir. Bu karakterler, daha önceki çalışmaların verileri ile karşılaştırılmıştır. İkinci dönem erkek ve dişi nimflerdeki kalın çerçevevi porların varlığı ilk defa bu çalışmada ortaya konmuştur. Ergin dişiyi de içeren tüm biyolojik dönemlerinin teşhis anahtarı da sunulmuştur.

1. Introduction

Sphaerolecanium Sulc (Hemiptera: Coccidae) is a monotypic genus (Hodgson, 1994) and *S. prunastri* (Boyer De Fonscolombe) is well known as globose scale, hemispherical plum scale, or plum lecanium that is an economically significant stone fruit pest as well as a pest on ornamental *Prunus* spp.

(Rosaceae) worldwide. Although it is most widespread in Palearctic (Kozár, 1998; Kaydan et al., 2013), it has also been recorded in Nearctic Region (Pfeifer, 1997; Garcia et al., 2021). Besides *Prunus* species, it is recorded on *Amygdalus* spp., *Malus silvestris*, *Cydonia* spp., *Pyrus* spp. (Rosaceae) and *Vitis* spp. (Vitaceae) (Kosztarab and Kozár, 1988). It is a severe pest on Japanese plum, stone fruits, especially cherry, cheery plum and almond, peach, in Armenia, Greece, Turkey and more common on ornamental plum than fruit plum in the USA (Kosztarab, 1959; Babayan, 1986; Kosztarab and Kozár, 1988; Ülgentürk et al., 2001). *Sphaerolecanium prunastri* has an economic impact on plum production, peach and apricot industries and ornamental plants in Turkey (Bodenheimer, 1958; Ülgentürk and Toros, 1999; Ülgentürk et al., 2004; Anonymous, 2008; Özgen and Bolu, 2009; Akşit and Apak, 2013; Çiftçi and Bolu, 2021). It has one generation in a year and overwinters in the second nymph stage on stone fruit trees in Turkey (Anonymous, 2008; Akşit and Apak, 2013). *Sphaerolecanium prunastri* is sap-feeding on twigs and branches of their host (Kozar, 1989). Besides the direct effects of feeding by this soft scale the production of honeydew covers the plant surface, which in turn produces sooty mold, reducing photosynthesis which has a negative impact on fruit quality and quantity. The honeydew also might cover the plum fruits, giving especially early plums a dirty look (local varieties Havran and Can plum), complicate of harvest, and reducing their market value (Anonymous, 2008). Producers notice Plum Lecanium infestations usually not before a large amount of honeydew has already been produced. At this stage sclerotization of the female has already begun, and all tree branches are covered in honeydew, rendering all intervention useless at this point. Early plum varieties run a high risk of containing pesticide residue, an intervention with pesticides is therefore not appropriate. *Sphaerolecanium prunastri* has many natural enemies, but they are not frequently enough to control the population of plum lecanium (Ülgentürk et al., 2004; Özgen and Bolu, 2009).

Also, *Didesmococcus unifasciatus* (Archangelskaya) and *Rhodococcus turanicus* (Archangelskaya) (Hemipteran: Coccidae), which are very similar appearances after maturity of a female with plum lecanium, was recorded pests on *Prunus persica* in Hakkari province, Eastern Anatolia (Kaydan and Kozár, 2010). After that *Didesmococcus unifasciatus* is recorded as an almond and peach pest in Diyarbakır provinces (Bolu, 2012; Çiftçi and Bolu, 2021). For this reason, these three species, which are pests of stone fruit trees in Eastern and Southeastern Anatolia, can be confused with each other.

The study of immature stages of the Coccidae is in its infancy. Most of the research has been conducted on first-instar nymphs, with little attention being paid to other immature stages (Williams and Hodges, 1997). Although the adult female of *S. prunastri* was described by Boyer de Fonscombe in 1834, and subsequently redescribed by Borchsenius (1957), Kosztarab and Kozár (1988), Hodgson (1994), and male by Giliomee (1967), immature stages of *S. prunastri* were described very briefly and limited illustrations made by Silvestri (1919), Borchsenius (1957), Rehacek, (1960). After that, Ben-Dov (1968) described the first and second instars and described and illustrated third-instar female first time.

The aim of the study is to redescribe and illustrate first, second (male and female), and third instar female and offer an identification key for all instars of *S. prunastri* and help to distinguish similar species and timing of control strategies for this pest.

2. Material and Method

The scale crawlers emerge from the eggs between May–July and then settle on twigs where they take feeding positions and overwinter as second-instar stage and, depending on climatic conditions, in Ankara. Branches infected by immature stages of plum lecanium were collected every week between the months, March and November Ankara Parks and some distinct, in 2014 and examined under a stereomicroscope. Nymphs were put into 70% alcohol and stored in Coccidology Laboratory at Ankara University, Plant Protection Department. At the same time, some infested branches were kept in the climatic room to obtain more specimens in case of some problem in progress. For a slide-mounting the method of Kosztarab and Kozár (1988).

All characteristics of the stages are illustrated and measured. The terminologies were taken from Hodgson (1994) was based on; B= bilocular pore; C= claw; D1= tubular duct, Type 1; D2= tubular ducts, Type 2; H= heavy rimmed pore; I= ano-genital fold; K= anal plate; L= antenna; M= spiracular disc-pore; N= marginal seta; P= simple pore; R= microtubular duct; S= spiracle setae; T= triloculi pore.

3. Result and Discussion

***Sphaerolecanium prunastri* (Boyer De Fonscolombe);**

Synonym: *Eulecanium piligerum* Fonscolombe; *Coccus prunastri* Fonscolombe; *Lecanium blanchardii* Targioni and Tozzetti; *Lecanium prunastri* Signoret; *Lecanium (Eulecanium) prunastri* Cockerell; *Eulecanium prunastri* Fernald; *Sphaerolecanium prunastri* Šulc; *Eulecanium piligerum* Leonardi; *Lecanium (Sphaerolecanium) prunastri* Šulc (Kozar, 1998).

First-instar nymph (n=10) (Figure 1)

Material Examined: Ankara, Haymana, Gölbaşı, Ankara, Botanic Park, Çankaya, *Prunus domestica* 16.vi.2014, Đurović & Ülgentürk (SP2/ 1 first instar nymphs); Ankara, Botanic Park, Çankaya, *Prunus domestica*, 16.vi.2014, Đurović & Ülgentürk (SP1/ 2 first instar nymphs); Afyon; Ankara, Haymana Çiftlik, *Prunus avium* (Rosaceae), 30.vi.2014, Anonymus (ASP1/ 3 first instar nymphs); Ankara, Gölbaşı, *Prunus avium*, 30.vi.2014, Anonymous (ASP2/ 2 first instar nymphs)

General appearance. Body oval; colour pinkish.

Mounted material. Crawlers body oval; 400–440 μm long; 235–250 μm wide.

Dorsum; derm membranous. **Simple pores** with the granulate surface, each 2 μm wide in submarginal and submedial longitudinal lines, extending from head apex to anal lobe, with about 10 pores in each line. **Bilocular pores** each 2 μm wide, about 9–11, in a longitudinal line between lines of simple pores. Anal plates reticulated; each sub-triangular; 25–40 μm long, 20–30 μm wide; each plate with 1 apical setae, 300 μm long, plus 2 sub-apical setae, each 15–18 μm long and one inner setae. Ano-genital fold with 1 pair of anterior margin and lateral margin setae, each 5–18 μm long. Anal ring with pores and 6 setae, each setae 25–34 μm long. Dorsal setae present three on the thorax, each 4–5 μm long. A pair of trilocular pores, each 3 μm wide, placed anterior to each basal antennal segment, near body margin in specimens from plum threes but absent in the specimens from cherry threes.

Margin. Marginal setae long (10–13 μm), 1 μm wide, blunted on the apex, distributed in a single line along body margin as follows: 12 between anterior stigmatic setae; 2 between each stigmatic area; 8 between posterior stigmatic area and anal cleft. Stigmatic clefts narrow; spiracle setae are obviously shorter than margin setae, each stigmatic area with 3 spiracle setae, medial one slightly bigger (7–12 μm long) and 2 μm wide, rounded, lateral ones 5–8 μm long well differentiated in shape from marginal setae. The basal socket of medial spiracle setae 4–5 μm and socket of lateral ones 3–5 μm . Eyes 10 μm wide close to body margin.

Venter. Derm membranous. Segmentation visible. Minute dermal spinules in rows, on medial and submedial areas of three last segments of the abdomen, never extending to body margins. Antennae each 6 segmented; 113–120 μm long; segment III longer than other segments; setal distribution as follows: scape with 2 or 3 thick setae, pedicel with two thick setae; segment III: 2 or 3 hairlike setae; IV: 1 spine-like setae; V: 1 fleshy setae and 1 hairlike setae; apical segment: with 6 fleshy setae and 3 hairlike setae Clypeolabral shield 83–105 μm long, 63–78 μm wide, with 1 pair of setae 12–25 μm long. Labium 1-segmented, triangular, 35–43 μm long, 45–55 μm wide; with 4 pairs labial setae, each setae 5–12 μm long. Spiracles subequal in size, each peritreme 5–8 μm wide, with spiracular disc-pores each 4 μm wide, usually 5 loculi (range 3–7), 3 in a single row anterior, from spiracle to body margin, posterior 3 or 4 in a single row.

Legs well-developed, without tibio-tarsal scleroses; setae present on all leg segments; measurements of metathoracic leg: coxa 33–38 μm , trochanter 20–25 μm half of the trochanter has sclerotization, femur 33–40 μm , tibia 35–38 μm , tarsus 33–38 μm , claw 15–18 μm , each claw with small denticle near tip; trochanter with oval sensory pores on each side and a pair of hairlike setae, each more than 25–40 μm long; tarsal digitules knobbed apically, each 28–38 μm long; claw digitules knobbed apically, each 15–20 μm long; one claw digitule broader than the other. Ventral setae hairlike: 1 pair, each 7–10 μm long, anterior to basal antennal segment near body margin; 1 pairs inter-antennal setae, 4–20 μm long; 2 longitudinal lines of submarginal setae; 1 line extending from anterior stigmatic spines to anal lobe each setae 5–7 μm long, second line from posterior stigmatic spines to anal lobe, 2–4 μm long. Three pairs of pregenital setae, longest one 12–20 μm in length. Microducts each 1–2 μm wide, 6 microtubular ducts on the abdomen in a single row and 2 more in the same row between stigmatic areas.

Comments: Borchsenius (1957) offered descriptions of adult females and the first-stage of *S. prunastri* (Table 1). In the first instar, he described major characteristics such as spiracle setae, medial one 7–8 μm , and others 5–6 μm long. Each stigma with 3 quinquelocular spiracular disc-pores band

broadening near margine. Ben-Dov (1968) provides more detail about the number of marginal setae in the first instar (Table 1). *S. prunastri* collected from Ankara in the first instar is similar to Ben-Dov's description regarding the number and distribution of spiracular disc-pores and stigmatic setae, from our description differs in the number of marginal setae between anterior stigmatic areas; in having microtubular ducts, rows of simple and bilocular pores and one pair of trilocular pores on dorsum. In addition, presence of stigma disc-pores with 3 to 7 loculi. In the works of both previous authors, no descriptions of dorsally simple, bilocular, and trilocular pores are found.

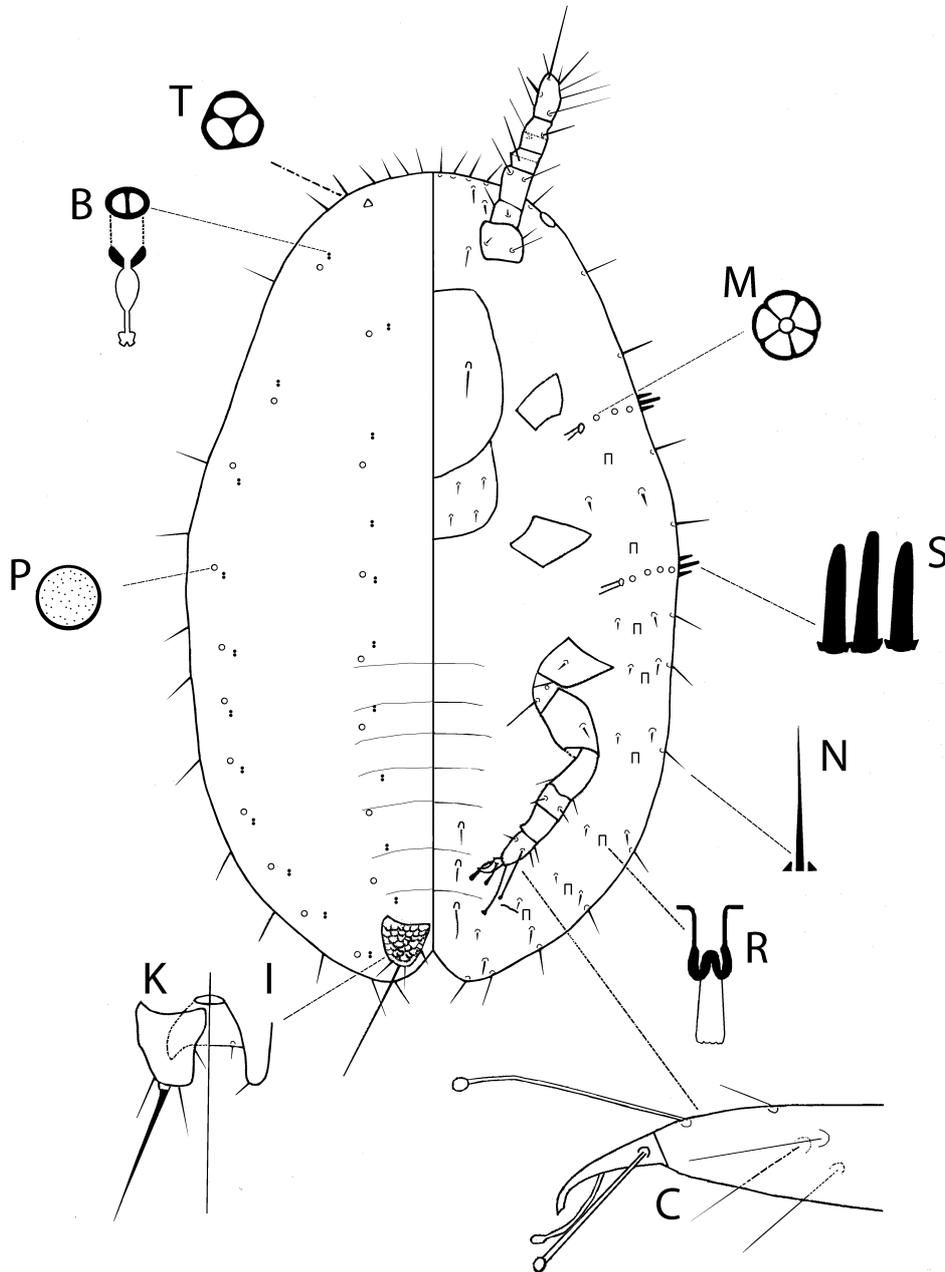


Figure 1. First-instar of *Sphaerolecanium prunastri* (Boyer De Fonscolombe) (original).

Second-instar male (n=5) (Figure 2)

Material Examined: Ankara, Haymana, Gölbaşı, *Prunus domestica*, 13.iii.2014, Erdoğan (SPL4/ 1 second instar (♂), 1 second instar (♀)); Ankara, Haymana, Gölbaşı, *Prunus domestica*, 13.iii.2014, Erdoğan (SPL2/ 1 second instar (♂)); Ankara, Haymana, Gölbaşı, *Prunus domestica*, 13.iii.2014, Erdoğan (SPL3/ three second instar (♂))

General appearance. Body elongated oval;

Mounted material. Body elongated oval; 910–1175 µm long, 540–675 µm wide.

Dorsum. Derm membranous. Preopercular pores are absent. **Simple pores** with the granulate surface, each 1–2 µm in diameter, throughout in a few numbers scattered. **Bilocular pores** each 2 µm in diameter, scattered. **Tubular ducts** of two sizes: (i) larger ducts each with a very long outer ductule 13–15 µm long, a shorter inner ductule about 8–15 µm long, cup-shaped invagination, 3–5 µm wide; and a terminal gland end, 2–4 µm wide: present in submarginal band one duct wide, with one row 32–39; and radial posterior in the middle of the abdomen on each side 6–11; and (ii) smaller, stouter ducts, each with outer ductule 5–8 µm long, inner ductule, 5–13 µm long, cup-shaped invagination, 4–5 µm wide; and with a terminal gland end, 3–4 µm wide: present in submarginal lines of the tubular duct on the abdomen as well in posterior radial line, between larger ducts. **Anal plates** each sub-triangular; 25–45 µm long, 63–73 µm wide; each plate with 4 apical setae, middle one 18–23 µm long, lateral ones 13–19 µm. Ano-genital fold with 2 pair of anterior margin setae 15–18 µm long and lateral pair 7–10 µm long, some specimens have two setae on lateral margin. Anal ring with pores and 6 setae, each setae 60–80 µm long.

Margin. Marginal setae long and thin, on the top slightly curved with round apex, they are not arranged along marginal fringe in the same line, with a big variation in length, each 15–27 µm long and 3 µm wide, distributed along body margin as follows: 12 between anterior stigmatic setae; 2 between each stigmatic area; 10–12 between posterior stigmatic area and anal cleft. Stigmatic clefts slightly shallow; each stigmatic area with 3 spiracle setae, all subequal in shape rounded apex, medial one 7–8 µm long and lateral ones 8–9 µm long, well differentiated in shape from and shorter than marginal setae, Eyes visible on mounted specimens 10–15 µm wide.

Venter. Derm membranous, segmentation distinct; minute dermal spinules in rows, on medial and submedial areas of the whole body, never extending to body margins with more abundant anterior to each coxa. Antennae 7-segmented, each 155–185 µm long, segment III longer than other segments; setal distribution as follows: scape 3 thick setae and pedicel with 2 thick setae or with one thick setae and one spine-like; segment III: setae absent; IV: 1 spine-like seta and 1 fleshy; V: 1 spine-like seta; VI: 1 spine-like or just 1 fleshy; apical segment: with 4–5 fleshy setae and 2–3 hairlike setae. Clypeolabral shield 145–160 µm long, 113–123 µm wide, with 1 pair of setae 23–48 µm long. Labium 1-segmented, triangular, 145–160 µm long, 113–123 µm wide; with 4 pairs of labial setae, each setae 10–33 µm long. Spiracles, all peritremes 10–13 µm wide; spiracular disc-pores quinquelocular, 6 or 7 loculi can be seen, each about 4 µm in diameter, with 4–8 anterior, 5–9 posterior forming a double or single band from each spiracle to body margin. Legs well-developed, without tibio-tarsal scleroses; setae present on all leg segments; measurements of metathoracic leg: coxa 48–65 µm, trochanter 25–40 µm, femur 50–70 µm, tibia 48–55 µm, tarsus 43–58 µm, claw 15–20 µm, each claw with a denticle near tip; trochanter with 2 oval sensory pores on each side and a pair of hairlike setae, each 38–58 µm long; tarsal digitules knobbed apically, each 30–38 µm long, slightly dissimilar; claw digitules knobbed apically, each 20–25 µm long; one claw digitule broader than the other. Several microducts in a submarginal band from head apex to anal lobe and second band in the most inner part of the body through the thorax and first segment of the abdomen, each 2–3 µm in diameter. A few number heavy rimmed pores around the venter surface, 3 µm wide.

Ventral setae hairlike: 2 pair inter-antennal setae, long pair 38–55 µm long and short pair 5–13 µm long. One pair of setae anterior to basal antennae segment 12–18 µm long. Setae, 8–15 µm long, in a submarginal band extending from head to anal lobe; 7 setae 5–13 µm long in a second row extending from posterior stigmatic furrow and innermost line from posterior spiracle to anal lobe, 4–5 setae in third submarginal lines, 3–4 µm long. One seta, 3–5 µm long, medial to each coxa. Three pairs of pregenital setae, each 40–50 µm long.

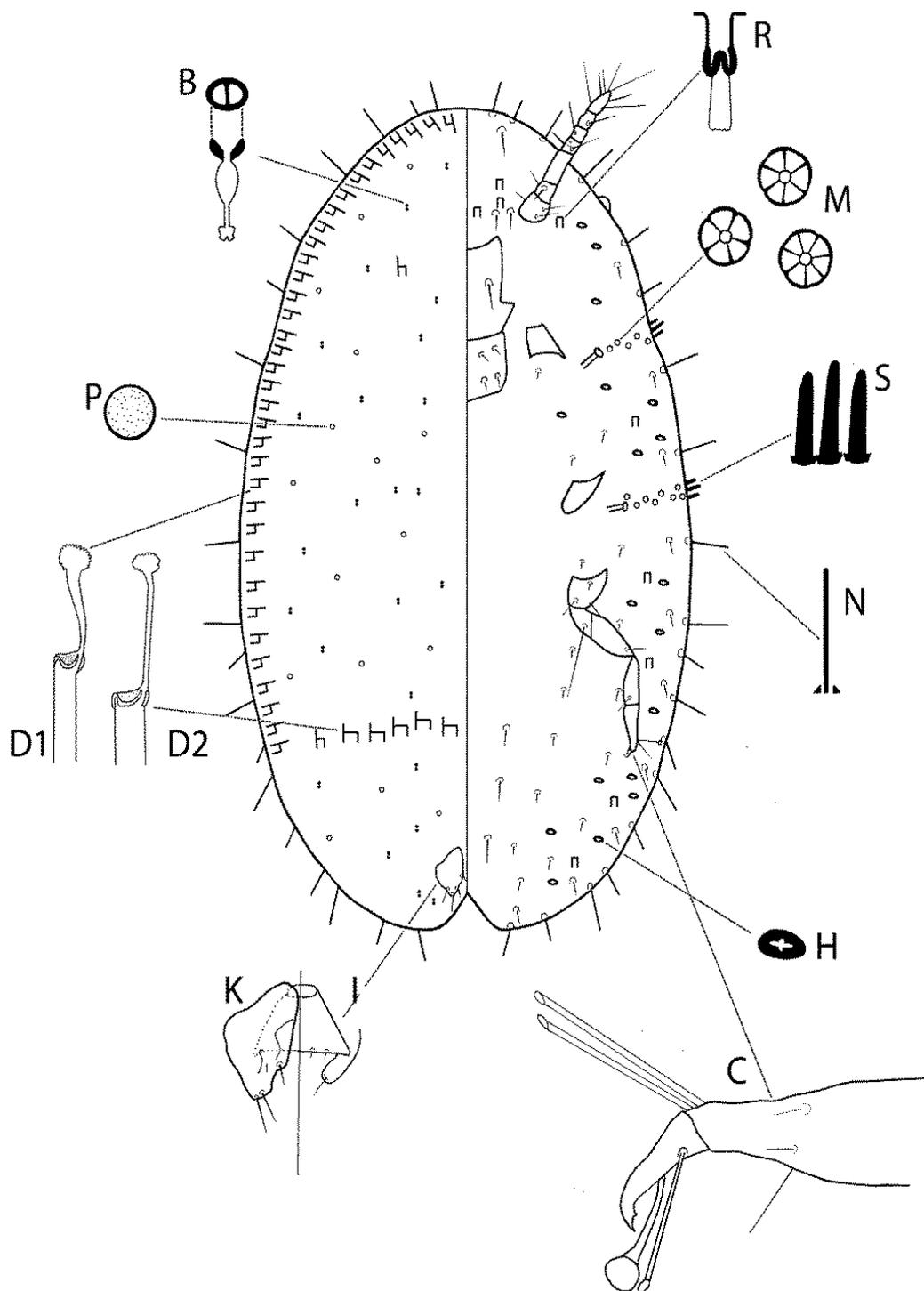


Figure 2. Second-instar male of *Sphaerolecanium prunastri* (Boyer De Fonscolombe) (original).

Comments: Ben-Dov (1968) described the second-instar male and female instar of *S. prunastri* as similar in number and position of marginal setae (without giving their number and shapes), but his description of males differs from the females as the males have tubular ducts (Table 1). For *S. prunastri* second-instar male, we present in this work two types of tubular ducts and indicate their position, simple pores, bilocular pores on dorsum, and presence of heavy rimmed pores on ventrum. These characteristics

could help to distinguish the second stages male of Plum Lecanium from other second-instar males of coccids. Miller & Williams (1990) have described a test for *S. prunastri* that sutures reduced posterolateral and posterior transverse sutures fused to form a single transverse posterior suture. Submarginal lines of the tubular duct on the abdomen as well as radial posterior line, between larger ducts in our description, explain this posterior suture in the test.

Second-instar female (n=5) (Figure 3)

Examined material: Ankara, Haymana, *Prunus domestica*, 13.iii.2014, Erdoğan (2 second instar (♀)); Ankara, Haymana, *Prunus domestica*, 13.iii.2014, Erdoğan (SPL3/ three second instar (♀))

General appearance. Body round; color brown-pinkish

Mounted material. Body round; 1225–1175 µm long, 775–850 µm wide.

Dorsum. Derm membranous. Body segmentation is not obvious as in first-instar nymph. Preopercular pores are absent. **Simple pores** with the granulate surface, each 1 µm wide, spread around the whole body in small numbers. **Bilocular pores** each 2 µm wide, spread around all body surfaces. Anal plates triangular, 70–78 µm long, 40–48 µm wide; each plate with 4 apical setae, the middle one 15–28 µm long, laterals 13–15 µm long. Ano-genital fold with 2 pairs of anterior margin setae 7–30 µm long and 1–2 pairs of lateral margin setae 4–12 µm long. Anal ring with pores and 6 setae, each 68–88 µm long. Heavy rimmed pores around all body surface 3 µm wide, present on dorsum and on ventrum. Dorsally, in some specimens, trilocular pores are present on the anal lobe.

Margin. Marginal setae two types, slightly curved, some straight with rounded apex, some with spine-like apex, each 18–23 µm long and 2–3 µm wide, they are not arranged along the marginal fringe in a line: 12 between anterior stigmatic setae; 2 between each stigmatic area; 9–13 between posterior stigmatic area and anal cleft. Stigmatic clefts absent; each stigmatic area with 3 spiracle setae, well different in shape than marginal setae, all with rounded apex, shorter than marginal setae, medial spiracle setae 8–12 long with a basal socket 5 µm wide, lateral spiracle setae 7–9 µm and basal socket 4 µm wide, in most cases the medial setae is slightly longer than the lateral setae. Eyes on the mounted material on some specimens 8–13 µm wide, located on the inner part of the head, on most specimens they cannot be seen.

Venter. Derm membranous, segmentation pronounced; the minute dermal spinules in the middle of the abdomen never spread to the margin. Antennae 6- or 7-segmented; each 170–190 µm long, segment III longer than other segments; setal distribution as follows: scape with 2–3 hairlike setae; pedicel with 2 thick setae; segment III: 2 thick; IV: 1 spine-like seta; V: 1 spine-like setae or 1 spine-like with one thick seta; apical segment: with 4 thick setae and 3 hairlike setae. Clypeolabral shield 130–150 µm long, 120–130 µm wide with one pair of setae 25–30 µm long. Labium 1-segmented, triangular, 33–65 µm long, 75–95 µm wide; with 4 pairs of labial setae, each setae 13–23 µm long. Spiracles subequal in size, all peritremes 10–13 µm wide; spiracular disc-pores mostly quinquelocular, and between them 1–2 7-loculi pores, each about 4–5 µm wide, anterior with 7–10 pores forming a narrow band, and posterior 6–9 pores. Legs well-developed, without tibio-tarsal scleroses; setae present on all leg segments; measurements of metathoracic leg: coxa 43–65 µm, trochanter 38–40 µm, femur 50–55 µm, tibia 55–58 µm, tarsus 48–53 µm, claw 13–20 µm, each claw with a denticle near tip; trochanter with 2 oval sensory pores on each side and a pair of hairlike setae, each more than 43–58 µm long; tarsal digitules knobbed apically, each 38–40 µm long, slightly dissimilar; claw digitules knobbed apically, each 18–25 µm long; one claw digitule broader than the other.

Ventral setae: hairlike, setae anterior to basal antennal segment 13–15 µm long, 2 pairs of inter-antennal setae, long pair 28–50 µm long and short pair 7–8 µm long. Setae, 13–18 µm long, in a submarginal longitudinal band extending from head apex to anal lobe; second row extending from posterior metacoxa to anal lobe 13–18 µm long and third innermost longitudinal line on the abdomen submedially with 5 setae 4–5 µm long. One seta, 3–4 µm long, medial to each coxa. Three pairs of pregenital setae, each 43–53 µm long. Microducts absent.

Comment: In this paper, on the dorsum of second-instar female of *S. prunastri*, many characteristics such as simple, bilocular, heavy rimmed pores were described, and their dimensions were given. We have determined large numbers of heavy rimmed pores on the dorsum and ventrum of the second instar female. These pores are present only ventrally in the second instar of males. Ben-Dov (1968) described only the number of marginal setae and spiracular disc-pores in second-instar females (Table 1). In his description was not mentioned the presence of dark-rimmed pore on ventrum and

dorsum of second instar of female. Small differences between the numbers of these spiracular disc-pores can be explained by geographical occurrence and differences in host plants.

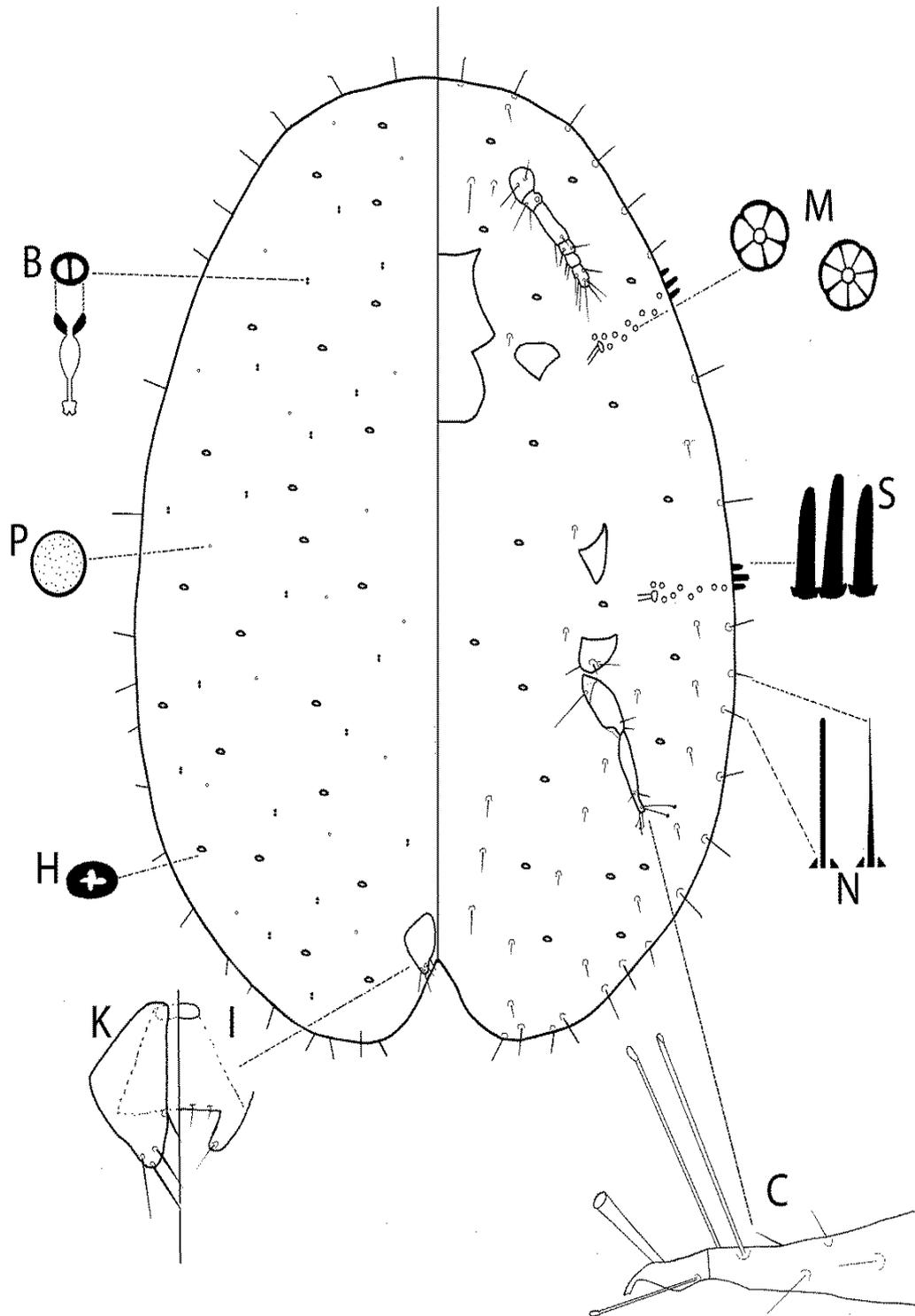


Figure 3. Second-instar female of *Sphaerolecanium prunastri* (Boyer De Fonscolombe) (original).

Third-instar female nymph (n=5) (Figure 4)

Material Examined: Ankara, Gölbaşı, *Prunus domestica*, 21.iii. 2014, Đurović (TSP1, TSP2, TSP4/ 3 Third instar (♀); Ankara, Haymana, *Prunus domestica*, 21.iii. 2014, Đurović (TSP3/ 2 third instar female (♀) (cultured material)).

General appearance. Body round; color dark gray similar to branches.

Mounted material. Body round; 1350–1875 µm long, 1000–1475 µm wide.

Dorsum. Derm membranous. Preopercular pores were absent. **Simple pores** with a granulate surface, each 2 µm wide, spread around the whole body to a greater extent than in second-instar nymph. **Bilocular pores** each 2 µm wide, spread around all body surfaces. Heavy rimmed pores 3 µm wide, abundant and more numerous than in second-stage females and scattered all over the dorsum. Anal plates sub-triangular, 65–143 µm long, 65–138 µm wide; each plate with apical setae, the middle one 38–45 µm long, laterals 20–50 µm long, and 1 inner setae. Ano-genital fold with 3 pair of setae on anterior margin, longer pairs 33–53 µm long, shorter pairs 20–35 µm long, 1 small seta on lateral margin 5–15 µm long. Anal ring with pores and 6 setae, each 105–150 µm long.

Margin. Marginal setae slightly curved with round apex, arranged along the marginal fringe, not in a clear line, each 28–30 µm long and 3 µm wide, distributed as follows: 12–14 between anterior stigmatic setae; 5–6 between each stigmatic area; 19–26 between posterior stigmatic area and anal cleft. Stigmatic clefts absent, each stigmatic area with 3 spiracle setae, different in shape and shorter than marginal setae, medial spiracle setae longer than the lateral ones, rounded on the apex, medial spiracle setae 17–20 µm long with basal socket 5 µm wide, lateral spiracle setae 15–18 µm long and basal socket 5–6 µm wide. Eyes on the mounted material cannot be seen.

Venter. Derm membranous, segmentation obscure; minute dermal spinules on abdomen around the vulva at the two last segments of abdomen, present on thorax but in very small density. Antennae 6–7-segmented, each 175–245 µm long, segment III longer than other segments; setal distribution as follows: scape with 3 setae; pedicel with 2 setae; segment III: setae absent; IV: 1 fleshy and 1 spine-like setae; V: 1 spine-like or 1 spine-like and fleshy; VI: 1 spine-like and 1 fleshy or if it is an apical segment with 3–4 spine-like and 6–10 fleshy; VII: apical segment; with 7–11 fleshy setae and 4–5 hairlike setae. Clypeolabral shield 175–200 µm long, 158–180 µm wide with 1 pair of setae 38–60 µm long. Labium 1-segmented, triangular, 45–80 µm long, 118–150 µm wide; with 4 pairs of labial setae, each setae 15–33 µm long. Spiracles subequal in size, all peritremes 23–28 µm wide; spiracular disc-pores mostly quinquelocular or between them 1 or 2 pores with 3,4, 6,7- loculi, each about 5 µm wide, anterior with 10–12 pores forming a band about 2 pores wide from each spiracle to body margin and posterior with 12–16 pores.

Legs well-developed, without tibio-tarsal scleroses; setae present on all leg segments; measurements of metathoracic leg: coxa 75–85 µm, trochanter 35–55 µm, femur 70–85 µm, tibia 53–75 µm, tarsus 55–70 µm, claw 15–18 µm, each claw with a denticle near tip; trochanter with 2 oval sensory pores on each side and a pair of hairlike setae, each more than 33–60 µm long; tarsal digitules knobbed apically, each 30–40 µm long, slightly dissimilar; claw digitules knobbed apically, each 23–28 µm long; one claw digitule broader than the other.

Ventral setae hairlike: three pairs of inter-antennal setae, innermost long pair 50–73 µm long, middle one 8–13 µm and short pair 4–5 µm long. Seta, 8–20 µm long, in a submarginal band extending from head apex to anal lobe and second submarginal line 5–9 µm from anterior spiracle area to anal lobe; third submarginal line with 5–8 µm long innermost line on the abdomen posterior from metacoxa to anal plate. Two or three setae, medial to each coxa 3–8 µm long. One pair of pregenital setae, each 85–103 µm long, as well as one more pair setae on the next two abdominal segments above were found. Microducts each 3 µm wide, in a single submarginal band from head apex to anal lobe, on the head 4 of them around antennae scapulae. A pair of setae anterior to basal antenna segments 23 µm long. Heavy rimmed pores are more abundant, scattered all over the body on the venter, 3 µm long. They are more abundant than in second-instar nymph.

Comment: *S. prunastri* third-instar female was described for the first time by Ben-Dov (1968). At the body margin, he described some marginal setae, with the same number anteriorly between the eyespots, on each side between eyespots and anterior stigmatic area and between stigmatic areas laterally, as for second-instar and third-instar female, but for third-instar female, number on each side of the abdomen increases 15–18, spiracular disc-pores 15–28 in number, on ventrum submarginally, heavy rimmed pores distributed 3–4 pore wide from each other (Table 1). This paper describes third-instar female of *S. prunastri* collected in Ankara and shows some differences from Ben-Dov's (1968) descriptions. Spiracular disc-pores have 3, 4, 6, 7 loculi, each stigmatic area anterior with a 10–12 quinquelocular spiracular disc-pores band, each stigma area posterior with a 12–16 spiracular disc-

pores band broadening near the margin. Heavy rimmed pores are more abundant, scattered all over the body on venter and dorsum of a specimen from Ankara, with ventral microduct in single submarginal and without ventral submarginal band extending around the body as described by Ben-Dov (1968).

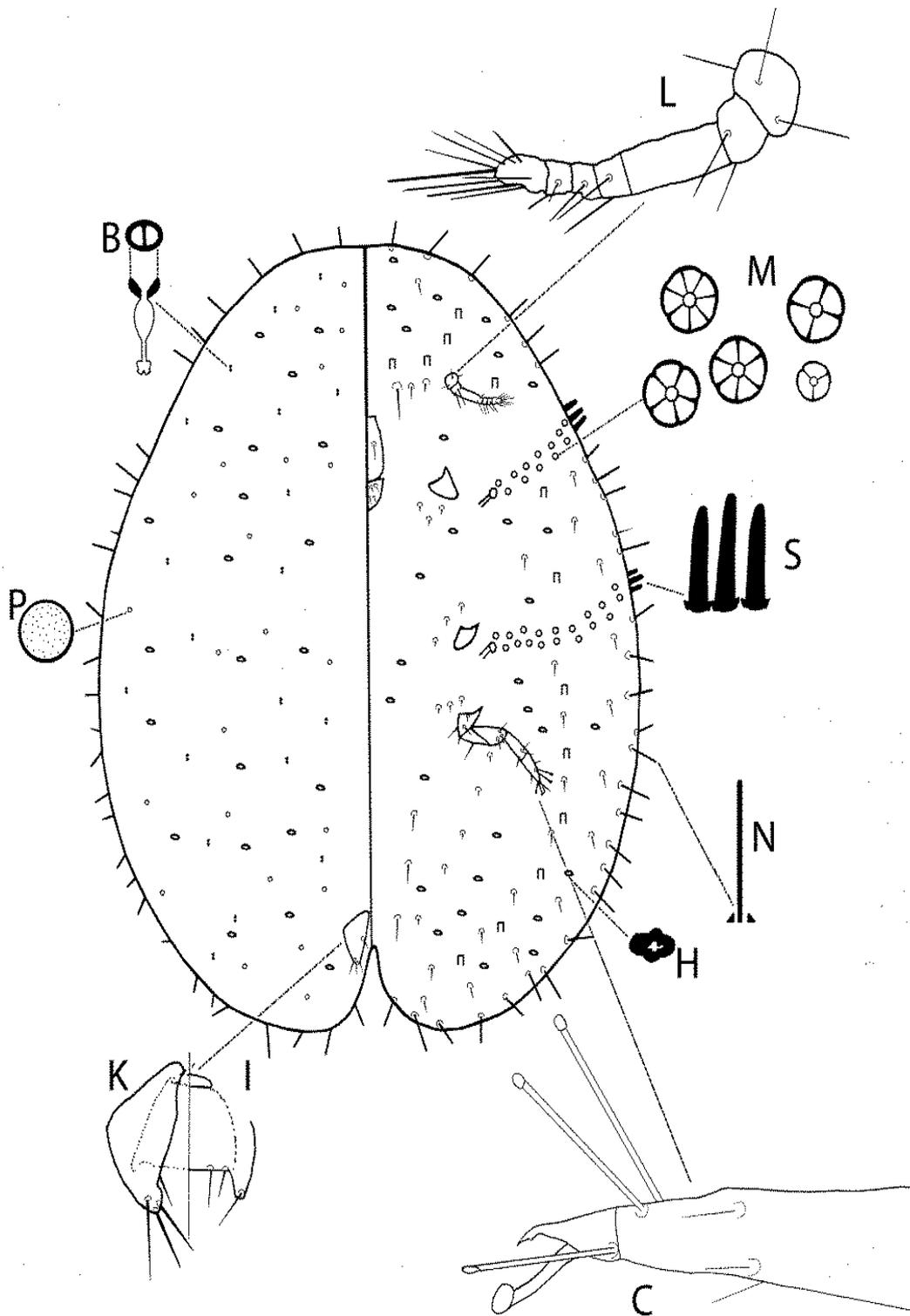


Figure 4. Third-instar female of *Sphaerolecanium prunastri* (Boyer De Fonscolombe) (original).

Key to instars and adults of Plum Lecanium;

1. Preopercular pores absent dorsally 2
 – Preopercular pores present dorsally, multilocular disc-pores present on ventrally..... adult female
2. Margine setae of one type; each anal plate with very long apical seta 1st instar
 – Margine setae of two types; each anal plate without a very long apical seta 3
3. Tubular ducts present on dorsum, heavy rimmed pore presents only ventrally 2nd instar male
 – Tubular ducts absent on dorsum, heavy rimmed pore present on dorsally and ventrally 4
4. Number of setae between stigmatic are 2, spiracular disc-pores 7–10 2nd instar female
 – Number of setae between stigmatic area 5–6, spiracular disc-pores 10–12, heavy rimmed pores more abundant 3th instar female

Currently, *S. prunastri* is placed in the Eulecaniinae subfamily. This subfamily species has characteristically 6 pairs of ventral submedian setae on adult females (Hodgson, 1994; Kozar, 1997). In this study are detected first, second (male and female), and the third instar of *S. prunastri* has 3 pairs of submedian setae. Williams and Hodges (1997) reported *S. prunastri* could be attributed to the Coccinae tribe Saissetiini. According to Hodgson (1994), an adult female of *S. prunastri* appear to be fairly typical Coccini, in lacking ventral tubular duct and in having pregenital disc pore with only 6 loculi, but in having no tibio-tarsal articulatory scleriosis, dissimilar claw digitules, and spine-like marginal setae there do appear to be linked with Eulecaniinae. Within Eulecaniinae, it is closest to *Didesmococcus*, with which it shares the lack of ventral tubular duct and presence of long fine setae dorsally and large preopercular pores. Immature stages of *Didesmococcus* and more Eulecaninae species should work before resolution of a new placement for *S. prunastri*.

Table 1. Morphological characteristic of *Sphaerolecanium prunastri* (Boyer De Fonscolombe) for all instar that include descriptions from previously and newly described characteristics

Authors	Characters	N ₁			N ₂ ♀		N ₂ ♂		N ₃ ♀	
		*A.	B	C	B	C	B	C	B	C
Number of marginal setae	Between anterior stigmatic setae	-	8	12	10	12	10	12	10	12-14
	Between stigmatic area	-	2	2	2	2	2	2	2	5-6
	Between posterior stigmatic area and anal cleft	-	8	8	8	9-13	10-11	10-12	15-18	19-26
Spiracular disc-pores	Anterior	3	3	3	5-7	7-10	5-10	4-8	28-15	10-12
	Posterior			3-4		6-9		5-9		12-16
Tubular duct	Submarginal	-	-	-	-	-	+	32-39	-	-
	Anterior radial	-	-	-	-	-	?	-	-	-
	Posterior radial line	-	-	-	-	-	?	6-11	-	-
Trilocular pores		+	-	+	-	-	+	-	-	-
Bilocular pore		8-10 in rows		+		+	-	+	-	+
Microduct		-	-	+ in single sub marginal band	-	-	-	+ in two bands	-	
Simple pore		-	-	+ two rows	-	+ all around the body	-	+all around the body	-	+ all around the body
Heavy rimmed pore		-	-	-	-	+ on dorsum and venter	-	+ on ventrum	+ventral sub marginal band 3-4 pore wide	+ scattered all over the body on venter and dorsum

*A: Borchsenius, 1957, B: Ben-Dov, 1968 and C: Durovic & Ülgentürk

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