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Author-formatted, not peer-reviewed document posted on 21/09/2021

DOI: <https://doi.org/10.3897/arphapreprints.e75546>

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## Studies on Mealybug Species (Hemiptera: Coccoomorpha: Pseudococcidae) with Description of Two New Species and Three Newly Recorded Species from Indonesia

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### Abstract

Mealybugs (Hemiptera: Coccoomorpha: Pseudococcidae) include economically important insect pests worldwide. However, little is known about mealybug species in Indonesia. Scale insects were collected and identified from natural and cultivated plants in several regions of southern Sumatra, Indonesia between 2018 and 2019. In total, 16 species of Pseudococcidae in 7 genera were found, including two new species and three new records for the Indonesian mealybug fauna. *Dysmicoccus sosromarsonoae* Zarkani & Kaydan sp. n., and *Dysmicoccus zeynepae* Zarkani & Kaydan sp. n. are described and illustrated as new species for science-based on the adult female. Furthermore, *Dysmicoccus arachidis* Williams and *Dysmicoccus carens* Williams and *Pseudococcus leptotrichotus* Williams were found as new records for the country. New locality and host plant data are given for all species. Additionally, an identification key to mealybug genera occurring in Indonesia is also provided.

**Keywords:** Biodiversity, host plant, insect pests, mealybugs, taxonomy.

### Introduction

Pseudococcidae (Hemiptera: Coccoomorpha), whose members are known as mealybugs (Hemiptera: Sternorrhyncha: Coccoomorpha) is one of the families of scale insect which include many important insect pests on woody and herbaceous plants. These insects not only directly injure and feed their host plants but also indirectly promote sooty mold growth and transmit plant viruses (Franco et al., 2009, Daane et al., 2012).

To date, there are 2032 species in 258 genera of Pseudococcidae in the world and this is the second abundant family after the Diaspididae which consists of about 2653 species in 418 genera (Garcia et al., 2016). In Indonesia, there are 105 species in 32 genera of Pseudococcidae and this is also the second-largest family after Diaspididae with 158 species in 44 genera recorded in this archipelago country (Garcia et al., 2016). From the family Pseudococcidae, *Dysmicoccus* Ferris (9 species), *Paraputo* Laing (13

species), *Planococcus* Ferris (6 species), *Pseudococcus* Westwood (13 species), and *Rastrococcus* Ferris (14 species) are the most species-rich and harmful genera in Indonesia (Williams, 2004; Garcia et al., 2016).

As a tropical climate country located along major sea lanes connecting East Asia, South Asia and Oceania, it is not surprising that Indonesia has a flooding number of indigenous plants, vertebrates and invertebrates including insect richness (McNeely et al. 1990; CBD Secretariat 2021). The first exploration of insect richness, including mealybugs in Indonesia was started in the British, Dutch and Japan colonial-era, resulting many new Indonesian native fauna species. However, the only comprehensive review of mealybugs species was one published in the monograph by Williams (2004). The study had been reported by Dammerman (1929), Wirjati (1958; 1959), and Kalshoven (1981), then continued by Reyne (1954; 1957; 1961; 1965), Muniappan et al. (2008; 2011; 2012), Sartiami et al. (2016), Gavrilov-Zimin (2013; 2017; 2019; 2020; 2021) and Zarkani et al. (2020; 2021), which have made several additional records to the scale insect fauna. Generally, over 16 years the number of described scale insect species in Indonesia has increased slowly by 53 species (Garcia et al. 2016). Nowadays, studies of Scale Insect species are still incomplete and irregular.

In the present paper, two new species and three newly recorded species from Indonesia, and an identification key and new additional locality records for the currently known Pseudococcidae species are provided and discussed.

## Materials and Methods

**Sample collection.** Mealybugs (nymphs and adult females) were collected from tropical plants located in several regions of southern Sumatra, Indonesia between April 2018 and October 2019. Specimens were collected from the infested parts of the plants (fruits, trunks, and leaves) and taken to the Laboratory of Plant Protection, University of Bengkulu for examination. For species determination, nymphs were reared on the respective fruits (at  $25 \pm 1$  °C, ~70% relative humidity and of 16:8 h light: dark photoperiod) until they reached the adult stage. Labeled specimens were killed and stored in 95% ethyl alcohol.

**Morphological identification.** Adult females specimens were slide-mounted and identified by light microscopy in the Plant Protection Department of the University of Bengkulu, using the method of Kosztarab & Kozár (1988) with some modifications (using distilled water after KOH and cleaning the specimens using a fine brush). The Mealybugs were examined under a phase-contrast compound microscope (Olympus BX41) and identified using the keys of Williams (2004), Cox & Ben-Dov (1986), Granara de Willink (2009), Granara de Willink & Szumik (2007) and Kaydan & Gullan (2012).

**Morphometric analysis.** For description of the new species, the main taxonomic characters of the adult females were evaluated and quantified under a compound microscope. The morphological terms used here are those used by Williams (2004) and Williams & Granara de Willink (1992). All the measurements given are for the maximum dimensions (e.g., body width was recorded at the widest part) and are expressed as ranges. Tarsal length excludes the claw. Setal length includes the setal base. Cerarii are numbered as described by Williams & Granara de Willink (1992), with cerarius 1 on the head, anterior to the antenna, and cerarius 17 being on abdominal segment VIII. An illustration is provided for the new species. The figure represents the

holotype, used for description. The illustration is split longitudinally, with the left half representing the dorsum and the right half the venter. Structural details are shown as enlargements around the central drawing, and are not drawn to the same scale. The translucent pores on the hind legs which are mostly found on the dorsal surface, but they are illustrated ventrally on the main figure for convenience.

## Results and Discussion

In this study a total of 149 samples were collected from southern Sumatra, Indonesia. Among these samples, 16 species were identified, of which 2 species are new to science and 3 species are new records for the Indonesian scale insect fauna. The identified specimens consist of the genus *Dysmicoccus* (5 species), *Ferrisia* (2 species), *Nipaecoccus* (1 species), *Paracoccus* (1 species), *Planococcus* (2 species), *Pseudococcus* (2 species) and *Rastrococcus* (4 species). The species marked below with an asterisk (\*) are recorded for the first time from Indonesia.

Key to adult females of Pseudococcidae genera occurring on fruit trees in Indonesia [adapted from Williams, 2004, Williams & Granara de Willink (1992) and Williams & Watson (1988)].

- 1 Dorsal tubular ducts large, each with orifice surrounded by circular, sclerotized area containing 1 or more setae within its borders, or with the setae adjacent to the rim ..... *Ferrisia* Cockerell
- Dorsal tubular ducts, if present, without this combination of characters ..... 2
- 2 Cerarii always conspicuous, each bearing numerous truncate-conical setae, each cerarian seta flat at apex ..... *Rastrococcus* Ferris
- Cerarii, if present, normally bearing pointed, conical, lanceolate or flagellate setae, never truncate-conical ..... 3
- 3 Oral rim tubular ducts present ..... 4
- Oral rim tubular ducts entirely absent ..... 5
- 4 Venter of each anal lobe with anal lobe bar and auxiliary setae present in anal lobe cerarii only. Cerarii numbering 12-17 pairs ..... *Paracoccus* Ezzat & McConnel
- Venter of each anal lobe with triangular to quadrate sclerotized area occupying much of lobe, never with an anal lobe bar only. Cerarii numbering 12-17 pairs ..... *Pseudococcus* Westwood
- 5 Anal lobe bars present. All abdominal cerarii each bearing 2 cerarian setae. Cerarii numbering 18 pairs ..... *Planococcus* Ferris
- Anal lobe bars absent. Cerarii numbering fewer than 18 pairs ..... 6
- 6 Some or most dorsal setae enlarged, conical to lanceolate, about same size as cerarian setae. Cerarii numbering less than 18 pairs. Anal lobe cerarii each usually bearing 2 or 3 broadly lanceolate or conical setae ..... *Nipaecoccus* Sulc
- Dorsal setae either flagellate or conical to lanceolate, all noticeably slender than cerarian setae. Cerarii numbering 8-17 pairs. Anal lobe cerarii each bearing either 2 cerarian setae or as many as 8, these usually conical, sometimes replaced by flagellate setae ..... *Dysmicoccus* Ferris

### Genus *Dysmicoccus* Ferris

#### *Dysmicoccus* Ferris, 1950

**Type species:** *Dactylopius brevipes* Cockerell by original designation.

**Generic diagnosis** (adapted from Williams, 2004).

**Adult female description.** Body normally broadly oval. Anal lobes usually developed, either membranous or sclerotized, each lobe bearing normal apical seta. Ventral margin of abdominal segments always membranous anterior to anal lobes. Antennae each normally with 6-8-segments. Legs well developed, translucent pores present or absent, tarsal digitules usually knobbed, occasionally setose. Claw usually stout, claw denticle absent. Cerarii numbering 6-17 pairs (never 18), always some cerarii each bearing either 2 cerarian setae or as many as 8, these usually conical, sometimes conical setae replaced by flagellate setae but cerarii always recognizable by concentrations of trilocular pores. Anterior cerarii each sometimes containing more than 2 setae. Circulus present or absent. Anal ring normally situated at apex of abdomen (rarely a short distance from apex), usually bearing 6 setae, occasionally with multiple setae present. Anterior and posterior ostioles present. Dorsal setae variously shaped. Ventral setae flagellate. Trilocular pores present on dorsum and venter. Multilocular disc pores usually present, at least on venter. Quinquelocular pores always absent. Oral collar tubular ducts usually apparent, at least on venter, sometimes present on dorsum, rarely absent entirely. Oral rim tubular ducts always absent. Discoidal pores present, sometimes large and occasionally present next to each eye.

Key to adult females of *Dysmicoccus* genus found in Indonesia (adapted from Williams, 2004).

- 1 Circulus present.....2
- Circulus absent.....12
- 2 Cerarii numbering 7 pairs including frontal pair. Dorsal oral collar tubular ducts numerous, present in rows across most segments..... *D. boninsis* (Kuwana)
- Cerarii numbering more than 7 pairs. Oral collar tubular ducts, if present on dorsum, never forming rows across segments .....3
- 3 Most cerarii without auxiliary setae.....4
- Most cerarii with auxiliary setae.....5
- 4 Ventral oral collar tubular duct sparse, a few present in medial area of abdomen and on lateral margin of abdominal segment VI and posterior segments only, absent from head and thoracic margins.....*D. carens* (Williams)
- Ventral oral collar tubular duct more numerous, present in rows across most abdominal segments to lateral margin, and around lateral margins forwards to head and thorax .....*D. arachidis* Williams
- 5 With series of large oral collar tubular ducts around dorsal lateral margins, each about twice as wide as trilocular pore, present around dorsal lateral margins .....*D. lepelleyi* (Betrem)
- Without a series of large oral collar tubular ducts, around dorsal lateral margins 6
- 6 Anal lobe cerarii each containing a group of about 2-7 conical setae .....7
- Anal lobe cerarii each containing 2 conical setae .....8
- 7 Multilocular disc pores and oral collar tubular ducts absent on dorsum. A few multilocular disc pores and oral collar tubular ducts on venter...*D. finitimus* Williams
- Multilocular disc pores and oral collar tubular ducts present in both dorsum and ventral .....*D. sosromarsonae* Zarkani & Kaydan, sp.n
- Multilocular disc pores and oral collar tubular ducts absent on dorsum. A few multilocular disc pores without oral collar tubular ducts on venter.....*D. zeynepae* Zarkani & Kaydan, sp.n

- 8 Abdominal cerarii anterior to anal lobe pair, with 2 conical setae except for an occasional cerarius with only a single conical seta .....9
- Some abdominal cerarii, anterior to anal lobe pair, each usually containing more than 2 conical setae .....10
- 9 Dorsal setae never thick or conical; all dorsal setae flagellate.....  
.....*D. debregeasiae* (Green)
- Dorsal marginal setae, including auxiliary setae, about same length as other dorsal setae or only slightly longer ..... *D. orchidium* Williams
- 10 Dorsal setae on abdominal segment VIII, anterior to anal ring, longer than other dorsal setae, almost as long as anal ring setae. .... *D. brevipes* (Cockerell)
- Dorsal setae on abdominal segment VIII, anterior to anal ring, short, about same size as other dorsal setae. .... *D. neobrevipes* Beardsley

***Dysmicoccus sosromarsonoae* Zarkani & Kaydan sp. n.**

(Figure 1)

**Material examined.** Holotype, adult female: INDONESIA: left label: AZ203/ Sumatra/ Bengkulu/ Arecaceae/ *Elaeis guineensis* Jacq./ 2.ii.2018/ 03°59'07"S, 102°25'37"E/ coll. A. Zarkani; right label: Holotype/ *Dysmicoccus sosromarsonoae* sp. n. Zarkani & Kaydan. Paratypes, 2 adult females, same data as holotype (AZ203), deposited in the Mealybugs Museum, Department of Plant Protection, Faculty of Agriculture, University of Bengkulu, Bengkulu, INDONESIA (MMUB).

**Adult female description.** Body oval, 1.98–2.42 mm long, 1.38–1.48 mm wide. Eyes situated on margins, each 25–30 µm wide. Antenna 7-segmented, 270–280 µm long, with 4 fleshy setae each 22.5–30.0 µm long; apical segment 75–90 µm long, 22.5–30.0 µm wide, with apical 27.5–30 µm long. Clypeolabral shield 220–230 µm long, 175–185 µm wide. Labium 3-segmented, 110–120 µm long, 80–85 µm wide. Anterior spiracles each 60–65 µm long, 20–25 µm wide across atrium; posterior spiracles each 75.0–85.0 µm long, 40–45 µm wide across atrium. Circulus 80–110 µm wide. Legs well-developed; segment lengths for posterior leg: coxa 115–135 µm, trochanter + femur 205–220 µm, tibia + tarsus 160–170 µm, claw 27.5–30.0 µm. Ratio of length of tibia + tarsus to trochanter + femur, 0.77–0.78:1; ratio of length of tibia to tarsus, 1.2–1.4:1; ratio of length of trochanter + femur to greatest width of femur, 3.41–3.60:1; coxa with 30–50 translucent pores, plus 40–50 translucent pores present surrounding each coxa. Tarsal digitules capitate, each 27.5–30.0 µm long. Claw digitules capitate, each about 22.5–25.0 µm long. Both pairs of ostioles present, anterior ostioles each with a total for both lips of 28–40 trilocular pores and 4–6 setae; posterior ostioles each with a total for both lips of 58–60 trilocular pores and 6–8 setae. Anal ring about 95 µm wide, with 6 setae, each seta 160–165 µm long.

**Dorsum.** Derm membranous, with 16 pairs of cerarii around body margin, each cerarius with 2–5 cerarian setae and 3–5 auxiliary setae. Each anal lobe cerarius set on membranous cuticle and containing 3–5 enlarged setae 25–30 µm long, plus 55–57 trilocular pores and 3–5 hair-like auxiliary setae. Dorsal setae short and flagellate, each 30–110 µm long, scattered throughout dorsum. Trilocular pores, each 3–4 µm in diameter, scattered. A few multilocular disc pores present.

**Venter.** Setae flagellate, each 30–110 µm long, longest setae located medially on head. Apical setae of anal lobe each 125–150 µm long. Multilocular disc pores, each 7–8 µm in diameter, present throughout venter, numbers on each abdominal segment as follow: I–III each with 60–70, IV 20–24, V 38–43, VI 100–110, VII 90–98, VIII + IX 36–38 and 125–145 on thorax and head. Trilocular pores, each 2.5–3.0 µm across,

scattered throughout venter. Oral collar tubular ducts each 8–10 µm long, 4–5 µm wide, present throughout, but in bands across abdominal segments, as follows: VI 21, VII 15, VIII + IX 14.

**Comments.** *Dysmicoccus sosromarsonoae* Zarkani & Kaydan sp. n., is most similar to *D. finitimus* Williams in having anal lobe cerarii each containing a group of about 2–7 conical setae. However, *D. sosromarsonoae* can be readily distinguished from *D. finitimus* in having multilocular disc pores and oral collar tubular ducts present in both dorsum and venter.

**Etymology.** This species is named after Dr. Soemartono Sosromarsono, the first Indonesian entomologist.

**Host plants.** *Elaeis guineensis* (Figure 2)

**Distribution.** Indonesia (Bengkulu province).

### ***Dysmicoccus zeynepae* Zarkani & Kaydan sp. n.**

(Figure. 3)

**Material examined.** Holotype, adult female: INDONESIA: left label: AZ205/ Sumatra/ Bengkulu/ Malvaceae/ *Durio zibethinus* Murr./ 4.ii.2018/ 03°34'54.4"S, 102°38'33"E/ coll. A. Zarkani; right label: Holotype/ *Dysmicoccus zeynepaea* sp. n. Zarkani & Kaydan. Paratypes, 5 adult females, same data as holotype (AZ205); 3 adult females: INDONESIA, AZ206/ Sumatra/ Bengkulu/ Meliaceae/ *Lansium parasiticum* Corr./ 11.ii.2018/ 03°59'28.0"S 102°25'50.4"E/ coll. A. Zarkani; 3 adult females: INDONESIA, AZ207/ Sumatra/ Bengkulu/ Sapotaceae/ *Manilkara zapota* L./ 12.ii.2018/ 04°00'05.7"S 102°26'52.1"E/ coll. A. Zarkani; 3 adult females: INDONESIA, AZ208/ Sumatra/ Bengkulu/ Rubiaceae/ *Coffea robusta* Lindl.Ex De Wil./ 19.ii.2018/ 03°36'15.4"S 102°36'30.8"E/ coll. A. Zarkani. Holotype and Paratypes are deposited in the MMUB (INDONESIA).

**Adult female description.** Body oval, 1.95–2.54 mm long, 1.64–2.25 mm wide. Eyes situated on margins, each 42–45 µm wide. Antenna 8-segmented, 340–380 µm long, with 4 fleshy setae each 22.5–25.0 µm long; apical segment 75–80 µm long, 27.5–30.0 µm wide, with apical 30–35 µm long. Clypeolabral shield 200–220 µm long, 175–185 µm wide. Labium 3-segmented, 110–120 µm long, 80–85 µm wide. Anterior spiracles each 85–90 µm long, 45–50 µm wide across atrium; posterior spiracles each 95.0–115.0 µm long, 55–60 µm wide across atrium. Circulus 80–110 µm wide. Legs well-developed; segment lengths for posterior leg: coxa 160–175 µm, trochanter + femur 145–155 µm, tibia + tarsus 175–180 µm, claw 35.0–37.5 µm. Ratio of length of tibia + tarsus to trochanter + femur, 1.77–1.78:1; ratio of length of tibia to tarsus, 1.2–1.4:1; ratio of length of trochanter + femur to greatest width of femur, 2.41–2.60:1; coxa with 30–50 translucent pores. Tarsal digitules capitate, each 35–40 µm long. Claw digitules capitate, each about 27.5–30.0 µm long. Both pairs of ostioles present, anterior ostioles each with a total for both lips of 28–40 trilocular pores and 4–6 setae; posterior ostioles each with a total for both lips of 58–60 trilocular pores and 6–8 setae. Anal ring about 70 µm wide, with 6 setae, each seta 80–90 µm long.

**Dorsum.** Derm membranous, with 16 pairs of cerarii around body margin, each cerarius with 4–7 cerarian setae and 3–5 auxiliary setae. Each anal lobe cerarius set on membranous cuticle and containing 5–7 enlarged setae 25–35 µm long, plus 40–45 trilocular pores and 3–5 hair-like auxiliary setae. Dorsal setae flagellate, each 15–75 µm long, scattered throughout dorsum. Trilocular pores, each 3–4 µm in diameter, scattered. Multilocular disc pores absent.

**Venter.** Setae flagellate, each 30–110 µm long, longest setae located medially on head. Apical setae of anal lobe each 80–90 µm long. Multilocular disc pores, each 7–8

µm in diameter, present only around the vulva, 8–10 in numbers. Trilocular pores, each 2.5–3.0 µm across, scattered throughout venter. Oral collar tubular ducts absent.

**Comments.** *Dysmicoccus zeynepae* Zarkani & Kaydan sp. n., is most similar to *D. finitimus* Williams in having anal lobe cerarii each containing a group of about 2–7 conical setae. However, *D. zeynepae* can be readily distinguished from *D. finitimus* in having: (i) no multilocular disc pores and oral collar tubular ducts on dorsum; (ii) a few multilocular disc pores without oral collar tubular ducts on venter.

**Etymology.** This species is named after Zeynep Kaydan (mother of Kaydan's Lab.), Zeynep Güleç and Zeynep Kaya whom are good friends.

**Host plant.** *Durio zibethinus*, *L. parasiticum*, *M. zapota.*, *C. robusta* (Figure 4).

**Distribution.** Indonesia (Bengkulu province).

### **\**Dysmicoccus arachidis* Williams**

**Material examined.** Bengkulu province: 6 ♀♀, Kabawetan, Kepahiang district, *Crassocephalum crepidioides* (Benth.) S. Moore, 600 m a.s.l, 03°34'54.4"S, 102°35'33"E, 12.vi.2018, Coll. A. Zarkani (AZ80–81).

This is a newly recorded species from Indonesia and the second record after Williams (2004) who previously reported this species in India (Tripura) on *Arachis hypogaea* L. There is little information available about *D. arachidis*.

### ***Dysmicoccus brevipes* (Cockerell)**

**Material examined.** Bengkulu province: 3 ♀♀, Slebar, Bengkulu city, *Syzygium aqueum* Alston, 20 m a.s.l, 03°49'25.2"S, 102°19'08.7"E, 10.vii.2018, Coll. A. Zarkani (AZ210).

The species is polyphagous on ornamentals and fruits within 62 families and 147 genera. Cosmopolitan, found in 126 countries. Distribution in Indonesia: Irian Jaya (Williams & Watson, 1988a), Java (Ben-Dov, 1994; Betrem, 1937; Williams, 2004), Sumatra (Williams, 2004).

### **\**Dysmicoccus carens* Williams**

**Material examined.** Bengkulu province: 3 ♀♀, Sukaraja, Seluma district, *Psophocarpus tetragonolobus* L., 10 m a.s.l, 03°59'07"S, 102°25'37"E, 15.vi.2018, Coll. A. Zarkani (AZ82–83).

The species was recorded previously in Bangladesh (North) on *Andropogon squarrosus* L.; India (New Delhi) on *Setaria verticillata* L. (Grasses), (Orissa) on grass, (Tamil Nadu) on *Saccharum officinarum* L., *Cymbopogon* sp. *Chloris barbata* Sw.; Pakistan (Rawalpindi) on *Sorghum nitidum* Pers., *S. sudanensis* (Piper) Hitch, (Mona) on *Arundo donax* L., (Lasbela, Ambagh) on *Panicum antidotale* Retz.; Sri Lanka (Uva province, Wellawa, Kokagala) on grass (Williams, 2004; Kaydan et al., 2004; Garcia et al., 2016). This is a newly recorded species from Indonesia.

### ***Dysmicoccus lepellei* (Betrem)**

**Material examined.** Bengkulu province: 3 ♀♀, Slebar, Bengkulu city, *Manilkara zapota* L., 20 m a.s.l, 03°49'25.2"S 102°19'08.7"E, 10.vii.2018, Coll. A. Zarkani (AZ230).

This is polyphagous species on ornamentals and fruits within 17 families of plants such as Anacardiaceae, Annonaceae, Arecaceae, Asparagaceae, Clusiaceae, Euphorbiaceae, Fagaceae, Malvaceae, Meliaceae, Moraceae, Musaceae, Myrtaceae, Rubiaceae, Rutaceae, Sapindaceae, Sapotaceae, and Zingiberaceae. In Indonesia, the species was recorded previously from Java (Ben-Dov, 1994; Betrem, 1937; Williams, 2004), Lombok (Williams, 2004), Sumatra (Williams, 2004). It is also found in neighboring countries such as Cambodia, Malaysia, Singapore, Thailand, and Vietnam.

#### ***Ferrisia dasyliroi* (Cockerell)**

**Material examined.** Bengkulu province: 6 ♀♀, Muara Bangkahulu, Bengkulu city, *Solanum torvum* Swartz, *Theobroma cacao* L., 20 m a.s.l. 3°45'33.0"S, 102°16'10.1"E, 3.vii.2019, Coll. A. Zarkani (AZ245-246).

Polyphagous on ornamentals and fruits and known from 23 families and 52 genera. In Indonesia, the species was recorded previously from Sumatra (Zarkani *et al.*, 2020)

#### ***Ferrisia virgata* (Cockerell)**

**Material examined.** Bengkulu province: 3 ♀♀, Muara Bangkahulu, Bengkulu city, *Psidium guajava* L., 20 m a.s.l., 03°45'33.0"S, 102°16'10.1"E, 5.iii.2019, Coll. A. Zarkani (AZ247).

Polyphagous on ornamentals and fruits; known from 78 plant families and 207 genera. Cosmopolitan: recorded from 101 countries. In Indonesia, the species was recorded previously in Irian Jaya (Gavrilov-Zimin, 2013; Williams & Watson, 1988a), Java (Ben-Dov, 1994; Betrem, 1937; Keuchenius, 1915; Ali, 1968; Williams, 2004), Sulawesi (Williams, 2004).

#### ***Nipaecoccus viridis* (Newstead)**

**Material examined.** Bengkulu province: 3 ♀♀, Kampung Melayu, Bengkulu city, *Citrus* sp., 10 m a.s.l, 03°54'16.5"S 102°19'11.7"E, 18.ii.2018, Coll. A. Zarkani (AZ211).

Polyphagous on ornamentals and fruits; recorded from 45 plant families and 114 genera. Cosmopolitan; reported from 63 countries. In Indonesia, the species was recorded previously in Irian Jaya (Ben-Dov, 1994; CABI, 1983), Java (Ben-Dov, 1994; CABI, 1983; Williams, 2004), and Sulawesi (Williams, 2004).

#### ***Paracoccus evae* Williams**

**Material examined.** Bengkulu province: 3 ♀♀, Sukaraja, Seluma district, *Melastoma malabathricum* L, 50 m a.s.l, 03°52'00.4"S, 102°22'51.2"E, 23.vii.2019, Coll. A. Zarkani (AZ249).

This is the second report from Indonesia after Williams (2004) found the species in Java on *Eupatorium* sp., Poaceae.

#### ***Planococcus dischidiae* (Takahashi)**

**Material examined.** Bengkulu province: 1 ♀, Kabawetan, Kepahiang district, *C. robusta*, 600 m a.s.l, 03°34'54.4"S, 102°35'33"E, 12.vi.2018, Coll. A. Zarkani (AZ235-239).

*Planococcus dischidia* was firstly found on *Dischidia* sp. The previous record was from Indonesia (Sulawesi) (Ben-Dov, 1994; Cox, 1989; Williams, 2004) and Malaysia (Ben-Dov, 1994; Takahashi, 1951).

#### ***Planococcus lilacinus* (Cockerell)**

**Material examined.** Bengkulu province: 1 ♀, Muara Bangkahulu, Bengkulu city, *Saraca asoca* (Roxb.), 20 m a.s.l., 03°45'33.0"S, 102°16'10.1"E, 10.ii.2019 & 15.iii.2020, Coll. A. Zarkani (AZ313).

Polyphagous on ornamentals and fruits; recorded from 73 families and 196 genera. Cosmopolitan: reported from 64 countries. In Indonesia, the species was recorded previously in Irian Jaya (Ben-Dov, 1994) (Williams *et al.*, 1988a), Java (Williams, 2004), Kalimantan (Ben-Dov, 1994), (Cox, 1989), Lombok (Williams, 2004), Sulawesi (Williams, 2004), Sumatra (Ben-Dov, 1994; Cox, 1989; Williams, 2004).

#### ***Pseudococcus jackbeardsleyi* Gimpel & Miller**

**Material examined.** Bengkulu province: 1 ♀, Kabawetan, Kepahiang district, *Selenicereus undatus* (Haw.) DR Hunt, 600 m a.s.l, 03°34'54.4"S, 102°35'33"E, 10.vii.2018, Coll. A. Zarkani (AZ227).

Polyphagous on ornamentals and fruits; reported from 52 families and 112 genera. Cosmopolitan: reported from 52 countries. In Indonesia, the species was recorded previously in Flores (Gavrilov-Zimin, 2017), Irian Jaya (Gavrilov-Zimin, 2013), Java (Williams, 2004)

#### **\**Pseudococcus leptotrichotus* Williams**

**Material examined.** Bengkulu province: 12 ♀♀, Kabawetan, Kepahiang district, *C. robusta*, 600 m a.s.l, 03°34'54.4"S, 102°35'33"E, 12.vi.2018, Coll. A. Zarkani (AZ235-239).

This is the first mealybug species recorded from Indonesia which was previously reported in Malaysia (Sarawak) in a leaf nest of *Oecophylla* sp. ants. In these specimens, *P. leptotrichotus* were collected on leaf nest on coffee leaves of *Oecophylla* sp. ants and from a soil nest on coffee berries and trees of unidentified black ants.

#### ***Pseudococcus longispinus* (Targioni Tozzetti)**

**Material examined.** Bengkulu province: 3 ♀♀, Muara Bangkahulu, Bengkulu city, *Theobroma cacao* L., 20 m a.s.l., 03°45'33.0"S, 102°16'10.1"E, 5.iii.2019, Coll. A. Zarkani (AZ247).

Polyphagous on ornamentals and fruits; recorded from 84 families and 167 genera. Cosmopolitan: reported from 115 countries. In Indonesia, the species was recorded previously in Irian Jaya (Ben-Dov, 1994; Williams, 1988a), Java (Ben-Dov, 1994; Betrem, 1937), Lombok (Williams, 2004), Sulawesi (Watson *et al.*, 2014), and Sumatra (Green, 1930).

### ***Rastrococcus chinensis* Ferris**

**Material examined.** Bengkulu province: 12 ♀♀, Singaran Pati, Bengkulu city, *Nephelium lappaceum* L., 20 m a.s.l., 03°48'57.9"S, 102°18'38.9"E, 12.vi.2018, Coll. A. Zarkani (AZ168-170).

The species was recorded previously on *Alocasia* sp., *Ardisia lindleyana* D. Dietr., *Eugenia* sp., *Melastoma malabathricum* L., *Morinda umbellata* L., *Psychotria asiatica* L., *Syzygium* sp., *Syzygium anomalum* Lauterb., *Syzygium hancei* Merr. & Perry. The species was recorded previously in Brunei, China, and Malaysia. In Indonesia, the species was recorded previously in Java (Ben-Dov, 1994; Williams, 1989; 2004a).

### ***Rastrococcus invadens* Williams**

**Material examined.** Bengkulu province: 12 ♀♀, Kabawetan, Kepahiang district, *Mangifera indica* L., 600 m a.s.l., 03°34'54.4"S, 102°35'33"E, 12.vi.2018, Coll. A. Zarkani (AZ235-239).

Polyphagous on ornamentals and fruits; recorded from 29 families and 54 genera. Cosmopolitan on 32 countries. In Indonesia, the species was recorded previously in Bali (Ben-Dov, 1994; Williams, 1989; Williams, 2004), Java (Ben-Dov, 1994; Williams, 1989, 2004).

### ***Rastrococcus tropicasiatricus* Williams**

**Material examined.** Bengkulu province: 1 ♀, Air Periukan, Seluma district, *Azadirachta excelsa* (Jack) M. Jacobs, 10 m a.s.l., 3°59'07.1"S, 102°25'37.4"E, 1.v.2019, Coll. A. Zarkani, (AZ336).

Zarkani *et al.* (2021) reported *R. tropicasiatricus* on *A. excelsa* (Meliaceae), *Cerbera manghas* L. (Apocynaceae), *Dimocarpus longan* Lour. (Sapindaceae), *Ficus* sp. (Moraceae), and *Tectona grandis* L. (Lamiaceae) for the first time in Indonesia (Bengkulu). The species is also known to live on woody plants and wild grass in southern Asia such as Malaysia, Philippines, Thailand, and Vietnam.

### **Acknowledgments**

The authors wish to thank Dr. Takumasa Kondo (Corporación Colombiana de Investigación Agropecuaria - Agrosavia, Colombia), for his kind help and for critical reading of the manuscript. The project was financially supported by the Research and Community Service Centre, Lembaga Penelitian dan Pengabdian pada Masyarakat (LPPM), The University of Bengkulu with grants No. SP. DIPA-041.012.400977/2020. The writing manuscript was assisted by WCP Dikti Program 2021.

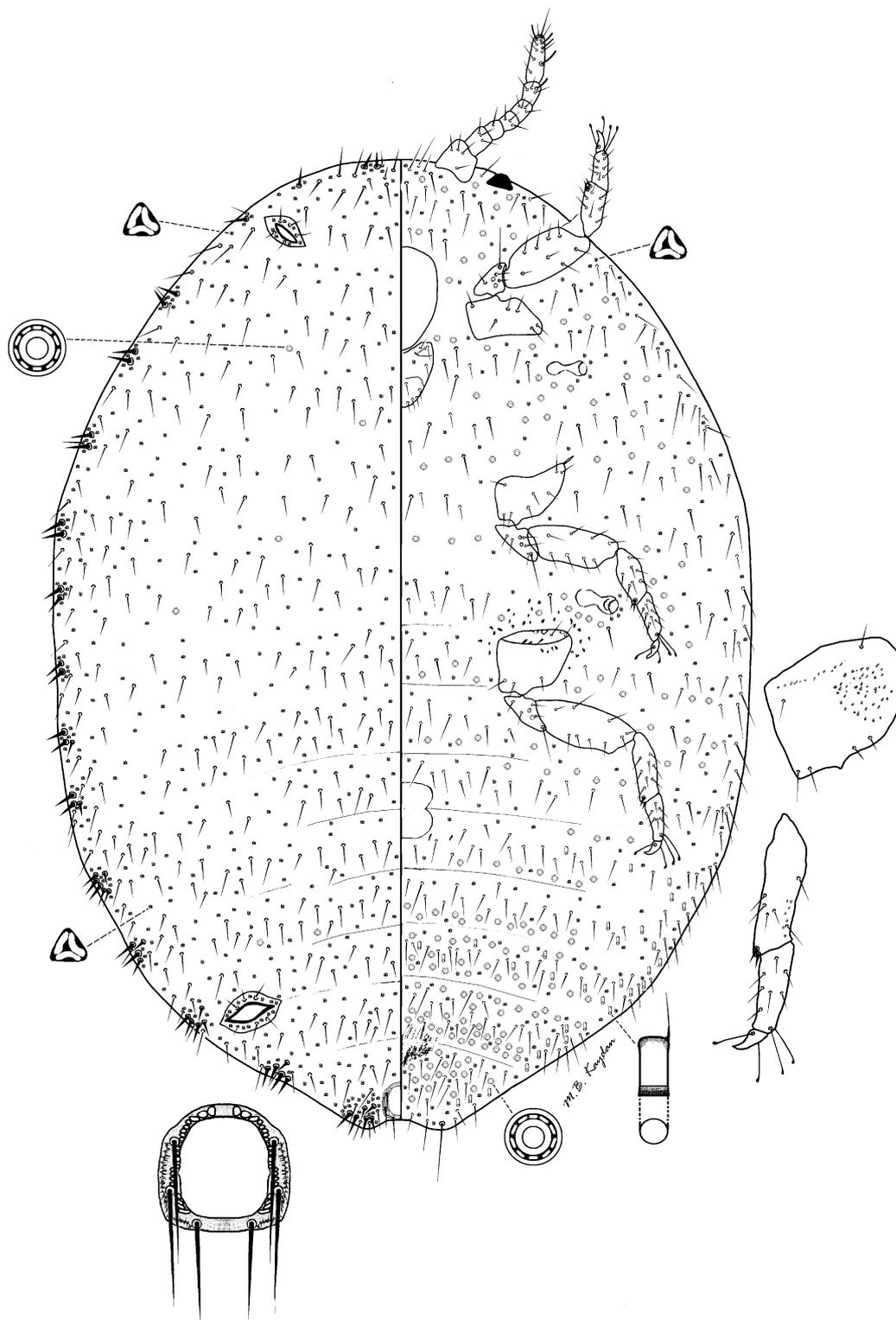
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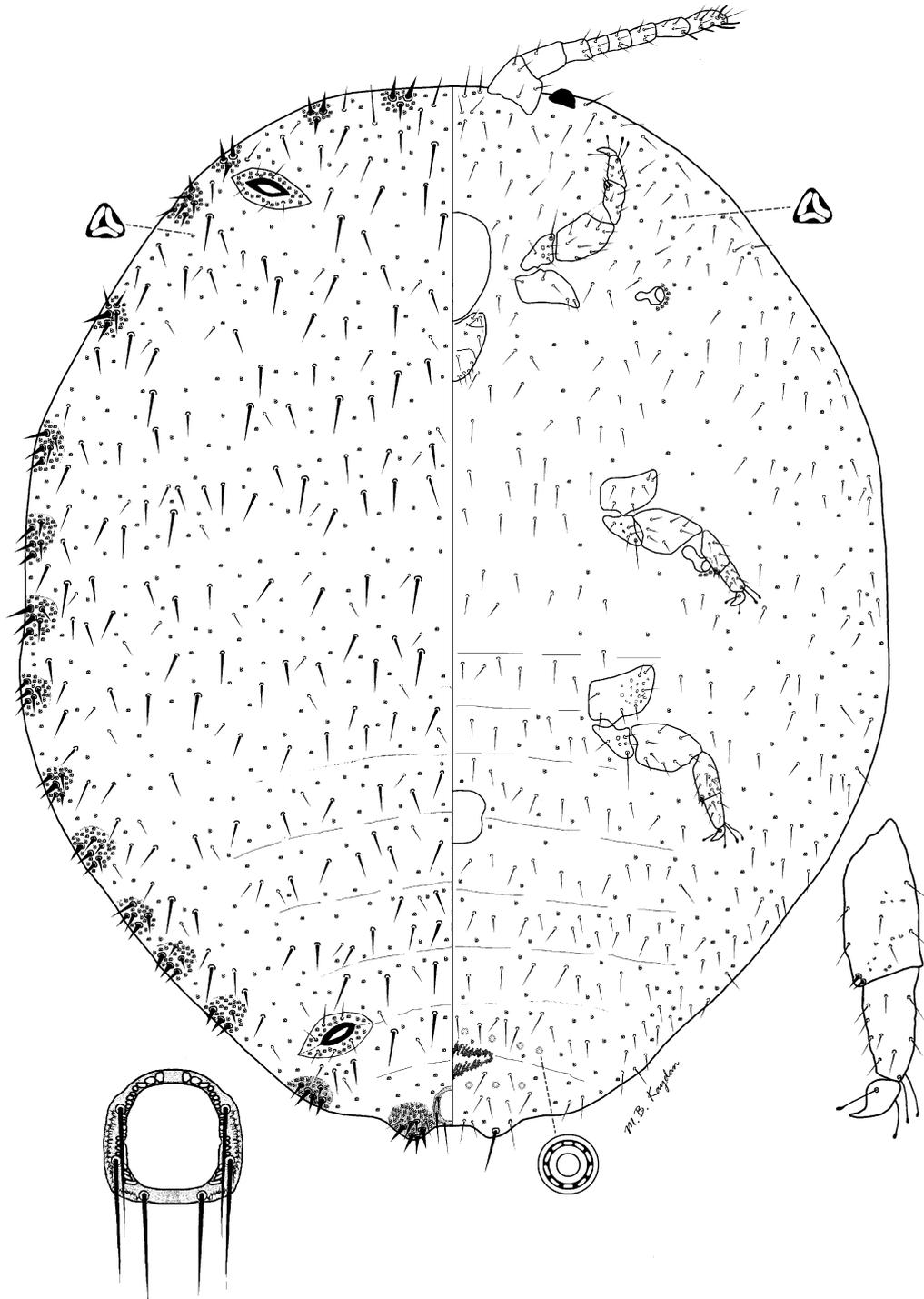
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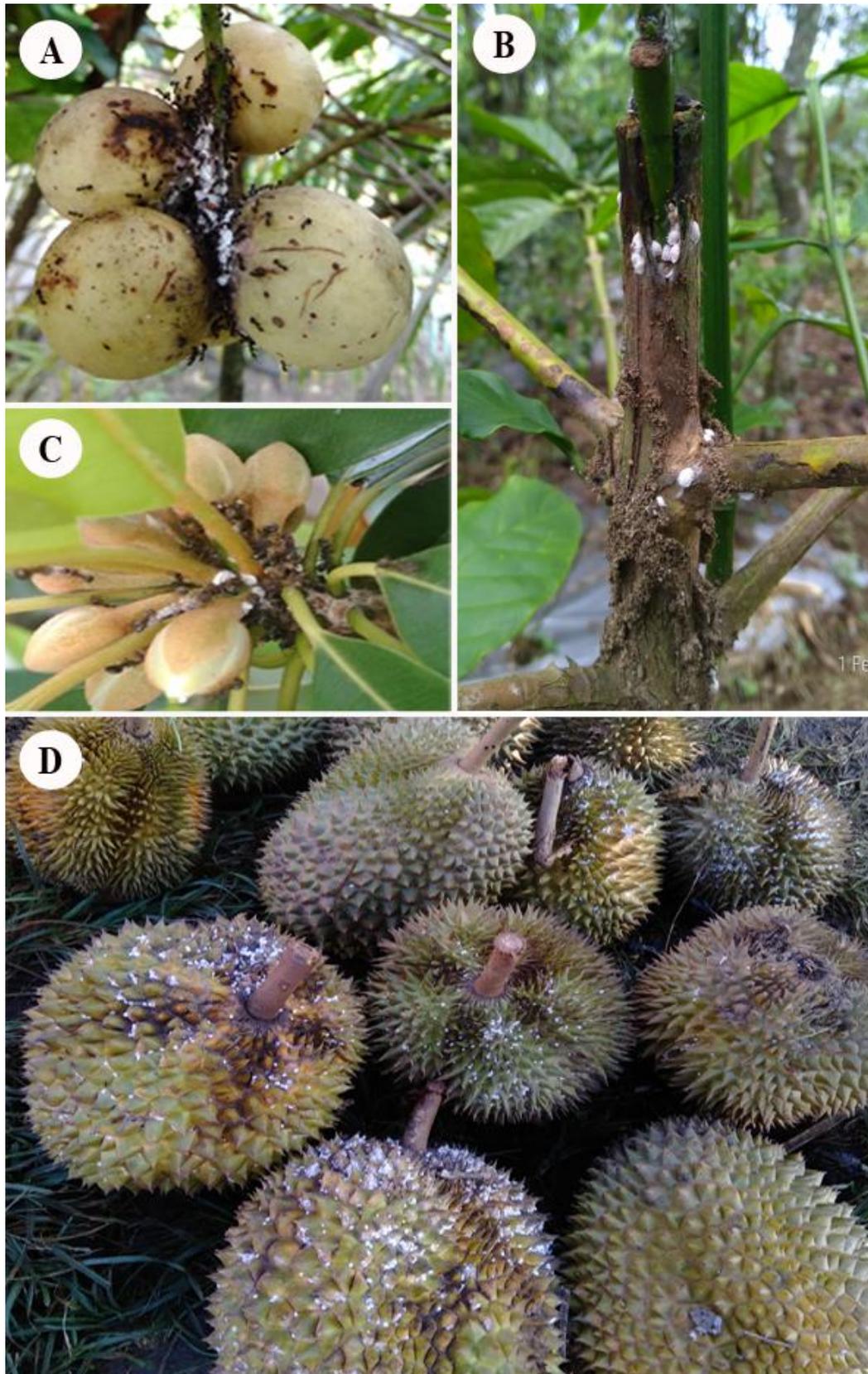
**FIGURE 1.** Adult female *Dysmicoccus sosromarsonoae* Zarkani & Kaydan sp. n. Holotype



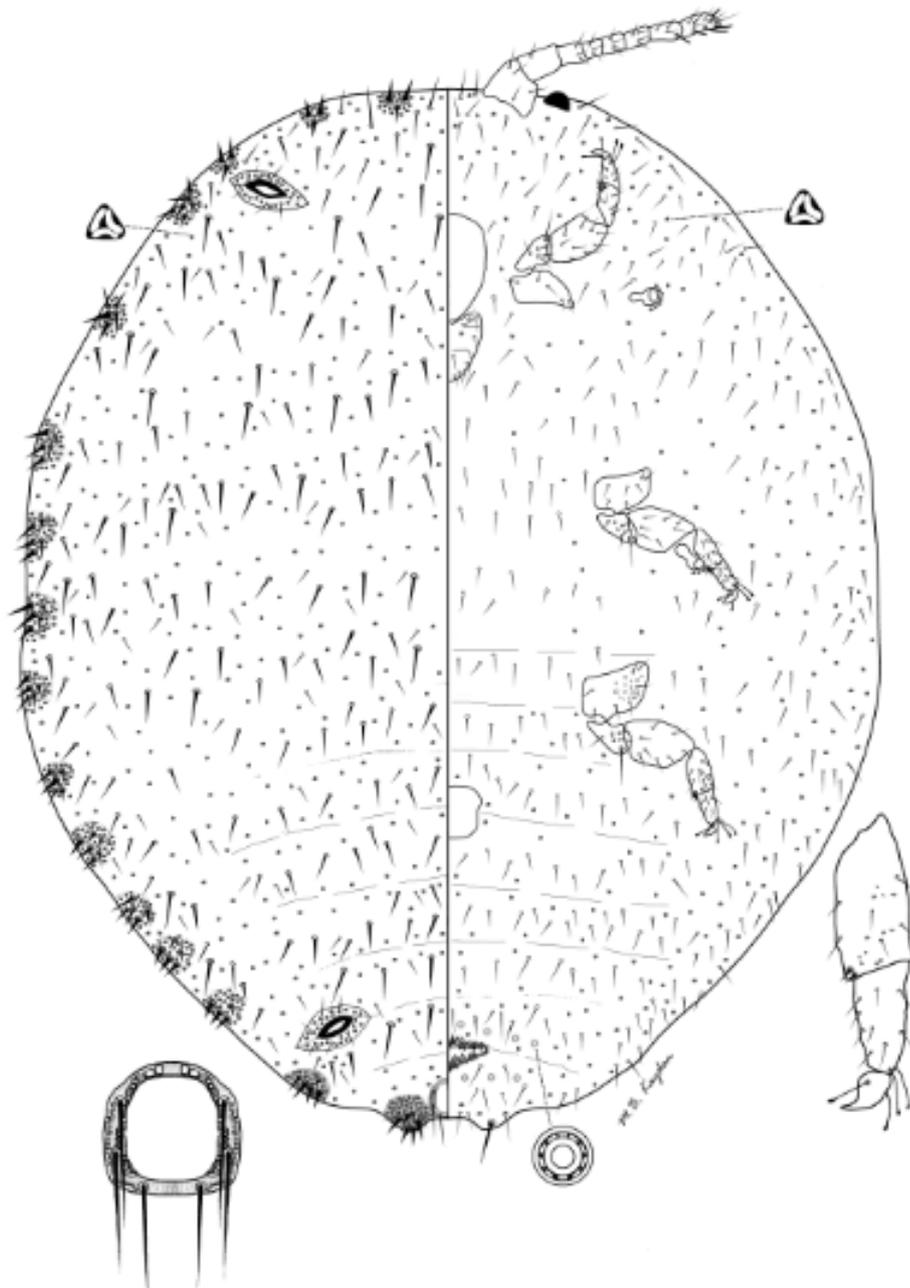
**FIGURE 2.** *Dymicoccus sosromarsonae* Zarkani & Kaydan sp. n. on *Elaeis guineensis* Jacq.



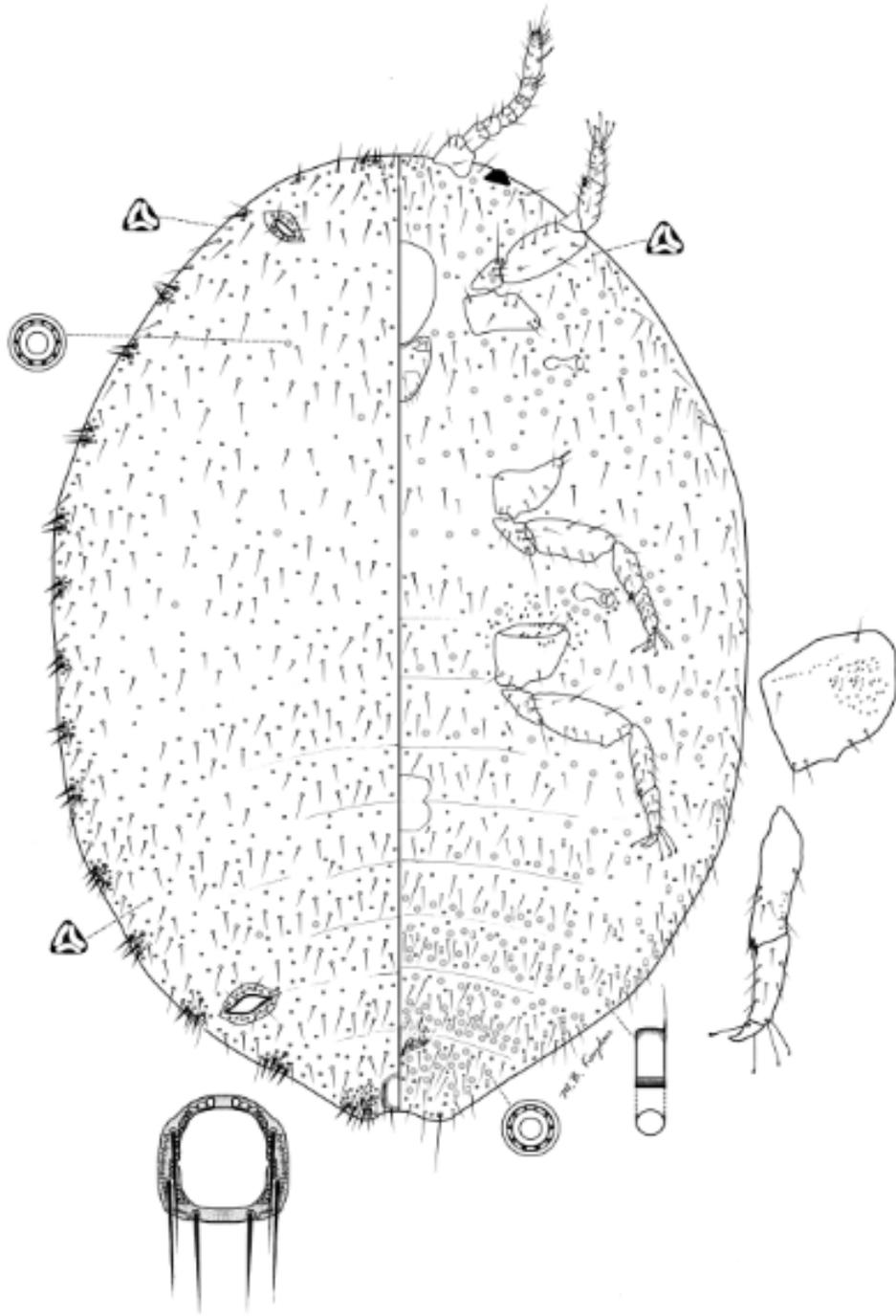
**FIGURE 3.** Adult female *Dysmicoccus zeynepae* Zarkani & Kaydan sp. n. Holotype.



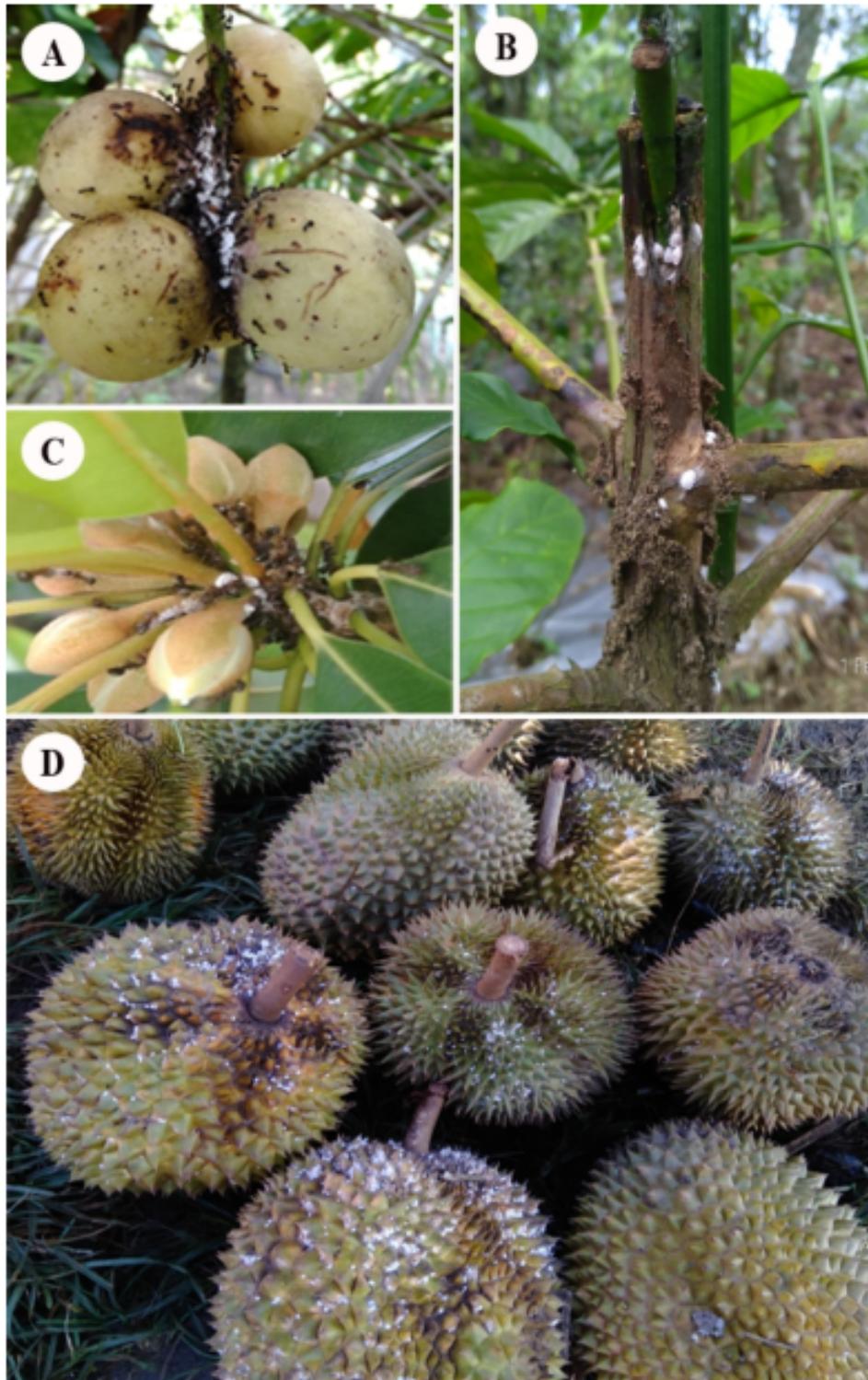
**FIGURE 4.** *Dysmicoccus zeynepae* Zarkani & Kaydan sp. n. on (A) *Lansium parasiticum* Corr., (B) *Coffea robusta* Lindl.Ex De Will, (C) *Manilkara zapota* L., and (D) *Durio zibethinus* Murr.



**FIGURE 3.** Adult female *Dysmicoccus zeynepae* Zarkani & Kaydan sp. n. Holotype.



**FIGURE 1.** Adult female *Dymicooccus sosromarsonoae* Zarkani & Kaydan sp. n.  
Holotype



**FIGURE 4.** *Dysmicoccus zeynepae* Zarkani & Kaydan sp. n. on (A) *Lansium parasiticum* Corr., (B) *Coffea robusta* Lindl.Ex De Will, (C) *Manilkara zapota* L., and (D) *Durio zibethinus* Murr.



**FIGURE 2.** *Dymicoccus sosromarsonoae* Zarkani & Kaydan sp. n. on *Elaeis guineensis* Jacq.