

# Studies on mealybug-species (Hemiptera: Coccoomorpha: Pseudococcidae) in Indonesia, with description of two new species and three new country record species from Indonesia

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## Abstract

Mealybugs (Hemiptera: Coccoomorpha: Pseudococcidae) include economically important insect pests worldwide; however, little is known about the mealybug-species present in Indonesia. ~~Scale insects~~ Samples were collected and identified from natural-wild and cultivated plants in several regions of southern Sumatra, Indonesia between 2018 and 2019. In total, ~~16~~Sixteen species of Pseudococcidae in 7 genera were found/identified, including two new undescribed species, and three new species records new for to 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 morphology of the adult female, and a key is provided for their identification. Furthermore, *Dysmicoccus arachidis* Williams and *Dysmicoccus D. carens* Williams and *Pseudococcus leptotrichotus* Williams were found are recorded as new records for the country for the first time from Indonesia. New locality and host-host-plant data are given for all these species. Additionally, an identification key to the new mealybug species is provided.

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

## Introduction

The Pseudococcidae (Hemiptera: ~~Sternorrhyncha~~Coccoomorpha: Coccoomorpha), whose members are known as mealybugs, is one of the family of families of scale insects which include many important sap-sucking insect pests on of woody and herbaceous plants. These insects not only damage their host plants directly, by mechanical injure-injury and feed their host plants/extraction of sap, but also indirectly by promote-promoting sooty mold growth on their sugary honeydew waste and transmit-transmission of plant virus diseases (Franco *et al.* 2009, Daane *et al.* 2012).

The Pseudococcidae, with 2041 species in 259 genera, is the second largest scale insect family after the Diaspididae, which contains about 2693 species in 418 genera (García Morales *et al.* 2016). To date, there are 2034 species in 258 genera of Pseudococcidae in the world and this is the second abundant family after the Diaspididae which consists of about

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2693 species in 418 genera (García-Morales *et al.* 2016). In the Indonesian archipelago, there are 1058 species of Pseudococcidae in 32-31 genera of Pseudococcidae have been recorded so far, and this is also the second-largest family after the Diaspididae, with which has 158-118 species in 44-46 genera recorded in this archipelago country (García-Morales *et al.* 2016). From In the family Pseudococcidae, the most species-rich and damaging genera in Indonesia are: *Rastrococcus* Ferris (15 species), *Pseudococcus* Westwood (13 species), *Paraputo* Laing (13 species), *Dysmicoccus* Ferris (9 species), and *Paraputo* Laing (13 species), *Planococcus* Ferris (6-7 species), *Pseudococcus* Westwood (13 species), and *Rastrococcus* Ferris (14 species) are the most species-rich and harmful genera in Indonesia (Williams, 2004; García-Morales *et al.* 2016).

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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-very large number of indigenous plants, vertebrates and invertebrates including great insect bionrichness-diversity (McNeely *et al.* 1990; CBD Secretariat 2021). The first exploration-documentation of Indonesian insect richness-diversity, including mealybugs in Indonesia was started-began in the British, Dutch and Japanese colonial-eras, resulting in the description of many new Indonesian native fauna-species. The study was continued by Reyne (1954; 1957; 1961; 1965), Muniappan *et al.* (2008; 2011; 2012), Sartiami *et al.* (2015, 2016), Gavrilov-Zimin (2013; 2016; 2017; 2019; 2020; 2021) and Zarkani *et al.* (2020; 2021a & b), in which several additional records to the scale insect fauna were made. However, the only comprehensive review of mealybugs recorded from Indonesia was published in the monograph by Williams (2004). The study had been 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; 2021a & b), which have made several additional records to the scale insect fauna. Generally, Over the last 16 years the number of described scale insect species recorded in Indonesia has increased slowly by 53 species (García-Morales *et al.* 2016). However, The knowledge studies of Indonesian scale insect species are still patchy and incomplete-and-irregular.

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In the present paper, covers two new species and three newly-new country recorded species from Indonesia, and an Identification keys to genera and *Dysmicoccus* species, 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 plant parts of the plants (fruits, trunk and branches, and leaves) were cut, bagged, labeled and taken to the Laboratory of Plant Protection, University of Bengkulu for examination. For species determination, nymphs were reared on the respective-relevant fruits-plant material (at 25 ± 1 °C, ~70% relative humidity and of 16:8 h light: dark photoperiod) until they reached the adult stage. Mention the microscope used to sort specimens for preservation and slide mounting. Specimens were killed, labeled and stored in 95% ethyl alcohol.

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**Morphological identification.** In the Plant Protection Department of the University of Bengkulu, Adult-adult females specimens were slide-mounted using the method of Kosztarab and Kozár (1988) with some modifications (using distilled water after KOH and cleaning the specimens using a fine brush). They were identified by light microscopy using in the Plant Protection Department of the University of Bengkulu, using the method of Kosztarab and

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~~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 ~~were~~ identified using the keys of Williams (2004), Cox and Ben-Dov (1986), Granara de Willink (2009), Granara de Willink and Szumik (2007) and Kaydan and 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 ~~light~~ microscope. The morphological terms used ~~here are~~ those used by ~~Williams and Granara de Willink (1992) and~~ Williams (2004) ~~and Williams and 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 and Granara de Willink (1992), with cerarius 1 on the head, anterior to the antenna, and cerarius 17 being on abdominal segment VIII.~~ ~~An A taxonomic illustration is provided for the each new species, and is based on . The figure represents the holotype, used for the~~ 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 ~~all~~ 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.

~~Type specimens of the new species described are deposited in the Mealybugs Museum, Department of Plant Protection, Faculty of Agriculture, University of Bengkulu, Bengkulu, Indonesia (MMUB). Add an explanation of the use of “/” in holotype data listing. Also explain where the terminology you use in the descriptions comes from, and the units of measurement used in the descriptions.~~

## Results and ~~Discussion~~ discussion

~~In this study a~~From total of 149 samples ~~were~~ collected from southern Sumatra, Indonesia. ~~Among these samples, 16 mealybug species were identified, of which 2 two species of which~~ are new to science and ~~3 species three~~ are new records for the Indonesian scale insect fauna. The identified ~~specimens species consist of~~ belong to the ~~genus genera~~ *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 some tropical plants in Indonesia** [adapted from Williams, (2004), Williams and Granara de Willink (1992) and Williams and Watson (1988)].

- 1(0) Dorsal tubular ducts large, each with an orifice surrounded by a 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(1) Cerarii always conspicuous, each bearing numerous truncate-conical setae, ~~each~~ cerarian setae flat at apex ..... *Rastrococcus* Ferris
- Cerarii, if present, bearing pointed, conical, lanceolate or flagellate setae, never truncate-conical ..... 3
- 3(2) Oral rim tubular ducts present ..... 4
- Oral rim tubular ducts ~~entirely~~ absent ..... 5

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Dikomentari [GW5]: This key is not much use, as there are 31 mealybug genera known from Indonesia and this key covers only 7 of them.

It would be useful, instead, to modify Williams' (2004) key, to make it possible to identify all 31 genera in Indonesia including *Komodesia* (as that genus was not covered in Williams (2004)).

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- 4(3) Venter of each anal lobe with anal lobe bar; ~~and~~-auxiliary setae present in anal lobe cerarii only. .... *Paracoccus* Ezzat & McConnel  
 Venter of each anal lobe with triangular to quadrate sclerotized area occupying much of lobe, never with ~~an~~ a slender anal lobe bar ~~only~~ only. .... *Pseudococcus* Westwood
- 5(3) Anal lobe bars present. Cerarii numbering 18 pairs ..... *Planococcus* Ferris  
 - Anal lobe bars absent. Cerarii numbering fewer than 18 pairs ..... 6
- 6(5) Some or most dorsal setae enlarged, conical to lanceolate, about same size as cerarian setae. .... *Nipaeococcus* ~~S~~Sulc  
 - Dorsal setae flagellate or hair like. .... *Dysmicoccus* Ferris

**Genus *Dysmicoccus* Ferris**  
*Dysmicoccus* Ferris, 1950

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

**Generic-Genus diagnosis of adult female** (adapted from Williams, 2004). :-

**Adult female description**—Body normally broadly oval, 1.65–4.20 mm long, 0.90–2.89 mm wide. Antennae each normally with 6–8 segments. Cerarii present, numbering 6–17 pairs (never 18), anal lobe cerarii each 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. Legs well developed, hind legs with translucent pores present or absent; ~~;~~ tarsal digitules usually knobbed, occasionally setose. Claw usually stout, claw denticle absent. Anal lobes usually developed, either membranous or sclerotized, each lobe bearing a normal apical seta. Ventral margin of abdominal segments anterior to anal lobes always membranous ~~anterior to anal lobes~~. Anal ring normally situated at apex of abdomen (rarely a short distance from apex), usually bearing 6 setae, occasionally with multiple more setae present. Anterior and posterior ostioles present. Dorsal setae variously shaped, often flagellate. Ventral setae flagellate. Trilocular pores present on dorsum and venter. Multilocular disc pores usually present, at least on venter. Quinquelocular pores and oral rim tubular ducts 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~~. Discodial pores present, sometimes large and occasionally present next to each eye.

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

- 1—Circulus present..... 2
- Circulus absent..... (continue to next Williams key) 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. Dorsal oral collar tubular ducts if present 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)

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	Ventral oral collar tubular duct numerous, present in rows across most abdominal segments to lateral margin, and around lateral margins forwards to head and thorax	
	..... <i>D. arachidis</i> 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	
	..... <i>D. lepellei</i> (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	9
7	Oral collar tubular ducts absent on both dorsum and venter. A few multilocular disc pores on venter	
	..... <i>D. zeynepae</i> Zarkani & Kaydan, sp. n.	
	Oral collar tubular ducts present on venter. Many multilocular disc pores on venter	8
8	Multilocular disc pore present entirely on dorsum. Translucent pore present on anterior surface of hind coxa	
	..... <i>D. sosromarsonae</i> Zarkani & Kaydan, sp. n.	
	Multilocular disc pore absent entirely from dorsum. Translucent pore absent on anterior surface of hind coxa	
	..... <i>D. finitimus</i> Williams	
9	Abdominal cerarii anterior to anal lobe pair, with 2 conical setae except for an occasional cerarius with only a single conical seta	10
	Some abdominal cerarii, anterior to anal lobe pair, usually containing more than 2 conical setae	11
10	Dorsal setae flagellate, never thick or conical	
	..... <i>D. debregeasiae</i> (Green)	
	Dorsal marginal setae, including auxiliary setae, about same length as other dorsal setae or only slightly longer	
	..... <i>D. orchidium</i> Williams	
11	Dorsal setae on abdominal segment VIII, anterior to anal ring, longer than other dorsal setae, almost as long as anal ring setae	
	..... <i>D. brevipes</i> (Cockerell)	
	Dorsal setae on abdominal segment VIII, anterior to anal ring, short, about same size as other dorsal setae	
	..... <i>D. neobrevipes</i> Beardsley	

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

(Figure Fig. 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 sosromarsonae* sp. n. Zarkani & Kaydan. MMUB.

**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).

**Appearance in life.** The body of an adult female is covered with a fluffy white wax secretion. The species of *D. dysmicoccus*, *sosromarsonae* sp. n. lives on the fruit of the host plants and it symbioses with attended by ants.

**Species diagnosis.**

**Description of Adult-adult female** (based on holotype and 2 paratypes): Body oval, 1.98–2.42 mm long, 1.38–1.48 mm wide. Eyes situated on margins, each 25–30 µm wide in diameter. Antenna 7-segmented, each 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 setae 27.5–30.0 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

**Dikomentari [GW8]:** These features are not directly comparable. Use opposite conditions of the same character. Williams (2004: 161) separates these using the distribution of marginal oral collar ducts (see his couplet 10)

**Dikomentari [GW9]:** See my comments about your genus assignment and species identification below. I do not think this is a species new to science.

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**Dikomentari [GW10]:** A diagnosis is a brief list of the most useful diagnostic characters, used for species that have been described before. A new species requires a full, detailed description.

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atrium; posterior spiracles each 75-85  $\mu$ m long, 40-45  $\mu$ m wide across atrium. Circulus ~~circular~~, 80-110  $\mu$ m wide. Legs well-developed; segment lengths for each posterior leg: coxa 115-135  $\mu$ m, trochanter + femur 205-220  $\mu$ m, tibia + tarsus 160-170  $\mu$ m, claw 27.5-30.0  $\mu$ m. 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: derm surrounding each posterior coxa with 40-50 translucent pores present surrounding each coxa~~; tibia with numerous translucent pores. Tarsal digitules capitate, each 27.5-30.0  $\mu$ m long. Claw digitules capitate, each about 22.5-25.0  $\mu$ m 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  $\mu$ m wide, ~~with bearing~~ 6 setae, each seta 160-165  $\mu$ m long.

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

**Venter.** Setae flagellate, each 30-110  $\mu$ m long, longest setae located medially on head. Apical setae ~~of-on~~ anal lobe each 125-150  $\mu$ m long. Multilocular disc pores, each 7-8  $\mu$ m in diameter, present throughout venter, numbers on each abdominal segment as follows: 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  $\mu$ m across, scattered throughout venter. Oral collar tubular ducts each 8-10  $\mu$ m long, 4-5  $\mu$ m wide, present throughout, but in bands across abdominal segments, as follows: VI 21, VII 15, VIII + IX 14.

**Comments.** *Dysmicoccus sosromarsonoae* 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* sp. n. 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* (Arecaceae) (Figure Fig. 2).

**Distribution.** Indonesia, Bengkulu provinceProvince.

***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. MMUB.

**Paratypes**, 5 adult females, INDONESIA: 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 Will. / 19.ii.2018 / 03°36'15.4"S, 102°36'30.8"E / coll. A. Zarkani. ~~Holotype and All Paratypes are deposited in the-MMUB (Indonesia).~~

**Dikomentari [GW11]:** Not circular! It has a strong middle constriction!

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**Dikomentari [GW12]:** This character does not occur in species of *Dysmicoccus*. When I take your drawing through Williams' (2004) key, it comes out in the genus *Palmicultor*.

**Dikomentari [GW13]:** Your illustration shows 6 setae

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**Dikomentari [GW14]:** These setae are longer than those recorded previously in *Palmicultor palmarum*

**Dikomentari [GW15]:** But it is not very close to that species at all (*D. finitimus* does not have pores on the derm by the hind coxae)!

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**Dikomentari [GW16]:** See my comment about the genus assignment above. The palm host is consistent with this being a species of *Palmicultor*. See von Ellenrieder, N., Kinnee, S.A. & Watson, G.W. (2022) Review of the genus *Palmicultor* Williams, 1963 (Hemiptera: Coccomorpha: Pseudococcidae), with evidence of a cryptic species. *The Pan-Pacific Entomologist*, 97 (4), 240-260. In the key in von Ellenrieder et al. (2022) your drawing keys out as a member of the *Palmicultor palmarum* species complex, which has not been studied. You would need to do molecular analysis to identify it further. See Williams (2004: 457) and von Ellenrieder et al. (2022: 253).

**Memformat:** Coretan

**Memformat:** Coretan, Sorot

**Memformat:** Font: Tebal

**Memformat:** Font: Tebal

**Telah Diformat:** Kanan: -1 cm

**Telah Diformat:** Kanan: -1 cm, Spasi Sebelum: 0 pt

**Telah Diformat:** Kanan: -1 cm

**Telah Diformat:** Kanan: -1 cm, Spasi Setelah: 0 pt

**Memformat:** Font: Tebal

**Telah Diformat:** Kanan: -1 cm

**Memformat:** Font: Tebal

**Telah Diformat:** Inden: Baris Pertama: 1 cm, Kanan: -1 cm

**Appearance in life.** Adult females secrete a thin powdery white wax covering across their bodies. The mealybug species live on the leaf leaves, flowers, and fruits of the host plants, and they commonly live in symbioses with ants.

**Species diagnosis.**

**Description of Adult-adult female** (based on holotype and 5 paratypes): 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 setae 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 circular, 80–110 µm wide. Legs well-developed; segment lengths for each 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; ratio of length of tibia to tarsus, 1.2–1.4; ratio of length of trochanter + femur to greatest width of femur, 2.41–2.60; coxa with 30–50 translucent pores; tibia with numerous 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 bearing 6 setae, each seta 80–90 µm long.

**Dorsum.** Derm membranous, with 16 pairs of cerarii around body margin, each cerarius with 4–7 enlarged cerarian-conical setae and 3–5 auxiliary setae. Each anal lobe cerarius set on membranous cuticle and containing 5–7 enlarged conical 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 and absent, tubular ducts absent.

**Venter.** Setae flagellate, each 30–110 µm long, longest setae located medially on head. Apical setae of on anal lobes unusually short, each 80–90 µm long. Multilocular disc pores, each 7–8 µm in diameter, present only immediately around the vulva, numbering 8–10 in numbers. Trilocular pores, each 2.5–3.0 µm across, scattered throughout venter. Oral collar tubular ducts absent.

**Comments.** *Dysmicoccus zeynepae* sp. n. is most similar to *D. finitimus* in having anal lobe cerarii each containing a group of about 2–7 conical setae. However, *D. zeynepae* sp. n. 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 Laboratory), Zeynep Güleç and Zeynep Kaya who are good friends.

**Host plants.** *Durio zibethinus* (Malvaceae), *L. parasiticum* (Meliaceae), *M. zapota* (Sapotaceae) and *C. robusta* (Rubiaceae) (Figure 4).

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

**\*Dysmicoccus arachidis Williams**

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

**Comments.** This species is a newly country recorded species from for Indonesia and only the second record of the species; after Williams (2004) who previously reported this species in

Memformat: Coretan

**Dikomentari [GW17]:** Use of decimal places for such large measurements is unnecessary and inappropriate

**Dikomentari [GW18]:** Not circular! It is rounded-quadrate

Memformat: Coretan

Memformat: Coretan

Memformat: Sorot

**Dikomentari [GW19]:** This species is nothing like *D. finitimus*! They don't even have the same number of cerarii or same-sized legs!

You need to take the species through Williams's (2004: 161) key to *Dysmicoccus* carefully to find the species closest to it.

Memformat: Sorot

Memformat: Coretan, Sorot

Memformat: Coretan

Memformat: Coretan

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Telah Difomat: Kanan: -1 cm

Telah Difomat: Inden: Baris Pertama: 1 cm, Kanan: -1 cm

Telah Difomat: Kanan: -1 cm

Memformat: Font: 12 pt

Telah Difomat: Kanan: -1 cm, Spasi Sebelum: 0 pt, Setelah: 0 pt

**Dikomentari [GW20]:** This is a very different host to that previously recorded for *D. arachidis*. In view of the misidentification above I recommend that you double-check all the other identifications using Williams's (2004) key to make sure they are correct!

Telah Difomat: Kanan: -1 cm

Telah Difomat: Inden: Baris Pertama: 0 cm, Kanan: -1 cm

from India (Tripura) on *Arachis hypogaea* L. (Fabaceae). There is very little information available ~~about on~~ *D. arachidis*.

***Dysmicoccus brevipes* (Cockerell)**

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

**Comments.**—The species is polyphagous on ornamentals and fruits within 62 plant families and 147 genera. ~~Cosmopolitan~~It is cosmopolitan, being found in 126 countries. ~~Distribution in Indonesia:— it has been recorded from~~ Irian Jaya (Williams ~~and &~~ Watson, 1988), Java (~~Ben-Dov, 1994;~~ Betrem, 1937; Ben-Dov 1994; Williams, 2004) and Sumatra (Williams, 2004).

**\**Dysmicoccus carens* Williams**

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

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

***Dysmicoccus lepelleyi* (Betrem)**

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

**Comments.** This is polyphagous species on ornamentals and fruits within 17 plant families ~~of plants:—such as~~ Anacardiaceae, Annonaceae, Arecaceae, Asparagaceae, Clusiaceae, Euphorbiaceae, Fagaceae, Malvaceae, Meliaceae, Moraceae, Musaceae, Myrtaceae, Rubiaceae, Rutaceae, Sapindaceae, Sapotaceae, and Zingiberaceae (~~Garcia~~García-Morales *et al.* 2016). In Indonesia, ~~the species wasit has been~~ recorded previously from Java (Ben-Dov, 1994; Betrem, 1937; Williams, 2004), Lombok (Williams, 2004), ~~and~~ Sumatra (Williams, 2004). It is also found in neighboring countries such as Cambodia, Malaysia, Singapore, Thailand, and Vietnam (~~Garcia~~García-Morales *et al.* 2016).

**Key to adult female *Dysmicoccus* found in Indonesia** (adapted from Williams, 2004)

1(0) Circulus present ..... 2  
- Circulus absent ..... (continue to Williams (2004: 162) key, couplet 12)

Teloh Diformat: Inden: Baris Pertama: 1 cm, Kanan: -1 cm

Teloh Diformat: Kanan: -1 cm

Teloh Diformat: Kanan: -1 cm, Spasi Sebelum: 0 pt, Setelah: 0 pt

Memformat: Font: 12 pt

Teloh Diformat: Kanan: -1 cm

Teloh Diformat: Kanan: -1 cm, Spasi Sebelum: 0 pt, Setelah: 0 pt

Teloh Diformat: Kanan: -1 cm

Teloh Diformat: Inden: Baris Pertama: 0 cm, Kanan: -1 cm

Memformat: Font: Miring

Teloh Diformat: Inden: Baris Pertama: 1 cm, Kanan: -1 cm

Teloh Diformat: Kanan: -1 cm

Teloh Diformat: Kanan: -1 cm, Spasi Sebelum: 0 pt, Setelah: 0 pt

Teloh Diformat: Kanan: -1 cm

Teloh Diformat: Inden: Baris Pertama: 0 cm, Kanan: -1 cm

Memformat: Font: Miring

Memformat: Font: Miring

Teloh Diformat: Kanan: -1 cm

Teloh Diformat: Inden: Kiri: 0 cm, Gantung: 1,75 cm, Kanan: -1 cm, Tab berhenti: 1,25 cm, Kiri + 16 cm, Kanan, Pimpinan: ... + Tidak di 1 cm + 15 cm



- 2(1) 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. Dorsal oral collar tubular ducts, if present, never forming rows across segments ..... 3
- 3(2) Most cerarii without auxiliary setae ..... 4
- Most cerarii with auxiliary setae ..... 5
- 4(3) Ventral oral collar tubular ducts sparse, a few present in medial area of abdomen and on lateral margins of abdominal segment VI and posterior segments only, absent from head and thoracic margins ..... *D. carens* (Williams)
- Ventral oral collar tubular ducts numerous, present in rows across most abdominal segments to lateral margin, and around lateral margins forwards to head and thorax ..... *D. arachidis* Williams
- 5(3) With series of large oral collar tubular ducts, each about twice as wide as a 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(5) Anal lobe cerarii each containing a group of about 2–7 conical setae ..... 7
- Anal lobe cerarii each containing only 2 conical setae ..... 9
- 7(6) Oral collar tubular ducts absent from both dorsum and venter. Venter with a few multilocular disc pores ..... *D. zeynepae* Zarkani & Kaydan sp. n.
- Oral collar tubular ducts absent from dorsum but present on venter. Venter with numerous multilocular disc pores ..... 8
- 8(7) Dorsum with a few multilocular disc pores, more numerous over entire venter. Translucent pores present on anterior surface of hind coxa ..... *D. sosromarsonoae* Zarkani & Kaydan sp. n.
- Multilocular disc pores absent from dorsum, present on venter of abdomen only. Translucent pores absent from anterior surface of hind coxa but present on posterior surface ..... *D. finitimus* Williams
- 9(6) Abdominal cerarii anterior to anal lobe pair, each with 2 conical setae except for an occasional cerarius with only a single conical seta ..... 10
- Some abdominal cerarii, anterior to anal lobe pair, usually containing more than 2 conical setae ..... 11
- 10(9) Dorsal setae flagellate, never thick or conical ..... *D. debregesiae* (Green)
- Dorsal marginal setae, including auxiliary setae, about same length as other dorsal setae or only slightly longer ..... *D. orchidium* Williams
- 11(9) 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, shorter, about same size as other dorsal setae ..... *D. neobrevipes* Beardsley

**Telah Diformat:** Inden: Kiri: 0 cm, Gantung: 1,75 cm, Kanan: -1 cm, Tab berhenti: 1,25 cm, Kiri + 16 cm, Kanan, Pimpinan: ... + Tidak di 1 cm + 15 cm

**Memformat:** Sorot

**Dikomentari [GW21]:** Remove this species from thi skey

**Memformat:** Sorot

**Telah Diformat:** Inden: Kiri: 0 cm, Gantung: 1,75 cm, Kanan: -1 cm, Tab berhenti: 1,25 cm, Kiri + 16 cm, Kanan, Pimpinan: ... + Tidak di 1 cm + 15 cm

**Dikomentari [GW22]:** These features are not directly comparable. Use opposite conditions of the same character. Williams (2004: 161) separates these using the distribution of marginal oral collar ducts (see his couplet 10)

**Telah Diformat:** Kanan: -1 cm

### *Ferrisia dasyliirii* (Cockerell)

**Material examined.** INDONESIA: Bengkulu ~~province~~Province: Muara Bangkahulu, Bengkulu city, 6 ♀♀, on *Solanum torvum* Swartz (Solanaceae) and *Theobroma cacao* L. (Sterculiaceae), 20 m a.s.l. 3°45'33.0"S, 102°16'10.1"E, 3.vii.2019, ~~CoH~~coll. A. Zarkani (AZ245–246).

**Telah Diformat:** Kanan: -1 cm, Spasi Sebelum: 0 pt, Setelah: 0 pt

**Telah Diformat:** Kanan: -1 cm

**Comments.**—The species is polyphagous on ornamentals and fruits and has been recorded on host plants in known from 23 families and 52 genera (García-Morales *et al.* 2016).

**Memformat:** Font: Miring

In Indonesia, ~~the species it was has been~~ recorded previously from Sumatra (Zarkani *et al.* 2020).

Memformat: Font: Miring

*Ferrisia virgata* (Cockerell)

Telah Diformat: Kanan: -1 cm

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

Telah Diformat: Kanan: -1 cm, Spasi Sebelum: 0 pt, Setelah: 0 pt

Telah Diformat: Kanan: -1 cm

**Comments.** ~~Polyphagous-The species is polyphagous~~ on ornamentals and fruits; ~~and is~~ known from 78 plant families and 207 genera (~~GarciaGarcía-~~ Morales *et al.* 2016). ~~CosmopolitanIt is cosmopolitan, having been~~ recorded from 101 countries (~~GarciaGarcía-~~ Morales *et al.* 2016). In Indonesia, ~~the speciesit was has been~~ recorded previously ~~in-from~~ Irian Jaya (Gavrilov-Zimin; 2013; Williams and Watson; 1988), Java (Ben-Dov; 1994; Betrem; 1937; Keuchenius; 1915; Ali; 1968; Williams; 2004); ~~and~~ Sulawesi (Williams; 2004).

Telah Diformat: Inden: Baris Pertama: 0 cm

Memformat: Font: Miring

Memformat: Font: Miring

*Nipaecoccus viridis* (Newstead)

Telah Diformat: Inden: Baris Pertama: 1 cm, Kanan: -1 cm

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

Telah Diformat: Kanan: -1 cm, Spasi Sebelum: 0 pt, Setelah: 0 pt

Memformat: Font: 12 pt

**Comments.** ~~Polyphagous-The species is polyphagous~~ on ornamentals and fruits; ~~and has been~~ recorded from 45 plant families and 114 genera (~~GarciaGarcía-~~ Morales *et al.* 2016). ~~CosmopolitanIt is cosmopolitan, having been~~ reported from 63 countries (~~GarciaGarcía-~~ Morales *et al.* 2016). In Indonesia, ~~the speciesit was has been~~ recorded previously in Irian Jaya (Ben-Dov; 1994; CABI, 1983), Java (Ben-Dov; 1994; CABI; 1983; Williams; 2004); and Sulawesi (Williams; 2004).

Telah Diformat: Kanan: -1 cm

Telah Diformat: Inden: Baris Pertama: 0 cm

Memformat: Font: Miring

Memformat: Font: Miring

*Paracoccus evae* Williams

Telah Diformat: Inden: Baris Pertama: 1 cm, Kanan: -1 cm

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

Telah Diformat: Kanan: -1 cm, Spasi Sebelum: 0 pt, Setelah: 0 pt

Telah Diformat: Kanan: -1 cm

**Comments.** —This is the second report of *P. evae* from Indonesia ~~after;~~ Williams (2004) ~~found-recorded the speciesit in-from~~ Java on *Eupatorium* sp. (Asteraceae).

Telah Diformat: Kanan: -1 cm

*Planococcus dischidia* (Takahashi)

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

Telah Diformat: Kanan: -1 cm, Spasi Sebelum: 0 pt, Setelah: 0 pt

Telah Diformat: Kanan: -1 cm

**Comments.** ~~Previously, —Planococcus dischidia was has firstly foundbeen collected~~ on *Dischidia* sp. (Apocynaceae) ~~and Epipremnum (Araceae), and —The species whas been~~ ~~previously~~ recorded ~~in-from~~ Indonesia (Sulawesi) (Ben-Dov; 1994; Cox; 1989; Williams; 2004) and Malaysia (Ben-Dov; 1994; Takahashi; 1951).

Memformat: Font: Tidak Tebal

Telah Diformat: Kanan: -1 cm

*Planococcus lilacinus* (Cockerell)

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

**Comments.** ~~The species is polyphagous on ornamentals and fruits, and has been~~ recorded from 73 ~~plant~~ families and 196 genera (~~García~~García- Morales *et al.* 2016). ~~Cosmopolitan~~It is cosmopolitan, having been reported from 64 countries (~~García~~García- Morales *et al.* 2016). In Indonesia, ~~the species it has been was~~ recorded previously ~~in from~~ Irian Jaya (Ben-Dov, 1994) (Williams *et al.*, 1988), Java (Williams, 2004), Kalimantan (Ben-Dov, 1994), (Cox, 1989), Lombok (Williams, 2004), Sulawesi (Williams, 2004), and Sumatra (Ben-Dov, 1994; Cox, 1989; Williams, 2004).

#### *Pseudococcus jackbeardsleyi* Gimpel & Miller

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

**Comments.** ~~Polyphagous~~This neotropical species is polyphagous on ornamentals and fruits, vegetables and herbs; it has been reported from 52 ~~plant~~ families and 112 genera (~~García~~García- Morales *et al.* 2016). ~~Cosmopolitan~~It is cosmopolitan, having been reported from 52 countries (~~García~~García- Morales *et al.* 2016). In Indonesia, ~~the species it has been was~~ recorded previously ~~in from~~ Flores (Gavrilov-Zimin, 2017), Irian Jaya (Gavrilov-Zimin, 2013), and Java (Williams, 2004).

#### \**Pseudococcus leptotrichotus* Williams

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

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

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

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

**Comments.** ~~The species is polyphagous on ornamentals and fruits, and has been~~ recorded from 84 ~~plant~~ families and 167 genera (~~García~~García- Morales *et al.* 2016). ~~Cosmopolitan~~It is cosmopolitan, having been reported from 115 countries (~~García~~García- Morales *et al.* 2016). In Indonesia, ~~the species was it has been~~ recorded previously ~~in from~~

Telah Diformat: Kanan: -1 cm, Spasi Sebelum: 0 pt, Setelah: 0 pt

Telah Diformat: Kanan: -1 cm

Telah Diformat: Inden: Baris Pertama: 0 cm

Memformat: Font: Miring

Memformat: Font: Miring

Memformat: Font: Miring

Telah Diformat: Inden: Baris Pertama: 1 cm, Kanan: -1 cm

Telah Diformat: Kanan: -1 cm, Spasi Sebelum: 0 pt, Setelah: 0 pt

Telah Diformat: Kanan: -1 cm

Telah Diformat: Inden: Baris Pertama: 0 cm

Memformat: Font: Miring

Memformat: Font: Miring

Telah Diformat: Inden: Baris Pertama: 1 cm, Kanan: -1 cm

Telah Diformat: Kanan: -1 cm, Spasi Sebelum: 0 pt, Setelah: 0 pt

Telah Diformat: Kanan: -1 cm

Telah Diformat: Inden: Baris Pertama: 0 cm

Dikomentari [GW23]: Was this a true ants' nest containing ant eggs and larvae? or just mealybugs covered by a protective carton shelter of soil made by the ants?

Memformat: Sorot

Memformat: Sorot

Dikomentari [GW24]: Was this a true ants' nest containing ant eggs and larvae, or just mealybugs covered by a protective carton shelter of soil made by the ants?

Telah Diformat: Inden: Baris Pertama: 1 cm, Kanan: -1 cm

Telah Diformat: Kanan: -1 cm, Spasi Sebelum: 0 pt, Setelah: 0 pt

Telah Diformat: Kanan: -1 cm

Telah Diformat: Inden: Baris Pertama: 0 cm

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Irian Jaya (Ben-Dov, 1994; Williams, 1988), Java (Ben-Dov, 1994; Betrem, 1937), Lombok (Williams, 2004), Sulawesi (Watson *et al.* 2014), and Sumatra (Green, 1930).

### *Rastrococcus chinensis* Ferris

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

**Comments.**—The species was recorded previously on *Alocasia* sp. (Araceae), *Ardisia lindleyana* D. Dietr. (Primulaceae), *Eugenia* sp. (Myrtaceae), *Melastoma malabathricum* L. (Melastomataceae), *Morinda umbellata* L. (Rubiaceae), *Psychotria asiatica* L. (Rubiaceae), *Syzygium* sp. (Myrtaceae), *Syzygium anomalum* Lauterb. (Myrtaceae), and *Syzygium hancei* Merr. & Perry (Myrtaceae). ~~The species~~It has been recorded previously ~~in from~~ Brunei, China, and Malaysia (~~García~~García-Morales *et al.* 2016). In Indonesia, ~~the species~~it was ~~has been~~ recorded previously ~~in from~~ Java (Ben-Dov, 1994; Williams, 1989; 2004).

### *Rastrococcus invadens* Williams

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

**Comments.** ~~Polyphagous~~The species is polyphagous on ornamentals and fruits; it has been recorded from 29 plant families and 54 genera (~~García~~García-Morales *et al.* 2016). ~~Cosmopolitan~~It is cosmopolitan, having been reported from 32 countries (~~García~~García-Morales *et al.* 2016). In Indonesia, ~~the species~~was it has been recorded previously ~~in from~~ Bali (Ben-Dov, 1994; Williams, 1989, 2004), and Java (Ben-Dov, 1994; Williams, 1989, 2004).

### *Rastrococcus tropicasiatricus* Williams

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

**Comments.**—Zarkani *et al.* (2021) reported *R. tropicasiatricus* for the first time in Indonesia (Bengkulu) 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 speciesIt is also known to live on woody plants and wild grass in parts of southern Asia such as Malaysia, Philippines, Thailand, and Vietnam (~~García~~García-Morales *et al.* 2016).

### Acknowledgements

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

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Bengkulu with grants No. SP. DIPA-041.012.400977/2020. The writing of the manuscript was assisted by WCP Dikti Program 2021.

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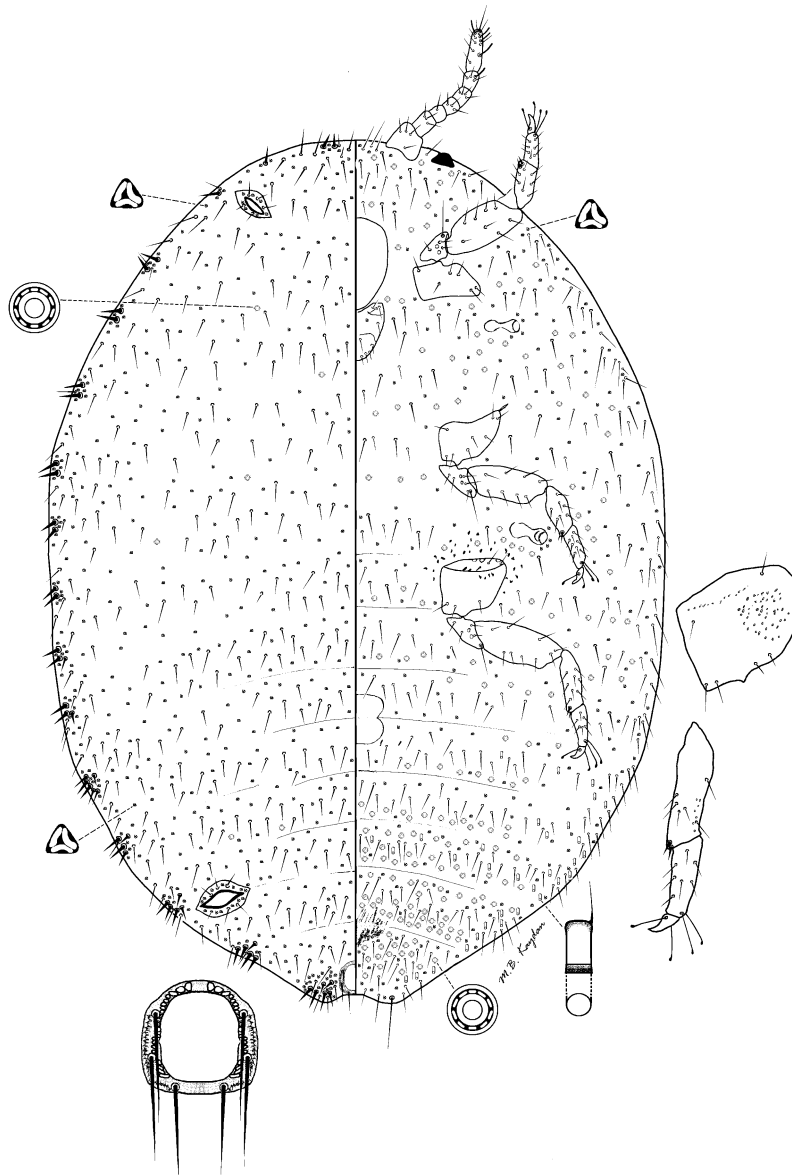
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**FIGURE 1.** Adult female *Dysmicoccus sosromarsonae* Zarkani & Kaydan **sp. n.**  
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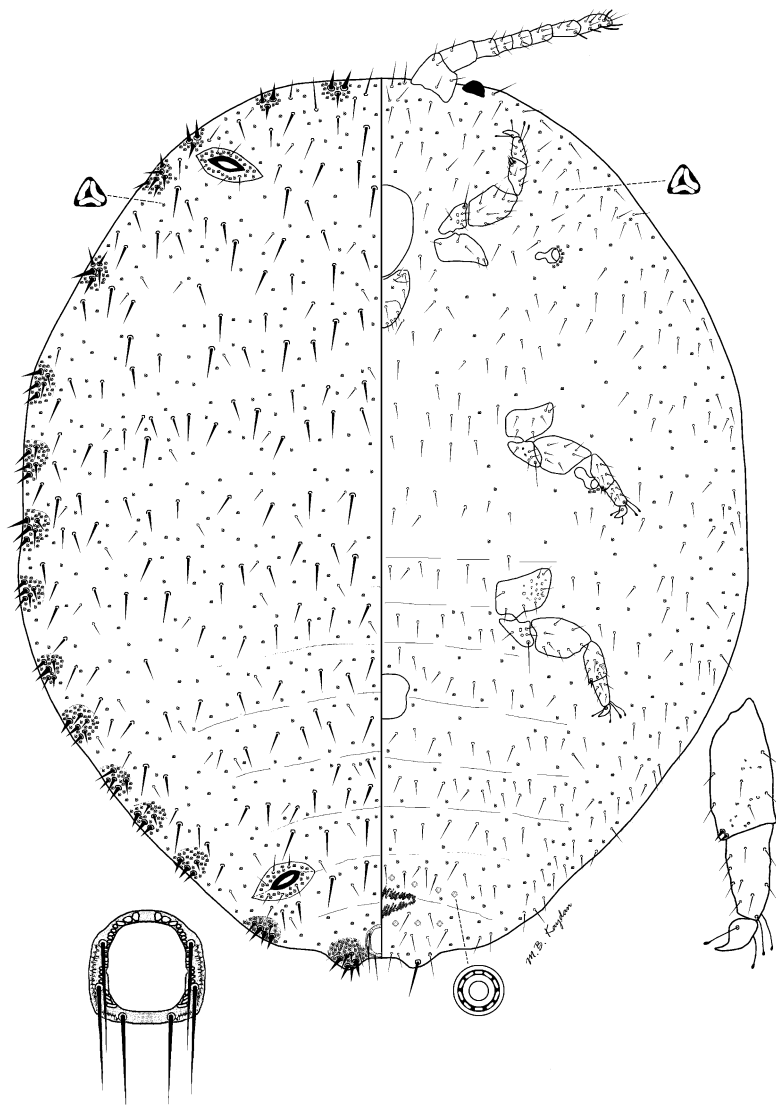
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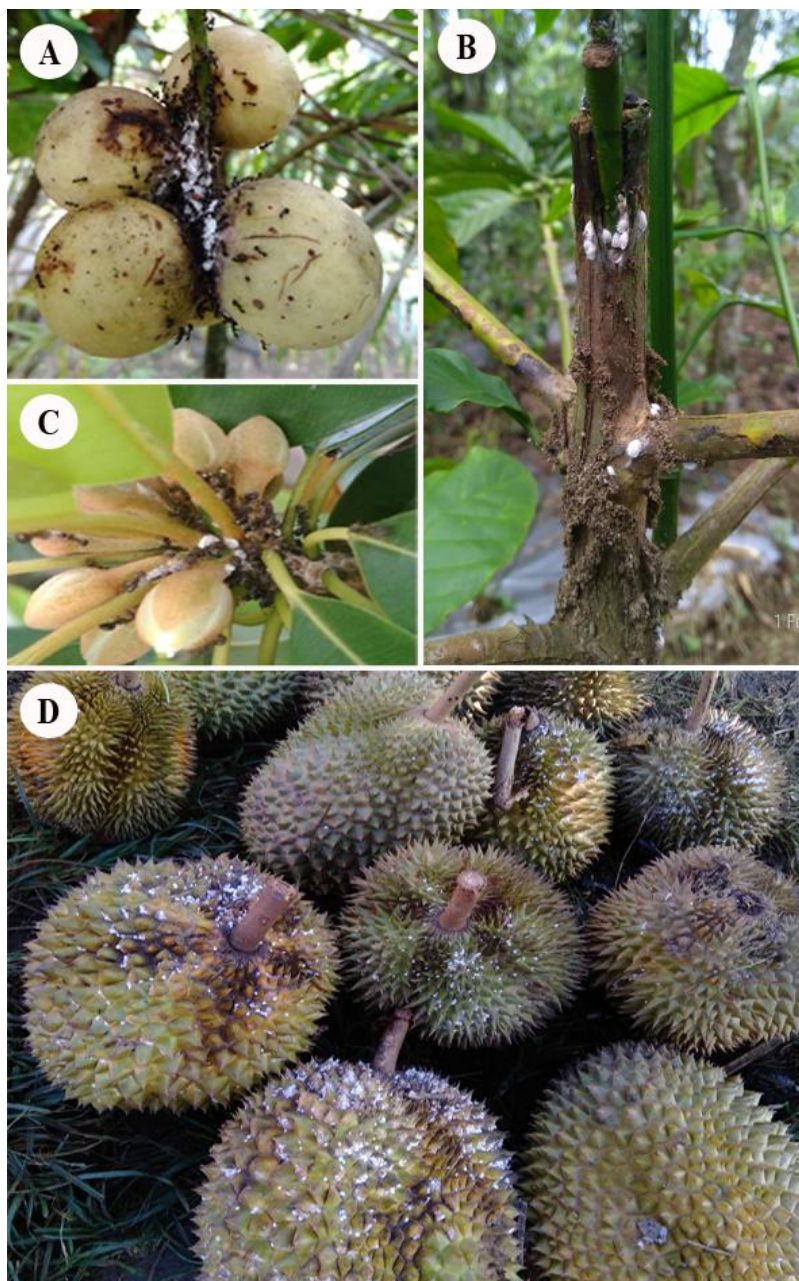
**FIGURE 2.** *Dysmicoccus sosromarsonoae* Zarkani & Kaydan sp. n. on *Elaeis guineensis* Jacq.





**FIGURE 3.** Adult female *Dysmicoccus zeynepae* Zarkani & Kaydan **sp. n.** ~~Holotype~~holotype. Memformat: Font: Tebal





**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.

## Studies on mealybugs (Hemiptera: Coccoomorpha: Pseudococcidae) in Indonesia, with description of a new species and three new country records

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### Abstract

Mealybugs (Hemiptera: Coccoomorpha: Pseudococcidae) include economically important insect pests worldwide; however, little is known about the species present in Indonesia. Samples were collected and identified from wild and cultivated plants in several regions of southern Sumatra, Indonesia between 2018 and 2019. Eighteen species of Pseudococcidae in 8 genera were identified, including one undescribed species. *Dysmicoccus zeynepae* Zarkani & Kaydan **sp. n.** is described and illustrated based on the morphology of the adult female, and a key is provided for the identification of all 18 species. Furthermore, *Dysmicoccus arachidis* Williams, *D. carens* Williams and *Pseudococcus leptotrichotus* Williams are recorded for the first time from Indonesia; new locality and host-plant data are given for these species.

**Keywords:** Biodiversity, host plant, pests, Sternorrhyncha, taxonomy

### Introduction

The Pseudococcidae (Hemiptera: Coccoomorpha: Coccoomorpha), whose members are known as mealybugs, is a family of scale insects which include many important sap-sucking insect pests of woody and herbaceous plants. These insects not only damage their host plants directly, by mechanical injury and extraction of sap, but also indirectly by promoting sooty mold growth on their sugary honeydew waste and by facilitating the transmission of plant virus diseases (Franco *et al.* 2009, Daane *et al.* 2012).

The Pseudococcidae, with 2041 species in 259 genera, is the second largest scale insect family after the Diaspididae, which contains about 2693 species in 418 genera (García Morales *et al.* 2016). In the Indonesian archipelago, 108 species of Pseudococcidae in 31 genera have been recorded so far, the second-largest family after the Diaspididae, which has 118 species in 46 genera recorded (García Morales *et al.* 2016). In the family Pseudococcidae, the most species-rich and damaging genera in Indonesia are: *Rastrococcus* Ferris (15 species), *Pseudococcus* Westwood (13 species), *Paraputo* Laing (13 species), *Dysmicoccus* Ferris (9 species), and *Planococcus* Ferris (7 species) (Williams 2004; García Morales *et al.* 2016).

As a tropical country located along major sea lanes connecting East Asia, South Asia and Oceania, it is not surprising that Indonesia has a very large number of indigenous plants, vertebrates and invertebrates including great insect biodiversity (McNeely *et al.* 1990; CBD

Secretariat 2021). The first documentation of Indonesian insect diversity, including mealybugs in Indonesia began in the British, Dutch and Japanese colonial eras and has continued to the present, resulted in the description of many new Indonesian native species and several additional records to the scale insect fauna (Dammerman 1929; Reyne 1954, 1957, 1961, 1965; Wiriati 1958, 1959; Kalshoven 1981; Muniappan *et al.* 2008, 2011, 2012; Sartiami *et al.* 2015, 2016; Gavrilov-Zimin 2013, 2016, 2017, 2019, 2020, 2021; and Zarkani *et al.* 2020, 2021a, b). However, the only comprehensive review of mealybugs recorded from Indonesia is in the monograph by Williams (2004). In the last 16 years the number of described scale insect species recorded in Indonesia has increased by 53 species (García Morales *et al.* 2016) but the knowledge of Indonesian scale insect species are still patchy and incomplete.

The present paper covers a new species and three new country records from Indonesia. Identification keys to genera and *Dysmicoccus* species, and new locality records for the currently known Pseudococcidae species, are provided and discussed.

## Materials and methods

Mealybugs (nymphs and adult females) were collected from tropical plants in several regions of southern Sumatra, Indonesia between April 2018 and October 2019. Infested plant parts (fruits, trunk and branches, and leaves) were cut, bagged, labeled and taken to the Laboratory of Plant Protection, University of Bengkulu for examination. For species determination, nymphs were reared on the relevant plant material (at  $25 \pm 1$  °C, ~70% relative humidity and of 16:8 h light: dark photoperiod) until they reached the adult stage. A compound lightbinocular dissection microscope, LEICA EZ4HD, was used to sort specimens for preservation and slide mounting. Specimens were killed, labeled and stored in 70% ethyl alcohol.

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

For description of the new species, the main taxonomic characters of the adult females were evaluated and quantified under a compound light microscope. The morphological terms used are those used by Williams and Granara de Willink (1992) and Williams (2004). 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 and Granara de Willink (1992), with cerarius C<sub>1</sub> on the head, anterior to the antenna, and cerarius C<sub>17</sub> being on abdominal segment VIII. A taxonomic illustration is provided for each new species, and is based on the holotype used for the 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 all drawn to the same scale. The translucent pores on the hind legs are mostly found on the dorsal surface, but they are illustrated ventrally on the main figure for convenience.

Type specimens of the new species described are deposited in the Mealybugs Museum, Department of Plant Protection, Faculty of Agriculture, University of Bengkulu, Bengkulu, Indonesia (MMUB). Add an explanation of the use of “/” in holotype data listing (to indicate

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## Results and discussion

From 149 mealybug samples collected from southern Sumatra, Indonesia, 18 species were identified, one of which is a new to science and three are new country records for Indonesia. The identified species belong to the genera *Dysmicoccus* (5 species), *Ferrisia* (2 species), *Nipaecoccus* (1 species), *Palmicultor* (1 species), *Paracoccus* (1 species), *Planococcus* (2 species), *Pseudococcus* (3 species) and *Rastrococcus* (3 species). The species marked below with an asterisk (\*) are recorded for the first time from Indonesia.

**Key to adult females of Pseudococcidae genera occurring in this study** (adapted from Williams and Granara de Willink (1992), Williams and Watson (1988) and Williams (2004).

1(0)	Dorsal tubular ducts large, each with an orifice surrounded by a circular, sclerotized area containing 1 or more setae within its borders, or with the setae adjacent to the rim	<i>Ferrisia</i> Cockerell
-	Dorsal tubular ducts, if present, without this combination of characters	2
2(1)	Cerarii always conspicuous, each containing numerous truncate-conical cerarian setae, each with apex flat	<i>Rastrococcus</i> Ferris
-	Cerarii, if present, containing cerarian setae with pointed apices, never truncate-conical setae	3
3(2)	Oral rim tubular ducts present	4
-	Oral rim tubular ducts absent	5
4(3)	Venter of each anal lobe with anal lobe bar; auxiliary setae present in anal lobe cerarii only	<i>Paracoccus</i> Ezzat & McConnel
-	Venter of each anal lobe with triangular to quadrate sclerotized area occupying much of lobe, never with a slender anal lobe bar only	<i>Pseudococcus</i> Westwood
5(3)	Anal lobe bars present. Cerarii numbering 18 pairs	<i>Planococcus</i> Ferris
-	Anal lobe bars absent. Cerarii numbering fewer than 18 pairs	6
6(5)	Some or most dorsal setae enlarged, conical to lanceolate, about same size as cerarian setae	<i>Nipaecoccus</i> Šulc
-	Dorsal setae either flagellate or conical to lanceolate, all noticeably slender than cerarian setae	7
7(6)	Minute duct-like pores numerous on derm next to hind coxae	<i>Palmicultor</i> Williams
-	Minute duct-like pores absent from derm next to hind coxae	<i>Dysmicoccus</i> Ferris

## Genus *Dysmicoccus* Ferris

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

**Genus diagnosis of adult female** (adapted from Williams, 2004). Body normally broadly oval, 1.65–4.20 mm long, 0.90–2.89 mm wide. Antennae each normally with 6–8 segments. Cerarii present, numbering 6–17 pairs (never 18), anal lobe cerarii each 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. Legs well developed, hind legs with translucent pores present or absent; tarsal digitules usually

**Dikomentari [GW1]:** *Zootaxa* is an international journal. Keys in its articles should provide coverage at country level or more widely. Your key does not cover the whole of Sumatra, never mind Indonesia. If your article does not provide coverage at the country level then it will not be suitable for publication in *Zootaxa*, but should go in an Indonesian or regional journal.

It would be very useful if you modified Williams' (2004) key, to make it possible to identify all 31 genera in Indonesia including *Komodesia* (as that genus was not covered by Williams (2004)). You can easily do this without writing out the entire key to genera, in the same way as in your key later in the manuscript, by referring to a couplet in the key to genera in Williams (2004). *Komodesia* is very distinctive and keys out in the first 5 couplets of Williams' (2004) key.

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knobbed, occasionally setose. Claw usually stout, claw denticle absent. Anal lobes usually developed, either membranous or sclerotized, each lobe bearing a normal apical seta. Ventral margin of abdominal segments anterior to anal lobes always membranous. Anal ring normally situated at apex of abdomen (rarely a short distance from apex), usually bearing 6 setae, occasionally with more setae present. Anterior and posterior ostioles present. Dorsal setae variously shaped, often flagellate. Ventral setae flagellate. Trilocular pores present on dorsum and venter. Multilocular disc pores usually present, at least on venter. Quinquelocular pores and oral rim tubular ducts always absent. Oral collar tubular ducts usually apparent, at least on venter, sometimes present on dorsum, rarely absent entirely. Discoidal pores present, sometimes large and occasionally present next to each eye.

**\**Dysmicoccus arachidis* Williams**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Kepahiang district, Kabawetan, on *Crassocephalum crepidioides* (Benth.) S. Moore (Asteraceae), 600 m a.s.l., 03°34'54.4" S, 102°35'33" E, 12.vi.2018, coll. A. Zarkani (AZ80-81), 6 ♀♀.

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**Comments.** This species is a new country record for Indonesia and only the second record of the species; Williams (2004) previously reported it from India (Tripura) on *Arachis hypogaea* L. (Fabaceae). There is very little information available on *D. arachidis*.

***Dysmicoccus brevipes* (Cockerell)**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Slebar, on *Syzygium aqueum* Alston (Myrtaceae), 20 m a.s.l., 03°49'25.2" S, 102°19'08.7" E, 10.vii.2018, coll. A. Zarkani (AZ210), 3 ♀♀.

**Comments.** The species is polyphagous on ornamental plants and fruits belonging to 62 plant families and 147 genera. It is cosmopolitan, being found in 126 countries; in Indonesia it has been recorded from Irian Jaya (Williams & Watson 1988), Java (Betrem 1937; Ben-Dov 1994; Williams 2004) and Sumatra (Williams 2004).

**\**Dysmicoccus carens* Williams**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Seluma district, Sukaraja, on *Psophocarpus tetragonolobus* L. (Fabaceae), 10 m a.s.l., 03°59'07" S, 102°25'37" E, 15.vi.2018, coll. A. Zarkani (AZ82-83), 3 ♀♀.

**Comments.** *Dysmicoccus carens* is a new country record for Indonesia. The species ~~was has been~~ recorded previously on Poaceae, ~~previously~~ from Bangladesh (North) on *Andropogon squarrosus* L.; India, New Delhi on *Setaria verticillata* L., Orissa on grass, Tamil Nadu on *Saccharum officinarum* L., *Cymbopogon* sp. and *Chloris barbata* Sw.; Pakistan, Rawalpindi on *Sorghum nitidum* Pers. and *S. sudanensis* (Piper) Hitch, Mona on *Arundo donax* L., Lasbela, Ambagh on *Panicum antidotale* Retz.; and Sri Lanka, Uva Province, Wellawa, Kokagala on grass (Williams 2004). ~~*Dysmicoccus carens* is a new country record for Indonesia.~~

***Dysmicoccus lepellei* (Betrem)**



**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Slebar, on *Manilkara zapota* L. (Sapotaceae), 20 m a.s.l, 03°49'25.2" S, 102°19'08.7" E, 10.vii.2018, coll. A. Zarkani (AZ230), 3 ♀♀.

**Comments.** This is polyphagous species on ornamentals and fruits within 17 plant families: Anacardiaceae, Annonaceae, Arecaceae, Asparagaceae, Clusiaceae, Euphorbiaceae, Fagaceae, Malvaceae, Meliaceae, Moraceae, Musaceae, Myrtaceae, Rubiaceae, Rutaceae, Sapindaceae, Sapotaceae, and Zingiberaceae (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Java (Betrem 1937; Ben-Dov 1994; Williams 2004), Lombok (Williams 2004) and Sumatra (Williams 2004). It is also found in neighboring countries such as Cambodia, Malaysia, Singapore, Thailand, and Vietnam (Williams 2004).

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

(Fig. 1)

**Material examined.** all deposited at MMUB.

**Holotype:** adult female, INDONESIA: left label: AZ205, Sumatra, Bengkulu on *Durio zibethinus* Murr. (Malvaceae), 03°34'54.4" S 102°38'33" E, 4.ii.2018, coll. A. Zarkani; right label: Holotype, *Dysmicoccus zeynepae* sp. n. Zarkani & Kaydan. MMUB.

**Paratypes,** 5 adult females, INDONESIA: same data as holotype (AZ205); 3 adult females, AZ206, Sumatra, Bengkulu on *Lansium parasiticum* Corr. (Meliaceae), 03°59'28.0" S, 102°25'50.4" E, 11.ii.2018, coll. A. Zarkani; 3 adult females, AZ207, Sumatra, Bengkulu on *Manilkara zapota* L. (Sapotaceae), 04°00'05.7" S, 102°26'52.1" E, 12.ii.2018, coll. A. Zarkani; 3 adult females, AZ208, Sumatra, Bengkulu, *Coffea robusta* Lindl. Ex De Will. (Rubiaceae), 03°36'15.4" S, 102°36'30.8" E, 19.ii.2018, coll. A. Zarkani. All deposited in MMUB.

#### Description of adult female

**Appearance in life** (Fig. 1). Adult females secrete a thin powdery white wax covering across their bodies. Living on leaves, flowers and fruits of host plants, commonly attended by ants.

**Description of Slide-mounted adult female** (based on holotype and 5 paratypes) (Fig. 2): 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 seta 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 95–115 µm long, 55–60 µm wide across atrium. Circulus rounded-quadrate 80–110 µm wide. Legs well developed; segment lengths for each 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; tibia with numerous 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, bearing 6 setae, each seta 80–90 µm long.

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**Dikomentari [GW2]:** Please check that the data given here is exactly as it is written on the slide labels, with "/" indicating where the line breaks are

**Telah Diformat:** Inden: Baris Pertama: 1 cm, Spasi Sebelum: 0 pt, Setelah: 0 pt

**Dikomentari [GW3]:** Please check that the data given here is exactly as it is written on the slide labels, with "/" indicating where the line breaks are

**Telah Diformat:** Spasi Sebelum: 0 pt, Setelah: 0 pt

**Dikomentari [GW4]:** Figures must be numbered in the order in which they are referred to. I have re-numbered the figures (see separate file).

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**Dorsum.** Derm membranous, with 16 pairs of cerarii around body margin, each cerarius with 4–7 enlarged conical setae and 3–5 auxiliary setae. Each anal lobe cerarius set on membranous cuticle and containing 5–7 enlarged conical 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 and tubular ducts absent.

**Venter.** Setae flagellate, each 30–110 µm long, longest setae located medially on head. Apical setae on anal lobes unusually short, each 80–90 µm long. Multilocular disc pores, each 7–8 µm in diameter, present only immediately around vulva, numbering 8–10. Trilocular pores, each 2.5–3.0 µm across, scattered throughout venter. Oral collar tubular ducts absent.

**Comments.** *Dysmicoccus zeynepae* is most similar to *D. finitimus* 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. It is also closed to *D. lepelleyi* in term of small legs and having translucent pore on hind coxa and femur, but *D. zeynepae* have no oral collar tubular ducts from both dorsum and venter.

**Etymology.** This species is named after Zeynep Kaydan (“mother” of Kaydan’s Laboratory), Zeynep Güleç and Zeynep Kaya who are good friends of the Kaydan’s lab.

**Host plants.** *Durio zibethinus* (Malvaceae), *L. parasiticum* (Meliaceae), *M. zapota* (Sapotaceae) and *C. robusta* (Rubiaceae) (Figure 2).

**Distribution.** Indonesia (Sumatra I., Bengkulu Province).

**Key to adult female *Dysmicoccus* found in Indonesia** (adapted from Williams 2004).

- 1(0) Circulus present ..... 2
- Circulus absent ..... (continue to Williams (2004: 162) key, couplet 19)
- 2(1) 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. Dorsal oral collar tubular ducts, if present, never forming rows across segments ..... 3
- 3(2) Most cerarii without auxiliary setae ..... 4
- Most cerarii with auxiliary setae ..... 5
- 4(3) Ventral oral collar tubular ducts sparse, a few present in medial area of abdomen and on lateral margins of abdominal segment VI and posterior segments only, absent from head and thoracic margins ..... *D. carens* (Williams)
- Ventral oral collar tubular ducts numerous, present in rows across most abdominal segments to lateral margin, and around lateral margins forwards to head and thorax ..... *D. arachidis* Williams
- 5(3) With series of large oral collar tubular ducts, each about twice as wide as a 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(5) Anal lobe cerarii each containing a group of about 2–7 conical setae ..... 7
- Anal lobe cerarii each containing only 2 conical setae ..... 8
- 7(6) Oral collar tubular ducts absent from both dorsum and venter. Venter with a few multilocular disc pores ..... *D. zeynepae* Zarkani & Kaydan sp. n.
- Oral collar tubular ducts absent from dorsum but present on venter. Venter with numerous multilocular disc pores ..... *D. finitimus* Williams
- 8(6) Abdominal cerarii anterior to anal lobe pair, each with 2 conical setae except for an occasional cerarius with only a single conical seta..... 9

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**Dikomentari [GW5]:** I took your illustration through Williams’s (2004: 161) key to *Dysmicoccus* to find the closest species. I think the closest fit is *D. castanopseus*. Your comparison should be to the taxonomically closest species, even if that species does not occur in Indonesia.

DEAR GILLIAN YOU ARE RIGHT BUT WE COULD NOT FIND ANY CLOSE ONES. WE THINK CERARIAN SETAE IS MOST IMPORTANT AT THE MOMENT. FURTHER STUDIES NEEDS TO BE DONE FOR THAT.

I see your point. Maybe mention that it also has similarities with *D. castanopseus*? We will see what the reviewers say.

- Some abdominal cerarii, anterior to anal lobe pair, usually containing more than 2 conical setae ..... 10
- 9(8) Venter with marginal oral collar tubular duct present, at least as far anterior as thorax ..  
..... *D. debregeasiae* (Green)
- Venter with marginal oral collar tubular duct confined to abdomen .....  
..... *D. orchidium* Williams
- 10(8) 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, shorter, about same size as other dorsal setae ..... *D. neobrevipes* Beardsley

***Ferrisia dasyliirii* (Cockerell)**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Muara Bangkahulu, on *Solanum torvum* Swartz (Solanaceae) and *Theobroma cacao* L. (Sterculiaceae), 20 m a.s.l. 3°45'33.0" S, 102°16'10.1" E, 3.vii.2019, coll. A. Zarkani (AZ245–246), 6 ♀♀.

**Comments.** The species is polyphagous on ornamentals and fruits and has been recorded on host plants in 23 families and 52 genera (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Sumatra (Zarkani *et al.* 2020).

***Ferrisia virgata* (Cockerell)**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Muara Bangkahulu, on *Psidium guajava* L. (Myrtaceae), 20 m a.s.l., 03°45'33.0" S, 102°16'10.1" E, 5.iii.2019, coll. A. Zarkani (AZ247), 3 ♀♀.

**Comments.** The species is polyphagous on ornamentals and fruits, and is known from 78 plant families and 207 genera (García Morales *et al.* 2016). It is cosmopolitan, having been recorded from 101 countries (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Irian Jaya (Williams & Watson 1988; Gavrilov-Zimin 2013), Java (Keuchenius 1915; Betrem 1937; Ali 1968; Ben-Dov 1994; Williams 2004) and Sulawesi (Williams 2004).

***Nipaecoccus viridis* (Newstead)**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Kampung Melayu, on *Citrus* sp. (Rutaceae), 10 m a.s.l., 03°54'16.5" S, 102°19'11.7" E, 18.ii.2018, coll. A. Zarkani (AZ211), 3 ♀♀.

**Comments.** The species is polyphagous on ornamentals and fruits, and has been recorded from 45 plant families and 114 genera (García Morales *et al.* 2016). It is cosmopolitan, having been reported from 63 countries (García Morales *et al.* 2016). In Indonesia, it has been recorded previously in Irian Jaya (CABI, 1983; Ben-Dov 1994), Java (CABI, 1983; Ben-Dov 1994; Williams 2004) and Sulawesi (Williams 2004).

***Palmicutor* cryptic species complex, species near *palmarum* (Ehrhorn) ~~cryptic species complex~~  
(Fig. 3)**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Seluma district, Air Periukan, on *Elaeis guineensis* Jacq (Arecaceae), 8 m a.s.l., 03°59'07" S, 102°25'37" E, 2.ii.2018, coll. A. Zarkani (AZ203), 3 ♀♀.

**Appearance in life** (Fig. 3). Body of adult female covered with fluffy white wax secretion. The mealybugs live mainly on the fruits and are attended by ants (Fig. 4).

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**Description of adult female** (based on holotype and 2 paratypes) (Fig. 4): Body oval, 1.98–2.42 mm long, 1.38–1.48 mm wide. Eyes situated on margins, each 25–30 µm in diameter. Antenna 7 segmented, each 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 seta 27.5–30.0 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 75–85 µm long, 40–45 µm wide across atrium. Circulus notched on each side with a strong middle constriction, 80–110 µm wide. Legs well developed; segment lengths for each posterior leg: coxa 115–135 µm, trochanter + femur 205–220 µm, tibia + tarsus 160–170 µm, claw 27.5–30.0 µm. Ratio of lengths 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; derm surrounding each posterior coxa with 40–50 translucent pores; coxa with 30–50 translucent pores; tibia with numerous translucent pores. 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, bearing 6 setae, each seta 160–165 µm long.

**Dorsum.** Derm membranous, with 16 pairs of cerarii around body margin, each cerarius with 2–5 enlarged conical setae and 3–5 auxiliary setae. Each anal lobe cerarius set on membranous cuticle and containing 3–6 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 on thorax and abdomen.

**Venter.** Setae flagellate, each 30–110 µm long, longest setae located medially on head. Apical setae on 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 follows: 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.** The Indonesian specimen is a member of the *P. palmarum* cryptic species complex, which was discussed by von Ellenrieder *et al.* (2022). Members of this species complex have more than 12 pairs of cerarii; the derm surrounding each posterior coxa has 40–50 duct-like pores, and each hind coxa and hind tibia have numerous translucent pores. The dorsal setae in the Indonesian specimen are up to twice as long as those recorded previously in *P. palmarum* by Williams and Watson (1988) and Williams (2004). You need to say why you have not given this species a name (von Ellenrieder *et al.* (2022) may give you ideas for what to say here). Is there a reason why you have not done a DNA sequence for it? The cryptic species complex will only get resolved if molecular data is documented on it.

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*Paracoccus evae* Williams

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Seluma district, Sukaraja, on *Melastoma malabathricum* L. (Melastomataceae), 50 m a.s.l., 03°52'00.4" S, 102°22'51.2" E, 23.vii.2019, coll. A. Zarkani (AZ249), 3 ♀♀.

**Comments.** This is the second report of *P. evae* from Indonesia; Williams (2004) recorded it from Java on *Eupatorium* sp. (Asteraceae).

***Planococcus dischidiae* (Takahashi)**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Kepahiang district, Kabawetan, on *Coffea robusta*, 600 m a.s.l., 03°34'54.4" S, 102°35'33" E, 12.vi.2018, coll. A. Zarkani (AZ235–239), 1 ♀.

**Comments.** Previously, *P. dischidiae* has been collected on *Dischidia* sp. (Apocynaceae) and *Epipremnum* (Araceae), and has been recorded from Indonesia (Sulawesi) (Cox 1989; Ben-Dov 1994; Williams 2004) and Malaysia (Takahashi 1951; Ben-Dov 1994).

***Planococcus lilacinus* (Cockerell)**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Muara Bangkahulu, on *Saraca asoca* (Roxb.) (Fabaceae), 20 m a.s.l., 03°45'33.0" S, 102°16'10.1" E, 10.ii.2019 and 15.iii.2020, coll. A. Zarkani (AZ313), 1 ♀.

**Comments.** The species is polyphagous on ornamentals and fruits, and has been recorded from 73 plant families and 196 genera (García Morales *et al.* 2016). It is cosmopolitan, having been reported from 64 countries (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Irian Jaya (Williams & Watson 1988; Ben-Dov 1994), Java (Williams 2004), Kalimantan (Cox 1989; Ben-Dov 1994), Lombok (Williams 2004), Sulawesi (Williams 2004) and Sumatra (Cox 1989; Ben-Dov 1994; Williams 2004).

***Pseudococcus jackbeardsleyi* Gimpel & Miller**

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

**Comments.** This neotropical species is polyphagous on ornamentals, fruits, vegetables and herbs; it has been reported from 52 plant families and 112 genera (García Morales *et al.* 2016). It is cosmopolitan, having been reported from 52 countries (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Flores (Gavrilov-Zimin 2017), Irian Jaya (Gavrilov-Zimin 2013) and Java (Williams 2004).

**\**Pseudococcus leptotrichotus* Williams**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Kepahiang district, Kabawetan, on *C. robusta*, 600 m a.s.l., 03°34'54.4" S, 102°35'33" E, 12.vi.2018, coll. A. Zarkani (AZ235–239), 12 ♀♀.

**Comments.** This is a new country record for Indonesia, and is the first mealybug species recorded from Indonesia that had been previously recorded in a leaf nest of *Oecophylla* sp.



ants in Malaysia (Sarawak). In Indonesia, *P. leptotrichotus* were collected in a leaf nest of *Oecophylla* sp. ants on coffee leaves and within a protective carton shelter of soil made by unidentified ants on coffee berries and trees.

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

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Muara Bangkahulu, on *Theobroma cacao* L. (Sterculiaceae), 20 m a.s.l., 03°45'33.0" S, 102°16'10.1" E, 5.iii.2019, coll. A. Zarkani (AZ247), 3 ♀♀.

**Comments.** The species is polyphagous on ornamentals and fruits, and has been recorded from 84 plant families and 167 genera (García Morales *et al.* 2016). It is cosmopolitan, having been reported from 115 countries (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Irian Jaya (Williams & Watson 1988; Ben-Dov 1994), Java (Betrem 1937; Ben-Dov 1994), Lombok (Williams 2004), Sulawesi (Watson *et al.* 2014) and Sumatra (Green 1930).

***Rastrococcus chinensis* Ferris**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Singaran Pati, on *Nephelium lappaceum* L. (Sapindaceae), 20 m a.s.l., 03°48'57.9" S, 102°18'38.9" E, 12.vi.2018, coll. A. Zarkani (AZ168–170), 12 ♀♀.

**Comments.** The species was recorded previously on *Alocasia* sp. (Araceae), *Ardisia lindleyana* D. Dietr. (Primulaceae), *Eugenia* sp. (Myrtaceae), *Melastoma malabathricum* L. (Melastomataceae), *Morinda umbellata* L. (Rubiaceae), *Psychotria asiatica* L. (Rubiaceae), *Syzygium* sp. (Myrtaceae), *S. anomalum* Lauterb. (Myrtaceae) and *S. hancei* Merr. & Perry (Myrtaceae). It has been reported previously from Brunei, China and Malaysia (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Java (Williams 1989, 2004; Ben-Dov 1994).

***Rastrococcus invadens* Williams**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Kepahiang district, Kabawetan, on *Mangifera indica* L. (Anacardiaceae), 600 m a.s.l., 03°34'54.4" S, 102°35'33" E, 12.vi.2018, coll. A. Zarkani (AZ235–239), 12 ♀♀.

**Comments.** The species is polyphagous on ornamentals and fruits; it has been recorded from 29 plant families and 54 genera (García Morales *et al.* 2016). It is cosmopolitan, having been reported from 32 countries (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Bali and Java (Williams 1989, 2004; Ben-Dov 1994).

***Rastrococcus tropicasiaticus* Williams**

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

**Comments.** Zarkani *et al.* (2021) reported *R. tropicasiaticus* for the first time in Indonesia (Bengkulu) on *A. excelsa* (Meliaceae), *Cerbera manghas* L. (Apocynaceae), *Dimocarpus*

*longan* Lour. (Sapindaceae), *Ficus* sp. (Moraceae), and *Tectona grandis* L. (Lamiaceae). It is also known to live on woody plants and wild grass in parts of southern Asia such as Malaysia, Philippines, Thailand and Vietnam (Williams 2004).

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Figure captions

**FIGURE 1.** *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.

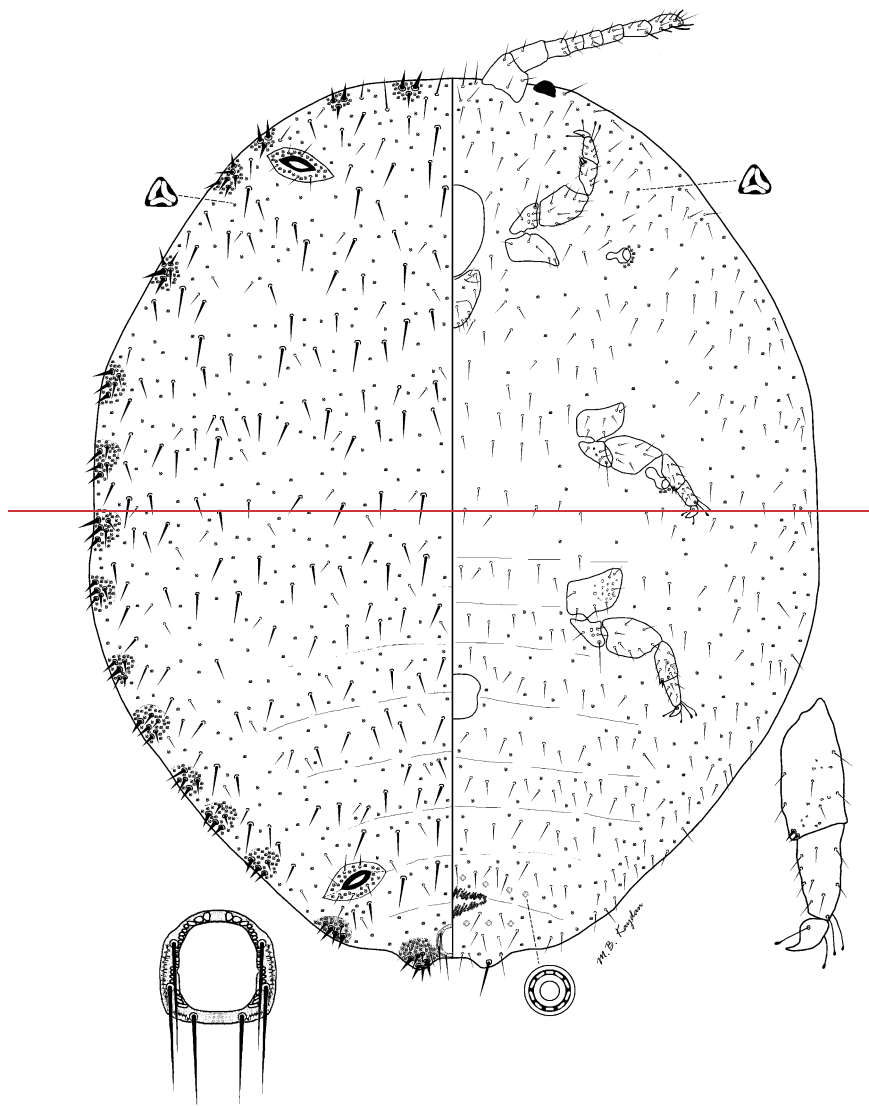
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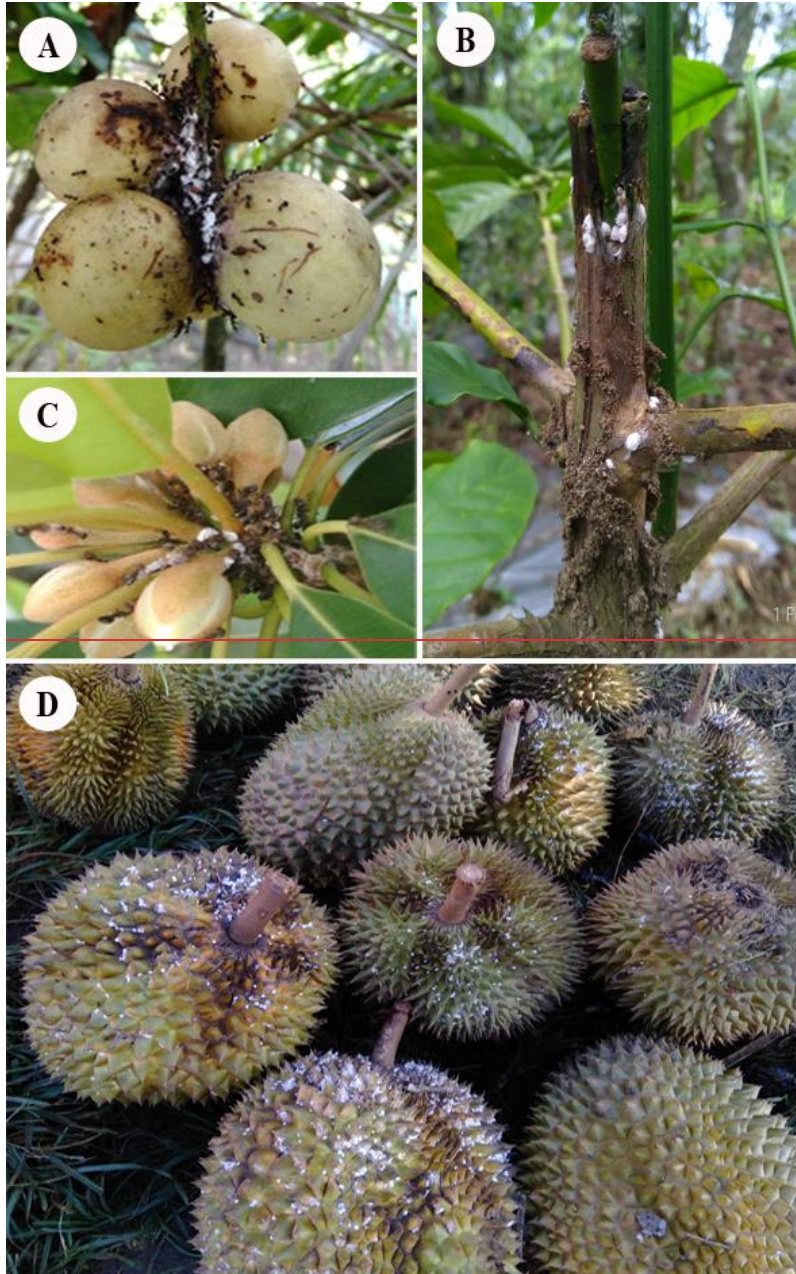


**FIGURE 12.** Adult female *Dysmicoccus zeynepae* Zarkani & Kaydan **sp. n.** holotype.

**Teloh Diformat:** Kanan: -1 cm

**FIGURE 3.** *Palmicultor* cryptic species group, species near *palmarum* (Ehrhorn) attacking *Elaeis guineensis* Jacq. fruits.

**Teloh Diformat:** Normal, Inden: Kiri: 0 cm, Baris Pertama: 0 cm, Kanan: -1 cm, Sesuaiakan spasi antara teks Latin dan Asia, Sesuaiakan spasi antara teks Asia dan angka

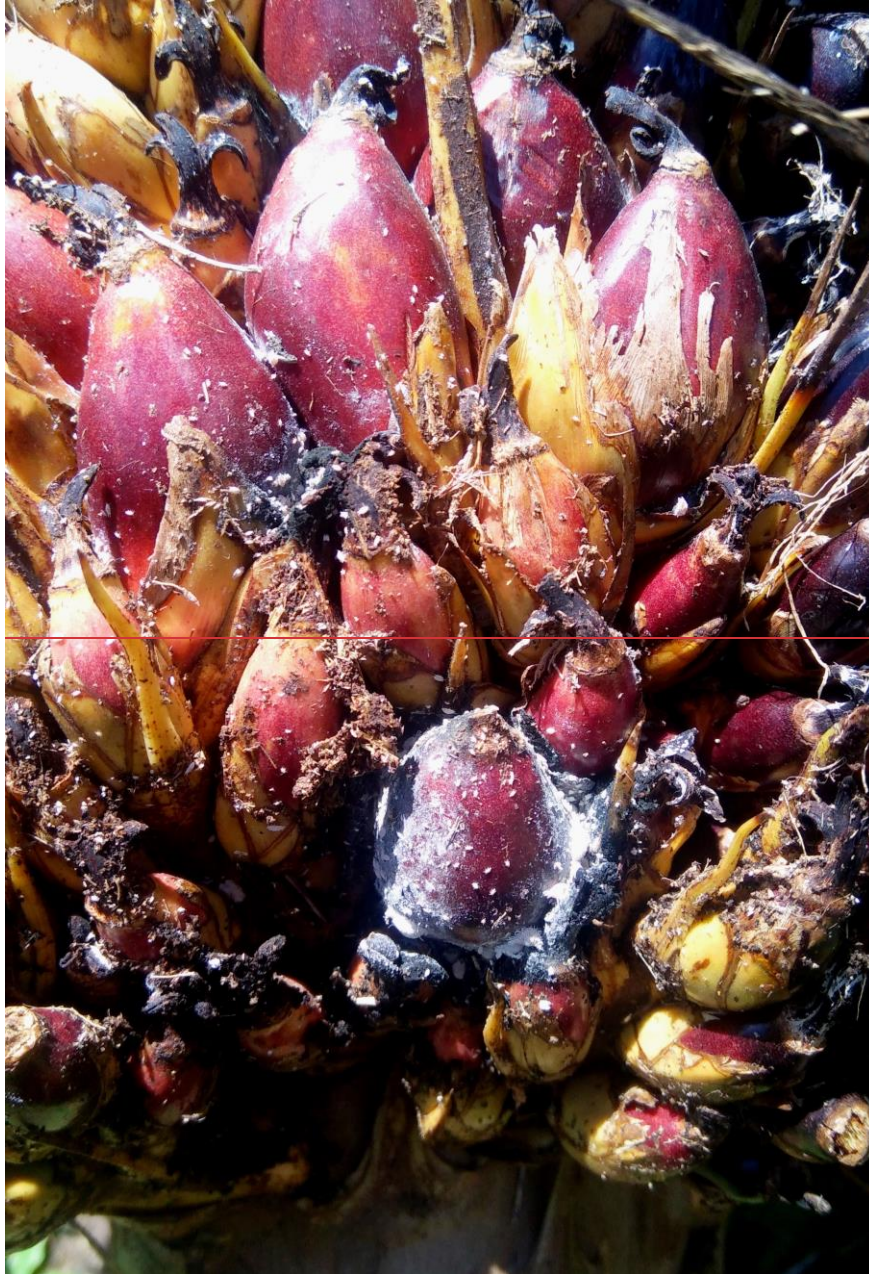


**FIGURE 2.** *Dysmicoccus zeynepae* Zarkani & Kaydan sp. n. on (A) *Lansium parasiticum* Corr.; (B) *Coffea robusta* Lindl. ex De Will.; (C) *Manilkara zapota* L.; and (D) *Durio zibethinus* Murr.

Telah Difomat: Kanan: -1 cm







**FIGURE 4.** *Palmicaultor palmarum* (Ehrhorn) cryptic species group: attack on *Elaeis guineensis* Jacq. fruits.

← **Telah Diformat:** Kiri, Kanan: -1 cm

**Telah Diformat:** Kanan: -1 cm

← **Telah Diformat:** Inden: Kiri: 0 cm, Baris Pertama: 0 cm, Kanan: -1 cm

← **Telah Diformat:** Kanan: -1 cm

## Studies on mealybugs (Hemiptera: Coccoomorpha: Pseudococcidae) in Indonesia, with description of a new species and three new country records

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### Abstract

Mealybugs (Hemiptera: Coccoomorpha: Pseudococcidae) include economically important insect pests worldwide; however, little is known about the species present in Indonesia. Samples were collected and identified from wild and cultivated plants in several regions of southern Sumatra, Indonesia between 2018 and 2019. Eighteen species of Pseudococcidae in 8 genera were identified, including one undescribed species. *Dysmicoccus zeynepae* Zarkani & Kaydan **sp. n.** is described and illustrated based on the morphology of the adult female, and a key is provided for the identification of all 18 species. Furthermore, *Dysmicoccus arachidis* Williams, *D. carens* Williams and *Pseudococcus leptotrichotus* Williams are recorded for the first time from Indonesia; new locality and host-plant data are given for these species.

**Keywords:** Biodiversity, host plant, pests, Sternorrhyncha, taxonomy

### Introduction

The Pseudococcidae (Hemiptera: Coccoomorpha: Coccoomorpha), whose members are known as mealybugs, is a family of scale insects which include many important sap-sucking insect pests of woody and herbaceous plants. These insects not only damage their host plants directly, by mechanical injury and extraction of sap, but also indirectly by promoting sooty mold growth on their sugary honeydew waste and by facilitating the transmission of plant virus diseases (Franco *et al.* 2009, Daane *et al.* 2012).

The Pseudococcidae, with 2041 species in 259 genera, is the second largest scale insect family after the Diaspididae, which contains about 2693 species in 418 genera (García Morales *et al.* 2016). In the Indonesian archipelago, 108 species of Pseudococcidae in 31 genera have been recorded so far, the second-largest family after the Diaspididae, which has 118 species in 46 genera recorded (García Morales *et al.* 2016). In the family Pseudococcidae, the most species-rich and damaging genera in Indonesia are: *Rastrococcus* Ferris (15 species), *Pseudococcus* Westwood (13 species), *Paraputo* Laing (13 species), *Dysmicoccus* Ferris (9 species), and *Planococcus* Ferris (7 species) (Williams 2004; García Morales *et al.* 2016).

As a tropical country located along major sea lanes connecting East Asia, South Asia and Oceania, it is not surprising that Indonesia has a very large number of indigenous plants, vertebrates and invertebrates including great insect biodiversity (McNeely *et al.* 1990; CBD



Secretariat 2021). The first documentation of Indonesian insect diversity, including mealybugs in Indonesia began in the British, Dutch and Japanese colonial eras and has continued to the present, resulted in the description of many new Indonesian native species and several additional records to the scale insect fauna (Dammerman 1929; Reyne 1954, 1957, 1961, 1965; Wiriati 1958, 1959; Kalshoven 1981; Muniappan *et al.* 2008, 2011, 2012; Sartiami *et al.* 2015, 2016; Gavrilov-Zimin 2013, 2016, 2017, 2019, 2020, 2021; and Zarkani *et al.* 2020, 2021a, b). However, the only comprehensive review of mealybugs recorded from Indonesia is in the monograph by Williams (2004). In the last 16 years the number of described scale insect species recorded in Indonesia has increased by 53 species (García Morales *et al.* 2016) but the knowledge of Indonesian scale insect species are still patchy and incomplete.

The present paper covers a new species and three new country records from Indonesia. Identification keys to genera and *Dysmicoccus* species, and new locality records for the currently known Pseudococcidae species, are provided and discussed.

## Materials and methods

Mealybugs (nymphs and adult females) were collected from tropical plants in several regions of southern Sumatra, Indonesia between April 2018 and October 2019. Infested plant parts (fruits, trunk and branches, and leaves) were cut, bagged, labeled and taken to the Laboratory of Plant Protection, University of Bengkulu for examination. For species determination, nymphs were reared on the relevant plant material (at  $25 \pm 1$  °C, ~70% relative humidity and of 16:8 h light: dark photoperiod) until they reached the adult stage. A **binocular dissection** microscope, LEICA EZ4HD, was used to sort specimens for preservation and slide mounting. Specimens were killed, labeled and stored in 70% ethyl alcohol.

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

For description of the new species, the main taxonomic characters of the adult females were evaluated and quantified under a compound light microscope. The morphological terms used are those used by Williams and Granara de Willink (1992) and Williams (2004). 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 and Granara de Willink (1992), with cerarius C<sub>1</sub> on the head, anterior to the antenna, and cerarius C<sub>17</sub> being on abdominal segment VIII. A taxonomic illustration is provided for each new species, and is based on the holotype used for the 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 all drawn to the same scale. The translucent pores on the hind legs are mostly found on the dorsal surface, but they are illustrated ventrally on the main figure for convenience.

Type specimens of the new species described are deposited in the Mealybugs Museum, Department of Plant Protection, Faculty of Agriculture, University of Bengkulu, Bengkulu, Indonesia (MMUB). Add an explanation of the use of “/” in holotype data listing (to indicate line break son the slide labels). Also explain where the terminology you use in the descriptions comes from, and the units of measurement used in the descriptions.

**Dikomentari [AZ1]:** We do not use line break son in the slide label. Could we delete it?

## Results and discussion

From 149 mealybug samples collected from southern Sumatra, Indonesia, 18 species were identified, one of which is a new to science and three are new country records for Indonesia. The identified species belong to the genera *Dysmicoccus* (5 species), *Ferrisia* (2 species), *Nipaecoccus* (1 species), *Palmicultor* (1 species), *Paracoccus* (1 species), *Planococcus* (2 species), *Pseudococcus* (3 species) and *Rastrococcus* (3 species). The species marked below with an asterisk (\*) are recorded for the first time from Indonesia.

**Key to adult females of Pseudococcidae genera occurring in Indonesia** (adapted from Williams and Watson (1988), Williams and Granara de Willink (1992) and Williams (2004).

- 1(0) Legs absent ..... 2
- Legs present ..... 4
- 2 (1) Disc-like pores absent. Duct-like pore present on venter in a group posterior to each second spiracle. Anal ring normally situated on surface or at base of vary short tube, bearing at least 6 setae ..... *Chaetococcus* Maskell
- Disc-like pores present on venter of abdomen. Duct-like pore absent. Anal ring situated at base of anal tube, normally bearing 6 setae, rarely without setae ..... 3
- 3 (2) Circulus numbering 5. Micro tubular duct present behind posterior spiracle ..... *Komodosia* Gavrilov-Zimin
- Circulus numbering 1. Micro tubular duct absent behind posterior spiracle..... *Antonina* Signoret
- 4(3) Claws digitules each expanding widely, either from proximal end, or nearer to distal end..... 5
- Claws digitules, either setose or minutely dilated distally..... 8
- 5 (4) Antennae each with 8 segments..... *Archeomyrmococcus* Williams
- Antennae each with 6-7 segments ..... 5
- 6 (5) Head sclerotized at anterior end, at least on venter. Constriction present between head and thorax. Posterior lip of each anterior ostiole larger than anterior lip, usually semi-circular and flap like, often bearing a few short setae ..... *Malaicoccus* Takahashi
- Head membranous on venter. Except sometimes for small areas of sclerotization around basal antenna segments. Constriction absent from between head and thorax. Posterior lip of each anterior ostiole about same size as anterior lip, not semi-circular and flap like, without any setae ..... 7
- 7 (6) Posterior of abdomen folk-like; anal lobes prominent and elongate ..... *Dicranococcus* Williams
- Posterior of abdomen pointed; anal lobes not prominent poorly developed, recognisable by presence or apical setae ..... *Hippeococcus* Reyne
- 8 (6) Dorsal tubular ducts large, each with an orifice surrounded by a 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 ..... 9
- 9(8) Cerarii always conspicuous, each containing numerous truncate-conical cerarian setae, each with apex flat ..... *Rastrococcus* Ferris
- Cerarii, if present, containing cerarian setae with pointed apices, never truncate-conical setae ..... 10
- 10 (9) Recognisable cerarii, absent ..... 11
- Recognisable cerarii, present, sometimes on anal lobes only ..... 13

11(10)	Dorsal ostioles usually represented by both anterior and posterior pairs, although sometimes poorly developed .....	part of <i>Crisicoccus</i> Ferris
-	Dorsal ostioles represented by posterior pair only .....	12
12 (10)	Anal ring oval or triangular, situated on venter a short distance from apex of abdomen. Cephalothorax dilated.....	<i>Leptorhizoecus</i> Williams
-	Anal ring usually circular, rarely V-shaped, situated on dorsum. Cephalothorax not dilated .....	<i>Mollicoccus</i> Williams
13 (10)	Oral rim tubular duct present, each with well-developed rim .....	14
-	Oral rim tubular duct absent entirely .....	16
14 (13)	Cerarii numbering no more than 6 pairs, present on abdomen only, except for frontal cerarii occasionally present.....	<i>Maconellicoccus</i> Ezzat
-	Cerarii numbering 9-18 pairs; present on abdomen and at least on thorax .....	15
15(14)	Venter of each anal lobe with anal lobe bar; auxiliary setae present in anal lobe cerarii only .....	<i>Paracoccus</i> Ezzat & McConnel
	Venter of each anal lobe with triangular to quadrate sclerotized area occupying much of lobe, never with a slender anal lobe bar only .....	<i>Pseudococcus</i> Westwood
16(13)	Quinquelocular pores present at least, on venter; if only few present, these situated near mouthparts only .....	<i>Brevennia</i> Goux
-	Quinquelocular pores absent.....	17
17 (16)	Anal lobe cerarii large, each bearing multiple cerarian setae, dispersed over entire sclerotized area occupying most of lobe and sometimes extending to medial area of abdominal segment VIII. All dorsal setae, at least on abdomen, thick, conical or lanceolate .....	<i>Lanceococcus</i> Williams
-	Anal lobe cerarii, each bearing 2 or more cerarian setae, either on membranous or sclerotized area; if on sclerotized area, then cerarian setae occupying either marginal area of each lobe or area near centre, not occupying most of lobe. All dorsal setae either slender or conical.....	18
18(17)	Venter of each anal lobe sclerotized, with inner edge of sclerotized area thick, bar-like, extending anterior medially; bar-like structure not connected to apical seta or bar seta. Cerarii numbering 16-18 pairs, each cerarius bearing multiple setae; preocular cerarii (C2) always present .....	<i>Exallomochlus</i> Williams
-	Venter of each anal lobe membranous or sclerotized; if sclerotized, not as above. Cerarii numbering 1-18 pairs, each cerarius bearing varying numbers of setae: preocular cerarii present or absent.....	19
19(18)	Anal lobe bars present, always associated with bar setae, each bar either complete from apical seta or present forwards from bar seta only (note: occasional specimens of <i>Formicococcus lingnani</i> Ferris may lack anal lobe bars) .....	20
-	Anal lobe bars absent. Anal lobes either membranous or variously sclerotized.....	21
20(19)	Some or all abdominal cerarii bearing more than 2 cerarian setae each (note: occasional specimens of <i>Formicococcus lingnani</i> Ferris may lack anal lobe bars) .....	<i>Formicococcus</i> Takahashi
-	All abdominal cerarii bearing 2 cerarian setae each .....	<i>Planococcus</i> Ferris
21(19)	Some or most dorsal setae enlarged, conical to lanceolate, about same size as cerarian setae .....	22
-	Dorsal setae either flagellate or conical to lanceolate, all noticeably slenderer than cerarian setae .....	24
22(21)	Trilocular pores concentrated around setal collar of cerarian setae and enlarged dorsal setae, much smaller than trilocular pores elsewhere on body .....	<i>Pedrococcus</i> Mamet
-	Trilocular pores all about the same size.....	23
23(22)	Dorsal cerarii absent. ....	<i>Nipaeococcus</i> Sulc

-	Dorsal cerarii present .....	<i>Dorsoceraricoccus</i> Dong & Wu
24(21)	Cerarii numbering fewer than 6 pairs .....	25
-	Cerarii numbering more than 6 pairs .....	26
25(24)	Circulus hour-glass-shaped. Minute disc pores present on derm around each hind coxa, in an area reaching almost as far forward as each second spiracle, minute duct-like pores absent from this area .....	<i>Saccharicoccus</i> Ferris
-	Circulus, if present, round to oval, not hour-glass-shaped. Minute disc pores normally absent from derm around each hind coxa; if any are present, they do not extend as far forward as each second spiracle. Minute duct-like pores sometimes present around hind coxa.....	part of <i>Palmicultor</i> Williams
26(24)	Minute duct-like pores numerous on derm next to hind coxa .....	part of <i>Palmicultor</i> Williams
-	Minute pores duct-like pores absent from derm next to hind coxa .....	27
27(26)	Legs and spiracles located near lateral margins. Posterior abdominal cerarii each situated at apex of a sclerotized projection extending from margin, bearing more than 2 conical setae but no trilocular pores .....	<i>Extanticoccus</i> Williams
-	Legs and spiracles located sub medially, not near lateral margins. Posterior abdominal cerarii each not normally situated at apex of a sclerotized projection extending from margin. If some cerarii extend from margin than projection is membranous and trilocular pores present .....	28
28(27)	Claw with denticle present.....	part of <i>Phenacoccus</i> Cockerell
-	Claw without denticle .....	29
29(28)	Anal lob bars present .....	<i>Mutabilicoccus</i> Williams
-	Anal lob bars absent.....	30
30(29)	Cerarii numbering 8-17 pairs, always distinct, never with intermediate cerarii; preocular cerarii (C <sub>2</sub> ) always absent. Abdominal cerarii often bearing 2 conical setae each; ventral margin of penultimate abdominal segment never sclerotized. Hind tibia + tarsus usually longer than trochanter + femur. Anal ring usually situated at or near apex of abdomen.....	<i>Dysmicoccus</i> Ferris
-	Cerarii numbering 5-18 pairs, intermediate cerarii often present or cerarii forming a continuous marginal zone; preocular cerarii (C <sub>2</sub> ) present. Abdominal cerarii often bearing more than 2 conical setae each; if with only 2 conical setae each, then ventral margin of penultimate abdominal segment always sclerotized. Hind tibia + tarsus usually shorter than trochanter + femur. Anal ring usually separated from apex of abdomen by at least its own length.....	<i>Paraputo</i> Laing

### Genus *Dysmicoccus* Ferris

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

**Genus diagnosis of adult female** (adapted from Williams, 2004). Body normally broadly oval, 1.65–4.20 mm long, 0.90–2.89 mm wide. Antennae each normally with 6–8 segments. Cerarii present, numbering 6–17 pairs (never 18), anal lobe 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. Legs well developed, hind legs with translucent pores present or absent; tarsal digitules usually knobbed, occasionally setose. Claw usually stout, claw denticle absent. Anal lobes usually developed, either membranous or sclerotized, each lobe bearing a normal apical seta. Ventral

margin of abdominal segments anterior to anal lobes always membranous. Anal ring normally situated at apex of abdomen (rarely a short distance from apex), usually bearing 6 setae, occasionally with more setae present. Anterior and posterior ostioles present. Dorsal setae variously shaped, often flagellate. Ventral setae flagellate. Trilocular pores present on dorsum and venter. Multilocular disc pores usually present, at least on venter. Quinquelocular pores and oral rim tubular ducts always absent. Oral collar tubular ducts usually apparent, at least on venter, sometimes present on dorsum, rarely absent entirely. Discoidal pores present, sometimes large and occasionally present next to each eye.

**\**Dysmicoccus arachidis* Williams**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Kepahiang district, Kabawetan, on *Crassocephalum crepidioides* (Benth.) S. Moore (Asteraceae), 600 m a.s.l, 03°34'54.4" S, 102°35'33" E, 12.vi.2018, coll. A. Zarkani (AZ80-81), 6 ♀♀.

Memformat: Warna font: Otomatis

**Comments.** This species is a new country record for Indonesia and only the second record of the species; Williams (2004) previously reported it from India (Tripura) on *Arachis hypogaea* L. (Fabaceae). There is very little information available on *D. arachidis*.

***Dysmicoccus brevipes* (Cockerell)**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Slebar, on *Syzygium aqueum* Alston (Myrtaceae), 20 m a.s.l, 03°49'25.2" S, 102°19'08.7" E, 10.vii.2018, coll. A. Zarkani (AZ210), 3 ♀♀.

**Comments.** The species is polyphagous on ornamental plants and fruits belonging to 62 plant families and 147 genera. It is cosmopolitan, being found in 126 countries; in Indonesia it has been recorded from Irian Jaya (Williams & Watson 1988), Java (Betrem 1937; Ben-Dov 1994; Williams 2004) and Sumatra (Williams 2004).

**\**Dysmicoccus carens* Williams**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Seluma district, Sukaraja, on *Psophocarpus tetragonolobus* L. (Fabaceae), 10 m a.s.l, 03°59'07" S, 102°25'37" E, 15.vi.2018, coll. A. Zarkani (AZ82-83), 3 ♀♀.

**Comments.** *Dysmicoccus carens* is a new country record for Indonesia. The species has been recorded previously on Poaceae, from Bangladesh (North) on *Andropogon squarrosus* L.; India, New Delhi on *Setaria verticillata* L., Orissa on grass, Tamil Nadu on *Saccharum officinarum* L., *Cymbopogon* sp. and *Chloris barbata* Sw.; Pakistan, Rawalpindi on *Sorghum nitidum* Pers. and *S. sudanensis* (Piper) Hitch, Mona on *Arundo donax* L., Lasbela, Ambagh on *Panicum antidotale* Retz.; and Sri Lanka, Uva Province, Wellawa, Kokagala on grass (Williams 2004).

***Dysmicoccus lepelleyi* (Betrem)**



**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Slebar, on *Manilkara zapota* L. (Sapotaceae), 20 m a.s.l, 03°49'25.2" S, 102°19'08.7" E, 10.vii.2018, coll. A. Zarkani (AZ230), 3 ♀♀.

**Comments.** This is polyphagous species on ornamentals and fruits within 17 plant families: Anacardiaceae, Annonaceae, Arecaceae, Asparagaceae, Clusiaceae, Euphorbiaceae, Fagaceae, Malvaceae, Meliaceae, Moraceae, Musaceae, Myrtaceae, Rubiaceae, Rutaceae, Sapindaceae, Sapotaceae, and Zingiberaceae (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Java (Betrem 1937; Ben-Dov 1994; Williams 2004), Lombok (Williams 2004) and Sumatra (Williams 2004). It is also found in neighboring countries such as Cambodia, Malaysia, Singapore, Thailand, and Vietnam (Williams 2004).

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

**Material examined,** all deposited at MMUB.

**Holotype:** adult female, INDONESIA: left label: AZ205, Sumatra, Bengkulu on *Durio zibethinus* Murr. (Malvaceae), 03°34'54.4" S 102°38'33" E, 4.ii.2018, coll. A. Zarkani; right label: Holotype, *Dysmicoccus zeynepae* sp. n. Zarkani & Kaydan.

**Paratypes,** 5 adult females, INDONESIA: same data as holotype (AZ205); 3 adult females, AZ206, Sumatra, Bengkulu on *Lansium parasiticum* Corr. (Meliaceae), 03°59'28.0" S, 102°25'50.4" E, 11.ii.2018, coll. A. Zarkani; 3 adult females, AZ207, Sumatra, Bengkulu on *Manilkara zapota* L. (Sapotaceae), 04°00'05.7" S, 102°26'52.1" E, 12.ii.2018, coll. A. Zarkani; 3 adult females, AZ208, Sumatra, Bengkulu, *Coffea robusta* Lindl. Ex De Will. (Rubiaceae), 03°36'15.4" S, 102°36'30.8" E, 19.ii.2018, coll. A. Zarkani.

**Description of adult female**

**Appearance in life** (Fig. 1). Adult females secrete a thin powdery white wax covering over their bodies. Living on leaves, flowers and fruits of host plants, commonly attended by ants.

**Slide-mounted adult female** (based on holotype and 5 paratypes) (Fig. 2): 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 seta 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 95–115 µm long, 55–60 µm wide across atrium. Circulus rounded-quadrate 80–110 µm wide. Legs well developed; segment lengths for each 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; tibia with numerous 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, bearing 6 setae, each seta 80–90 µm long.

**Dorsum.** Derm membranous, with 16 pairs of cerarii around body margin, each cerarius with 4–7 enlarged conical setae and 3–5 auxiliary setae. Each anal lobe cerarius set on membranous cuticle and containing 5–7 enlarged conical 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,

**Dikomentari [GW2]:** Please check that the data given here is exactly as it is written on the slide labels, with "/" indicating where the line breaks are

**Dikomentari [AZ3R2]:** We do not use "/"

**Dikomentari [GW4]:** Figures must be numbered in the order in which they are referred to. I have re-numbered the figures (see separate file).

**Dikomentari [AZ5R4]:** Many thanks

scattered throughout dorsum. Trilocular pores, each 3–4 µm in diameter, scattered. Multilocular disc pores and tubular ducts absent.

**Venter.** Setae flagellate, each 30–110 µm long, longest setae located medially on head. Apical setae on anal lobes unusually short, each 80–90 µm long. Multilocular disc pores, each 7–8 µm in diameter, present only immediately around vulva, numbering 8–10. Trilocular pores, each 2.5–3.0 µm across, scattered throughout venter. Oral collar tubular ducts absent.

**Comments.** *Dysmicoccus zeynepae* is most similar to *D. finitimus* 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. It is also closed to *D. lepelleyi* in term of small legs and having translucent pore on hind coxa and femur, but *D. zeynepae* have no oral collar tubular ducts from both dorsum and venter. It is also closed to *D. castanopseus* in lack of oral collar tubular duct on dorsum and venter. However it can be readily distinguished in having: (i) stout and small legs; (ii) translucent pore on hind coxa and femur.

**Etymology.** This species is named after Zeynep Kaydan (“mother” of Kaydan’s Laboratory), Zeynep Güleç and Zeynep Kaya who are good friends of the Kaydan’s lab.

**Host plants.** *Durio zibethinus* (Malvaceae), *L. parasiticum* (Meliaceae), *M. zapota* (Sapotaceae) and *C. robusta* (Rubiaceae) (Figure 2).

**Distribution.** Indonesia (Sumatra I., Bengkulu Province).

**Dikomentari [GW6]:** I took your illustration through Williams’s (2004: 161) key to *Dysmicoccus* to find the closest species. I think the closest fit is *D. castanopseus*. Your comparison should be to the taxonomically closest species, even if that species does not occur in Indonesia.

**DEAR GILLIAN YOU ARE RIGHT BUT WE COULD NOT FIND ANY CLOSE ONES. WE THINK CERARIAN SETAE IS MOST IMPORTANT AT THE MOMENT. FURTHER STUDIES NEEDS TO BE DONE FOR THAT.**

I see your point. Maybe mention that it also has similarities with *D. castanopseus*? We will see what the reviewers say.

**Dikomentari [AZ7]:** We added some information.

#### Key to adult female *Dysmicoccus* found in Indonesia (adapted from Williams 2004).

- 1(0) Circulus present ..... 2
- Circulus absent ..... (continue to Williams (2004: 162) key, couplet 19)
- 2(1) 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. Dorsal oral collar tubular ducts, if present, never forming rows across segments ..... 3
- 3(2) Most cerarii without auxiliary setae ..... 4
- Most cerarii with auxiliary setae ..... 5
- 4(3) Ventral oral collar tubular ducts sparse, a few present in medial area of abdomen and on lateral margins of abdominal segment VI and posterior segments only, absent from head and thoracic margins ..... *D. carens* (Williams)
- Ventral oral collar tubular ducts numerous, present in rows across most abdominal segments to lateral margin, and around lateral margins forwards to head and thorax ..... *D. arachidis* Williams
- 5(3) With series of large oral collar tubular ducts, each about twice as wide as a 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(5) Anal lobe cerarii each containing a group of about 2–7 conical setae ..... 7
- Anal lobe cerarii each containing only 2 conical setae ..... 8
- 7(6) Oral collar tubular ducts absent from both dorsum and venter. Venter with a few multilocular disc pores ..... *D. zeynepae* Zarkani & Kaydan sp. n.
- Oral collar tubular ducts absent from dorsum but present on venter. Venter with numerous multilocular disc pores ..... *D. finitimus* Williams
- 8(6) Abdominal cerarii anterior to anal lobe pair, each with 2 conical setae except for an occasional cerarius with only a single conical seta ..... 9
- Some abdominal cerarii, anterior to anal lobe pair, usually containing more than 2 conical setae ..... 10

- 9(8) Venter with marginal oral collar tubular duct present, at least as far anterior as thorax ..  
 ..... *D. debregeasiae* (Green)
- Venter with marginal oral collar tubular duct confined to abdomen .....  
 ..... *D. orchidium* Williams
- 10(8) 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, shorter, about same size  
 as other dorsal setae ..... *D. neobrevipes* Beardsley

***Ferrisia dasyliirii* (Cockerell)**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Muara Bangkahulu, on *Solanum torvum* Swartz (Solanaceae) and *Theobroma cacao* L. (Sterculiaceae), 20 m a.s.l. 3°45'33.0" S, 102°16'10.1" E, 3.vii.2019, coll. A. Zarkani (AZ245–246), 6 ♀♀.

**Comments.** The species is polyphagous on ornamentals and fruits and has been recorded on host plants in 23 families and 52 genera (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Sumatra (Zarkani *et al.* 2020).

***Ferrisia virgata* (Cockerell)**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Muara Bangkahulu, on *Psidium guajava* L. (Myrtaceae), 20 m a.s.l., 03°45'33.0" S, 102°16'10.1" E, 5.iii.2019, coll. A. Zarkani (AZ247), 3 ♀♀.

**Comments.** The species is polyphagous on ornamentals and fruits, and is known from 78 plant families and 207 genera (García Morales *et al.* 2016). It is cosmopolitan, having been recorded from 101 countries (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Irian Jaya (Williams & Watson 1988; Gavrilov-Zimin 2013), Java (Keuchenius 1915; Betrem 1937; Ali 1968; Ben-Dov 1994; Williams 2004) and Sulawesi (Williams 2004).

***Nipaecoccus viridis* (Newstead)**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Kampung Melayu, on *Citrus* sp. (Rutaceae), 10 m a.s.l., 03°54'16.5" S, 102°19'11.7" E, 18.ii.2018, coll. A. Zarkani (AZ211), 3 ♀♀.

**Comments.** The species is polyphagous on ornamentals and fruits, and has been recorded from 45 plant families and 114 genera (García Morales *et al.* 2016). It is cosmopolitan, having been reported from 63 countries (García Morales *et al.* 2016). In Indonesia, it has been recorded previously in Irian Jaya (CABI, 1983; Ben-Dov 1994), Java (CABI, 1983; Ben-Dov 1994; Williams 2004) and Sulawesi (Williams 2004).

***Palmicultor* cryptic species complex, species near *palmarum* (Ehrhorn)  
 (Fig. 3)**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Seluma district, Air Periukan, on *Elaeis guineensis* Jacq (Arecaceae), 8 m a.s.l., 03°59'07" S, 102°25'37" E, 2.ii.2018, coll. A. Zarkani (AZ203), 3 ♀♀.

**Appearance in life** (Fig. 3). Body of adult female covered with fluffy white wax secretion. The mealybugs live mainly on the fruits and are attended by ants (Fig. 4).

**Description of adult female** (based on holotype and 2 paratypes) (Fig. 4): Body oval, 1.98–2.42 mm long, 1.38–1.48 mm wide. Eyes situated on margins, each 25–30 µm in diameter. Antenna 7 segmented, each 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 seta 27.5–30.0 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 75–85 µm long, 40–45 µm wide across atrium. Circulus notched on each side with a strong middle constriction, 80–110 µm wide. Legs well developed; segment lengths for each posterior leg: coxa 115–135 µm, trochanter + femur 205–220 µm, tibia + tarsus 160–170 µm, claw 27.5–30.0 µm. Ratio of lengths 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; derm surrounding each posterior coxa with 40–50 translucent pores; coxa with 30–50 translucent pores; tibia with numerous translucent pores. 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, bearing 6 setae, each seta 160–165 µm long.

**Dorsum.** Derm membranous, with 16 pairs of cerarii around body margin, each cerarius with 2–5 enlarged conical setae and 3–5 auxiliary setae. Each anal lobe cerarius set on membranous cuticle and containing 3–6 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 on thorax and abdomen.

**Venter.** Setae flagellate, each 30–110 µm long, longest setae located medially on head. Apical setae on 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 follows: 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.** The Indonesian specimen is a member of the *P. palmarum* cryptic species complex, which was discussed by von Ellenrieder *et al.* (2021). Members of this species complex have more than 12 pairs of cerarii; the derm surrounding each posterior coxa has 40–50 duct-like pores, and each hind coxa and hind tibia have numerous translucent pores. The dorsal setae in the Indonesian specimen are up to twice as long as those recorded previously in *P. palmarum* by Williams and Watson (1988) and Williams (2004). Even though there have been some difference it is believed that some further studies must be none to decide this species complex. Especially further molecular studies will be useful to resolve the species concept. ▲

Memformat: Warna font: Merah

*Paracoccus evae* Williams

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Seluma district, Sukaraja, on *Melastoma malabathricum* L. (Melastomataceae), 50 m a.s.l., 03°52'00.4" S, 102°22'51.2" E, 23.vii.2019, coll. A. Zarkani (AZ249), 3 ♀♀.

**Comments.** This is the second report of *P. evae* from Indonesia; Williams (2004) recorded it from Java on *Eupatorium* sp. (Asteraceae).

***Planococcus dischidiae* (Takahashi)**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Kepahiang district, Kabawetan, on *Coffea robusta*, 600 m a.s.l., 03°34'54.4" S, 102°35'33" E, 12.vi.2018, coll. A. Zarkani (AZ235–239), 1 ♀.

**Comments.** Previously, *P. dischidiae* has been collected on *Dischidia* sp. (Apocynaceae) and *Epipremnum* (Araceae), and has been recorded from Indonesia (Sulawesi) (Cox 1989; Ben-Dov 1994; Williams 2004) and Malaysia (Takahashi 1951; Ben-Dov 1994).

***Planococcus lilacinus* (Cockerell)**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Muara Bangkahulu, on *Saraca asoca* (Roxb.) (Fabaceae), 20 m a.s.l., 03°45'33.0" S, 102°16'10.1" E, 10.ii.2019 and 15.iii.2020, coll. A. Zarkani (AZ313), 1 ♀.

**Comments.** The species is polyphagous on ornamentals and fruits, and has been recorded from 73 plant families and 196 genera (García Morales *et al.* 2016). It is cosmopolitan, having been reported from 64 countries (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Irian Jaya (Williams & Watson 1988; Ben-Dov 1994), Java (Williams 2004), Kalimantan (Cox 1989; Ben-Dov 1994), Lombok (Williams 2004), Sulawesi (Williams 2004) and Sumatra (Cox 1989; Ben-Dov 1994; Williams 2004).

***Pseudococcus jackbeardsleyi* Gimpel & Miller**

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

**Comments.** This neotropical species is polyphagous on ornamentals, fruits, vegetables and herbs; it has been reported from 52 plant families and 112 genera (García Morales *et al.* 2016). It is cosmopolitan, having been reported from 52 countries (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Flores (Gavrilov-Zimin 2017), Irian Jaya (Gavrilov-Zimin 2013) and Java (Williams 2004).

**\**Pseudococcus leptotrichotus* Williams**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Kepahiang district, Kabawetan, on *C. robusta*, 600 m a.s.l., 03°34'54.4" S, 102°35'33" E, 12.vi.2018, coll. A. Zarkani (AZ235–239), 12 ♀♀.

**Comments.** This is a new country record for Indonesia, and is the first mealybug species recorded from Indonesia that had been previously recorded in a leaf nest of *Oecophylla* sp.



ants in Malaysia (Sarawak). In Indonesia, *P. leptotrichotus* were collected in a leaf nest of *Oecophylla* sp. ants on coffee leaves and within a protective carton shelter of soil made by unidentified ants on coffee berries and trees.

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

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Muara Bangkahulu, on *Theobroma cacao* L. (Sterculiaceae), 20 m a.s.l., 03°45'33.0" S, 102°16'10.1" E, 5.iii.2019, coll. A. Zarkani (AZ247), 3 ♀♀.

**Comments.** The species is polyphagous on ornamentals and fruits, and has been recorded from 84 plant families and 167 genera (García Morales *et al.* 2016). It is cosmopolitan, having been reported from 115 countries (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Irian Jaya (Williams & Watson 1988; Ben-Dov 1994), Java (Betrem 1937; Ben-Dov 1994), Lombok (Williams 2004), Sulawesi (Watson *et al.* 2014) and Sumatra (Green 1930).

***Rastrococcus chinensis* Ferris**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Singaran Pati, on *Nephelium lappaceum* L. (Sapindaceae), 20 m a.s.l., 03°48'57.9" S, 102°18'38.9" E, 12.vi.2018, coll. A. Zarkani (AZ168–170), 12 ♀♀.

**Comments.** The species was recorded previously on *Alocasia* sp. (Araceae), *Ardisia lindleyana* D. Dietr. (Primulaceae), *Eugenia* sp. (Myrtaceae), *Melastoma malabathricum* L. (Melastomataceae), *Morinda umbellata* L. (Rubiaceae), *Psychotria asiatica* L. (Rubiaceae), *Syzygium* sp. (Myrtaceae), *S. anomalum* Lauterb. (Myrtaceae) and *S. hancei* Merr. & Perry (Myrtaceae). It has been reported previously from Brunei, China and Malaysia (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Java (Williams 1989, 2004; Ben-Dov 1994).

***Rastrococcus invadens* Williams**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Kepahiang district, Kabawetan, on *Mangifera indica* L. (Anacardiaceae), 600 m a.s.l., 03°34'54.4" S, 102°35'33" E, 12.vi.2018, coll. A. Zarkani (AZ235–239), 12 ♀♀.

**Comments.** The species is polyphagous on ornamentals and fruits; it has been recorded from 29 plant families and 54 genera (García Morales *et al.* 2016). It is cosmopolitan, having been reported from 32 countries (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Bali and Java (Williams 1989, 2004; Ben-Dov 1994).

***Rastrococcus tropicasiaticus* Williams**

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

**Comments.** Zarkani *et al.* (2021) reported *R. tropicasiaticus* for the first time in Indonesia (Bengkulu) on *A. excelsa* (Meliaceae), *Cerbera manghas* L. (Apocynaceae), *Dimocarpus*

*longan* Lour. (Sapindaceae), *Ficus* sp. (Moraceae), and *Tectona grandis* L. (Lamiaceae). It is also known to live on woody plants and wild grass in parts of southern Asia such as Malaysia, Philippines, Thailand and Vietnam (Williams 2004).

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#### Figure captions

**FIGURE 1.** *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.** Adult female *Dysmicoccus zeynepae* Zarkani & Kaydan **sp. n.**, holotype.

**FIGURE 3.** *Palmicultor* cryptic species group, species near *palmarum* (Ehrhorn) attacking *Elaeis guineensis* Jacq. fruits.

**FIGURE 4.** Adult female *Palmicultor palmarum* (Ehrhorn) cryptic species group, from Indonesia, Sumatra I., Bengkulu Province, Seluma district, Air Periukan, on *Elaeis guineensis* Jacq. (Arecaceae).



# Studies on ~~pseudococcid~~ mealybugs (Hemiptera: ~~Coccoomorpha~~~~Pseudococcidae~~) in Indonesia, with description of a new species and three new country records

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## Abstract

~~Mealybugs~~ ~~Pseudococcid~~ ~~mealybugs~~ (Hemiptera: Coccoomorpha: ~~Pseudococcidae~~) include economically important insect pests worldwide; however, little is known about the species present in Indonesia. Samples were collected and identified from wild and cultivated plants in several regions of southern Sumatra, Indonesia between 2018 and 2020. Eighteen species of Pseudococcidae in 8 genera were identified, including one undescribed species. *Dysmicoccus zeynepae* Zarkani & Kaydan **sp. n.** is described and illustrated based on the morphology of the adult female, and a key is provided for the identification of all 18 species. Furthermore, *Dysmicoccus arachidis* Williams, *D. carens* Williams and *Pseudococcus leptotrichotus* Williams are recorded for the first time from Indonesia; new locality and host-plant data are given for these species.

**Dikomentari [GW1]:** As you have not covered the 4 genera of Rhizoecidae or 2 genera of Xenococcidae mealybugs found in Indonesia, you need to specify that you are only dealing with the Pseudococcidae here

**Keywords:** Biodiversity, host plant, pests, Sternorrhyncha, ~~Pseudococcidae~~, ~~Rhizoecidae~~, taxonomy

## Introduction

The ~~pseudococcid~~ mealybugs are scale insects (Hemiptera: Coccoomorpha: ~~Pseudococcidae~~) ~~which-that~~ include many important sap-sucking insect pests of woody and herbaceous plants. As presently understood, the mealybugs include three families: Pseudococcidae, Rhizoecidae and Xenococcidae (Choi & Lee 2022). These insects not only damage their host plants directly, by mechanical injury and extraction of sap, but also indirectly by promoting sooty mold growth on their sugary honeydew waste and by facilitating the transmission of plant virus diseases (Franco *et al.* 2009, Daane *et al.* 2012).

The Pseudococcidae, with 2041 species in 259 genera, is the second largest scale insect family after the Diaspididae, which contains about 2693 species in 418 genera (García Morales *et al.* 2016). In the Indonesian archipelago, 108 species of Pseudococcidae in 31 genera have been recorded so far, the second-largest family after the Diaspididae, which has 118 species in 46 genera recorded (García Morales *et al.* 2016). In the family Pseudococcidae, the most species-rich and damaging genera in Indonesia are: *Rastrococcus* Ferris (15 species), *Pseudococcus* Westwood (13 species), *Paraputo* Laing (13 species), *Dysmicoccus* Ferris (9 species), and *Planococcus* Ferris (7 species) (Williams 2004; García Morales *et al.* 2016).

As a tropical country located along major sea lanes connecting East Asia, South Asia and Oceania, it is not surprising that Indonesia has a very large number of indigenous plants,

vertebrates and invertebrates including great insect biodiversity (McNeely *et al.* 1990; CBD Secretariat 2021). The first documentation of Indonesian insect diversity, including mealybugs in Indonesia began in the British, Dutch and Japanese colonial eras and has continued to the present, resulted in the description of many new Indonesian native species and several additional records to the scale insect fauna (Dammerman 1929; Reyne 1954, 1957, 1961, 1965; ~~Wirjati~~ Wirjati 1958, 1959; Kalshoven 1981; Muniappan *et al.* 2008, 2011, 2012; Sartiami *et al.* 2015, 2016; Gavrilov-Zimin 2013, 2016, 2017, 2019, 2020, 2021; and Zarkani *et al.* 2020, 2021a, b). However, the only comprehensive review of mealybugs recorded from Indonesia is in the monograph by Williams (2004). In the last 16 years the number of described scale insect species recorded in Indonesia has increased by 53 species (García Morales *et al.* 2016) but the knowledge of Indonesian scale insect species are still patchy and incomplete.

The present paper covers a new species and three new country records of Pseudococcidae from Indonesia. Identification keys to genera and *Dysmicoccus* species, and new locality records for the currently known Pseudococcidae species, are provided and discussed.

## Materials and methods

Mealybugs (nymphs and adult females) were collected from tropical plants in several regions of southern Sumatra, Indonesia between April 2018 and October 2019. Infested plant parts (fruits, trunk and branches, and leaves) were cut, bagged, labeled and taken to the Laboratory of Plant Protection, University of Bengkulu for examination. For species determination, nymphs were reared on the relevant plant material (at  $25 \pm 1$  °C, ~70% relative humidity and of 16:8 h light: dark photoperiod) until they reached the adult stage. A binocular dissection microscope, Leica EZ4HD, was used to sort specimens for preservation and slide mounting. Specimens were killed, labeled and stored in 70% ethyl alcohol.

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

For description of the new species, the main taxonomic characters of the adult females were evaluated and quantified under a compound light microscope. The morphological terms used are those used by Williams and Granara de Willink (1992) and Williams (2004). 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 and Granara de Willink (1992), with cerarius C<sub>1</sub> on the head, anterior to the antenna, and cerarius C<sub>17</sub> being on abdominal segment VIII. A taxonomic illustration is provided for each new species, and is based on the holotype used for the 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 all drawn to the same scale. The translucent pores on the hind legs are mostly found on the dorsal surface, but they are illustrated ventrally on the main figure for convenience.

Type specimens of the new species described are deposited in the Mealybugs Museum, Department of Plant Protection, Faculty of Agriculture, University of Bengkulu, Bengkulu,

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Indonesia (MMUB). In Material examined, the holotype data is listed as it is written on the slide label, with "/" used to indicate line breaks on the slide labels).

## Results and discussion

Since Williams (2004) provided a key to the mealybugs-mealybug genera of southern Asia, an additional genus (*Komodesia* Gavrilov-Zimin) has (*Komodesia* Gavrilov-Zimin) been described from Indonesia (Gavrilov-Zimin 2016). A key to the 2931 pseudococcid mealybug genera found in Indonesia is therefore provided below.

**Key to adult females of mealybug genera occurring in Indonesia**, adapted from Williams and Watson (1988), Williams and Granara de Willink (1992) and Williams (2004).

- 1(0) Legs present ..... 4
- Legs absent ..... 2
- 2(1) Anal ring normally situated on body surface or at base of very short tube, bearing at least 6 setae. Venter with duct-like pores in a group posterior to each second spiracle. Ventral disc-like pores absent from abdomen ..... *Chaetococcus* Maskell
- Anal ring situated at base of anal tube, normally bearing 6 setae (rarely without setae). Venter without duct-like pores posterior to each second spiracle, but disc-like pores or very short, button-like microtubular ducts present in this position, sometimes also in a wider distribution on submedian to submarginal areas of abdomen ..... 3
- 3(2) Circuli numbering 5. Very short, button-like microtubular ducts present posterior to each second spiracle; disc-like pores absent from this position ..... *Komodesia* Gavrilov-Zimin
- Circuli numbering 0–1. Disc-like pores present behind each second spiracle; short, button-like microtubular ducts absent from this position, sometimes also in a wider distribution on submedian to submarginal areas of abdomen ..... *Antonina* Signoret
- 4(3) Claw digitules each expanded widely, either from proximal end or nearer to distal end ..... 5
- Claw digitules either setose or only minutely dilated distally ..... 8
- 5(4) Antennae each with 8 segments ..... *Archeomyrmococcus* Williams
- Antennae each with 6 or 7 segments ..... 6
- 6(5) Constriction present between head and thorax. Head sclerotized at anterior end, at least on venter. Each anterior ostiole with posterior lip larger than anterior lip, usually semi-circular and flap like, often bearing a few short setae ... *Malaicoccus* Takahashi
- Constriction absent from between head and thorax. Head membranous on venter, except sometimes for small areas of sclerotization around basal antennal segments. Each anterior ostiole with posterior and anterior lips about same size, without any setae ..... 7
- 7(6) Posterior of abdomen fork-like, with anal lobes prominent and elongate ..... *Dicranococcus* Williams
- Posterior of abdomen pointed; anal lobes poorly developed, recognisable by presence of apical setae ..... *Hippeococcus* Reyne
- 8(4) Dorsal tubular ducts large, each with orifice surrounded by a circular, sclerotized area containing 1 or more setae within its borders or just adjacent to the rim ..... *Ferrisia* Cockerell
- Dorsal tubular ducts, if present, without this combination of characters ..... 9

**Dikomentari [AZ2]:**

**Dikomentari [AZ3R2]:** We do not use line break (see attached picture)

**Dikomentari [GW4R3]:** Thanks for the photo. You DO use line breaks so I have left this wording in the manuscript.

**Memformat:** Warna font: Otomatis, Tidak Coretan

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**Dikomentari [GW5]:** On ScaleNet at <http://scalenet.info/scaleplace/list/>, there are 31 genera of Pseudococcidae [and 4 genera of Rhizocidae and 2 genera of Xenococcidae mealybugs] listed for Indonesia. This figure for the Pseudococcidae needs to be changed from 29 to 31

**Memformat:** Coretan, Sorot

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9(8)	Cerarii always conspicuous, each containing numerous truncate-conical cerarian setae (each seta with apex flat) .....	<i>Rastrococcus</i> Ferris
-	Cerarii, if present, containing cerarian setae with pointed apices, setae never truncate-conical .....	10
10(9)	Recognisable cerarii absent .....	11
-	Recognisable cerarii present, sometimes on anal lobes only .....	13
11(10)	Dorsal ostioles usually represented by both anterior and posterior pairs, although sometimes poorly developed .....	<i>Crisicoccus</i> Ferris
-	Dorsal ostioles represented by posterior pair only .....	12
12(10)	Anal ring oval or triangular, situated on venter a short distance from apex of abdomen. Cephalothorax dilated. ....	<i>Leptorhizococcus</i> Williams (family Rhizoecidae)
-	Anal ring usually circular, rarely V-shaped, situated on dorsum. Cephalothorax not dilated. ....	<i>Mollicoccus</i> Williams
13(10)	Oral rim tubular ducts present, each with well-developed rim .....	14
-	Oral rim tubular ducts absent .....	16
14(13)	Cerarii numbering no more than 6 pairs, present on abdomen only, except for frontal cerarii occasionally present .....	<i>Maconellicoccus</i> Ezzat
-	Cerarii numbering 9–18 pairs; present on abdomen and at least on thorax .....	15
15(14)	Venter of each anal lobe with anal lobe bar; auxiliary setae present in anal lobe cerarii only .....	<i>Paracoccus</i> Ezzat & McConnel
	Venter of each anal lobe with triangular to quadrate sclerotized area occupying much of lobe, never with a slender anal lobe bar only .....	<i>Pseudococcus</i> Westwood
16(13)	Quinquelocular pores present, at least on venter; if only few present, these situated near mouthparts only .....	<i>Brevennia</i> Goux
-	Quinquelocular pores absent .....	17
17(16)	Anal lobe cerarii large, occupying most or all of lobe, each bearing multiple cerarian setae dispersed over entire sclerotized area. Dorsal setae, at least on abdomen, thick, conical or lanceolate, each situated on membranous cuticle .....	<i>Lanceacoccus</i> Williams
-	Anal lobe cerarii of various sizes, each bearing 2 or more cerarian setae situated on either on membranous or sclerotized cuticle; if on sclerotized cuticle, then cerarian setae occupying either marginal area of each lobe or area near centre, not dispersed over most of lobe. Dorsal setae all either slender or conical, if conical then sometimes situated on slightly sclerotized cuticle .....	18
18(17)	Venter of each anal lobe sclerotized, with inner edge of sclerotized area thick, bar-like, extending antero-medially; bar-like structure not connected to apical seta or bar seta. Cerarii numbering 16–18 pairs, each cerarius bearing multiple setae; preocular cerarii (C <sub>2</sub> ) always present .....	<i>Exallomochlus</i> Williams
-	Venter of each anal lobe membranous or sclerotized; if sclerotized, not as above. Cerarii numbering 1–18 pairs, each cerarius bearing varying numbers of setae; preocular cerarii (C <sub>2</sub> ) present or absent .....	19
19(18)	Anal lobe bars present, always associated with bar setae, each bar either complete from apical seta or only present forwards from bar seta (note: occasional specimens of <i>Formicococcus lingnani</i> Ferris may lack anal lobe bars) .....	20
-	Anal lobe bars absent. Anal lobes either membranous or variously sclerotized .....	21
20(19)	Some or all abdominal cerarii bearing more than 2 cerarian setae each (note: occasional specimens or <i>Formicococcus lingnani</i> Ferris may lack anal lobe bars) ....	<i>Formicococcus</i> Takahashi
-	Abdominal cerarii each bearing only 2 cerarian setae .....	<i>Planococcus</i> Ferris

- 21(19) Each eye associated with sclerotized patch containing discoidal pores, these pores sometimes as large as a multilocular disc pore; other similar disc pores also present, dispersed, at least on venter. Cerarii always numbering 18 pairs ..... *Hordeolicoccus*
- If eyes are associated with discoidal pores then these are few, small and inconspicuous. Cerarii numbering 1–17 pairs ..... 22
- 22(21) Some or most dorsal setae enlarged, conical to lanceolate, about same size as cerarian setae..... 23
- Dorsal setae either flagellate or conical to lanceolate, all noticeably slenderer than cerarian setae..... 25
- 23(22) Trilocular pores concentrated around setal collars of cerarian setae and enlarged dorsal setae, much smaller than trilocular pores elsewhere on body ... *Pedrococcus* Mamet
- Trilocular pores all about same size..... 24
- 24(23) Enlarged dorsal setae each closely associated with trilocular pores ..... *Dorsoceraricoccus* Dong & Wu
- Enlarged dorsal setae not closely associated with trilocular pores ..... *Nipaecoccus* Šulc
- 25(22) Anterior margin of hind coxa indistinct; spiracles and leg bases situated much closer to margin than to midline ..... *Extanticoccus*
- Anterior margin of hind coxa distinct; spiracles and leg bases situated submedially, about half way between margin and midline ..... 26
- 26(25) Derm around hind coxa with numerous minute pores ..... 27
- Derm around hind coxa without minute pores ..... 28
- 27(26) Circulus large and strongly constricted, hour-glass-shaped. Derm around each hind coxa with numerous minute disc pores, in an area reaching almost as far forward as each posterior spiracle; minute duct-like pores absent from this area ..... *Saccharicoccus* Ferris
- Circulus smaller, square to oval, not strongly constricted. Derm around each hind coxa with numerous minute duct-like pores, these not extending as far forward as each posterior spiracle; minute disc-like pores absent from derm around each hind coxa ..... *Palmicultor* Williams
- 28(26) Claw with denticle present..... *Phenacoccus* Cockerell
- Claw without denticle ..... 29
- 29(28) Anal lobe bars present ..... *Mutabilicoccus* Williams
- Anal lobe bars absent..... 30
- 30(29) Cerarii numbering 8–17 pairs, always distinct, never with intermediate cerarii; preocular cerarii (C<sub>2</sub>) always absent. Abdominal cerarii often bearing 2 conical setae each; ventral margin of penultimate abdominal segment never sclerotized. Hind tibia + tarsus usually longer than trochanter + femur. Anal ring usually situated at or near apex of abdomen..... *Dysmicoccus* Ferris
- Cerarii numbering 5–18 pairs, intermediate cerarii often present or cerarii forming a continuous marginal zone; preocular cerarii (C<sub>2</sub>) present. Abdominal cerarii often bearing more than 2 conical setae each; if with only 2 conical setae each, then ventral margin of penultimate abdominal segment always sclerotized. Hind tibia + tarsus usually shorter than trochanter + femur. Anal ring usually separated from apex of abdomen by at least its own length ..... *Paraputo* Laing

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From 149 mealybug samples collected from southern Sumatra, Indonesia, 18 species were identified, one of which is a new to science and three are new country records for Indonesia. The identified species belong to the genera *Dysmicoccus* (5 species), *Ferrisia* (2 species), *Nipaecoccus* (1 species), *Palmicultor* (1 species), *Paracoccus* (1 species), *Planococcus* (2

species), *Pseudococcus* (3 species) and *Rastrococcus* (3 species). The species marked below with an asterisk (\*) are recorded for the first time from Indonesia.

### **Genus *Dysmicoccus* Ferris**

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

**Genus diagnosis of adult female** (adapted from Williams, 2004). Body normally broadly oval, 1.65–4.20 mm long, 0.90–2.89 mm wide. Antennae each normally with 6–8 segments. Cerarii present, numbering 6–17 pairs (never 18), anal lobe 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. Legs well developed, hind legs with translucent pores present or absent; tarsal digitules usually knobbed, occasionally setose. Claw usually stout, claw denticle absent. Anal lobes usually developed, either membranous or sclerotized, each lobe bearing a normal apical seta. Ventral margin of abdominal segments anterior to anal lobes always membranous. Anal ring normally situated at apex of abdomen (rarely a short distance from apex), usually bearing 6 setae, occasionally with more setae present. Anterior and posterior ostioles present. Dorsal setae variously shaped, often flagellate. Ventral setae flagellate. Trilocular pores present on dorsum and venter. Multilocular disc pores usually present, at least on venter. Quinquelocular pores and oral rim tubular ducts always absent. Oral collar tubular ducts usually apparent, at least on venter, sometimes present on dorsum, rarely absent entirely. Discoidal pores present, sometimes large and occasionally present next to each eye.

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

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Kepahiang district, Kabawetan, on *Crassocephalum crepidioides* (Benth.) S. Moore (Asteraceae), 600 m a.s.l, 03°34'54.4" S, 102°35'33" E, 12.vi.2018, coll. A. Zarkani (AZ80-81), 6 ♀♀.

**Comments.** This species is a new country record for Indonesia and only the second record of the species; Williams (2004) previously reported it from India (Tripura) on *Arachis hypogaea* L. (Fabaceae). There is very little information available on *D. arachidis*.

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

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Slebar, on *Syzygium aqueum* Alston (Myrtaceae), 20 m a.s.l, 03°49'25.2" S, 102°19'08.7" E, 10.vii.2018, coll. A. Zarkani (AZ210), 3 ♀♀.

**Comments.** The species is polyphagous on ornamental plants and fruits belonging to 62 plant families and 147 genera. It is cosmopolitan, being found in 126 countries; in Indonesia it has been recorded from Irian Jaya (Williams & Watson 1988), Java (Betrem 1937; Ben-Dov 1994; Williams 2004) and Sumatra (Williams 2004).

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



**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Seluma district, Sukaraja, on *Psophocarpus tetragonolobus* L. (Fabaceae), 10 m a.s.l, 03°59'07" S, 102°25'37" E, 15.vi.2018, coll. A. Zarkani (AZ82-83), 3 ♀♀.

**Comments.** *Dysmicoccus carens* is a new country record for Indonesia. The species has been recorded previously on Poaceae, from Bangladesh (North) on *Andropogon squarrosus* L.; India, New Delhi on *Setaria verticillata* L., Orissa on grass, Tamil Nadu on *Saccharum officinarum* L., *Cymbopogon* sp. and *Chloris barbata* Sw.; Pakistan, Rawalpindi on *Sorghum nitidum* Pers. and *S. sudanensis* (Piper) Hitch, Mona on *Arundo donax* L., Lasbela, Ambagh on *Panicum antidotale* Retz.; and Sri Lanka, Uva Province, Wellawa, Kokagala on grass (Williams 2004).

***Dysmicoccus lepelleyi* (Betrem)**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Slebar, on *Manilkara zapota* L. (Sapotaceae), 20 m a.s.l, 03°49'25.2" S, 102°19'08.7" E, 10.vii.2018, coll. A. Zarkani (AZ230), 3 ♀♀.

**Comments.** This is polyphagous species on ornamentals and fruits within 17 plant families: Anacardiaceae, Annonaceae, Arecaceae, Asparagaceae, Clusiaceae, Euphorbiaceae, Fagaceae, Malvaceae, Meliaceae, Moraceae, Musaceae, Myrtaceae, Rubiaceae, Rutaceae, Sapindaceae, Sapotaceae, and Zingiberaceae (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Java (Betrem 1937; Ben-Dov 1994; Williams 2004), Lombok (Williams 2004) and Sumatra (Williams 2004). It is also found in neighboring countries such as Cambodia, Malaysia, Singapore, Thailand, and Vietnam (Williams 2004).

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

**Material examined,** all deposited at MMUB.

**Holotype:** ~~adult female, INDONESIA: left label: AZ205, / 4.ii.2008 / Indonesia / Sumatra, Bengkulu / on Durio zibethinus Murr. (Malvaceae), 03°34'54.4" S-102°38'33" E, / 03°34'54.4" S / 520 m 4.ii.2018, coll. A. Zarkani; right label: Holotype, Dysmicoccus zeynepae sp. n. Zarkani & Kaydan, 3 f## / coll. A. Zarkani / det. MB Kaydan. The holotype specimen is ringed with red ink on the coverslip.~~

**Paratypes,** 5 ~~adult femalesf##~~, INDONESIA: (AZ205) same data as holotype (AZ205); 3 ~~adult femalesf##~~, AZ206, Sumatra, Bengkulu on *Lansium parasiticum* Corr. (Meliaceae), 03°59'28.0" S, 102°25'50.4" E, 11.ii.2018, coll. A. Zarkani; 3 ~~adult femalesf##~~, AZ207, Sumatra, Bengkulu on *Manilkara zapota* L. (Sapotaceae), 04°00'05.7" S, 102°26'52.1" E, 12.ii.2018, coll. A. Zarkani; 3 ~~adult femalesf##~~, AZ208, Sumatra, Bengkulu, *Coffea robusta* Lindl. ~~Ex-ex~~ De Will. (Rubiaceae), 03°36'15.4" S, 102°36'30.8" E, 19.ii.2018, coll. A. Zarkani.

**Description of adult female**

**Appearance in life** (Fig. 1). Adult females secrete a thin powdery white wax covering over their bodies. Living on leaves, flowers and fruits of host plants, commonly attended by ants.

**Slide-mounted adult female** (based on holotype and 5 paratypes) (Fig. 2): 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 seta 30–35 µm long. Clypeolabral shield 200–220 µm long, 175–185 µm wide. Labium 3 segmented, 110–120 µm long, 80–85

Telah Diformat: Kanan: -1 cm

**Dikomentari [GW6]:** Please check that the data given here is exactly as it is written on the slide labels, with "/" indicating where the line breaks are

**Dikomentari [AZ7R6]:** We attached the photo. Thanks for all of your corrections.

**Dikomentari [GW8R7]:** Thanks for the photo, I have amended the data listing accordingly.

**Dikomentari [GW9]:** In Zootaxa, f# will be printed as a female sign

µm wide. Anterior spiracles each 85–90 µm long, 45–50 µm wide across atrium; posterior spiracles each 95–115 µm long, 55–60 µm wide across atrium. Circulus rounded-quadrate 80–110 µm wide. Legs well developed; segment lengths for each 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 1.16–1.21 : 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; tibia with numerous 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, bearing 6 setae, each seta 80–90 µm long.

**Dorsum.** Derm membranous, with 16 pairs of cerarii around body margin, each cerarius with 4–7 enlarged conical setae and 3–5 auxiliary setae. Each anal lobe cerarius set on membranous cuticle and containing 5–7 enlarged conical 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 and tubular ducts absent.

**Venter.** Setae flagellate, each 30–110 µm long, longest setae located medially on head. Apical setae on anal lobes unusually short, each 80–90 µm long. Multilocular disc pores, each 7–8 µm in diameter, present only immediately around vulva, numbering 8–10. Trilocular pores, each 2.5–3.0 µm across, scattered throughout venter. Oral collar tubular ducts absent.

**Comments.** *Dysmicoccus zeynepae* is most similar to *D. finitimus* in having anal lobe and other abdominal 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; and (ii) a few multilocular disc pores without oral collar tubular ducts on venter. It is also closed to *D. lepelleyi* in term of small legs and having translucent pore on hind coxa and femur, but *D. zeynepae* have no oral collar tubular ducts from both dorsum and venter. *Dysmicoccus zeynepae* is also close to *D. castanopseus* Williams in lacking oral collar tubular ducts on dorsum and venter; however, it can be readily distinguished by having (character state for *D. castanopseus* given in parentheses): (i) small, stout legs with tibia + tarsus obviously shorter than trochanter + femur (large legs with tibia + tarsus very slightly longer than trochanter + femur); and (ii) translucent pores on the hind coxa and femur (translucent pores on hind femur and tibia).

**Etymology.** This species is named after Zeynep Kaydan (“mother” of Kaydan’s Laboratory), Zeynep Güleç and Zeynep Kaya who are good friends of the Kaydan’s lab.

**Host plants.** *Durio zibethinus* (Malvaceae), *L. parasiticum* (Meliaceae), *M. zapota* (Sapotaceae) and *C. robusta* (Rubiaceae) (Figure 2).

**Distribution.** Indonesia (Sumatra I., Bengkulu Province).

**Key to adult female *Dysmicoccus* found in Indonesia** (adapted from Williams 2004).

- 1(0) Circulus present ..... 2
- Circulus absent ..... (continue to Williams (2004: 162) key, couplet 19)
- 2(1) 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. Dorsal oral collar tubular ducts, if present, never forming rows across segments ..... 3
- 3(2) Most cerarii without auxiliary setae ..... 4
- Most cerarii with auxiliary setae ..... 5

- 4(3) Ventral oral collar tubular ducts sparse, a few present in medial area of abdomen and on lateral margins of abdominal segment VI and posterior segments only, absent from head and thoracic margins ..... *D. carens* (Williams)
- Ventral oral collar tubular ducts numerous, present in rows across most abdominal segments to lateral margin, and around lateral margins forwards to head and thorax ..... *D. arachidis* Williams
- 5(3) With series of large oral collar tubular ducts, each about twice as wide as a 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(5) Anal lobe cerarii each containing a group of about 2–7 conical setae ..... 7
- Anal lobe cerarii each containing only 2 conical setae ..... 8
- 7(6) Oral collar tubular ducts absent from both dorsum and venter. Venter with a few multilocular disc pores ..... *D. zeynepae* Zarkani & Kaydan sp. n.
- Oral collar tubular ducts absent from dorsum but present on venter. Venter with numerous multilocular disc pores ..... *D. finitimus* Williams
- 8(6) Abdominal cerarii anterior to anal lobe pair, each with 2 conical setae except for an occasional cerarius with only a single conical seta.....9
- Some abdominal cerarii, anterior to anal lobe pair, usually containing more than 2 conical setae ..... 10
- 9(8) Venter with marginal oral collar tubular duct present, at least as far anterior as thorax ..  
..... *D. debregeasiae* (Green)
- Venter with marginal oral collar tubular duct confined to abdomen .....  
..... *D. orchidium* Williams
- 10(8) 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, shorter, about same size as other dorsal setae .....*D. neobrevipes* Beardsley

#### ***Ferrisia dasyliirii* (Cockerell)**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Muara Bangkahulu, on *Solanum torvum* Swartz (Solanaceae) and *Theobroma cacao* L. (Sterculiaceae), 20 m a.s.l. 3°45'33.0" S, 102°16'10.1" E, 3.vii.2019, coll. A. Zarkani (AZ245–246), 6 ♀♀.

**Comments.** The species is polyphagous on ornamentals and fruits and has been recorded on host plants in 23 families and 52 genera (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Sumatra (Zarkani *et al.* 2020).

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

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Muara Bangkahulu, on *Psidium guajava* L. (Myrtaceae), 20 m a.s.l., 03°45'33.0" S, 102°16'10.1" E, 5.iii.2019, coll. A. Zarkani (AZ247), 3 ♀♀.

**Comments.** The species is polyphagous on ornamentals and fruits, and is known from 78 plant families and 207 genera (García Morales *et al.* 2016). It is cosmopolitan, having been recorded from 101 countries (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Irian Jaya (Williams & Watson 1988; Gavrilov-Zimin 2013), Java

(Keuchenius 1915; Betrem 1937; Ali 1968; Ben-Dov 1994; Williams 2004) and Sulawesi (Williams 2004).

***Nipaecoccus viridis* (Newstead)**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Kampung Melayu, on *Citrus* sp. (Rutaceae), 10 m a.s.l., 03°54'16.5" S, 102°19'11.7" E, 18.ii.2018, coll. A. Zarkani (AZ211), 3 ♀♀.

**Comments.** The species is polyphagous on ornamentals and fruits, and has been recorded from 45 plant families and 114 genera (García Morales *et al.* 2016). It is cosmopolitan, having been reported from 63 countries (García Morales *et al.* 2016). In Indonesia, it has been recorded previously in Irian Jaya (CABI, 1983; Ben-Dov 1994), Java (CABI, 1983; Ben-Dov 1994; Williams 2004) and Sulawesi (Williams 2004).

***Palmicultor* cryptic species complex, species near *palmarum* (Ehrhorn)**

(Fig. 3)

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Seluma district, Air Periukan, on *Elaeis guineensis* Jacq (Arecaceae), 8 m a.s.l., 03°59'07" S, 102°25'37" E, 2.ii.2018, coll. A. Zarkani (AZ203), 3 ♀♀.

**Appearance in life** (Fig. 3). Body of adult female covered with fluffy white wax secretion. The mealybugs live mainly on the fruits and are attended by ants (Fig. 4).

**Description of adult female** (based on holotype and 2 paratypes) (Fig. 4): Body oval, 1.98–2.42 mm long, 1.38–1.48 mm wide. Eyes situated on margins, each 25–30 µm in diameter. Antenna 7 segmented, each 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 seta 27.5–30.0 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 75–85 µm long, 40–45 µm wide across atrium. Circulus notched on each side with a strong middle constriction, 80–110 µm wide. Legs well developed; segment lengths for each posterior leg: coxa 115–135 µm, trochanter + femur 205–220 µm, tibia + tarsus 160–170 µm, claw 27.5–30.0 µm. Ratio of lengths 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; derm surrounding each posterior coxa with 40–50 translucent pores; coxa with 30–50 translucent pores; tibia with numerous translucent pores. 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, bearing 6 setae, each seta 160–165 µm long.

**Dorsum.** Derm membranous, with 16 pairs of cerarii around body margin, each cerarius with 2–5 enlarged conical setae and 3–5 auxiliary setae. Each anal lobe cerarius set on membranous cuticle and containing 3–6 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 on thorax and abdomen.

**Venter.** Setae flagellate, each 30–110 µm long, longest setae located medially on head. Apical setae on 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 follows: 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.** The Indonesian specimen is a member of the *P. palmarum* cryptic species complex, which was discussed by von Ellenrieder *et al.* (2021). Members of this species complex have more than 12 pairs of cerarii; the derm surrounding each posterior coxa has 40–50 duct-like pores, and each hind coxa and hind tibia have numerous translucent pores. The dorsal setae in the Indonesian specimen are up to twice as long as those recorded previously in *P. palmarum* by Williams and Watson (1988) and Williams (2004). Even though there have been some difference it is believed that some further studies must be none to decide this species complex. Especially further molecular studies will be useful to resolve the species concept. ▲

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#### *Paracoccus evae* Williams

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Seluma district, Sukaraja, on *Melastoma malabathricum* L. (Melastomataceae), 50 m a.s.l, 03°52'00.4" S, 102°22'51.2" E, 23.vii.2019, coll. A. Zarkani (AZ249), 3 ♀♀.

**Comments.** This is the second report of *P. evae* from Indonesia; Williams (2004) recorded it from Java on *Eupatorium* sp. (Asteraceae).

#### *Planococcus dischidia* (Takahashi)

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Kepahiang district, Kabawetan, on *Coffea robusta*, 600 m a.s.l, 03°34'54.4" S, 102°35'33" E, 12.vi.2018, coll. A. Zarkani (AZ235–239), 1 ♀.

**Comments.** Previously, *P. dischidia* has been collected on *Dischidia* sp. (Apocynaceae) and *Epipremnum* (Araceae), and has been recorded from Indonesia (Sulawesi) (Cox 1989; Ben-Dov 1994; Williams 2004) and Malaysia (Takahashi 1951; Ben-Dov 1994).

#### *Planococcus lilacinus* (Cockerell)

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Muara Bangkahulu, on *Saraca asoca* (Roxb.) (Fabaceae), 20 m a.s.l, 03°45'33.0" S, 102°16'10.1" E, 10.ii.2019 and 15.iii.2020, coll. A. Zarkani (AZ313), 1 ♀.

**Comments.** The species is polyphagous on ornamentals and fruits, and has been recorded from 73 plant families and 196 genera (García Morales *et al.* 2016). It is cosmopolitan, having been reported from 64 countries (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Irian Jaya (Williams & Watson 1988; Ben-Dov 1994), Java (Williams 2004), Kalimantan (Cox 1989; Ben-Dov 1994), Lombok (Williams 2004), Sulawesi (Williams 2004) and Sumatra (Cox 1989; Ben-Dov 1994; Williams 2004).

#### *Pseudococcus jackbeardsleyi* Gimpel & Miller

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

**Comments.** This neotropical species is polyphagous on ornamentals, fruits, vegetables and herbs; it has been reported from 52 plant families and 112 genera (García Morales *et al.* 2016). It is cosmopolitan, having been reported from 52 countries (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Flores (Gavrilov-Zimin 2017), Irian Jaya (Gavrilov-Zimin 2013) and Java (Williams 2004).

**\**Pseudococcus leptotrichotus* Williams**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Kepahiang district, Kabawetan, on *C. robusta*, 600 m a.s.l, 03°34'54.4" S, 102°35'33" E, 12.vi.2018, coll. A. Zarkani (AZ235–239), 12 ♀♀.

**Comments.** This is a new country record for Indonesia, and is the first mealybug species recorded from Indonesia that had been previously recorded in a leaf nest of *Oecophylla* sp. ants in Malaysia (Sarawak). In Indonesia, *P. leptotrichotus* were collected in a leaf nest of *Oecophylla* sp. ants on coffee leaves and within a protective carton shelter of soil made by unidentified ants on coffee berries and trees.

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

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Muara Bangkahulu, on *Theobroma cacao* L. (Sterculiaceae), 20 m a.s.l., 03°45'33.0" S, 102°16'10.1" E, 5.iii.2019, coll. A. Zarkani (AZ247), 3 ♀♀.

**Comments.** The species is polyphagous on ornamentals and fruits, and has been recorded from 84 plant families and 167 genera (García Morales *et al.* 2016). It is cosmopolitan, having been reported from 115 countries (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Irian Jaya (Williams & Watson 1988; Ben-Dov 1994), Java (Betrem 1937; Ben-Dov 1994), Lombok (Williams 2004), Sulawesi (Watson *et al.* 2014) and Sumatra (Green 1930).

***Rastrococcus chinensis* Ferris**

**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Bengkulu city, Singaran Pati, on *Nephelium lappaceum* L. (Sapindaceae), 20 m a.s.l., 03°48'57.9" S, 102°18'38.9" E, 12.vi.2018, coll. A. Zarkani (AZ168–170), 12 ♀♀.

**Comments.** The species was recorded previously on *Alocasia* sp. (Araceae), *Ardisia lindleyana* D. Dietr. (Primulaceae), *Eugenia* sp. (Myrtaceae), *Melastoma malabathricum* L. (Melastomataceae), *Morinda umbellata* L. (Rubiaceae), *Psychotria asiatica* L. (Rubiaceae), *Syzygium* sp. (Myrtaceae), *S. anomalum* Lauterb. (Myrtaceae) and *S. hancei* Merr. & Perry (Myrtaceae). It has been reported previously from Brunei, China and Malaysia (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Java (Williams 1989, 2004; Ben-Dov 1994).

***Rastrococcus invadens* Williams**



**Material examined.** INDONESIA, Sumatra I., Bengkulu Province, Kepahiang district, Kabawetan, on *Mangifera indica* L. (Anacardiaceae), 600 m a.s.l., 03°34'54.4" S, 102°35'33" E, 12.vi.2018, coll. A. Zarkani (AZ235–239), 12 ♀♀.

**Comments.** The species is polyphagous on ornamentals and fruits; it has been recorded from 29 plant families and 54 genera (García Morales *et al.* 2016). It is cosmopolitan, having been reported from 32 countries (García Morales *et al.* 2016). In Indonesia, it has been recorded previously from Bali and Java (Williams 1989, 2004; Ben-Dov 1994).

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

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

**Comments.** Zarkani *et al.* (2021) reported *R. tropicasiatricus* for the first time in Indonesia (Bengkulu) on *A. excelsa* (Meliaceae), *Cerbera manghas* L. (Apocynaceae), *Dimocarpus longan* Lour. (Sapindaceae), *Ficus* sp. (Moraceae), and *Tectona grandis* L. (Lamiaceae). It is also known to live on woody plants and wild grass in parts of southern Asia such as Malaysia, Philippines, Thailand and Vietnam (Williams 2004).

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#### Figure captions

**FIGURE 1.** *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.** Adult female *Dysmicoccus zeynepae* Zarkani & Kaydan **sp. n.**, holotype.

**FIGURE 3.** *Palmicultor* cryptic species group, species near *palmarum* (Ehrhorn) attacking *Elaeis guineensis* Jacq. fruits.

**FIGURE 4.** Adult female *Palmicultor palmarum* (Ehrhorn) cryptic species group, from Indonesia, Sumatra I., Bengkulu Province, Seluma district, Air Periukan, on *Elaeis guineensis* Jacq. (Arecaceae).

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