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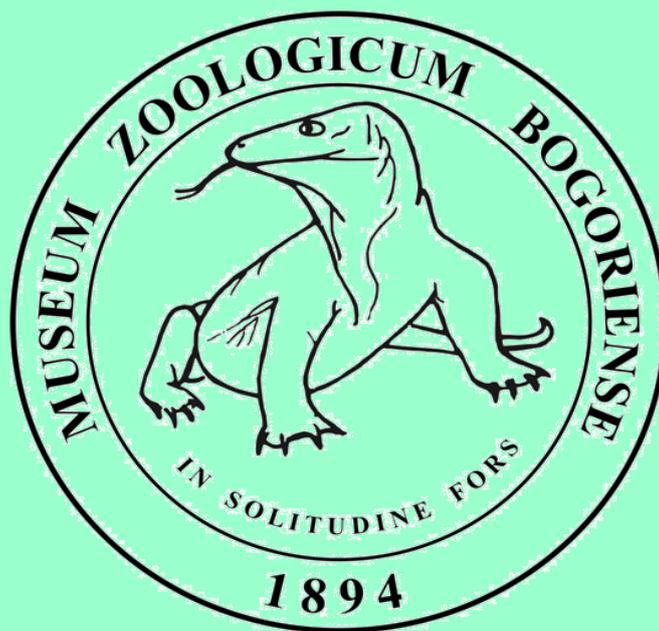


TREUBIA

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MACROCHELID MITES FROM A NEST OF HONEY BEE *APIS DORSATA DORSATA* AT BOGOR BOTANICAL GARDEN, WEST JAVA, INDONESIA

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ABSTRACT

Thirteen species of macrochelid mites belonging to the genera *Holostaspella*, *Macrocheles*, *Neopodocinum* and *Glyphtholaspis* were collected from a nest of honey bee *Apis dorsata dorsata* at Bogor Botanical Garden, Bogor, West Java, Indonesia. Of these, one species was described as new to science, two species were recorded from Indonesia for the first time, and all species were recorded from nest of *Apis dorsata dorsata* for the first time. *Macrocheles nidus* sp. nov. is similar to some species of *scutatus* subgroup, but it is discernible from the latter by the pilosity of dorsal setae.

Key word: *Apis dorsata dorsata*, Indonesia, macrochelid mite, nest

INTRODUCTION

Some species of the family Macrochelidae are associated with social insects especially ants and bees. Macrochelid mites associated with bees have been reported from three genera *i.e.* *Glyphtholaspis*, *Macrocheles* and *Trigonholaspis* (Richards & Richards 1977, De Jong *et al.* 1982, Eickwort 1988, Chmielewski 1991, Krantz 1998). *Trigonholaspis* has been recorded on nests of *Trigona* in Colombia and *Lestrimelitta* in Panama, whereas *Glyphtholaspis* and *Macrocheles* have been recorded from nests of bumble bee and honey bee. Of 11 species of *Glyphtholaspis* and *Macrocheles* associated with bees, eight species are associated with *Apis mellifera*: *i.e.* *Glyphtholaspis americana* (Berlese, 1888), *Macrocheles caucasicus* Bregetova & Koroleva, 1960, *M. decoloratus* (Koch, 1839), *M. glaber* (Müller, 1860), *M. martius* (Hull, 1925), *M. muscaedomesticae* (Scopoli, 1772), *M. nataliae* Bregetova & Koroleva, 1960, and *M. praedafimetorum* Richard & Richard, 1977 (University of Michigan 2013).

Honey bee *Apis dorsata* (Hymenoptera: Apidae) is the largest in body size and colony member among genus *Apis* (Ruttner 1988, Michener 2007). One subspecies *i.e.*: *Apis dorsata dorsata*, is the most widespread among *Apis dorsata*. This subspecies is found throughout India and Southeast Asia, including Palawan, Borneo, and string of islands of Indonesia from Sumatra to Timor and eastward to the Kai Islands (Otis 1991). *Apis dorsata* has a large single comb nest in the open. The nest is usually hung under trees and rocks (Koeniger & Koeniger 1980, Dyer & Seeley 1991, 1994) and parts of buildings (Lindauer 1956, Reddy 1980, Reddy & Reddy 1993). This species performs seasonal migration, carries out long distance migration, stays at certain periods

and places, and returns to previous nesting patches (Koeniger & Koeniger 1980, Dyer & Seeley 1991, Reddy & Reddy 1993). *Apis dorsata dorsata* comes into the collection site of Bogor Botanical Garden, West Java on a certain period of flowering season (Kahono *et al.* 1999, Kahono 2011).

Species of macrochelid mites from nest of living *Apis dorsata* has not been reported previously.

MATERIALS AND METHODS

All mite specimens were collected from a fallen nest of honey bee *Apis dorsata dorsata* at Bogor Botanical Garden, Bogor, West Java, Indonesia. The nest of *A. d. dorsata* was put on the Tullgren funnel for 2–7 days to extract the mites. Macrochelid mites collected were fixed in 70% ethanol and several mite specimens were dissected under a stereoscopic microscope after clearing in lactic acid. Each body part was mounted on a slide in Polyvinyl Alcohol (PVA) medium. Observations were made with differential interference contrast microscope. Illustrations were prepared with the aid of a drawing tube. All measurements are given in micrometers (μm). Measurements for the description of the new species are provided as averages and range in parentheses, if more than two specimens were measured. The dorsal chaetotaxy follows Halliday (1987). Other terminology, particularly that for the sternal ornamentation follows Walter & Krantz (1986b). All specimens including holotype and paratypes of the new species are deposited in the collection of the Museum Zoologicum Bogoriense, Bogor, Indonesia (MZB).

RESULTS

Description and locality records

Thirteen species were obtained from the nest of *Apis dorsata dorsata* at Bogor Botanical Garden. They are as follows:

1. *Macrocheles nidus* sp. nov.

(Figs. 1–5)

Type series. Holotype: female (MZB.Acar. 4184.2), Bogor Botanical Garden, Bogor, West Java, Indonesia, 30 January 2004, Sih Kahono leg., *ex* a nest of honey bee *Apis dorsata dorsata*. Paratypes: 22 females (MZB.Acar. 4180, 4183, 4184.1, 5941.14-15, 5942.24, 5943.5, 5943.7-8, 5946.1-2, 5946.6, 5948, 5950.1, 5950.3-6, 5950.10-11, 5950.13, 5953), data same as for holotype.

Female. Length of dorsal shield 697 (660–760), width at level of coxae II 401 (365–440) (n=23). Living specimens yellowish brown.

Dorsum (Fig. 1). Dorsal shield broadly rounded posteriorly; ornamented punctation and reticulated; lateral margin smooth; shield bearing 28 pairs of dorsal setae and 22 pairs of pores; setae j1 pilose distally; j2 slightly pilose; z1, j5, j6, z5, z6 and J2 simple; J5 pilose entirely; other dorsal setae pilose in their distal halves, or distal 2/3.

Venter (Fig. 2). Length of sternal shield similar to width; length 138 (135–150), width at level of coxae II 137 (130–150) (n=23); linea angulata (l.ang.), linea media transversa (l.m.t.), linea oblique posteriores (l.o.p.); two linea arcuata (l.arc.) present; l.o.p. with punctation in posterior 2/3, and disjunct from or connected with l.m.t.; shield with 3 pairs of simple setae and 2 pairs of pores; all setae similar in length and not reaching setae behind them. Metasternal shield oval and free; each shield with 1 simple seta and an anterior pore.

Width of epigynial shield 180 (170–195) (n=23); surface of the shield with lines and punctation, pair of simple setae and pores located on lateral side.

Ventrianal shield subpentagonal and reticulated, and wider than long; length 237 (215–275), width 240 (215–275) (n=23); shield with 3 pairs of preanal and pair of paranal simple setae, and 1 postanal pilose seta. Cribrum located posterior to postanal seta. Ophistogastric setae simple. A pair of metapodal shield oblong. Postcoxal pore free from podal shield. Anterior extremities of peritreme located at level of setae z1.

Gnathosoma (Fig. 3). Well developed and sclerotised. Deutosternal groove with anteriormost divided row of denticles and posterior 5 transverse rows of denticles; hypostomal and palpcoxal setae simple. Epistome (Fig. 4) with median process and pair of lateral elements; median process bifurcate distally and with small spicules; lateral margin serrate. Fixed digit of chelicera (Fig. 5) with simple dorsal seta, small distal tooth, robust median tooth, pilus dentilis, and terminal hook; movable digit with bidentate median tooth, distal tooth, and terminal hook; length of fixed digit 175 (165–185) and movable digit 74 (55–80) (n=23).

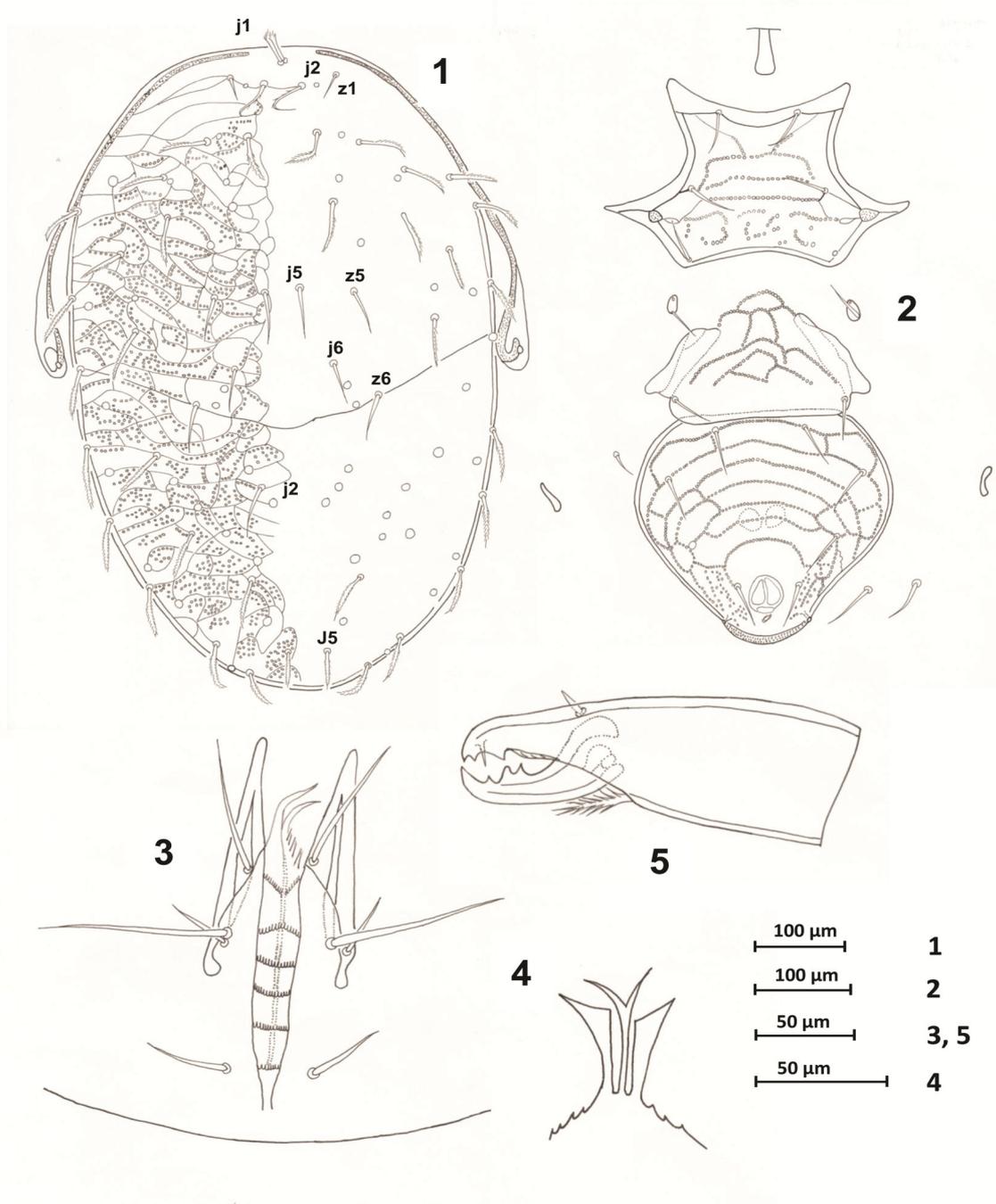
Legs. Most of leg segments with simple, plumose and pilose setae except for coxae I–IV, trochanters I–IV, tibia I and tarsi I–II with only simple setae and genu and tibia IV with pilose setae. Leg chaetotaxy typical for the genus. Genu IV with 6 setae. Leg length (except ambulacrum, n=23); leg I, 539 (470–610); leg II, 517 (415–575); leg III, 499 (435–555); leg IV, 773 (670–845).

Sacculus foemineus. Not observed.

Male and other stage. Unknown.

Etymology. The specific name *nidus* refers to nest in Latin word.

Remark. *Macrocheles nidus* sp. nov. is similar to *Macrocheles subscutatus* Walter & Krantz (1992) recorded from Southern Africa in the shape of sternal shield, but it is distinguished from the latter by the following characteristics (corresponding conditions of *M. subscutatus* in parentheses on the basis of the original description): 1) setae j2 long and slightly pilose (short and simple); 2) z2, s4-6, r4, S1-5, Z1-5 pilose (simple). The present species also resembles *Macrocheles scutatus* (Berlese, 1904) recorded from Italy, China and India, in sternal ornamentation, but it differs from the latter in the pilosity of the dorsal marginal setae.



Figures 1-5. *Macrocheles nidus* sp. nov., holotype (MZB.Acar.4184.2), female: 1, dorsum; 2, venter; 3, ventral view of gnathosoma; 4, epistome; 5, chelicera.

2. *Glypholaspis asperrima* (Berlese, 1905)

Holostaspis asperimus Berlese, 1905: 163, fig. 25.

Macrocheles (Macrocheles) asperrimus: Berlese, 1918: 172.

Glypholaspis asperrima: Filipponi & Pegazzano, 1960: 166–168, fig. 9; 1962: 202; Krantz, 1967: 150–152; Roy, 1988: 346.

Materials examined. 56 females, Bogor Botanical Garden, Bogor, West Java, Indonesia, 30 January 2004, Sih Kahono leg., *ex* a nest of honey bee *Apis dorsata dorsata*.

Diagnosis. Female. Dorsal shield bearing 28 pairs of setae, ornamented strongly in a crenulate-reticulate pattern; lateral border of shield serrate, dorsal pores large; setae z5 simple and pointed; j5, j6, z6, J2 and J5 pilose, remaining dorsal setae distinctly plumose; posterior margin mesal to Z5 variably serrated; sternal shield with crenulate-reticulate pattern, and plumose sternal setae; ventrianal shield broader than long, rounded laterally.

Habitat. This species has been collected from species of genus *Onthophagus* (Scarabaeidae), and forest leaf litters.

Distribution. Indonesia (Java), India, Caroline and Marshall Islands.

3. *Glypholaspis pontina* Filipponi & Pegazzano, 1960

Glypholaspis pontina Filipponi & Pegazzano, 1960: 161.

Glypholaspis pontina: Petrova, 1967: 24; Mašán, 2003: 128, figs. 130, 131.

Materials examined. 14 females, data same as preceding species.

Diagnosis. Female. Dorsal shield with punctate reticulate pattern, shield with 28 pairs of dorsal setae and 22 pairs of pores; most of dorsal setae brush-shape and densely plumose, except for setae pilose z5, z6, j6, J2, and J5; posterior margin between setae Z5 with 2 large denticles and numerous micro denticles. Sternal and ventrianal shield with network meshes and micropunctured.

Habitat. *Glypholaspis pontina* has been collected in various oakwood microhabitats, galleries of xylophagous insects.

Distribution. Indonesia [Java (new record)], Slovakia, Italy and Caucasus.

4. *Holostaspella pulchella* Mašán, 2003

Holostaspella pulchella Mašán, 2003: 133, figs. 138, 139.

Holostaspella pulchella: Hartini & Takaku, 2010: 109–111, figs. 1, 2.

Materials examined. 17 females and 5 males, data same as preceding species.

Diagnosis. Female. Length of dorsal shield less than 800µm; setae j1 narrow, plumose, inserted on long anterior projection; z1 short and lightly pectinate; other dorsal setae lightly pectinate; most setae thickened and broadened apically; setae not reaching to the insertions of succeeding setae. Sternal shield with distinct areolate pattern; 5 separated punctate-reticulate depressions (2 anterolateral, 1 medial, 2 posterolateral depressions) present; first pair of sternal

setae long and lightly pectinate distally; second and third pairs of sternal setae simple. Ventrianal shield with 4 pairs of simple preanal setae. Male. Dorsal setae in lateral margin long and reaching insertions of succeeding setae. Venter covered with holovenal shield; genital orifice located in anterior margin; a pair of ridges present between coxae IV; all ventral setae simple.

Habitat. This species has been collected from compost-excrement substrate and in horse dung, scarabaeid dung beetles and *Apis dorsata dorsata*.

Distribution. This species has been recorded from Slovakia, Philippines, and Indonesia (Java).

5. *Neopodocinum halimunense* Hartini & Takaku, 2003

Neopodocinum halimunensis Hartini & Takaku, 2003a: 49–56, figs. 1–25, 53–55.

Neopodocinum halimunense: Hartini & Takaku, 2004: 86.

Material examined. 1 female, data same as preceding species.

Diagnosis. Dorsal shield oval, surface strongly punctate in lateral parts, lateral margin of shield smooth; shield with 28 pairs of dorsal setae and 22 pairs of pores; unpaired seta Jx present; setae j1 broad and plumose; z1 short and half of j1, and plumose; j2, s2, r2, S1-5, and Z3-5 pilose, and other dorsal setae simple. Anal shield expanded with 2 pairs of preanal setae.

Habitat. *Neopodocinum halimunense* has been collected from *Catharsius molossus* and species of genus *Onthophagus*.

Distribution. Indonesia (Kalimantan and Java).

6. *Macrocheles dispar* (Berlese, 1910)

Holostaspis dispar Berlese, 1910: 251.

Macrocheles (Coprholaspis) dispar: Berlese, 1918: 151; Vitzthum, 1925: 13–16.

Macrocheles dispar: Walter & Krantz, 1992: 244, fig. 1D.

Materials examined. 192 females, data same as preceding species.

Diagnosis. Female. Dorsal setae j1 plumose distally; j4, z2, z4, r2–4, J5, Z5 and S5 pilose distally; j2, j3 and s2 simple but in some cases pilose distally; other setae simple. Sternal shield ornamented with lines and punctation; l.ang., l.m.t., l.o.p. with distinct punctations; l.m.t. complete; l.o.p. disjunct from l.m.t. and not bifurcated; center of posterior half of the shield with small punctations.

Habitat. *Macrocheles dispar* has been collected from scarabaeid beetle *Catharsius molossus*, *Onthophagus (Onthophagus) javensis* and *O. (O.) javaecola*, *O. (O.) orientalis* and species of genera *Aphodius*, *Catharsius*, *Copris*, *Enoplotrupes*, *Onthophagus* and *Paragymnopleurus*.

Distribution. Indonesia (Sumatra, Java, Lombok, Kalimantan, and Sulawesi), Vietnam, the Philippines, China (Sichuan Province) and Taiwan.

7. *Macrocheles hallidayi* Walter & Krantz, 1986

Macrocheles hallidayi Walter & Krantz, 1986a: 214–216, figs. 12, 13.

Macrocheles hallidayi: Walter & Krantz, 1986b: 289, fig. 1b.

Materials examined. 2 females, data same as in preceding species.

Diagnosis. Female. Dorsal shield ornamented with punctate-reticulate pattern and with well developed procurved line; dorsal setae j1 pilose; z1 shorter than j1 and not reaching insertions of j2; j5, j6, z5, z6, and J2 simple; J5 serrate; other dorsal setae sparsely to strongly bipectinate. Sternal shield with strongly punctate margin along l. ang., and with two deeply punctate l. arc., well developed l.m.t., l.o.p. and l.ang.; l.o.p. bifurcated, with distinct area punctatae posteriores (a.p.p.) and area punctatiformes (a.pf.). Genu IV with seven pectinate setae.

Habitat. *Macrocheles hallidayi* has been collected from *Catharsius molossus*, *Onthophagus* (*Onthophagus*) *javensis*, *O. (O.) orientalis*, *Microcopris hidakai*, and species of genera *Aphodius*, *Catharsius*, *Copris*, *Heliocopris*, *Microcopris*, *Oniticellus*, *Onitis*, *Onthophagus* and *Paragymnopleurus*.

Distribution. Indonesia (Sumatra, Java, Madura, Bali, Lombok, Sumbawa, Sumba, Flores, Kalimantan, and Sulawesi), Thailand, Cambodia, Malaysia (Sarawak) and India.

8. *Macrocheles jabarensis* Hartini & Takaku, 2003

Macrocheles jabarensis Hartini & Takaku, 2003b: 1266, figs. 7–12.

Macrocheles jabarensis: Hartini *et al.*, 2004: 308; Hartini *et al.*, 2007: 76; Hartini *et al.*, 2009: 420.

Materials examined. 10 females, data same as preceding species.

Diagnosis. Female. Dorsal setae j1 plumose distally, S5 and Z5 pilose in distal half, J5 entirely pilose, and in some case j4 pilose distally; other dorsal setae simple. Ornamentation of sternal shield distinct; l. ang., l.m.t., and l.o.p. distinct; l.o.p. disjunct from l.m.t. and not bifurcated.

Habitat. This species has been collected from *Onthophagus* (*Onthophagus*) *javensis*, *O. (O.) orientalis*, *Catharsius molossus*, *Microcopris hidakai* and species of genera *Catharsius*, *Microcopris*, *Onthophagus* and *Paragymnopleurus*.

Distribution. Indonesia (Sumatra, Java, Lombok, Sumbawa, and Kalimantan).

9. *Macrocheles kraepelini* (Berlese, 1905)

Holostaspis kraepelini Berlese, 1905: 164, fig. 26.

Macrocheles (*Coprholaspis*) *kraepelini*: Berlese, 1918: 146; Vitzthum, 1926: 34–35.

Macrocheles (*Coprholaspis*) *multihamatus* Vitzthum, 1926: 29–34, figs. 20–22.

Macrocheles kraepelini: Krantz & Filipponi, 1964: 40–42, figs. 3–5, tav. II figs. 1, 2; Halliday, 1986: 743, figs. 2, 33–39; Wallace, 1986: 8–9, fig. 2F, pl. 1(3); Walter & Krantz, 1986a: 212–213, figs. 1–3; Walter & Krantz, 1986b: 289; Halliday, 2000: 298–299.

Materials examined. 216 females, data same as preceding species.

Diagnosis. Female. Dorsal shield broadly rounded posteriorly; most of dorsal setae enlarge

and pilose, except for simple setae j6, z5, z6, and J2; seta z1 occasionally slightly pilose. Sternal shield with distinct ornamentation; l.ang. with many punctations; posterior l.arc. concave, l.o.p. bifurcated; a.p.p. with strong punctations.

Habitat. *Macrocheles kraepelini* has been collected from *Onthophagus* (*Onthophagus*) *javensis*, *O. (O.) malangensis*, *O. (O.) cribratus*, *O. (O.) orientalis*, *O. (O.) javaecola*, *O. (Parascatonomus) accedens*, *O. (Serrophorus) mulleri*, *O. laevis*, *O. laminatus*, *O. schwaneri*, *Catharsius dayacus*, *C. molossus*, *Copris incertus*, *Copris punctipennis*, *Coptodactyla ducalis*, *Onitis fulcatus*, *Pachylister chinensis*, *Paragymnopleurus maurus* and species of genera *Catharsius*, *Copris*, *Onitis*, *Onthophagus*, *Paragymnopleurus* (Scarabaeidae), compost, decaying forest litters.

Distribution. Indonesia (Sumatra, Java, Madura, Flores, Timor, and Kalimantan), Pakistan, India, Thailand, Vietnam, Malaya, Singapore, the Philippines, Samoa, Fiji, Caroline Island, Australia.

10. *Macrocheles limue* Samšinák, 1962

Macrocheles limue Samšinák, 1962: 202–203, figs. 34–36, pls. 7, 8.

Macrocheles eurygaster Krantz, 1981: 3–7, figs. 1–20.

Macrocheles limue: Walter & Krantz, 1986b: 283, fig. 3; Roy, 1991: 750; Roy, 1996: 311–314, figs. 1–14.

Materials examined. 413 females, 21 males, data same as preceding species.

Diagnosis. Most dorsal setae simple; except seta J5 bipectinate and j1 distally pilose. Sternal ornamentation well developed; l.ang. convergent medially; two l.arc. straight; posterior edge of sternal shield close to metasternal shield; ventrianal shield expanded and with strongly dimpled reticulation.

Habitat. This species has been collected from species of genera *Allonitis*, *Aphodius*, *Catharsius*, *Copris*, *Garreta*, *Heliocopris*, *Heteronotis*, *Liatongus*, *Onitis*, *Onitricellus*, *Onthophagus*, *Scarabeus* (Scarabaeidae), and compost, soil, cow dung, elephant dung, leaf litters, and so on.

Distribution. Indonesia (Sumatra, Java, Madura, Bali, Lombok, Sumbawa, Sumba, Flores, Timor, Sulawesi, and Papua), Ethiopia, Chad, Cameroon, Guinea, Zaire, Rwanda, Zambezi, Burundi, Kenya, Uganda, South Africa, Swaziland, India, China, and the Philippines.

11. *Macrocheles mammifer* Berlese, 1918

Macrocheles mammifer Berlese, 1918: 171.

Holostaspella polyornata Turk, 1948: 105.

Macrocheles pavlovskii Bregetova & Koroleva, 1960: 83; Karg, 1971: 140.

Macrocheles postneri Krauss, 1970: 28.

Macrocheles tridentatus Delfinado & Baker, 1975: 53.

Glyptolaspis orientalis Iavorschi, 1980: 149; Wallace, 1986: 11; Krantz & Whitaker, 1988: 236.

Macrocheles mammifer Berlese, 1918: Mašán, 2003: 93–94, figs. 76–77.

Materials examined. 6 females, 1 male, data same as preceding species.

Diagnosis. Female. Dorsal shield widely rounded, reticulated and micropunctured, shield with 28 pairs of dorsal setae, most dorsal setae brush shaped and plumose except j2, j5, j6, J2, J5, z1, z5, and z6 smooth and needle-like; setae s2, s6, and r4 plumose distally. Sternal shield sparsely and irregularly punctured to micropunctured, ventrianal shield wider than long and with thin micropunctuation in lateral area.

Habitat. *Macrocheles mammifer* is known as coprophilous species with phoretic activity, and reported from a variety of decaying substrates, and cow stable manure (Mašán 2003).

Distribution. Indonesia [Java (new record)], Spain, Germany, Poland, Slovakia, Russia, Israel, Malaysia, Singapore, USA, Cuba, Argentina, Australia, and Micronesia.

12. *Macrocheles* sp. aff. *glaber* (Müller, 1860)

Materials examined. 15 females, data same as preceding species.

The present species is similar to *Macrocheles glaber* in dorsal and sternal characteristics. However, for accurate identification of *M. glaber* and allies, it is necessary to observe characters of male and /or immature stages (Halliday 1986). We could not identify the present species because of the lack of other stages.

Habitat. This species has been collected from scarabaeid dung beetles *Catharsius molossus* and species of genera *Copris*, *Onitis* and *Onthophagus*.

13. *Macrocheles* sp.

Material examined. 1 female, data same as preceding species.

We could not confirm the taxonomic status of this species, because this is the only specimen.

DISCUSSION

Mesostigmatid mites, including macrochelid mites, are associated with several groups of Arthropoda. Coleoptera, Hymenoptera, Diptera and Lepidoptera are primary host insects of mesostigmatid mites (Hunter & Rosario 1988). According to De Jong et al. (1982), 34 species of mesostigmatid mites are associated with honey bees, and species belonging to genera *Varroa*, *Eugarroa* and *Tropilaelaps* are specific to honey bees, and they affect honey bees adversely (Hunter & Rosario 1988, Okabe 2013). However, most associations between mites and bees seem to be commensal or cleptoparasitic. If food is superabundant in the nest, cleptoparasitism is not always harmful to hosts and it does not become parasites in the strict sense (Walter & Proctor 1999). Furthermore, predacious mites feeding on other arthropods in the nest may be mutualistic (Okabe 2013).

In the present study, about 1,000 individuals of 13 macrochelid species were extracted from a nest of honey bee *Apis dorsata dorsata*. Nidicolous macrochelid mites associated with *A. d. dorsata* had not been investigated previously, and all of the present mite species are first record from a nest of the bee species. However, most mite species in the present study have been recorded previously from various habitats and hosts, for example, manure, dung, dung beetles, galleries of xylophagous insects, and so on. These macrochelid species may not show distinct specificity to species and habitat, and may be facultative predators in the nests of bees (Eickwort 1990). Most of macrochelids are free-living, usually feed on nematodes, small arthropods or eggs and larvae of small insects, and they are also supposed to feed on such organisms in the nests, for example *Macrocheles praedafimetorum* was found feeding on nematodes and larvae of flies in bumble bee nests (Richards & Richards 1977, Eickwort 1990). As mentioned above, in most cases of mite – bee association, macrochelids may not affect adversely or may be harmless to honey bees, because of their feeding habit and non-specificity to honey bees. However, feeding habit of mites in the nests, and association between macrochelid mites and *A. d. dorsata* have not been researched comprehensively. Besides, it has not been clarified why and how the macrochelid mites colonised the honey bee nest.

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