Mites of the Family Macrochelidae (Acari: Gamasida) from Sungai Wain, East Kalimantan, Indonesia

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Twenty-two mite species of four genera belonging to the family Macrochelidae were collected from the body surface of dung beetles (Scarabaeidae) in Sungai Wain, East Kalimantan, Indonesia. Three species, *Macrocheles dayaci* sp. nov., *M. riparius* sp. nov., and *M. wainensis* sp. nov., are described as new to science. Another eight species are recorded from Kalimantan for the first time.

Key Words: Acari, Macrochelidae, dung beetles, Sungai Wain, East Kalimantan, Indonesia.

Introduction

Kalimantan, the Indonesian part of the island of Borneo in Southeast Asia, comprises the largest land area in the Major Sunda Islands in Indonesia. Several taxonomic studies on macrochelid mites have been carried out in Sumatra and Java in the Major Sunda Islands (e.g., Vitzthum 1925; Takaku 2001; Hartini and Takaku 2003a, b; Hartini *et al.* 2009), where more than 30 species have been recorded, but there has been no comprehensive study of macrochelids in Kalimantan. To date, 16 species of macrochelids have been recorded from Kalimantan by Hartini and Takaku (2003c, 2004) and Hartini *et al.* (2003), all collected from scarabaeine dung beetles. These species belong to three genera: *Macrocheles* (10 species), *Neopodocinum* (5 species), and *Holostaspella* (1 species). Although most of the species were collected from East Kalimantan, *Macrocheles hallidayi* Walter and Krantz, 1986, *M. kraepelini* (Berlese, 1905), and *M. sp. aff. glaber* (Müller, 1860) were also collected from Central Kalimantan. Of the 16 species which have been described, only one, *Neopodocinum kalimantanense* Hartini and Takaku, 2003, appear to be endemic to Kalimantan.

Sungai Wain and the forest surrounding it play an important role for people and local industry in Balikpapan, East Kalimantan. The Sungai Wain forest is the water catchment area for Balikpapan city (Frederiksson and De Kam, 1999) and a habitat for the endangered orangutan, *Pongo pygmaeus* (Linnaeus, 1760).

As a result of our investigation of macrochelid mites in Sungai Wain in 2006–2008, we found 1,564 mite specimens of 22 species belonging to four genera. Three of these spe-

cies are described here as new to science and eight species are new records from Kalimantan.

Materials and Methods

Phoretic beetle hosts examined in the present study were collected in traps baited with fresh human dung or fish fillet set in several kinds of habitat (e.g., *Acacia* plantation, grassland) in Sungai Wain by A. Ueda and D. Dwibadra. All scarab beetle specimens were fixed in 70% ethyl alcohol in the field. Collected specimens from one trap were kept in the same vial. Some mites were collected from the ventral surface of the scarab beetles and others, detached from beetles, were collected from residue in the vials in which the scarabs had been fixed and preserved. All mite specimens were preserved in 70% ethyl alcohol. Some were dissected under a stereoscopic microscope after clearing in lactic acid. Each body part was mounted on a slide in PVA (polyvinyl alcohol-lactic acid mixture) medium. Observations were made with phase contrast and differential interference contrast microscopes. Illustrations were prepared with the aid of a drawing tube.

All measurements are given in micrometres (µm). Dorsal chaetotaxy follows Halliday (1987) and other terminology follows Walter and Krantz (1986b).

The holotype specimen of each new species will be deposited in the collection of the Museum Zoologicum Bogoriense, Cibinong, Bogor, Indonesia (MZB), and the remaining specimens will be divided between the MZB and The Hokkaido University Museum, Sapporo, Japan.

Surveys were conducted at several sites around the Wain

River at Balikpapan, East Kalimantan, Indonesia. Abbreviations of the localities used in the descriptions are as follows:

- BBG: Balikpapan Botanical Garden.
- Km 12 to Km 38: points 12–38 km away from Balikpapan on the road from Balikpapan to Samarinda.
- SWPF: Sungai Wain Protection Forest (= Hutan Lindung Sungai Wain)

Abbreviations for sternal ornamentation used in the descriptions follow Walter and Krantz (1986b) as below:

- a. pf.: area punctiformes
- a. p. l.: area punctata laterales
- a. p. p.: area punctata posteriores
- l. ang.: linea angulata
- l. arc.: linea arcuata
- l. m. t.: linea media transversa
- l. o. a.: linea oblique anteriores
- l. o. p.: linea oblique posteriores

Genus *Glyptholaspis* Filipponi and Pegazzano, 1960
Glyptholaspis asperrima (Berlese, 1905)

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

Macrocheles (Macrocheles) asperrimus: Berlese 1918: 172.

Glyptholaspis asperrima: Filipponi and Pegazzano 1960: 166, fig. 9, tav. XI; 1962: 202; Krantz 1967: 150–152; Roy 1989b: 346–348, figs 10–14.

Material examined. **Km 18:** 1 female, *Acacia mangium* Willd plantation, 23 December 2006, *ex* residue in vial. **Km 22:** 1 female, *A. mangium* plantation, 23 December 2006, *ex* *Onthophagus semicupreus* Harold, 1877. **Km 23:** 3 females, 17–22 December 2007, *ex* residue in vial. **Km 24:** 1 female, *A. mangium* plantation, 21 December 2006, *ex* residue in vial; 2 females, 7–12 December 2008, *ex* residue in vial.

Diagnosis. Female. Dorsal setae z1 half as long as j1; setae j6 and z6 located at same level; J5 as long as Z5; posterior margin of dorsal shield with regularly spaced small teeth between setae Z5. Sternal shield fused with metasternal shield and ornamented with distinct polygonal ornamentation.

Habitat. This species has been collected from the scarab beetle genera *Aphodius*, *Catharsius*, *Copris*, *Onitis*, and *Onthophagus*; otherwise it has been collected from cow dung, compost, manure, etc.

Distribution. Indonesia [Bali, Sulawesi, Flores, Java, Kalimantan (new record)], Philippines, China, India, England, Iceland, Italy, Greece, South Africa, Congo, and North America.

Glyptholaspis confusa (Foà, 1900)

Holostaspis confusus Foà, 1900: 137, figs 5, 5 bis, 6.

Macrocheles (Macrocheles) vagabundus var. *neotropicus* Berlese, 1918: 173 [partim].

Macrocheles plumiventris Evans and Browning, 1956: 36; Filipponi and Seganti 1957: 27; Balogh 1958: 253, figs 26–30.

Macrocheles (Macrocheles) confusus: Filipponi and Ilardi

1958: 118.

Glyptholaspis confusa: Filipponi and Pegazzano 1960: 154, figs 5, 6, tav. VII, VIII; Krantz 1972: 270; Halliday 1986: 73; Hyatt and Emberson 1988: 116; Mašán 2003: 122, figs 124–125.

Material examined. **Km 22:** 1 female, *Acacia mangium* plantation, 23 December 2006, *ex* residue in vial. **BBG:** 3 females, 4–9 December 2008, *ex* residue in vial.

Diagnosis. Female. Dorsal shield large, oval, with punctate-reticulate pattern; posterior margin of dorsal shield between setae Z5 with 5 large denticles and numerous microdenticles; most dorsal setae brush-shaped and densely plumose; setae j5 brush-shaped and longer than z6; setae j6, z5, and 1 unpaired median seta between j6 and J2 pilose; setae z6 and J2 pilose distally; network meshes of sternal and ventrianal shield mostly micropunctured; ventrianal shield with truncate anterior margin; preanal setae short and brush-like.

Habitat. This species has been found from the scarab beetle genera *Aphodius*, *Euoniticellus*, *Liatongus*, and *Onthophagus*. This was also collected from cadavers and in compost heaps, decaying fodder, silage, and bird nests.

Distribution. Indonesia (Kalimantan; new record), Philippines, Japan, Israel, Turkmenistan, Uzbekistan, Australia, New Zealand, British Isles, Germany, Switzerland, Austria, Slovakia, Italy, Bulgaria, Greece, Russia, Caucasus, and Argentina.

Genus *Holostaspella* Berlese, 1903
Holostaspella moderata Berlese, 1920

Holostaspella moderata Berlese, 1920: 188.

Holostaspella moderata: Krantz 1967: 130, figs 52, 54.; Filipponi and Pegazzano 1967: figs III, IV, tav. XIX, 3–4, tav. XX, 2; Roy 1989a: 334–335, figs 11–18.

Holostaspella (Holostaspella) egregia Vitzthum, 1925: 16.

Material examined. **Km 24:** 1 female, 7–12 December 2008, *ex* residue in vial.

Diagnosis. Female. Dorsal shield punctate, j1 plumose, on anterior projection of shield; z1 longer than j1; dorsal setae weakly or strongly pectinate; sternal shield typical for *sculpta* species group; st1 plumose, st2–3 short and smooth; ventrianal shield broader than long with 3 pairs of long preanal setae; Jv2 and Zv2 distinctly pectinate, Jv3 distally pectinate; paranal and postanal setae short and smooth.

Habitat. This species has been collected from banana plantation litter, grassy soil, leaf litter, and a refuse dump.

Distribution. Indonesia [Sumatra, Java, Kalimantan (new record)], Philippines, Japan, India, and Australia.

Genus *Macrocheles* Latreille, 1829
Macrocheles baramensis Evans and Hyatt, 1963

Macrocheles baramensis Evans and Hyatt, 1963: 335–337, figs 15–17.

Macrocheles baramensis: Hartini *et al.* 2003: 307–308.

Material examined. SWPF: 3 females, 20 December 2006, *ex Paragymnopleurus maurus* Sharp, 1875; 6 females, 15–20 December 2007, *ex P. maurus*; 1 female, 11 December 2008, *ex* residue in vial. **Km 15:** 2 females, 19 December 2007, *ex* Scarabaeinae; 2 females, 11 December 2008, *ex P. maurus*. **Km 24:** 2 females, burned ridge, 14–19 December 2007, *ex* residue in vials; 3 females, 14–19 December 2008, *ex P. maurus*; 1 female, burned valleys, 5–10 December 2008, *ex* residue in vial. **Km 12:** 5 females, 15–20 December 2007, *ex* Scarabaeinae.

Diagnosis. Female. Dorsal shield granular, covered with fine reticulations and bearing 28 pairs of setae; j1 pilose in their distal halves, dorsal setae bipectinate in their distal halves, except simple j5, j6, z5, z6, and J2 (in some cases these slightly pilose). Sternal shield granular with faint linear ornamentation.

Habitat. This species has been collected from the scarab beetle genera *Catharsius*, *Onthophagus*, and *Paragymnopleurus*.

Distribution. Indonesia (Kalimantan) and Malaysia (Sarawak).

Macrocheles dispar (Berlese, 1910)

Holostaspis dispar Berlese, 1910: 251.

Macrocheles (Coprholaspis) dispar: Berlese 1918: 151.

Macrocheles dispar: Walter and Krantz 1992: 244, fig. 1D; Hartini and Takaku 2003a: 1262–1263, figs 1–6; Hartini *et al.* 2003: 308.

Material examined. SWPF: 2 females, 14 December 2007, *ex Onthophagus vulpes* Harold, 1877 and *O. cervicapra* Boucomont, 1914; 1 female, 11 December 2008, *ex* residue in vial. **Km 12:** 1 female, 15–20 December 2007, *ex O. schwaneri* Vollenhoven, 1864. **Km 24:** 1 female, 14–19 December 2007, *ex Paragymnopleurus maurus*. **Km 29:** 2 females, 22 December 2006, *ex O. schwaneri*. **Km 38:** 5 females, 16–21 December 2007, *ex Onthophagus* sp., residue in vial.

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 bifurcate; center of posterior half of shield with small punctations.

Habitat. This species has been collected from the scarab beetle genera *Aphodius*, *Catharsius*, *Copris*, *Enoplotrupes*, *Onthophagus*, and *Paragymnopleurus*.

Distribution. Indonesia (Java, Sumatra, Kalimantan, Lombok, and Sulawesi), Viet Nam, Philippines, China (Szechuan), and Taiwan.

Macrocheles entetiensis Hartini and Takaku, 2005

Macrocheles entetiensis Hartini and Takaku, 2005 in Hartini *et al.* 2005: 204–206, figs 1–5.

Material examined. **Km 18:** 5 females, 23 December 2006, *ex Onthophagus schwaneri*, residue in vial. **Km 22:** 8 females, 23 December 2006, *ex* residue in vials. **Km 23:** 4 females, 23 December 2006, *ex O. limbatus* Herbs, 1789; 8 females, *Imperata cylindrical* (L.) grassland, 17–22 December 2007, *ex O. uedai* Ochi and Kon, 2006 and residue in vials. **Km 24:** 33 females, 23 December 2006, *ex O. limbatus* and residue in vials.

Diagnosis. Female. Dorsal setae j1 pilose distally; j3 and z4 thickened and pilose distally; j5, j6, z5, z6, and J2 simple; other dorsal setae pilose distally or pilose in distal half. Sternal shield with distinct l. ang., l. arc., l. m. t., and l. o. p.; l. o. p. disjunct from l. m. t. and not bifurcate.

Habitat. This species has been collected from the scarab beetle genera *Aphodius*, *Catharsius*, and *Onthophagus*.

Distribution. Indonesia [Timor, Sumba, Flores, Sumbawa, Java, and Kalimantan (new record)].

Macrocheles hallidayi Walter and Krantz, 1986

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

Macrocheles hallidayi: Walter and Krantz 1986b: 289, fig. 1b; Takaku 1998: 30–36, figs 1–14; Takaku 2001: 501, figs 3, 9; Takaku and Hartini 2001: 325; Hartini and Takaku 2003a: 1264; Hartini *et al.* 2003: 308; Hartini *et al.* 2005: 202.

Material examined. SWPF: 1 female, 16 December 2006, *ex* residue in vial; 1 female, 20 December 2006, *ex* residue in vial; 2 females, 15 December 2007, *ex Onthophagus schwaneri* and *Catharsius dayacus* Lansberge, 1886; 1 female, 17 December 2007, *ex* residue in vial; 1 female, 5 December 2008, *ex* residue in vial. **Km 12:** 1 female, 15–20 December 2007, *ex O. schwaneri*; **Km 18:** 39 females, 23 December 2006, *ex O. schwaneri*, *O. liliputani* Lansberge, 1883, *Onthophagus* sp., and residue in vials. **Km 22:** 2 females, 23 December 2006, *ex* residue in vials. **Km 23:** 5 females, *Imperata cylindrica* grassland, 17–22 December 2007, *ex* residue in vial; 8 females, *Acacia mangium* plantation, 17–22 December 2007, *ex Catharsius renaudpauliani* Ochi and Kon, 1996 and *O. obscurior* Boucomont, 1914. **Km 24:** 29 females, 21 December 2006, *ex C. dayacus*, residue in vials; 7 females, 26 December 2006, *ex O. limbatus*, residue in vials; 2 females, burned ridge, 14–19 December 2007, *ex O. schwaneri* and *Paragymnopleurus maurus*; 4 females, burned ridge, 6–11 December 2008, *ex* residue in vial; 16 females, *A. mangium* plantation, 7–12 December 2008, *ex* residue in vials; 4 females, *I. cylindrica* grassland, 7–12 December 2008, *ex* residue in vials. **Km 29:** 24 females, 22 December 2006, *ex O. cervicapra*, *O. schwaneri*, *C. renaudpauliani*, and residue in vials. **Km 38:** 1 female, secondary forest, 16–21 December 2007, *ex Onthophagus* sp.

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. bifurcate, with distinct a. p. p. and a. pf. Genu IV with 7 pectinate setae.

Habitat. This species has been collected from the scarab beetle genera *Aphodius*, *Catharsius*, *Copris*, *Heliocopris*, *Microcopris*, *Oniticellus*, *Onitis*, *Onthophagus*, and *Paragymnopleurus*.

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

***Macrocheles jabarensis* Hartini and Takaku, 2003**

Macrocheles jabarensis Hartini and Takaku, 2003a: 1266, figs 7–12.

Macrocheles jabarensis: Hartini *et al.* 2003: 308.

Material examined. SWPF: 32 females, 16 December 2006, *ex Onthophagus semicupreus*, *O. vulpes*, *O. obscurior*, *O. cervicapra*, *O. borneensis* Harold, 1877, *O. pasificus* Lansberge, 1885, *Catharsius dayacus*, and residue in vials; 14 females, 17 December 2006, *ex O. waterstradti* Boucomont, 1914, *O. schwaneri*, *O. borneensis*, and *Onthophagus* sp.; 14 females, 18 December 2006, *ex O. schwaneri*; 30 females, 20 December 2006, *ex O. obscurior*, *O. pastillatus* Boucomont, 1919, *O. cervicapra*, *C. dayacus*, and residue in vials; 53 females, 14 December 2007, *ex C. dayacus*, *O. schwaneri*, *O. waterstradti*, *O. incisus* Harold, 1877, *O. vulpes*, *Paragymnopleurus maurus*, and residue in vials; 3 females, 12 December 2008, *ex O. borneensis*; 4 females, 5 December 2008, *ex* residue in vials; 6 females, 11 December 2008, *ex* residue in vials. **Km 18:** 6 females, *Acacia mangium* plantation, 23 December 2006, *ex* residue in vials. **Km 22:** 6 females, *A. mangium* plantation, 23 December 2006, *ex C. renaudpauliani* and residue in vials. **Km 24:** 1 female, *Imperata cylindrica* grassland, 21 December 2006, *ex O. papulatus* Boucomont, 1914; 5 females, burned secondary forest, 21 December 2006, *ex* residue in vials; 19 females, secondary forest, 21 December 2006, *ex O. aurifex* Harold, 1877, *O. schwaneri*, *O. dux* Sharp, 1875, *C. dayacus*, and residue in vials; 16 females, natural forest, 21 December 2006, *ex O. schwaneri* and residue in vials; 2 females, burned secondary forest, 26 December 2006, *ex* residue in vial; 4 females, *I. cylindrica* grassland, 26 December 2006, *ex* residue in vial; 40 females, *A. mangium* plantation, 26 December 2006, *ex* residue in vial; 4 females, natural forest, 26 December 2006, *ex O. schwaneri*, *O. rudis* Sharp, 1875, and residue in vial; 3 females, burned ridges, 6–11 December 2008, *ex* residue in vials; 2 females, *A. mangium* plantations, 7–12 December 2008, *ex* residue in vials; 8 females, *I. cylindrica* grassland, 7–12 December 2008, *ex* residue in vial. **Km 29:** 165 females, 22 December 2006, *ex O. schwaneri*, *O. cervicapra*, *O. obscurior*, *C. renaudpauliani*, and residue in vials.

Diagnosis. Female. Dorsal setae j1 plumose distally; S5 and Z5 pilose in distal half; J5 entirely pilose; other setae simple (in some cases j4 pilose distally). 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 bifurcate.

Habitat. This species has been collected from the scarab beetle genera *Catharsius*, *Microcopris*, *Onthophagus*, and *Paragymnopleurus*.

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

***Macrocheles kalimantanensis* Hartini and Takaku, 2003**

Macrocheles kalimantanensis Hartini and Takaku, 2003 in Hartini *et al.* 2003: 310–312, figs 1–2.

Material examined. SWPF: 25 females, 16 December 2006, *ex Sisyphus thoracicus* Sharp, 1875, *Onthophagus pasificus*, *O. borneensis*, and residue in vials; 19 females, 17 December 2006, *ex O. semicupreus*, *O. schwaneri*, *O. borneensis*, *Onthophagus* sp., and residue in vials; 7 females, 18 December 2006, *ex S. thoracicus*, *O. waterstradti*, and *O. pastillatus*; 27 females, 20 December 2006, *ex O. obscurior*, *O. cervicapra*, *Paragymnopleurus maurus*, *Catharsius dayacus*, and residue in vials; 38 females, 14 December 2007, *ex O. waterstradti*, *O. incisus*, *O. schwaneri*, *O. cervicapra*, *O. vulpes*, *O. semicupreus*, *C. dayacus*, *P. maurus*, and residue in vials; 16 females, 15 December 2007, *ex C. dayacus*, *P. maurus*, and *O. schwaneri*; 5 females, 15–20 December 2007, *ex Copris* sp.; 4 females, 20–25 December 2007, *ex* residue in vials; 48 females, 11 December 2008, *ex O. borneensis* and residue in vials; 20 females, 12 December 2008, *ex O. obscurior*, *O. borneensis*, *O. pastillatus*, *S. thoracicus*, *P. maurus*, *O. semicupreus*, and *O. bonorae* Zunino, 1976; 6 females, 5 December 2008, *ex* residue in vials; 1 female, 7 December 2008, *ex* residue in vials; 10 females, 10 December 2008, *ex* residue in vials. **Km 12:** 8 females, secondary forest, 15–20 December 2007, *ex O. schwaneri*. **Km 23:** 1 female, *Imperata cylindrica* grassland, 17–22 December 2007, *ex* residue in vial; 1 female, *Acacia mangium* plantation, 17–22 December 2007, *ex* residue in vial. **Km 24:** 1 female, *A. mangium* plantation, 21 December 2006, *ex Caccobius unicornis* (Fabricius, 1798); 21 females, burned secondary forest, 21 December 2006, *ex O. dux*, *P. maurus*, and residue in vial; 16 females, secondary forest, 21 December 2006, *ex O. schwaneri*, *O. aurifex*, *O. vulpes*, *C. dayacus*, and residue in vial; 12 females, natural forest, 21 December 2006, *ex O. schwaneri*, *C. dayacus*, and residue in vial; 10 females, burned secondary forest, 26 December 2006, *ex* residue in vials; 6 females, *I. cylindrica* grassland, 26 December 2006, *ex* residue in vials; 32 females, *A. mangium* plantation, 26 December 2006, *ex O. limbatus* and residue in vials; 14 females, natural forest, 26 December 2006, *ex O. cervicapra*, *O. schwaneri*, *O. rudis*, and residue in vials; 18 females, burned ridge, 14–19 December 2007, *ex C. dayacus*, *P. maurus*, *O. schwaneri*, and residue in vials; 5 females, burned ridges, 19–24 December 2007, *ex* residue in vials; 16 females, burned ridges, 6–11 December 2008, *ex* residue in vials; 20 females, *A. mangium* plantation, 7–12 December 2008, *ex C. renaudpauliani* and residue in vials; 3 females, *I. cylindrica* grassland, 7–12 December 2008, *ex* residue in vials. **Km 29:** 51 females, 22

December 2006, *ex O. schwaneri*, *O. cervicapra*, *C. renaud-pauliani*, and residue in vials. **Km 38:** 3 females, 16–21 December 2007, *ex* residue in vials.

Additional specimens examined, deposited in MZB: **Sumatra:** 1 female, 350 m alt., Mt. Leuser, Ketambe National Park, Nanggroe Aceh Darussalam, 4 September 1989, Habley and D. C. Darling leg., *ex Onthophagus diabolicus* Harold, 1877; 9 females, Biology Research Forest, Andalas University, Padang, West Sumatra, 3–7 November 2001, S. Hartini and G. Takaku leg., *ex Catharsius* sp. and *Onthophagus* sp. **Bali:** 1 female, Pancasari, Sukasada, Buleleng, 3 December 1999, S. Hartini and G. Takaku leg., *ex Catharsius* sp. **Sulawesi:** 1 female, Tountimomoro, North Sulawesi, 27 November 1999, S. Hartini and G. Takaku leg., *ex Copris* sp.

Diagnosis. Female. Dorsal shield oval, attenuate posteriorly; j1 plumose in distal half; z1 simple; j5 and z5 slightly pilose or simple; j6 simple; z6 and J2 simple but in some cases slightly pilose; other dorsal setae pilose; l. ang., l. arc., l. m. t., and l. o. p. with punctations along lines.

Habitat. This species has been collected from the scarab beetle genera *Catharsius*, *Copris*, *Microcopris*, *Onthophagus*, *Paragymnopleurus*, and *Sisyphus*.

Distribution. Indonesia [Kalimantan; Sumatra, Bali, and Sulawesi (new records)].

Macrocheles kraepelini (Berlese, 1905)

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

Macrocheles (Cophrolaspis) kraepelini: Berlese 1918: 146; Vitzthum 1926: 34–35.

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

Macrocheles kraepelini: Krantz and 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 and Krantz 1986a: 212–213, figs 1–3; Walter and Krantz 1986b: 289; Halliday 2000: 298–299; Takaku 2001: 500–501, figs 2, 8; Hartini and Takaku 2003a: 1264.

Material examined. SWPF: 1 female, 15–20 December 2007, *ex Copris* sp.; 1 female, 7 December 2008, *ex* residue in vial; 1 female, 13 December 2008, *ex* residue in vial. **Km 18:** 1 female, *Acacia mangium* plantation, 23 December 2006, *ex* residue in vial. **Km 22:** 1 female, *A. mangium* plantation, 23 December 2006, *ex* residue in vial. **Km 24:** 2 females, *A. mangium* plantation, 26 December 2006, *ex* residue in vial; 4 females, burned ridge, 14–19 December 2007, *ex Onthophagus dux*, *O. schwaneri*, and residue in vials; 1 female, burned valley, 5–10 December 2008, *ex* residue in vial; 1 female, *Imperata cylindrica* grassland, 7–12 December 2008, *ex* residue in vial. **Km 29:** 1 female, 22 December 2006, *ex* residue in vial. **Km 38:** 6 females, secondary forest, 16–21 December 2007, *ex* residue in vials.

Diagnosis. Female. Dorsal shield broadly rounded posteriorly; most of dorsal setae enlarged and pilose, except for simple setae j6, z5, z6, and J2; seta z1 occasionally pilose. Sternal shield with distinct ornamentation; l. ang. with

many punctations; posterior l. arc. concave; l. o. p. bifurcate; a.p.p. with strong punctations. Genu IV with 6 pectinate setae.

Habitat. This species has been collected from the scarab beetle genera *Catharsius*, *Microcopris*, *Onthophagus*, and *Paragymnopleurus*.

Distribution. Indonesia (Java, Kalimantan, and Sumatra), Malaysia, Philippines, Singapore, Thailand, Vietnam, India, Pakistan, Australia, Caroline Islands, Fiji, and Samoa.

Macrocheles mammifer Berlese, 1918

Macrocheles mammifer Berlese, 1918: 146, 162, 171.

Holostaspis polyornata Turk, 1948: 105.

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

Macrocheles postneri Krauss, 1970: 28.

Macrocheles tridentatus: Delfinado and Baker 1975: 53, not Pearse and Wharton 1936 in Pearse *et al.* 1936: 473 (misidentification).

Macrocheles mammifer: Bregetova 1977: 363; Wallace 1986: 11; Krantz and Whitaker 1988: 236.

Material examined. **Km 22:** 1 female, *Imperata cylindrica* grassland, 23 December 2006, *ex* residue in vial.

Diagnosis. Dorsal shield widely rounded, reticulate and micropunctured; lateral and marginal dorsal setae plumose distally except for s2, s6, and r4; 8 pairs of dorsocentral and mediolateral dorsal setae (j2, j5, j6, J2, J5, z1, z5, and z6) smooth and needle-like; j1 brush-like, z2 pilose distally; ventral shield sculptured; sternal shield sparsely and irregularly punctured; sculptural lines absent; surface of epigyneal and ventrianal shield reticulate; ventrianal shield wider than long, with micropunctuation in lateral areas.

Habitat. This species has been collected from scarab beetles and decaying substrates.

Distribution. Indonesia (Kalimantan; new record), Malaysia, Singapore, Philippines, Israel, Australia, Micronesia, Spain, Germany, Poland, Slovakia, Russia, USA, Trinidad, Cuba, and Argentina.

Macrocheles merdarius (Berlese, 1889)

Holostaspis merdarius Berlese, 1889, fasc. 52(1), fig. 103.

Macrocheles merdarius: Filipponi and Pegazzano, 1963: 83–88, figs V, VI, tav. XXIV; Takaku and Hartini 2001: 326–327; Hartini and Takaku 2003a: 1265; Hartini *et al.* 2003: 309; Hartini *et al.* 2005: 204; Hartini and Takaku 2006: 32.

Material examined. **Km 22:** 4 females, *Imperata cylindrica* grassland, 23 December 2006, *ex* residue in vial; **Km 24:** 1 female, *Acacia mangium* plantation, 26 December 2006, *ex* residue in vial.

Diagnosis. Female. All dorsal setae simple. L. o. a. of sternal shield connected by transverse lines; punctations very faint. Genu IV with 6 setae.

Habitat. This species has been collected from the scarab

beetle genera *Aphodius*, *Catharsius*, *Copris*, *Coptodactyla*, *Euoniticellus*, *Lepanus*, *Liatongus*, *Notopedana*, *Onthophagus*, *Pentodon*, *Coptodactyhanaeus*, and *Synapsidis*, the geotrupid beetle genus *Geotrupes*, the histerid beetle genus *Pachylister*, and from beetles of other families including Lucanidae, Silphidae, and Trogidae. It has also been recorded from rodents, soil, leaf litter, cow dung, compost, manure, etc.

Distribution. Cosmopolitan. In Indonesia, this species is known from Java, Kalimantan, Sulawesi, Bali, Lombok, Flores, Sumbawa, Sumba, and West Papua.

Macrocheles muscaedomesticae (Scopoli, 1772)

Acarus muscaedomesticae Scopoli, 1772: 125, 157.

Macrocheles muscaedomesticae: Pereira and de Castro 1945: 16–178, figs 1–22.

Material examined. SWPF. 1 female, 16 December 2006, *ex Catharsius dayacus*; 1 female, 20 December 2006, *ex* residue in vial; 1 female, 14 December 2007, *ex Onthophagus schwaneri*. **Km 24:** 1 female, burned secondary forest, 21 December 2006, *ex O. waterstradti*. **Km 29:** 1 female, 22 December 2006, *ex* residue in vial.

Diagnosis. Dorsal shield ornamented with reticulate pattern; j1 plumose in distal third; j5, j6, J2, z1, z5, and z6 simple; other dorsal setae pilose in their distal third; sternal shield with punctures and ridges.

Habitat. This species has been collected from various kinds of animals, *e.g.*, beetles, flies, moths, rodents, birds, etc., and various habitats, *e.g.*, litter, rotting seaweed, bumble bee nests, compost, poultry manure, etc.

Distribution. Cosmopolitan. In Indonesia, this species is known from Java and Kalimantan (new record).

Macrocheles persimilis Hartini, Dwibadra and Takaku, 2007

Macrocheles persimilis Hartini, Dwibadra and Takaku, 2007: 82–83, 85, fig. 3.

Material examined. **Km 22:** 1 female, 23 December 2006, *ex* residue in vial. **Km 24:** 1 female, 26 December 2006, *ex* residue in vial.

Diagnosis. Dorsal shield oval, attenuate posteriorly; surface ornamented with distinct reticulations and punctations; lateral margin smooth; dorsal shield with 28 pairs of setae; j1–4 pilose distally; j5, j6, z1, z5, z6, and J2 simple; other dorsal setae pilose; sternal shield with one or two l. arc.

Habitat. This species has been collected from the scarab beetle genus *Onthophagus*.

Distribution. Indonesia [Sulawesi and Kalimantan (new record)].

Macrocheles sumbaensis Hartini and Takaku, 2005

Macrocheles sumbaensis Hartini and Takaku, 2005 in Hartini *et al.* 2005: 206–207, figs 6–11.

Material examined. **Km 23:** 1 female, *Acacia mangium* plantation, 23 December 2006, *ex* residue in vial.

Diagnosis. Dorsal shield oval, surface ornamented with distinct reticulation and punctations; 28 dorsal setae; setae j1, Z4, Z5, and S5 pilose distally; J5 entirely pilose; other setae simple. Sternal shield with granular ornamentation, short lines and punctation in edges of shields; epygynial shield ornamented with punctate reticulation.

Habitat. This species has been collected from scarab beetles of the genus *Aphodius* and from the histerid beetle *Pachylister lutarius* (Erichson, 1834).

Distribution. Indonesia [Sumba and Kalimantan (new record)].

Macrocheles dayaci Dwibadra and Takaku sp. nov.
(Fig. 1)

Type series. Holotype (MZB. Acar. 7559.2): female, Hutan Lindung Sungai Wain, Balikpapan, East Kalimantan, 20 December 2006, *ex Catharsius dayacus*, A. Ueda and D. Dwibadra leg. Paratypes: 1 female, data same as in holotype; **Km 24:** 2 females, 26 December 2006, *ex* residue in vial.

Description. *Female.* Length of dorsal shield 1035 (1020–1050), width at level of coxae II 627.5 (600–660) ($n=4$). Specimens reddish brown in color.

Dorsum (Fig. 1A). Dorsal shield broadly rounded posteriorly with procurved outline, surface of shield covered with strong punctations and reticulation; lateral margin of shield smooth; shield bearing 28 pairs of dorsal setae and 22 pairs of pores; seta j1 pilose distally; z1 simple; other setae pilose distally.

Venter (Fig. 1B). Sternal shield wider than long; length 178.8 (175–180), width at level of coxae II 207.5 (200–210) ($n=4$); shield with 3 pairs of simple setae and 2 pairs of pores; l. ang. and l. m. t. present; l.o.a. with faint punctation; two punctate l. arc. distinct; l. o. p. present as distinct line, with punctations, connected to l. m. t.; a. p. p. with strong and coarse punctations. Metasternal shields oval and free; each shield with 1 simple seta and anterior pore.

Width of epygynial shield 273.8 (270–275) ($n=4$); shield ornamented with punctations, with pair of simple setae on the posterior corner.

Ventrianal shield longer than wide, length 411.3 (400–420), width 317.5 (295–340) ($n=4$); shield with strong, dimpled reticulation and punctations; 3 pairs of preanal setae, 1 pair of paranal setae, and 1 postanal seta present; postanal seta pilose, other setae simple; cribrum located posterior to postanal seta.

Gnathosoma (Fig. 1C). Well developed and sclerotized. Deutosternal groove with 6 rows of denticles, anteriormost row divided; 3 pairs of simple hypostomal setae and 1 pair of simple palpcoxal setae present. Epistome (Fig. 1E) with median process and pair of lateral elements; median process bifurcate distally, and lacking minute spicules; basal margin serrate. Fixed digit of chelicera (Fig. 1D) with simple dorsal seta, robust median tooth, small distal tooth, *pilus dentilis*, and terminal hook; movable digit with robust bidentate median tooth, small distal tooth, and terminal hook; length of

Fig. 1. *Macrocheles dayaci* Dwibadra and Takaku, sp. nov., female, holotype (MZB. Acar. 7559.2). A, dorsal shield; B, ventral shield (paratype, MZB. Acar. 7560.2); C, ventral view of gnathosoma; D, chelicera; E, tectum (paratype, MZB. Acar. 7559.1). Scale bars: 200 μ m (A, B); 50 μ m (C–E).

fixed digit 220 (200–230) and movable digit 96.9 (95–100) ($n=4$).

Legs. Most leg segments with simple and pilose setae ex-

cept for coxae I–IV; trochanter I–III and tarsus I with only simple setae. Leg chaetotaxy typical for this genus. Genu IV with 6 pilose setae. Leg length (excluding ambulacrum,

$n=4$); leg I, 758.8 (720–830); leg II, 715.6 (647.5–765); leg III, 702.5 (660–760); leg IV, 1007.5 (945–1045).

Sacculus foemineus. Not observed.

Male and other stages. Unknown.

Etymology. The specific name is derived from the specific epithet of the phoretic host, the scarab beetle *Catharsius dayaci*.

Remarks. *M. dayaci* is a member of the *glaber* species group and is similar to *M. witcoskyanus* Walter and Krantz, 1986 (Walter and Krantz 1986b) in the shape of dorsal setae and shield sternal ornamentation. However, *M. dayaci* is distinguishable from *M. witcoskyanus* by the following characters (corresponding conditions of *M. witcoskyanus* in parentheses): 1) j4 and j5 pilose distally (simple); 2) z5 and j6 in some cases slightly pilose (simple); and 3) ventrianal shield not expanded, longer than wide (expanded laterally, wider than long).

Macrocheles riparius Dwibadra and Takaku sp. nov.
(Fig. 2)

Type series. Holotype (MZB. Acar. 7566): female, Hutan Lindung Sungai Wain, Balikpapan, East Kalimantan, 20 December 2006, *ex* residue in vial, A. Ueda and D. Dwibadra leg. Paratypes: **SWPF**: 5 females, 17 December 2006, *ex* *Onthophagus semicupreus*, *O. waterstradti*, and residue in vials; 2 females, 20 December 2006, *ex* residue in vial; 1 female, 12 December 2008, *ex* residue in vial, other data same as holotype. **Km 24**: 2 females, Balikpapan, East Kalimantan, 21 December 2006, *ex* *O. schwaneri*, residue in vial.

Description. *Female.* Length of dorsal shield 731.5 (680–770), width at level of coxae II 467.5 (410–510) ($n=10$). Specimens yellowish brown in color.

Dorsum (Fig. 2A). Dorsal shield with distinct punctations and reticulation; lateral margin of shield smooth; shield bearing 28 pairs of dorsal setae and 22 pairs of pores; seta j1 and Z5 pilose distally; J5 entirely pilose, r2 simple but sometimes slightly pilose; other setae simple.

Venter (Fig. 2B). Sternal shield wider than long; length 144 (130–150), width at level of coxae II 154.5 (150–160) ($n=10$); shield with 3 pairs of simple setae and 2 pairs of pores; l. ang. with punctation, disjunct from l. arc.; l. o. a. punctate; two l. arc. present as irregular punctate lines; l. m. t. punctate; l. o. p. present as paired transverse lines, with punctations, not connected to l. m. t.; two a. p. l. present. Metasternal shields oval and free; each shield with 1 simple seta and an anterior pore.

Width of epigynial shield 184.5 (160–200) ($n=10$); shield ornamented with punctations and pair of simple setae.

Ventrianal shield longer than wide; length 260 (235–280), width 221 (195–245) ($n=10$); shield ornamented with reticulation and punctations; 3 pairs of preanal setae, 1 pair of paranal setae, and 1 postanal seta present; postanal seta pilose, other setae simple; cribrum located posterior to postanal seta.

Gnathosoma (Fig. 2C). Well developed and sclerotized, differing from that of *Macrocheles dayaci* only in median process of epistome (Fig. 2E) bearing many small spicules.

Chelicera (Fig. 2D) same as in *M. dayaci*; length of fixed digit 217.5 (210–220) and movable digit 69.8 (67.5–72.5) ($n=10$).

Legs. Most leg segments with simple and pilose setae except for coxae I–IV, trochanters I–III and tarsus I with only simple setae. Leg chaetotaxy typical for this genus. Genu IV with 6 pilose setae. Leg length (excluding ambulacrum, $n=10$); leg I, 638.5 (610–665); leg II, 615 (585–680); leg III, 573.5 (525–625); leg IV, 847.5 (815–930).

Sacculus foemineus (Fig. 2F). Pair of sacculi present; cornu distinct, small and rounded distally; spermatheca oval.

Male and other stages. Unknown.

Etymology. This specific name alludes to its occurrence around the Wain River.

Remarks. The sternal punctate ornamentation of the present species is similar in pattern to that of *Macrocheles adenostictus* Krantz and Whitaker, 1988 (Krantz and Whitaker 1988) recorded from the USA. However, *M. riparius* is distinguishable by the following characters (corresponding conditions of *M. adenostictus* in parentheses): 1) most dorsal setae, including setae of z-Z and s-S series, simple (all z-Z and s-S series setae strongly pilose distally); and 2) ophiogastric setae simple (weakly pilose distally).

Macrocheles wainensis Dwibadra and Takaku sp. nov.
(Fig. 3)

Type series. Holotype (MZB. Acar. 7562): female, Hutan Lindung Sungai Wain, Balikpapan, East Kalimantan, 20 December 2006, *ex* *O. semicupreus*, A. Ueda and D. Dwibadra leg. Paratypes: **SWPF**: 1 female, 16 December 2006, *ex* residue in vial; 1 female, 17 December 2006, *ex* *O. semicupreus*; 1 female, 18 December 2006, *ex* *O. semicupreus*; 2 females, 20 December 2006, *ex* *O. semicupreus* and *Phaeocroops* sp.; **Km 24**: 1 female, 21 December 2006, *ex* *O. dux*; 2 females, 26 December 2006, *ex* *O. rudis* and residue in vial; 1 female, 5–10 December 2008, *ex* residue in vial.

Description. *Female.* Length of dorsal shield 674 (640–740), width at level of coxae II 417.5 (400–460) ($n=10$). Specimens yellowish brown in color.

Dorsum (Fig. 3A). Dorsal shield oval, attenuate posteriorly, strongly punctate laterally; punctation and reticulation indistinct in center of anterior half; lateral margin of shield smooth; shield bearing 28 pairs of dorsal setae and 22 pairs of pores; seta j1 pilose distally; z1 simple and reaching to insertion of j2; j5, j6, z5, z6, and J2 simple; other setae pilose entirely or in distal 2/3; some podonotal setae (*e.g.*, z4–6) inserted on tubercles.

Venter (Fig. 3B). Sternal shield wider than long; length 139.5 (130–150), width at level of coxae II 154 (150–160) ($n=10$); shield with 3 pairs of simple setae and 2 pairs of pores; l. ang. present; l. arc. and l. m. t. present as punctate transverse line; paired a. p. l. present; l. o. p. present as punctate line; a. p. p. producing scattered punctations and not reaching to l. m. t. Metasternal shields oval and free; each shield with 1 simple seta and anterior pore.

Width of epigynial shield 171.5 (160–185) ($n=10$); shield

Fig. 2. *Macrocheles riparius* Dwibadra and Takaku, sp. nov., female, holotype (MZB. Acar. 7566). A, dorsal shield (paratype, MZB. Acar. 7565.2); B, ventral shield; C, ventral view of gnathosoma (paratype, MZB. Acar. 7565.2); D, chelicera; E, tectum; F, sacculus foeminus (paratype, MZB. Acar. 8205). Scale bars: 50 μ m.

Fig. 3. *Macrocheles wainensis* Dwibadra and Takaku, sp. nov., female, holotype (MZB. Acar. 7562). A, dorsal shield; B, ventral shield; C, ventral view of gnathosoma (paratype, MZB. Acar. 7564); D, chelicera (paratype, MZB. Acar. 7563); E, tectum; F, sacculus foeminus (paratype, MZB. Acar. 8217). Scale bars: 100 μ m (A, B); 50 μ m (C–F).

ornamented with punctuations and one pair of simple setae on the posterior corner.

Ventrianal shield longer than wide, length 234.5 (220–245), width 200.5 (185–220) ($n=10$); shield ornamented with semiconcentric lines and reticulation; 3 pairs of preanal setae, 1 pair of paranal setae, and 1 postanal seta present; postanal seta pilose and other setae simple; cribrum located posterior to postanal seta.

Gnathosoma (Fig. 3C). Well developed and sclerotized. Features of gnathosoma, epistome (Fig. 3E), and chelicerae (Fig. 3D) similar to those of *Macrocheles riparius*. Length of fixed digit 198.5 (190–205) and that of movable digit 65.5 (63.8–67.5) ($n=10$).

Legs. Most leg segments with simple and pilose setae except for coxae I, III, and IV; trochanter I and tarsus I with only simple setae. Leg chaetotaxy typical for this genus. Genu IV with 6 pilose setae. Leg length (excluding ambulatorium, $n=10$); leg I, 521.5 (490–550); leg II, 518 (490–560); leg III, 476.8 (450–500); leg IV, 691.5 (620–770).

Sacculus foemineus (Fig. 3F). Very similar to that of *Macrocheles riparius*.

Male and other stages. Unknown.

Etymology. This specific name is derived from the type locality.

Remarks. *M. wainensis* is a member of the *glaber* species group. The pattern of sternal ornamentation in *M. wainensis* is similar to that of *M. nataliae* Bregetova and Koroleva, 1960 from Slovakia, as illustrated by Mašán (2003). Most of the dorsal setae are more or less pilose in *M. wainensis* whereas setae j1, r2–r4, J5, Z4, Z5, and S5 are pilose and the other setae are simple in *M. nataliae*. There is some variation in the distribution of pilose setae in *M. nataliae*, as was noted in the drawing and description by Bregetova and Koroleva (1960), and as has been discussed by Hyatt and Emberson (1988). Also the pilose setae of specimens from Kalimantan are stronger in pilosity and mostly inserted in the tubercles. The dorsal setae in the present species are similar in shape to those of *M. sukabumiensis* Hartini and Takaku, 2003 (Hartini and Takaku 2003a), but the shapes of j5, j6, z5, z6, and J2 differ. Those setae are simple in *M. wainensis*, but pilose in *M. sukabumiensis*.

Genus *Neopodocinum* Oudemans, 1902

Neopodocinum bosschai (Oudemans, 1901)

Emeus bosschai Oudemans, 1901: 290–291, pl. VIII, figs 16–18.

Cosmiphis bosschai: Vitzthum 1925: 33–36; 1926: 88–92, figs 55–57; Krantz 1965: 206; Hartini and Takaku 2004: 77–89, figs 1–21.

Material examined. SWPF: 4 males, 7 deutonymphs, 5 protonymphs, 16 December 2006, ex *Catharsius dayacus*, residue in vials; 1 female, 2 males, 2 deutonymphs, 3 protonymphs, 20 December 2006, ex *Paragymnopleurus maurus* and residue in vials; 6 males, 3 deutonymphs, 6 protonymphs, 14 December 2007, ex *C. dayacus*, *Onthophagus schwaneri*, *O. waterstradti* and residue in

vial; 1 male, 1 deutonymph, 15 December 2007, ex *C. dayacus*; 2 males, 15–20 December 2007, ex residue in vial; 1 male, 4 deutonymphs, 20–25 December 2007, ex residue in vial. **Km 15:** 1 protonymph, 19 December 2007, ex Scarabaeinae. **Km 18:** 1 deutonymph, *Acacia mangium* plantation, 23 December 2006, ex residue in vial. **Km 22:** 12 females, 2 deutonymphs, 1 protonymph, *A. mangium* plantation, 23 December 2006, ex *O. schwaneri*, *C. renaudpauliani*, and residue in vials. **Km 23:** 1 female, 1 male, 23 December 2006, ex *C. renaudpauliani*; 5 females, 4 males, 3 deutonymphs, 1 protonymph, 17–22 December 2007, ex residue in vial; 4 females, 2 males, 4 deutonymphs, *A. mangium* plantation, 17–22 December 2007, ex *C. renaudpauliani*, *O. obscurior*, and residue in vial. **Km 24:** 1 male, *A. mangium* plantation, 21 December 2006, ex residue in vial; 3 females, 1 protonymph, 21 December 2006, ex *C. renaudpauliani*; 1 female, 1 deutonymph, burned secondary forest, 21 December 2006, ex *C. dayacus*; 1 female, 2 males, 1 deutonymph, 2 protonymphs, secondary forest, 21 December 2006, ex *C. dayacus*, *S. thoracicus*, and residue in vials; 1 male, 1 deutonymph, natural forest, 21 December 2006, ex residue in vial; 2 females, 1 male, *Imperata cylindrica* grassland, 26 December 2006, ex *C. renaudpauliani* and residue in vial; 12 females, 6 males, 9 deutonymphs, 7 protonymphs, *A. mangium* plantation, 26 December 2006, ex *C. renaudpauliani*, *O. schwaneri*, *O. limbatus*, and residue in vial; 2 females, 1 male, 3 deutonymphs, 4 protonymphs, natural forest, 26 December 2006, ex *C. dayacus*, *O. vulpes*, and residue in vials; 2 females, 1 male, 1 deutonymph, 1 protonymph, burned ridge, 14–19 December 2007, ex *C. dayacus*, *O. schwaneri*, *O. dux*, and *P. maurus*; 1 male, 1 deutonymph, 1 protonymph, burned ridge, 19–20 December 2007, ex residue in vial; 2 deutonymphs, 6–11 December 2008, ex residue in vial; 1 female, 2 males, 3 deutonymphs, 1 protonymph, 7–12 December 2008, ex *C. renaudpauliani* and residue in vials; 1 female, 1 male, *I. cylindrica* grassland, 7–12 December 2008, ex residue in vial. **Km 29:** 19 females, 7 males, 4 deutonymphs, 5 protonymphs, 22 December 2006, ex *O. schwaneri*, *O. cervicapra*, *C. renaudpauliani*, and residue in vials.

Diagnosis. Dorsal shield of female oval, attenuate posteriorly; insertions of most pairs of dorsal setae connected by transverse ridges; shield with more than 40 pairs of dorsal setae, podonatal setae pilose in their distal half or 2/3; opisthonotal setae broadened and pectinate; l. m. t. in sternal shield complete.

Habitat. This species has previously been collected from *Heliocopris* sp., *Onthophagus schwaneri*, *Catharsius molossus* (Linnaeus, 1758), *Paragymnopleurus maurus*, and decaying leaves.

Distribution. Indonesia (Sumatra and Kalimantan).

Neopodocinum kalimantanense Hartini and Takaku, 2004

Neopodocinum kalimantanense Hartini and Takaku, 2004: 77–89, figs 22–26.

Material examined. SWPF: 5 females, 16 Decem-

ber 2006, *ex Catharsius dayacus* and residue in vials; 9 females, 20 December 2006, *ex C. dayacus*, *Paragymnopleurus maurus*, and residue in vials; 7 females, 14 December 2007, *ex C. dayacus*, *O. schwaneri*, and residue in vial; 1 female, 10 December 2008, *ex* residue in vial; 1 female, 15 December 2007, *ex C. dayacus*; 4 females, 20–25 December 2007, *ex* residue in vial. **Km 24:** 7 females, secondary forest, 21 December 2006, *ex C. dayacus*, *Sisyphus thoracicus*, and residue in vials; 1 female, natural forest, 26 December 2006, *ex* residue in vial; 1 female, burned ridge, 14–19 December 2007, *ex O. schwaneri*; 1 female, *Acacia mangium* plantation, 7–12 December 2008, *ex* residue in vial.

Diagnosis. Females. Dorsal shield oval, bearing more than 50 pairs of dorsal setae and 22 pores; insertions of most dorsal setae away from midline and connected by short transverse ridges; lateral margin smooth; most podonotal setae pilose; medial setae from J5 to posteromarginal setae simple and short; lateral and marginal setae pectinate. Sternal shield with complete l. m. t.; all sternal setae simple and long, surpassing insertions of setae behind them.

Habitat. This species has previously been collected from *Catharsius molossus*.

Distribution. Indonesia (Kalimantan).

Neopodocinum maius Berlese, 1911

Neopodocinum maius Berlese, 1911: 431.

Neopodocinum cophrophilum Vitzthum, 1925: 20–21; 1926: 40–52, figs 25–34.

Neopodocinum maius: Krantz 1965: 185–187, figs 47–48; Hartini and Takaku 2004: 78.

Material examined. SWPF: 3 females, 4 males, 4 protonymphs, 16 December 2006, *ex Catharsius dayacus* and residue in vials; 3 females, 4 males, 1 protonymph, 20 December 2006, *ex Onthophagus borneensis*, *Paragymnopleurus maurus* and residue in vials; 1 female, 2 protonymphs, 20 December 2006, *ex* 4 females, 3 males, 1 deutonymph, 1 protonymph, 14 December 2007, *ex O. schwaneri* and *C. dayacus*; 1 deutonymph, 3 protonymphs, 15 December 2007, *ex C. dayacus*; 1 male, 1 deutonymph, 15–20 December 2007, *ex* residue in vial; 5 females, 20–25 December 2007, *ex* residue in vial. **Km 24:** 1 female, burned

secondary forest, 21 December 2006, *ex C. dayacus*; 2 females, 1 protonymph, natural forest, 21 December 2006, *ex* residue in vials; 1 female, 1 deutonymph, natural forest, 26 December 2006, *ex C. dayacus* and residue in vials; 1 protonymph, burned ridge, 14–19 December 2007, *ex P. maurus*; 1 deutonymph, burned ridge, 19–24 December 2007, *ex* residue in vial; 2 females, 1 protonymph, burned ridge, 6–11 December 2008, *ex* residue in vial. **Km 29:** 1 protonymph, 22 December 2006, *ex C. renaudpauliani*.

Diagnosis. Female. Dorsal shield oval, bearing 28 pairs of setae; j1 and z1 plumose distally; unpaired seta Jx absent. Sternal shield broader than long; l. m. t. complete; anal shield expanded laterally, subtriangular, without preanal setae; ophistogastric setae pectinate or smooth.

Habitat. This species has previously been collected from *Heliocopris* sp., *Catharsius molossus*, and *Onthophagus* sp.

Distribution. Indonesia (Sumatra and Kalimantan).

Neopodocinum subjaspersi Hartini and Takaku, 2003

Neopodocinum subjaspersi Hartini and Takaku, 2003b: 56–64, figs 26–29, 32–52, 56.

Neopodocinum subjaspersi: Hartini and Takaku 2004: 86.

Material examined. SWPF: 4 females, 1 male, 1 deutonymph, 6 protonymphs, 16 December 2006, *ex Onthophagus* sp., and residue in vials; 1 male, 1 protonymph, 20 December 2006, *ex Onthophagus* sp. and residue in vial; 7 females, 8 males, 10 deutonymphs, 19 protonymphs, 14 December 2007, *ex O. schwaneri*, *O. borneensis*, *O. incisus*, *O. vulpes*, *O. semicupreus*, *Catharsius dayacus*, and residue in vial; 2 females, 15 December 2007, *ex C. dayacus* and residue in vial; 1 female, 1 deutonymph, 1 protonymph, 15–20 December 2007, *ex Copris* sp. and residue in vial; 1 female, 20–25 December 2007, *ex* residue in vial. **Km 24:** 1 female, 1 deutonymph, natural forest, 21 December 2006, *ex C. dayacus* and residue in vial; 1 female, 1 male, burned ridge, 19–24 December 2007, *ex* residue in vial. **Km 29:** 1 female, 22 December 2006, *ex O. schwaneri*.

Diagnosis. Female. Dorsal shield oval, attenuate posteriorly; surface strongly punctate posteriorly; lateral margin smooth; shield bearing 28 pairs of setae and 22 pairs of

Table 1. Number of macrochelid mite species on Indonesian islands and other islands in the surrounding area, number of species common to Kalimantan and each island or country, and Sørensen's coefficient index. The number of species recorded from Kalimantan is 27, including the results of the present study. Data on species numbers are based on serial works by Hartini and Takaku, *e.g.*, Hartini and Takaku (2003a–c); Takaku *et al.* (2012), etc.

	Philippines	Sumatra	Java	Sulawesi	Lesser Sunda Islands	New Guinea Island
Number of species recorded from Indonesian islands and surrounding area	21	21	36	20	19	17
Number of species common to Kalimantan and each island or country	9	14	14	9	7	2
Sørensen's coefficient index* between Kalimantan and each island or country	0.38	0.58	0.44	0.38	0.30	0.09

*: Sørensen's coefficient index = $2c / (a + b)$ (a: number of species recorded from area 1; b: number of species recorded from area 2; c: number of species common between area 1 and 2).

pores; unpaired seta Jx present; setae j1 broad and plumose; setae z1 short and plumose; setae j2, s2, s6, r2, J2, S1–5 pilose, other setae simple.

Habitat. This species has previously been collected from *Onthophagus* sp. and *C. molossus*.

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

Discussion

As a result of our investigation of macrochelid mites in East Kalimantan, eight species were newly recorded from Kalimantan, three new species were added to the Kalimantan macrochelid fauna, and the number of species of the family recorded as inhabiting the territory reached to 27 in total. Data on the number of species on some Indonesian islands and other islands in the area, the number of species common between islands, and Sørensen's similarity index are shown in Table 1. To date, the number of species in Kalimantan is similar to the number in the other Major Sunda Islands, i.e., Sumatra and Java. It has been well documented that species diversity of an island can be affected by island size (MacArthur and Wilson 1967). Larger islands generally support more species than smaller ones. Hartini (2005) reported that larger islands tend to harbour more macrochelid species than smaller one in Indonesia. Kalimantan is larger than other Major Sunda Islands, i.e.: Java (134,045 km²), Sumatra (524,100 km²), and the Indonesian part of Borneo (539,460 km²) (MacKinnon *et al.*, 1996), so the number of species in Kalimantan might be expected to exceed the number in Java and Sumatra. Of course, as Hartini (2005) mentioned, more humid and warmer islands tend to support more species than drier and cooler ones in Indonesia, since species number may be affected by precipitation, humidity, geological history, diversity of carrier species, and other biological or meteorological factors. In future studies we need to compare such data and analyze which factors affect diversity of these mites on the basis of plenty of faunal data.

Sørensen's coefficient index (Sørensen 1948), indicating similarity of fauna between two areas, is high between Kalimantan and Sumatra and between Kalimantan and Java. As well, several species in Kalimantan are common to the fauna of other surrounding islands, e.g., Sulawesi and the Philippines. These similarities may be due to the geological history of these islands and/or the dispersal ability of the phoretic vehicles, dung beetles. However, there has been no comprehensive study on phoretic macrochelid mites in most parts of Kalimantan and surrounding areas, and we lack enough data to conclude anything definite from our results. We need to study the Indonesian and SE Asian fauna further, and accumulate more data on the macrochelid mite and dung beetle faunas.

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