

ORIGINAL ARTICLE

# Macrochelid mite fauna in the eastern part of the Lesser Sunda Islands, with description of two new species

Sri HARTINI<sup>1</sup>, Gen TAKAKU<sup>2</sup>, Jun-ichi KOJIMA<sup>3</sup> and Haruo KATAKURA<sup>4</sup>

<sup>1</sup>Zoology Division (Museum Zoologicum Bogoriense), Research Center for Biology-LIPI, Cibinong, Bogor, Indonesia; <sup>2</sup>Biological Laboratory, Hokkaido University of Education, Sapporo, Sapporo, <sup>3</sup>Natural History Laboratory, Faculty of Sciences, Ibaraki University, Mito and <sup>4</sup>Division of Biological Sciences, Graduate School of Science, Hokkaido University, Sapporo, Japan

## Abstract

Thirteen species in four genera of mites of the family Macrochelidae phoretic on dung beetles were collected in the eastern part of the Lesser Sunda Islands, Indonesia, providing the first record of the family for that area. Of these, two species, *Macrocheles entetiensis* Hartini and Takaku, sp. nov. and *Macrocheles sumbaensis* Hartini and Takaku, sp. nov., are new to science. The remaining 11 species are *Glyptholaspis fimicola*, *Holostaspella bifoliata*, *Macrocheles baliensis*, *Macrocheles* sp. aff. *glaber*, *M. hallidayi*, *M. kraepelini*, *M. krantzi*, *M. limue*, *M. merdarius*, *M. oigru* and *Neopodocinum sinicum*.

**Key words:** dung beetle, Indonesia, Macrochelidae, phoretic mite.

## INTRODUCTION

The Lesser Sunda Islands, stretching from Bali in the west to Timor and Wetar in the east, are of particular interest from a zoogeographic point of view in that the islands occupy the southern part of Wallacea, the transitional zone between the Oriental and Australian regions.

As a part of our serial studies on the taxonomy and biogeography of Indonesian macrochelid mites associated with dung beetles, the present paper deals with 13 species, including two new species, that were collected on Flores and Sumba islands and from the western part of Timor Island in Wallacea. This is the first report of macrochelid mites from the region.

## MATERIALS AND METHODS

The present study was based on mite specimens collected mainly on Sumba and Flores islands and from the

western part of Timor Island in January and February 2003. All specimens were collected from the ventral surfaces of scarabaeid or histerid dung beetles and were fixed in 70% ethyl alcohol. One to several specimens of each species was dissected under a stereoscopic microscope after clearing in lactic acid. Each body part was mounted on a glass slide in Hoyer's medium or polyvinyl alcohol (PVA)-lactic acid mixture medium. Observations and photographs were made on compound, phase-contrast and differential interference contrast microscopes. Illustrations were prepared with the aid of a drawing tube.

All measurements are given in micrometres ( $\mu\text{m}$ ). The dorsal chaetotaxy follows Halliday (1987). Other terminology, particularly that for the sternal ornamentation, follows Walter and Krantz (1986a). The holotypes are deposited in the collection of the Museum Zoologicum Bogoriense, Bogor, Indonesia (MZB), and remaining specimens are in the MZB and the Zoological Collections of the Graduate School of Science, Hokkaido University, Sapporo, Japan (ZIHU).

## RESULTS AND DISCUSSION

Thirteen species, including two new species, were identified, and all are new records for the region. A key to distinguish them is provided, together with diagnostic

*Correspondence:* Sri Hartini, Zoology Division (Museum Zoologicum Bogoriense), Research Center for Biology-LIPI, Jl. Raya Jakarta Bogor Km. 46, Cibinong, 16911, Indonesia. Email: hrtin2001@yahoo.com

Received 8 November 2004; accepted 7 February 2005.

characters for species previously described. Unless otherwise specified, specimens were collected by the senior author.

### *Glyphtholaspis fimicola* (Sellnick, 1931)

*Glyphtholaspis fimicola* has been recorded from Europe (Iceland, England, Italy, Greece and Slovakia) (Sellnick 1931, 1940; Filipponi & Pegazzano 1960; Hyatt & Emberson 1988; Mašán & Zubáčová 2001), Africa (Congo, South Africa) (Krantz 1970), India (Roy 1989a), China (Yin *et al.* 1964) and North America (Farrier & Hennessey 1993). In South-East Asia, the species has been recorded only from Bali (Takaku & Hartini 2001). In the present study, only one male was collected on Flores Island.

*Material Examined.* Flores I.: 1♂, Labolewa, Aesesa, Ngada, West Flores, 25.i.2003, *ex Onitis* sp.

### *Holostaspella bifoliata* (Trägårdh, 1952)

This species has been recorded from various parts of the world: Europe (Italy) (Filipponi & Pegazzano 1967), North America (USA) (Krantz 1967), Africa (South Africa) (Krantz 1967), Middle East (Israel) (Costa 1966), India (Roy 1989b), South-East Asia (Singapore, the Philippines) (Krantz 1967), East Asia (Japan) (Ishikawa 1968; Ito 1970) and Middle and South America (Costa Rica, Peru, Argentina) (Krantz 1967). In Indonesia, the species has been recorded from Java (Hartini & Aziz 1992).

*Material examined.* Flores I.: 1♀, Labolewa, Aesesa, Ngada, West Flores, 25.i.2003, *ex Onitis* sp.

### *Neopodocinum sinicum* Li and Gu, 1987

*Neopodocinum sinicum* was described from China (Li & Gu 1987), and no other published record of the species is available. Besides the specimens from the eastern part of the Lesser Sunda Islands, we examined specimens collected on Lombok, Sumbawa and Moyo.

*Material examined.* Flores I.: 7♀, two deutonymphs and three protonymphs, Spizena, Detusoko, Ende, South Flores, 26.i.2003, *ex Catharsius* sp. Lombok I.: 3♀, five deutonymphs, seven protonymphs, National Park Mount Rinjani, Senaru, East Lombok, 10.xii.1999, *ex Catharsius* sp., *Onthophagus* sp.; one deutonymph, 340 m altitude (alt.), Kotaraja, Sikor, East Lombok, 5.xi.2000, *ex Catharsius* sp.; one protonymph, Sesaut, Narmada, West Lombok, 7.xi.2000, *ex Onthophagus* sp. Sumbawa I.: three protonymphs, Makale forest, Tatebal, Ropang, Sumbawa Besar, 9.xi.2000, *ex Catharsius* sp.; two protonymphs, 800 m

alt., Batudulang, Batulanteh, Sumbawa Besar, 10.xi.2000, *ex Catharsius* sp.; 1♀, one protonymph, 150 m alt., Tolonggeru, Bolo/Madapangga, Bima, 11.xi.2000, *ex Catharsius* sp.; 1♀, Wawo, Wawo, Bima, 14.xi.2000, *ex Catharsius* sp.; Moyo I.: one protonymph, 20.ii.1982, Hasan, *ex Catharsius* sp.

### *Macrocheles baliensis* Takaku and Hartini, 2001

*Macrocheles baliensis* was described from Bali (Takaku & Hartini 2001) and also recorded from Java (Hartini & Takaku 2003).

*Material examined.* Flores I.: 1♀, Woloweku, Ndona, Ende, Central Flores, 24.i.2003, *ex Catharsius* sp. Sumba I.: 2♀, Watumbaka, Pandawai, East Sumba, 28.i.2003, *ex Pachylister lutarius* (Erichson, 1834) (Histeridae).

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

Based on female characters, this species can be assigned to the *M. glaber* species complex (Walter & Krantz 1986a). However, the precise species recognition of *M. glaber* and its closely allied species needs examination of characters of the male and/or immatures in combination with characters of their female parent (Halliday 1986). The same and/or very closely allied species has been recorded from Kalimantan, Java and Madura islands (Hartini & Takaku 2003; Hartini *et al.* 2003).

*Material examined.* Flores I.: 8♀, Woloweku, Ndona, Ende, Central Flores, 24.i.2003, *ex Catharsius* sp., *Oniticellus* sp., *Onthophagus* sp.; 5♀, Labolewa, Aesesa, Ngada, West Flores, 25.i.2003, *ex Catharsius* sp., *Onitis* sp.; 1♀, Nangaroro, Ngada, West Flores, 25.i.2003, *ex Onthophagus* sp.; 18♀, Spizena, Detusoko, Ende, South Flores, 26.i.2003, *ex Onthophagus* sp.; 1♀, Koanara, Wolowaru, Ende, Central Flores, 26.i.2003, *ex Onthophagus* sp. Sumba I.: 2♀, Kamba Jawa, Kota Waingapu, East Sumba, 30.i.2003, *ex Onthophagus* sp.; 1♀, Hutan Langgaliru, Padiratama, Umbura Tunggal, West Sumba, 2.v.2001, Wahyu Widodo, *ex Onthophagus* sp. Timor I.: 2♀, 180 m alt., Takari, Kupang, 1.ii.2003, *ex Onthophagus* sp. and *Pachylister lutarius*; 1♀, 100 m alt., Boentuka, Batu putih, Timur Tengah Selatan, Kupang, 1.ii.2003, *ex Onthophagus* sp.; 10♀, 500 m alt., Amarasen, Amarasari, Kupang, 2.ii.2003, *ex Onthophagus* sp.

### *Macrocheles hallidayi* Walter and Krantz, 1986

*Macrocheles hallidayi* is widely distributed in tropical Asia, having been recorded from India, Thailand and

Sarawak (Borneo) (Walter & Krantz 1986a). In Indonesia, the species occurs on islands from Sumatra in the west to Sulawesi in the north and Timor in the east (Takaku 1998, 2001; Takaku & Hartini 2001; specimens listed below).

**Material examined.** **Flores I.:** 3♀, Woloweku, Ndonga, Ende, Central Flores, 24.i.2003, *ex Oniticellus* sp., *Onthophagus* sp.; 1♀, Spizena, Detusoko, Ende, South Flores, 26.i.2003, *ex Onthophagus* sp.; 1♀, Koanara, Wolowaru, Ende, Central Flores, 26.i.2003, *ex Onthophagus* sp.; 18♀, Labolewa, Aesesa, Ngada, West Flores, 25.i.2003, *ex Catharsius* sp., *Onitis* sp. **Sumba I.:** 20♀, Watumbaka, Pandawai, East Sumba, 28.i.2003, *ex Onthophagus* sp., *Pachylister lutarius*; 1♀, Watuhadang, Umalulu, East Sumba, 24.i.2003, *ex Onitis* sp.; 16♀, Kamba Jawa, Kota Waingapu, East Sumba, 30.i.2003, *ex Onthophagus* sp. **Timor I.:** 5♀, Camplong, Fatuleu, Kupang, 1.ii.2003, *ex Onthophagus* sp., *Pachylister lutarius*; 4♀, Naibonat, East Kupang, Kupang, 1.ii.2003, *ex Onthophagus* sp.; 4♀, Boentuka, Batuputih, Timur Tengah Selatan, Kupang, 1.ii.2003, *ex Onthophagus* sp.; 4♀, Takari, Kupang, 1.ii.2003, *ex Onthophagus* sp.; 1♀, Oekabiti, Amarasari, Kupang, 2.ii.2003, *ex Onitis* sp. **Madura I.:** 11♀, Jung Anyar, Socah, Bangkalan, 2.v.2002, *ex Onitis* sp.; 2♀, 80 m alt., Pemaju, Socah, Bangkalan, 2.v.2002, *ex Copris* sp.; 148♀, 20 m alt., Kalimuluk airport, Kacongan, Sumenep, Sumenep, 3.v.2002, *ex Onitis* sp. **Kalimantan I.:** 2♀, 650 m alt., Pujungan, Kayan Mentarang, East Kalimantan, 1.vi.1993, U. Rosichon and D. C. Darling, *ex Catharsius molossus*; 1♀, Kereng Bangkirai, Pahandut, Palangkaraya, Central Kalimantan, 18–20.vi.2001, S. Kahono, *ex Catharsius molossus*. **Lombok I.:** 21♀1♂, Malimba, Tanjung, West Lombok, 8.xii.1999, G. Takaku and S. Hartini, *ex Onitis* sp.; 1♀, Suranadi, Narmada, West Lombok, 6.xi.2000, *ex Onitis* sp.; 8♀, 550 m alt., Mount Rinjani National Park, Senaru, Anyar, West Lombok, 10.xii.1999 and 2.xi.2000, G. Takaku and S. Hartini, *ex Catharsius* sp., *Onitis* sp., *Onthophagus* sp.; 1♀, Sembalun Lawang, Bayan, East Lombok, 10.xii.1999, G. Takaku and S. Hartini, *ex Aphodius* sp.; 8♀, Pressa, Narmada, West Lombok, 10.xii.1999, G. Takaku and S. Hartini, *ex Onitis* sp. **Sumbawa I.:** 5♀, Bugis, Lape, Bima, 14.xi.2000, *ex Onthophagus* sp.; 6♀1♂, deutonymph, 160 m alt., Ndano, Madapangga (=Bolo), Bima, 13.xi.2000, *ex Oniticellus* sp.; 5♀, 800 m alt., Batudulang, Batulanteh, Sumbawa Besar, 10.xi.2000, *ex Catharsius* sp.; 1♀, Banggo, Manggalewa, Dompu, 13.xi.2000, *ex Scarabaeidae*; 4♀, 150 m alt., Tolonggeru, Bolo/Madapangga, Dompu, 11.xi.2000, *ex Onitis* sp. **Sulawesi I.:**

1♀, Tountimomoro, North Sulawesi, 27.xi.1999, G. Takaku and S. Hartini, *ex Onthophagus* sp.; 10♀, Tangkoko Batu Angus Reserve, North Sulawesi, 26.xi.1999, G. Takaku and S. Hartini, *ex Aphodius* sp., *Copris* sp.; 3♀, Tukombo Reserve, Lemah Teno, Bontobahari, Bulu Kumba, South Sulawesi, 29.v.2001, A. Saim, *ex Scarabaeidae* sp.

### *Macrocheles kraepelini* (Berlese, 1904)

This species is distributed widely in South Asia from Pakistan in the west to the Philippines in the north, and to the Lesser Sunda Islands in the east (Walter & Krantz 1986b). It also occurs in north Queensland in Australia (Halliday 2000) and on some Pacific islands including Samoa, Fiji and the Carolines (Walter & Krantz 1986b).

**Material examined.** **Flores I.:** 1♀, Spizena, Detusoko, Ende, South Flores, 26.i.2003, *ex Oniticellus* sp. **Timor I.:** 1♀, Baumata, Central Kupang, 23.i.2003, *ex Onthophagus* sp.

### *Macrocheles krantzi* Evans and Hyatt, 1963

This species has been recorded from India and Sri Lanka (Evans & Hyatt 1963; Halliday 2000), from Queensland in Australia (Halliday 2000), and in Indonesia from Java (Hartini & Takaku 2003), Bali (Takaku & Hartini 2001) and Madura Island (specimen listed below).

**Material examined.** **Sumba I.:** 12♀, Watumbaka, Pandawai, East Sumba, 28.i.2003, *ex Aphodius* sp., *Onthophagus* sp., *Pachylister lutarius*. **Madura:** 1♀, Jung Anyar Pesisir, Socah, Bangkalan, 2.v.2002, *ex Onitis* sp.

### *Macrocheles limue* Samšičák, 1962

*Macrocheles limue* is widely distributed in Africa (Walter & Krantz 1986a), and has been recorded from India (Samšičák 1962; Walter & Krantz 1986a), China (Samšičák 1962) and the Philippines (Walter & Krantz 1986a). In Indonesia, the species occurs on most islands from Sumatra to New Guinea (Takaku 2001; specimens listed below).

**Material examined.** **Flores I.:** 3♀, Woloweka, Ndonga, Ende, Central Flores, 24.i.2003, *ex Oniticellus* sp., *Onthophagus* sp.; 47♀, Labolewa, Aesesa, Ngada, West Flores, 25.i.2003, *ex Onitis* sp., *Catharsius* sp.; 2♀, Spizena, Detusoko, Ende, South Flores, 25.i.2003, *ex Onthophagus* sp. **Sumba I.:** 1♀, Kamba Jawa, Kota Waingapu, East Sumba, 30.i.2003, *ex Onthophagus* sp. **Timor I.:** 6♀, 360 m alt., Camplong, Fatuleu, Kupang, 1.ii.2003, *ex Scarabaeidae*, *Pachylister lutarius*; 1♀, 500 m alt., Amarasari, Kupang, 2.ii.2003, *ex Onthoph-*

*agus* sp. New Guinea I.: 4♀, Sabron Yaru, Sentani, Jayapura, 7.vii.2001, *ex Aphodius* sp.; 2♀, Sentani, Sentani, Jayapura, 6–7.vii.2001, *ex Aphodius* sp.

### ***Macrocheles merdarius* (Berlese, 1889)**

*Macrocheles merdarius* is a cosmopolitan species (Halliday 2000), which, in Indonesia, has been recorded from Java, Bali and Kalimantan (Takaku & Hartini 2001; Hartini & Takaku 2003; Hartini *et al.* 2003).

*Material examined.* Flores I.: 1♀, Spizena, Detusoko, Ende, South Flores, 26.i.2003, *ex Catharsius* sp. Sumba I.: 5♀, Watumbaka, Pandawai, East Sumba, 28.i.2003, *ex Onthophagus* sp., *Pachylister lutarius*.

### ***Macrocheles oigru* Walter and Krantz, 1986**

This species was described from India (Walter & Krantz 1986a). Additional records exist only for Indonesia (Sumatra, Java and Bali: Walter & Krantz 1986a; Takaku 2001; Takaku & Hartini 2001; Hartini & Takaku 2003).

*Material examined.* Flores I.: 2♀, Woloweku, Ndonga, Ende, Central Flores, 24.i.2003, *ex Scarabaeidae*; 11♀, Labolewa, Aesesa, Ngada, West Flores, 25–26.i.2003, *ex Onitis* sp., *Catharsius* sp.; 5♀, Spizena, Detusoko, Ende, South Flores, 26.i.2003, *ex Onthophagus* sp. Sumba I.: 8♀, Kamba Jawa, Kota Waingapu, East Sumba, 30.i.2003, *ex Onitis* sp., *Onthophagus* sp., *Pachylister lutarius*; 1♀, Watumbaka, Pandawai, East Sumba, 28–30.i.2003, *ex Aphodius* sp.

### ***Macrocheles entetiensis* Hartini and Takaku, sp. nov.**

(Figs 1–5)

*Female.* Length of dorsal shield 669 (635–680), width at level of coxae II 376 (350–400) ( $n = 5$ ). Living specimens yellowish brown.

Dorsum (Fig. 1): Dorsal shield oval, attenuated posteriorly; surface ornamented with reticulate pattern and punctation; lateral margin of shield smooth; shield with 28 pairs of setae and 22 pairs of pores; setae j1, j3 and z4 pilose distally; j5, j6, z5, z6 and J2 simple; other dorsal setae pilose distally or pilose in distal half.

Venter (Fig. 2): Tritosternum typical for the genus. Sternal shield wider than long; length 124 (115–125), width at level of coxae II 153 (140–190) ( $n = 5$ ); surface of sternal shield ornamented with lines and punctations; anterior paired lines on the sternal shield (linea angulata; hereafter abbreviated as “l.ang.”), transverse line connecting each insertion of st.2 (linea media transversa; “l.m.t.”), and paired lines posterior to l.m.t.

extending posteriorly (linea oblique posteriores; “l.o.p.”) distinct and with punctations; area between paired lines starting from insertions of st.2 and extending anteriorly on the sternal shield (linea oblique anteriores; “l.o.a.”) ornamented with faint reticulation; one transverse line between l.ang. and l.m.t. on the sternal shield (linea arcuata; “l.arc.”) present as a transverse line of a part of reticulation; l.o.p. with punctations, disjunct from l.m.t., and not bifurcated; shield with three pairs of simple setae and two pairs of pores; all setae simple and not reaching insertions of setae behind them. Metasternal shield small and free; each shield with a simple seta and an anterior pore. Epigynial shield triangular; shield with a pair of simple setae and auxiliary sclerites. Ventrianal shield pentagonal, ornamented with reticulation or somewhat semiconcentric pattern, and longer than wide; length 231 (215–255), width 216 (205–235) ( $n = 5$ ); shield with three pairs of preanal setae, a pair of paranal setae, and a postanal seta; all setae simple, except for pilose postanal seta; cribrum located posterior to the postanal seta. Opisthogastric setae simple. Pair of metapodal shields oblong.

Gnathosoma (Fig. 3): Well developed and sclerotized. Deutosternal groove with five transverse rows of denticles and with a medially interrupted row of denticles anteriorly. Epistome (Fig. 4) with median process and pair of lateral elements; median process bifurcated distally and with small spicules; lateral margin serrate. Fixed digit of chelicera (Fig. 5) with simple dorsal seta, robust median tooth, small distal tooth, *pilus dentilis*, and terminal hook; movable digit with bidentate median tooth, minute distal tooth, and terminal hook; arthrodistal process strongly pilose; length of fixed digit 180 (175–190), length of movable digit 75 ( $n = 5$ ).

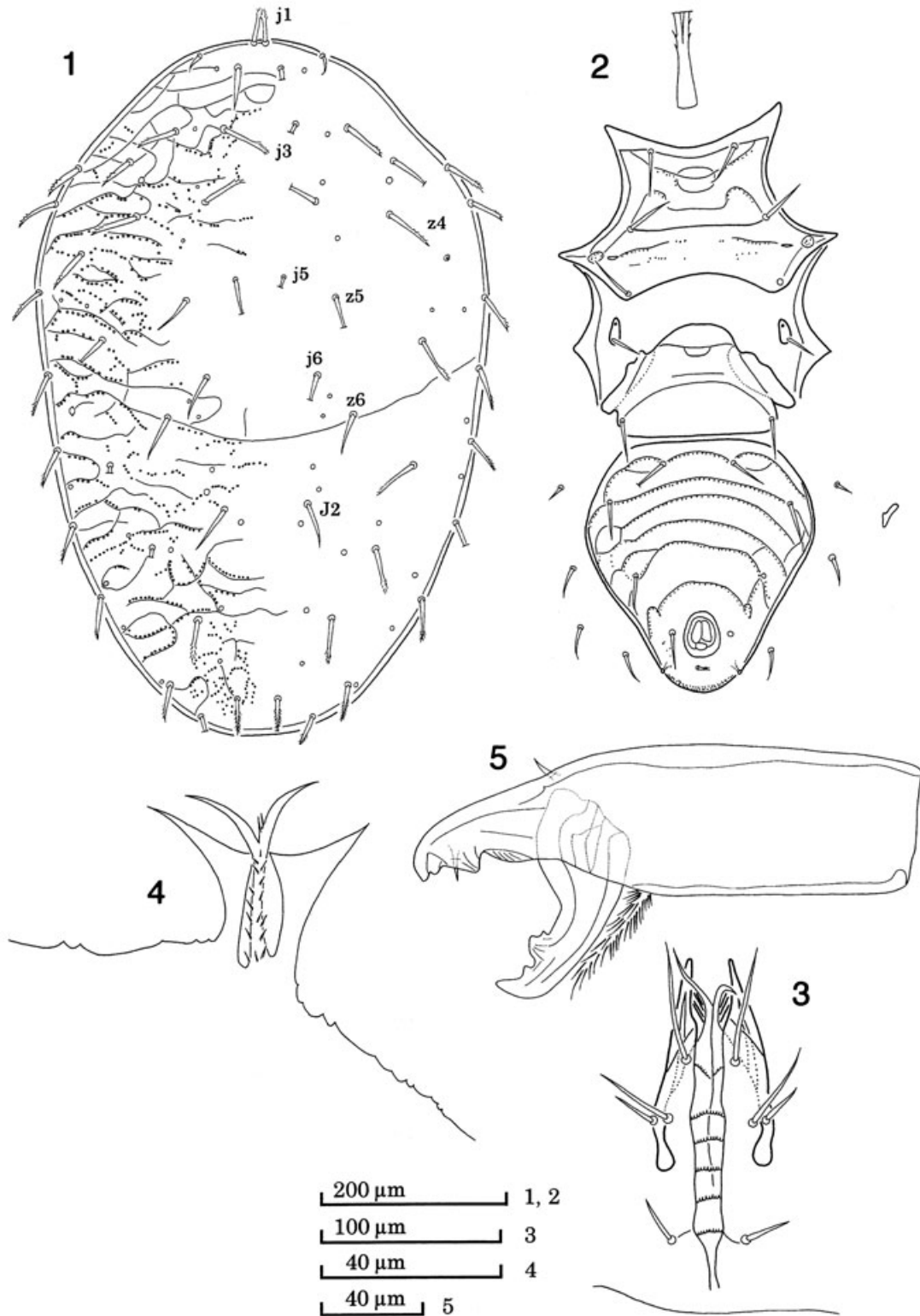
Legs: Most leg segments with only simple setae, except for femora I–IV, genua II and III, tibiae II–IV and tarsus IV with simple and pilose setae, and genu IV with only pilose setae. Leg chaetotaxy typical for the genus; genu IV with six pilose setae. Leg length (except ambulatory,  $n = 5$ ): leg I, 534 (500–580); leg II, 498 (470–520); leg III, 474 (440–500); leg IV, 708 (630–760).

Sacculus foemineus: Not observed.

*Male and immature stages.* Unknown.

*Holotype.* ♀ (MZB.Acar.3122.2), “Kamba Jawa, Kota Waingapu, East Sumba, Sumba Island, NTT, 30 January 2003, S. Hartini leg., *ex Scarabaeidae*”.

*Paratypes.* Flores I.: 1♀ (MZB.Acar.3093), Nangarara, Ngada, West Flores, 25.i.2003, *ex Onthophagus* sp. Sumba I.: 1♀ (MZB.Acar.3122.1), Kamba Jawa, Kota Waingapu, East Sumba, 30.i.2003, *ex Scarabaeidae*; 1♀,



Figures 1–5 *Macrocheles entetiensis* Hartini and Takaku, sp. nov., holotype female (MZB.Acar.3122.2). 1 Dorsum; 2 venter; 3 ventral view of gnathosoma; 4 epistome; and 5 chelicera.

Watumbaka, Pandawai, East Sumba, 28.i.2003, *ex Aphodius* sp. **Timor I.**: 1♀ (MZB.Acar.3169), Baumata, Central Kupang, 23.i.2003, *ex Onthophagus* sp.

*Etymology.* The specific name is derived from the abbreviation of Nusa Tenggara Timur (=Eastern Lesser Sunda Islands).

*Remarks.* *Macrocheles entetiensis* is similar to *M. dispar* (Berlese, 1910), a species recorded from Java, Sumatra and Kalimantan, in that they have similar dorsal and sternal shield shape and ornamentation. However, *M. entetiensis* is distinguishable from *M. dispar* on the basis of the following characters (corresponding conditions of *M. dispar* in parentheses): setae Z1–Z4, S1 and S4 pilose (simple); j3 and z4 thickened and pilose distally (pilose distally, but not thickened).

***Macrocheles sumbaensis* Hartini and Takaku, sp. nov.**

(Figs 6–11)

*Female.* Length of dorsal shield 567 (540–590), width at level of coxae II 300 (285–320) (*n* = 3). Living specimens yellowish brown.

Dorsum (Fig. 6): Dorsal shield oval, attenuated posteriorly; surface ornamented with distinct reticulation and punctations; lateral margin of shield smooth; shield with 28 pairs of dorsal setae and 22 pairs of pores; setae j1, Z4, Z5 and S5 pilose distally; J5 entirely pilose; other dorsal setae simple.

Venter (Fig. 7): Tritosternum typical for genus. Sternal shield longer than wide; length 122 (120–125), width at level of coxae II 107 (105–110) (*n* = 3); surface with granular ornamentation, short lines and punctations in edges of shield; l.ang. distinct and with punctations; shield bearing three pairs of simple setae and two pairs of pores. Metasternal shield oval, each with simple seta and an anterior pore. Epigynial shield triangular, with a pair of simple setae; surface ornamented with punctate reticulation. Ventrianal shield pentagonal, ornamented with reticulation and punctation along lines, longer than wide; length 195 (185–205), width 172 (165–180); shield with three pairs of preanal setae, pair of paranal setae, and postanal seta; all setae simple; cribrum located posterior to postanal seta. Opisthogastric setae simple. Pair of metapodal shields oblong.

Gnathosoma (Fig. 8): Well developed and sclerotized. Deutosternal groove with five transverse rows of denticles in addition to an anterior row of denticles interrupted medially. Epistome (Fig. 9) with median process and pair of lateral elements; median process bifurcated, lateral processes with small spicules distally; lateral margin serrate. Fixed digit of chelicera (Fig. 10) with simple

dorsal seta, robust median tooth, small distal tooth, *pilus dentilis*, and terminal hook; movable digit with bidentate median tooth, small distal tooth, and terminal hook; arthroal process strongly pilose; length of fixed digit 150, length of movable digit 62 (60–70) (*n* = 3).

Legs: Most leg segments with only simple setae, except for femora I–II and, genu II with simple and plumose setae. Leg chaetotaxy typical for the genus; genu IV with six simple setae. Leg length (except ambulatory, *n* = 3): leg I, 443 (440–450); leg II, 395 (385–400); leg III, 315 (305–325); leg IV, 475.

Sacculus foemineus (Fig. 11): Globular sacculi fused; cornu rounded distally and sclerotized; spermatheca oblong.

*Male and immatures.* Unknown.

*Holotype.* ♀ (MZB.Acar.3118), “Watumbaka, Pandawai, East Sumba, Sumba Island, NTT, 30 January 2003, S. Hartini leg., *ex Aphodius* sp.”

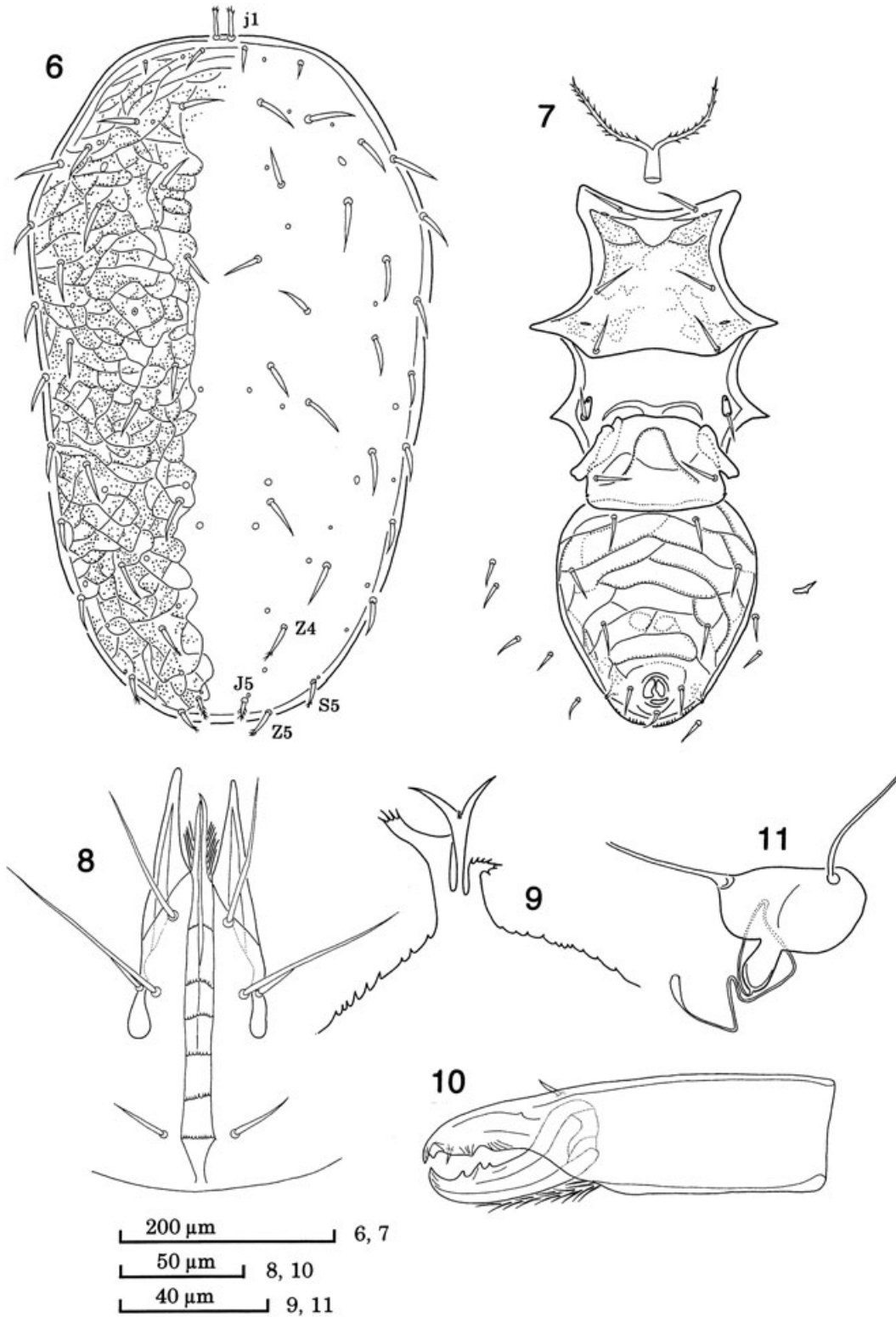
*Paratypes.* **Sumba I.**: 2♀ (MZB.Acar.3104 and MZB.Acar.3125), Watumbaka, Pandawai, East Sumba, 28.i.2003, *ex Scarabaeidae, Pachylister lutarius*.

*Etymology.* The specific name is derived from the type locality.

*Remarks.* *Macrocheles sumbaensis* is similar to *M. krantzi* Evans and Hyatt, 1963, a species recorded from India, Sri Lanka, Australia and Indonesia (Java, Bali, Madura, Sumba). However, *M. sumbaensis* is distinguishable from *M. krantzi* on the basis of the following features (corresponding conditions of *M. krantzi* in parentheses): setae j1, Z4, Z5 and S5 pilose distally, J5 entirely pilose (those setae simple); and surface of epigynial shield ornamented with lines and punctures (without lines and punctures). This species is also similar to the Australian species *M. guttatus* Halliday, 2000, but the sternal ornamentation of *M. sumbaensis* is confined mainly to the outer edges of the shield (most distinct in the center of the shield in *M. guttatus*); dorsal setae j4 and z4 simple (pilose distally in *M. guttatus*); and Z5 and S5 pilose in distal half (simple in *M. guttatus*).

**Key to macrochelid mite species associated with scarabaeid beetles in eastern Lesser Sunda Islands (females only)**

- 1 Epistome unipartite. Dorsal shield bearing 30 pairs of small setae. Sternal plate with interrupted linea media transversa; posterior margin of epigynial plate broadly rounded. . . . . *Neopodocinum sinicum* Li and Gu
- Epistome tripartite . . . . . 2
- 2 Sternal shield adjacent to metasternal shield, and with distinct polygonal ornamentation. Seta z1 half



Figures 6–11 *Macrocheles sumbaensis* Hartini and Takaku, sp. nov., holotype female (MZB.Acar.3118). 6 Dorsum; 7 venter; 8 ventral view of gnathosoma; 9 epistome; 10 chelicera; and 11 *sacculus foemineus*.

- as long as j1; J5 as long as Z5; posterior margin of dorsal shield with small equidistant teeth between Z5. . . . . *Glyphtholaspis fimicola* (Sellnick)
- Sternal shield separate from metasternal shield; ornamentation variable, but without distinct polygonal ornamentation . . . . . 3
- 3 Femur II with sclerotized spurs; dorsal shield with anterior projection, strong punctate pattern, and sclerotized ridges laterally; j1 broadly plumose. Most dorsal setae short and simple, but Z5 pectinate; sternal shield strongly punctate; ventrianal shield large, little broader than long, rounded posteriorly, and with reticulate pattern . . . . . *Holostaspella bifoliata* (Trägårdh)
- Femur II without spurs; dorsal shield without anterior projection and sclerotized ridges . . . . . 4, genus *Machrocheles*
- 4 All dorsal setae simple, short, and spine-like, except for pilose J5 (j1 slightly pilose in *M. baliensis* and *M. limue*) . . . . . 5
- Some dorsal setae in addition to j1 and J5 pilose or plumose or pectinate, at least distally. . . . . 9
- 5 Posterior corners of sternal shield close to metasternal shields; l.ang. convergent medially; ventrianal shield expanded laterally. Most dorsal setae simple (j1 pilose distally and J5 bipectinate). Sternal ornamentation well developed; two l.arc. straight; ventrianal shield expanded and with strongly dimpled reticulation . . . . . *M. limue* Samšičák
- Posterior corners of sternal shield separated from metasternal shields; l.ang. not as above; ventrianal shield subtriangular or pentagonal, not expanded . . . . . 6
- 6 L.o.a. of sternal shield connected by lines; genu IV with six setae. All dorsal setae simple; punctuation very faint . . . . . *M. merdarius* (Berlese)
- L.o.a. absent or not connected by lines . . . . . 7
- 7 Anterior half of sternal shield ornamented with somewhat reticulate pattern of punctate line . . . . . *M. baliensis* Takaku and Hartini
- Ornamentation of sternal shield faint and without reticulate ornamentation. All dorsal setae simple; sternal shield with granular ornamentation, lines and punctuation in the outer edges of the shield. . . . . 8
- 8 All dorsal setae simple; surface of epigynial shield without lines and punctures . . . . . *M. krantzi* Evans and Hyatt
- Dorsal setae j1, Z4, Z5 and S5 pilose distally, J5 entirely pilose; surface of epigynial shield ornamented with lines and punctures . . . . . *M. sumbaensis* Hartini and Takaku, sp. nov.

- 9 Some dorsal setae entirely pilose or pectinate . . 10
- Dorsal setae simple or pilose distally except for J5, which is pilose over its entire length . . . . . 11
- 10 Genu IV with seven setae. Most of dorsal setae pilose, except for simple j5, j6, z1, z5, z6 and J2; z1 not reaching insertions of j2; sternal shield with two l.arc., bifurcate l.o.p., and distinct punctations . . . . . *M. hallidayi* Walter and Krantz
- Genu IV with six setae. Most of dorsal setae pilose; j5 with pilosity in most case; j6, z1, z5, z6, and J2 simple; sternal shield with two l.arc., bifurcate l.o.p., and distinct punctations. . . . . *M. kraepelini* (Berlese)
- 11 Sternal ornamentation reduced; l.o.p. not bifurcated and disjunct from l.m.t . . . . . *M. entetiensis* Hartini and Takaku, sp. nov.
- Sternal ornamentation developed; l.o.p. bifurcate and reaching to l.m.t . . . . . 11
- 12 Most dorsal setae elongate, surpassing insertions of setae behind them; j1, j4, Z5 and S5 pilose distally, other dorsal setae simple. Sternal ornamentation developed, l.o.p. bifurcated and reaching to l.m.t . . . . . *M. oigru* Walter and Krantz
- Dorsal setae not elongate and not reaching insertions of setae behind them. Most of dorsal setae simple, except j1, j4, Z5 and S5 distally pilose and not reaching insertions of setae behind them. Sternal ornamentation developed; l.o.p. bifurcate and reaching to l.m.t . . . *Macrocheles* sp. aff. *glaber* (Müller)

## ACKNOWLEDGMENTS

We would like to express our sincere thanks to M. Ohara (the Hokkaido University Museum) and R. Ubaidillah (LIPI) for their collaboration during the field work, and S. Nuramaliati Prijono (LIPI) for giving us an opportunity to study this subject. This study was partly supported by RONPAKU Program from the Japan Society for the Promotion of Science (JSPS) to SH, grants-in-aid for Scientific Research (no.s 11691161, 14204081 and 14740468) from JSPS, and the 21st Century Center of Excellence (COE) Program on “Neoscience of Natural History” (Program Leader: Hisatake Okada) at Hokkaido University, financed by the Ministry of Education, Culture, Sports, Science and Technology, Japan.

## REFERENCES

Berlese A (1889) *Acari Myriopoda et Scorpioes Hucusque in Italia Reperta*, fasc. 52 N. 1, Tipografia del Seminario, Padova.



- Berlese A (1904) Acari nuovi. Manipulus Ilus. *Redia* 1, 258–280.
- Berlese A (1910) Lista di nuove specie e nuovi generi di Acari. *Redia* 6, 242–271.
- Costa M (1966) The present stage of knowledge of mesostigmatic mites in Israel (Acari, Mesostigmata). *Israel Journal of Zoology* 15, 69–82.
- Evans GO, Hyatt KH (1963) Mites of the genus *Macrocheles* Latr. (Mesostigmata) associated with coprid beetles in the collections of the British Museum (Natural History). *Bulletin of the British Museum (Natural History), Zoology* 9, 327–401.
- Farrier MH, Hennessey MK (1993) Soil-inhabiting and free-living Mesostigmata (Acari-Parasitiformes) from North America. *North Carolina State University Technical Bulletin* 302, 1–408.
- Filippini A, Pegazzano F (1960) Acari del genere *Glyphtholaspis* nom. nov. pro *Macrocheles* (*Macrocheles*) Berl. 1918 (Mesostigmata, Macrochelidae). *Redia* 45, 133–171.
- Filippini A, Pegazzano F (1967) Contributo alla conoscenza del genere *Holostaspella* Berlese, 1903 (Acari: Mesostigmata: Macrochelidae). *Redia* 50, 219–259.
- Halliday RB (1986) Mites of the *Macrocheles glaber* group in Australia (Acarina: Macrochelidae). *Australian Journal of Zoology* 34, 733–752.
- Halliday RB (1987) Further observations on the dorsal idiosomal chaetotaxy in the Macrochelidae (Acarina). *International Journal of Acarology* 13, 51–53.
- Halliday RB (2000) The Australian species of *Macrocheles* (Acarina: Macrochelidae). *Invertebrate Taxonomy* 14, 273–326.
- Hartini S, Aziz J (1992) Mites in poultry litter from Bogor Municipality, West Java. *Parasitologi Indonesia* 5, 105–112.
- Hartini S, Takaku G (2003) Javanese species of the mite genus *Macrocheles* (Arachnida: Acari: Gamasina: Macrochelidae). *Zoological Science* 20, 1261–1272.
- Hartini S, Takaku G, Katakura H (2003) Macrochelid mites of the genus *Macrocheles* (Acari: Macrochelidae) in Kalimantan, Indonesia. *International Journal of Acarology* 29, 307–313.
- Hyatt KH, Emberson RM (1988) A review of the Macrochelidae (Acari: Mesostigmata) of the British Isles. *Bulletin of the British Museum (Natural History), Zoology* 54, 63–125.
- Ishikawa K (1968) Studies on the mesostigmatid mites associated with the insects in Japan (I). *Reports of Research Matsuyama Shinonome Junior College* 3, 197–218.
- Ito Y (1970) Preliminary surveys on macrochelid and some other mesostigmatic mites occurring in the experimentally deposited live-stock dungs as predators of muscid flies. *Japanese Journal of Sanitary Zoology* 21, 205–208.
- Krantz GW (1967) A review of the genus *Holostaspella* Berlese, 1904 (Acarina: Macrochelidae). *Acarologia* 9 (Suppl.), 91–146.
- Krantz GW (1970) Acari (Mesostigmata): Macrochelidae. *South African Animal Life* 14, 19–23.
- Li C-c, Gu Y-m (1987) Notes on the genus *Neopodocinum* in China, with description of two new species (Acarina, Macrochelidae). *Entomotaxonomia* 9, 133–140.
- Mašán P, Zubáčová Z (2001) First records of macrochelid mites (Acari, Macrochelidae) in Slovakia. *Biologia Bratislava* 56, 577–578.
- Müller J (1860) Insectenepizoën der mährischen Fauna. *Jahresheft der Naturwissenschaftlichen Section der k. k. mähr. schles. Gesellschaft für Ackerbau, Nature- und Landeskunde* 1859, 157–184.
- Roy RK (1989a) Indian species of the genus *Glyphtholaspis* (Acari: Macrochelidae) with description of two new species. In: Channabasavanna GP, Viraktamath CA (eds) *Progress in Acarology*, Vol. 1, pp 343–353. EJ Brill, Leiden.
- Roy RK (1989b) Mites of the genus *Holostaspella* (Acari: Mesostigmata: Macrochelidae) in India. In: Channabasavanna GP, Viraktamath CA (eds) *Progress in Acarology*, Vol. 1, pp 329–342. EJ Brill, Leiden.
- Samsiňák K (1962) Neue entomophile Acari aus China. *Acta Societatis Entomologicae Cechosloveniae* 59, 186–204.
- Sellnick M (1931) Zoologische Forschungsreise nach den Janischen Inseln und dem Peloponnes. *Sitzungsberichte der Akademie der Wissenschaften in Wien. Mathematisch Naturwissenschaftlichen Klasse, Abtheilung L* 140, 693–776.
- Sellnick M (1940) Die Milbenfauna Islands. *Meddelanden från Göteborgs Musei, Zoologiska Advelning* 83, 1–129.
- Takaku G (1998) Descriptions of immature stages and male of *Macrocheles hallidayi* Walter and Krantz, 1986 (Acari: Macrocheles). *Journal of the Acarological Society of Japan* 7, 29–38.
- Takaku G (2001) Macrochelid mites (Acari: Macrochelidae: *Macrocheles*, *Holostaspella*) associated with scarabaeid beetles in Sumatra, Indonesia. *Tropics* 10, 497–507.
- Takaku G, Hartini S (2001) Macrochelid mites (Arachnida: Acari: Macrochelidae: *Glyphtholaspis*, *Macrocheles*, *Neopodocinum*) associated with dung beetles in Bali, Indonesia. *Species Diversity* 6, 323–345.
- Trägårdh I (1952) Acarina, collected by the Mangarevan expedition to south eastern Polynesia in 1934 by the Bernice P. Bishop Museum, Honolulu, Hawaii. *Arkiv För Zoological* 4, 45–90.
- Walter DE, Krantz GW (1986a) A review of *glaber*-group (s.str.) species of the genus *Macrocheles* (Acari: Macrochelidae), and a discussion of species complexes. *Acarologia* 2, 277–294.
- Walter DE, Krantz GW (1986b) Description of the *Macrocheles kraepelini* species complex (Acari: Macrochelidae) with two new species. *Canadian Journal of Zoology* 64, 212–217.
- Yin S-k, Cheng C-l Chang C-c (1964) A preliminary survey of the family Macrochelidae from Northeastern China with descriptions of two new species. *Acta Zootaxonomica Sinica* 1, 320–324.