

A NEW SPECIES OF THE GENUS *CORONIPES* (ACARI: HETEROSTIGMATA: SCUTACARIDAE) ASSOCIATED WITH *RETICULITERMES SPERATUS KYUSHUENSIS* (ISOPTERA: RHINOTERMITIDAE) FROM KOREA

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ABSTRACT: A new species of the genus *Coronipes* Mahunka, 1972 (Acari: Pygmephoroida: Scutacaridae), *C. sperati* sp. n. is described from termites *Reticulitermes speratus kyushuensis* Morimoto, 1968 (Isoptera: Rhinotermitidae) from South Korea. The genus *Coronipes* is redefined. A key to *Coronipes* species is provided. An association of pygmephoroid mites with termites is discussed.

KEY WORDS: Acari, Pygmephoroida, systematics, termites, association, phoresy.

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INTRODUCTION

The superfamily Pygmephoroida Cross, 1965 includes 4 families: Pygmephoridae Cross, 1965, Neopygmephoridae Cross, 1965, Microdispidae Cross, 1965 and Scutacaridae Oudemans, 1916 and more than 1200 species (Zhang *et al.* 2011). Probably all pygmephoroid mites are fungivorous (Khaustov 2008), but some species of the family Microdispidae might be parasitoids of insects (Kaliszewski *et al.* 1995). Many pygmephoroid mites are associated with various insects and utilize them for phoresy (Kaliszewski *et al.* 1995). Members of Pygmephoridae, the early derivative family of Pygmephoroida, are usually phoretic on Coleoptera and Diptera (Rahiminejad *et al.* 2015), while Neopygmephoridae, Microdispidae and Scutacaridae, which form a monophyletic group of derived pygmephoroid mites, are mainly phoretic on Hymenoptera, especially on various ants (Ebermann and Moser 2008; Khaustov 2008, 2014a, b; Ebermann *et al.* 2013). Association of pygmephoroid mites with termites is poorly studied. Representatives of all four families of pygmephoroid mites have been recorded as associates of various termites (Silvestri 1918; Mahunka 1964, 1966, 1981; Cross 1965; Cross and Moser 1971; Costa-Leonardo and Soares 1993; Kurosa 1994; Wang *et al.* 2002). More detailed information about association of pygmephoroid mites with termites is provided in discussion paragraph. The cosmopolitan family Scutacaridae is the largest in the superfamily Pygmephoroida and includes 24 genera and more than 800 species (Zhang *et al.* 2011). The genus *Coronipes* Mahunka, 1972 currently includes three described species (Mahunka, 1966, 1972; Mahunka and Mahunka-Papp 1988), one of which, *C. samsinaki* (Mahunka, 1966) is described from

termites *Coptotermes formosanus* Shiraki, 1909 from China (Mahunka 1966).

During a study of mites associated with termite *Reticulitermes speratus kyushuensis* Morimoto, 1968 in South Korea, a new species of the genus *Coronipes* was revealed. The main aim of this paper is to describe new species of *Coronipes* from Korea.

MATERIAL AND METHODS

Mites were collected from termites *Reticulitermes speratus kyushuensis* and mounted in Hoyer's medium. The terminology of idiosoma and legs follows that of Lindquist (1986); the nomenclature of subcapitular setae and the designation of cheliceral setae follow those of Grandjean (1944, 1947), respectively. The system of Pygmephoroida follows that of Khaustov (2004, 2008). All measurements are given in micrometers (µm). For leg chaetotaxy the number of solenidia is given in parentheses. The holotype and nine paratypes are deposited in the mite collection of the Tyumen State University Museum of Zoology, Tyumen, Russia, 13 paratypes are deposited in the QIA, Gimcheon, South Korea. Photographs were taken with the aid of digital camera Hitachi KP-HD20A and the compound microscope Axio Imager. A2, Carl Zeiss, Germany and Axio Cam MRc and the compound microscope Discovery V20, Carl Zeiss, Germany.

SYSTEMATICS

Family Scutacaridae Oudemans, 1916

Genus *Coronipes* Mahunka, 1972

Type species: *Coronipes divergens* Mahunka, 1972, by original designation.

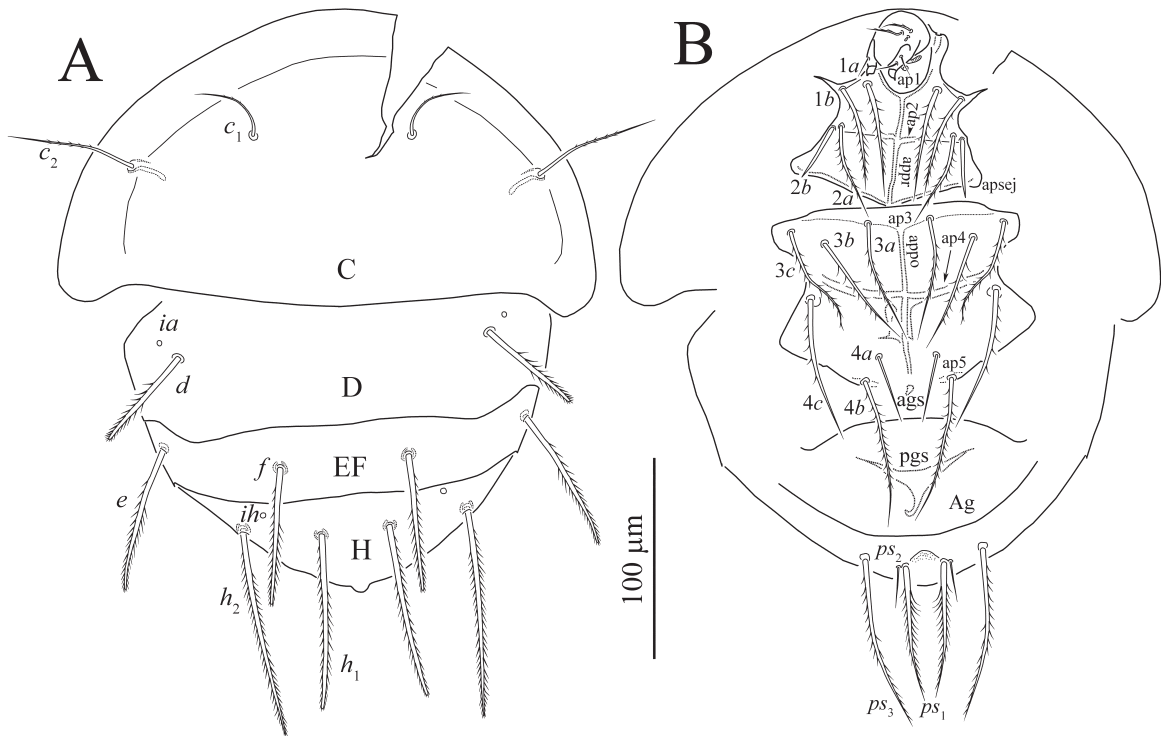


Fig 1. *Coronipes speratii* Khaustov, Lee, Lee et Park sp. n., female: A—idiosomal dorsum, B—idiosomal venter.

Diagnosis. Female. Body round. Prodorsum and gnathosoma completely covered by tergite C. Gnathosomal capsule of similar length and width, dorsally with two pairs of cheliceral setae (*cha* and *chb*) and pair of dorsolateral postpalpal setae (*pp*); palps prominent, with two pairs of dorsolateral setae (*dFe*, *dGe*) and distinct tibial claw distally. Palps ventrally with mushroom-like accessory setigenous structure and well developed solenidion. Pharyngeal pumps grouped together; pharyngeal pump 2 distinctly longer than pharyngeal pumps 1 and 3. Prodorsum with two pairs of simple setae (v_2 and sc_2), pair of clavate trichobothriae (sc_1) and oval stigmata. Lateral propodosomal spine well-developed. Tergite C with two pairs of setae (c_1 , c_2); tergite D with one pair of setae (*d*) and pair of round cupules *ia*; tergite EF with two pairs of setae (*e*, *f*); tergite H with two pairs of setae (h_1 , h_2) and pair of round cupules *ih*; posterior margin of tergite H with short tongue-like process. Coxal fields I with two pairs of setae (*1a*, *1b*); coxal fields II with two pairs of setae (*2a*, *2b*); coxal fields III with three pairs of setae (*3a*, *3b*, *3c*); coxal fields IV with three pairs of setae (*4a*, *4b*, *4c*). Pseudanal segment with three pairs of setae (ps_{1-3}). Apodemes 2 (*ap2*) short, joined with prosternal apodeme (*appr*); sejugal apodeme (*apsej*) well developed and joined with *appr*; secondary transverse

apodeme (*sta*) present; apodemes 3 (*ap3*) well developed, diffuse, joined with poststernal apodeme (*appo*), apodemes 4 (*ap4*) well developed, long. Apodemes 5 (*ap5*) shorter, situated near the base of trochanter IV. Anterior genital sclerite (*ags*) short, bell-like; posterior genital sclerite (*pgs*) large, triangular. Setae *2b* smooth, slightly thickened. Leg I distinctly shorter and thinner than leg II. Tibiotarsus I tapering distally, with small claw situated on short pretarsus; eupathidia *tc''* and *ft''* situated on long pinnaculum; eupathidion *ft''* situated in middle part of pinnaculum; seta *k* long, pointed and smooth. Legs II, III with pair of large padded claws and flipper-like empodium. Setae *pl''* on tarsi II and III distinctly thickened and dentate distally (Fig. 5B). Legs IV 5-segmented. Trochanter IV short and wide. Tibia and tarsus immovably connected. Pretarsus IV long and narrow, without claws; setae *pl''* of tarsus IV absent. Leg chaetotaxy: leg I; tr 1 (v'), fe 3 (d, l', v''), ge 4 (l', l'', v', v''), tita 16(4) ($d, l', l'', v', v'', k, tc', tc'', ft', ft'', p'', pl', pl'', pv', pv'', s, \omega_1, \omega_2, \varphi_1, \varphi_2$); leg II: tr 1 (v'), fe 3 (d, l', v''), ge 3 (l', l'', v'), ti 4(1) (d, l', v', v'', φ), ta 6(1) ($pl'', tc', tc'', u', pv', pv'', \omega$); leg III: tr 1 (v'), fe 2 (d, v'), ge 2 (l', v'), ti 4(1) (d, l', v', v'', φ), ta 6 ($pl'', tc', tc'', u', pv', pv''$); leg IV: tr 1 (v'), fe 2 (d, v'), ge 1 (v'), ti 3(1) (d, l', v', φ), ta 5 (tc', tc'', u', pv', pv'').

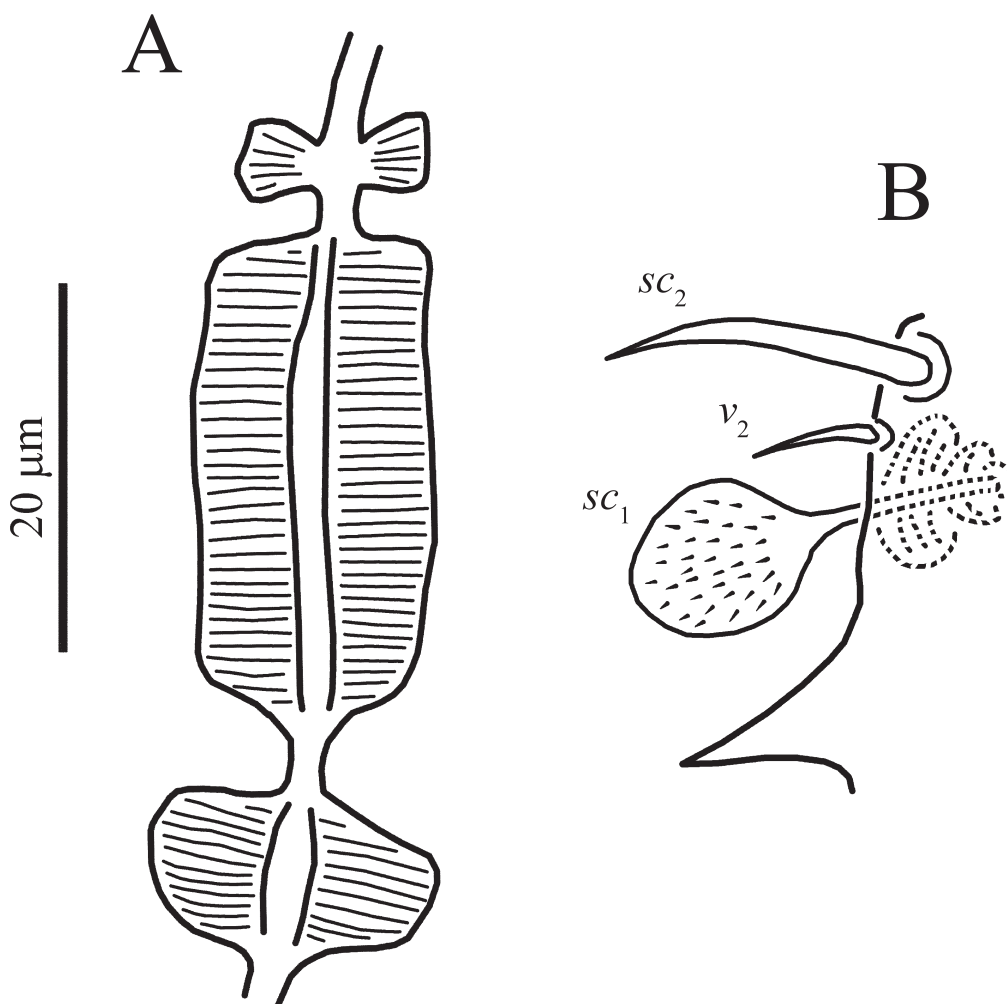


Fig. 2. *Coronipes speratii* Khaustov, Lee, Lee, Park sp. n., female: A—pharyngeal pumps, B—prodorsal setae.

Remarks. The genus *Coronipes* is very similar to *Imparipes* Berlese, 1903. It can be distinguished from *Imparipes* by dentate tip of setae *pl*'' on tarsi II and III (spine-like in *Imparipes*), absence of claws and setae *pl*'' on tarsus IV (usually present in *Imparipes* s.str.).

Species Included. The genus *Coronipes* includes three species, *C. samsinaki* (Mahunka, 1966), *C. divergens* Mahunka, 1972 and *C. hauseri* Mahunka and Mahunka-Papp, 1988.

Distribution and Habitat. *Coronipes samsinaki* is described from China (Mahunka 1966) and phoretic on termites *Coptotermes formosanus* Shiraki, 1909 (Isoptera: Rhinotermitidae); *C. divergens* described from New Guinea (Mahunka 1972) from litter accumulated at the base of sago palm; *C. hauseri* is described from Sabah (Eastern Malaysia) from forest litter (Mahunka and Mahunka-Papp 1988); *C. speratii* sp. n. phoretic on termites *Reticulitermes speratus kyushuensis* Morimoto, 1968 in South Korea.

***Coronipes speratii* Khaustov, Lee, Lee et Park sp. n.**

Figs. 1–6

Description. Female (Figs. 1–6). Length of idiosoma 290 (280–335), width 260 (255–300). Gnathosoma (Figs. 1B, 2A, 5A). Dorsal median apodeme present. Cheliceral setae subequal, sparsely barbed. Postpalpal setae (*pp*) claviform (Fig. 5A). Palpal solenidion very large, sausage-like. Setae *dGe* and *dFe* smooth, subequal. Pharyngeal pump as on figure 2A.

Idiosomal dorsum (Figs. 1A, 2B). Prodorsal setae smooth; *sc*₂ more than two times longer than *v*₂; trichobothria with numerous barbs (Fig. 2B). All hysterosomal tergites smooth. Setae *c*₁ and *c*₂ pointed, sparsely barbed, other dorsal setae blunt-ended and heavily barbed. Bases of setae *c*₂ associated with well-developed alveolar canal. Cupules *ia* on tergite D and *ih* on tergite H large, round. Lengths of dorsal setae: *c*₁ 50 (45–51), *c*₂ 62 (60–72), *d* 53 (52–55), *e* 70 (69–76), *f* 68 (67–70), *h*₁

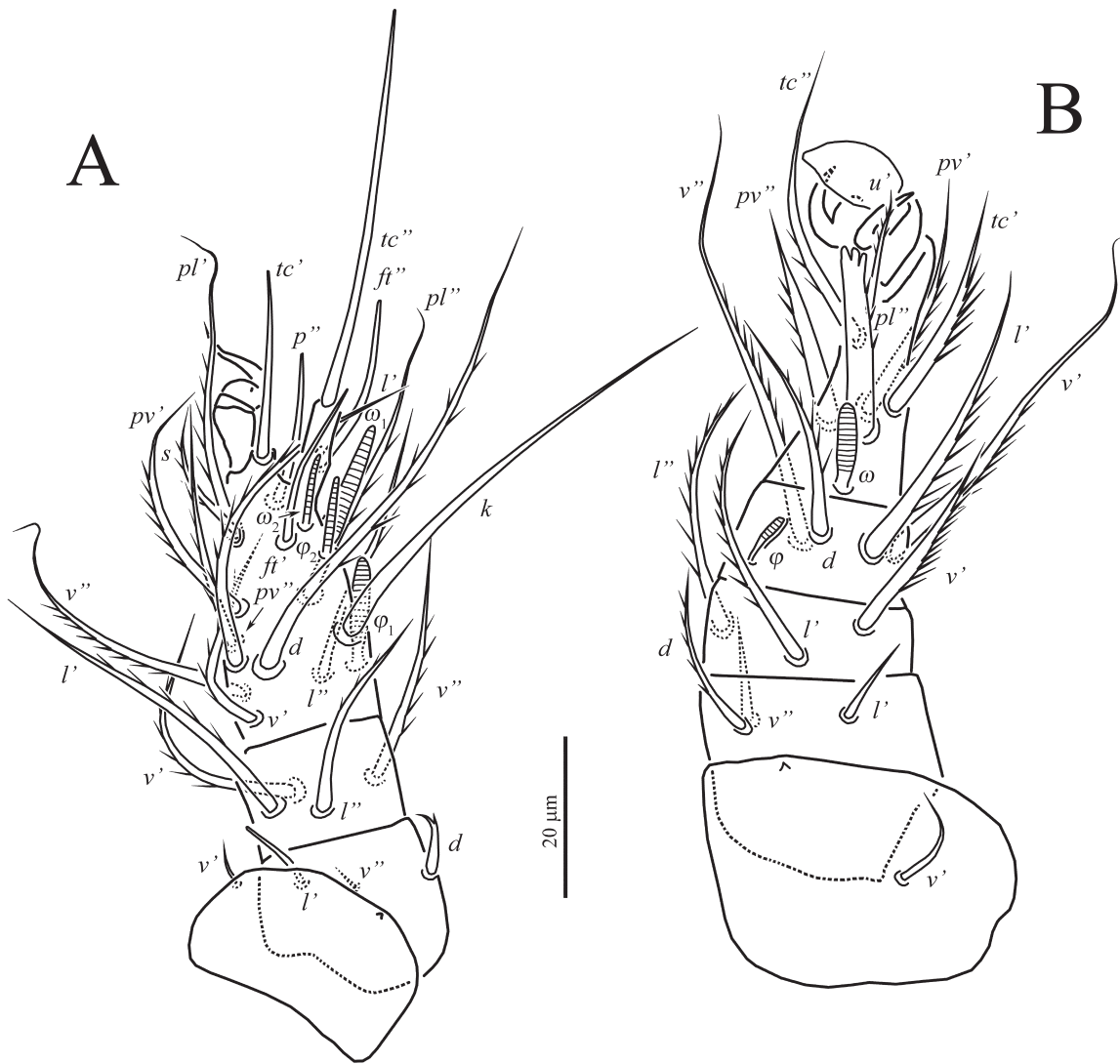


Fig. 3. *Coronipes speratii* Khaustov, Lee, Lee et Park sp. n., female: A—leg I, B—leg II.

88 (87–91), h_2 105 (105–110). Distances between setae: c_1 – c_1 71 (70–77), d – d 160 (160–170), e – f 64 (62–65), f – f 67 (65–76), h_1 – h_1 35 (34–40), h_1 – h_2 40 (39–42).

Idiosomal venter (Fig. 1B). All ventral plates smooth. Setae 4a and ps_2 smooth, pointed. Setae 2b smooth, slightly thickened, blunt-ended. Other ventral setae sparsely barbed and pointed. Posterior margin of posterior sternal plate distinctly concave. Posterior margin of aggenital plate rounded. Lengths of ventral setae: 1a 57 (55–60), 1b 52 (50–56), 2a 54 (52–59), 2b 32 (30–33), 3a 65 (63–68), 3b 65 (63–68), 3c 58 (57–61), 4a 36 (35–38), 4b 72 (70–77), 4c 66 (63–71), ps_1 68 (56–69), ps_2 21 (19–24), ps_3 87 (85–90). Legs (Figs. 3, 4, 5B). Leg I (Fig. 3A). Lengths of solenidia ω_1 16 (15–16) > ω_2 10 (10–11) < ϕ_1 14 (13–14) > ϕ_2 11 (11–12); ω_2 and ϕ_2 baculiform, ϕ_1 and ω_1 finger-shaped. Setae dFe slightly thickened and weakly

barbed. Setae l' of femur smooth, blunt-ended; v'' of femur and v' of trochanter smooth, pointed; seta k very long, smooth; other setae on leg segments (except eupathidia) sparsely barbed, pointed. Leg II (Fig. 3B). Solenidium ω 10 (10–11), finger-shaped, solenidium ϕ 7 (7–8) weakly clavate, situated in shallow depression. Setae v' of trochanter, l' and v'' of femur smooth, pointed; setae pl'' weakly barbed and with dentate tip (Fig. 5B); other setae on leg segments sparsely barbed, pointed. Leg III (Fig. 4A). Solenidium ϕ 7 (7–8) weakly clavate, situated in shallow depression. Setae pl'' as on tarsus II; other setae on leg segments sparsely barbed, pointed. Leg IV (Fig. 4B). Empodium small, round. Solenidium ϕ 8 (8–9) weakly clavate, situated in shallow depression. Setae d of femur and tibia blunt-ended, barbed; other setae on leg segments pointed, barbed. Femur divided into basi-

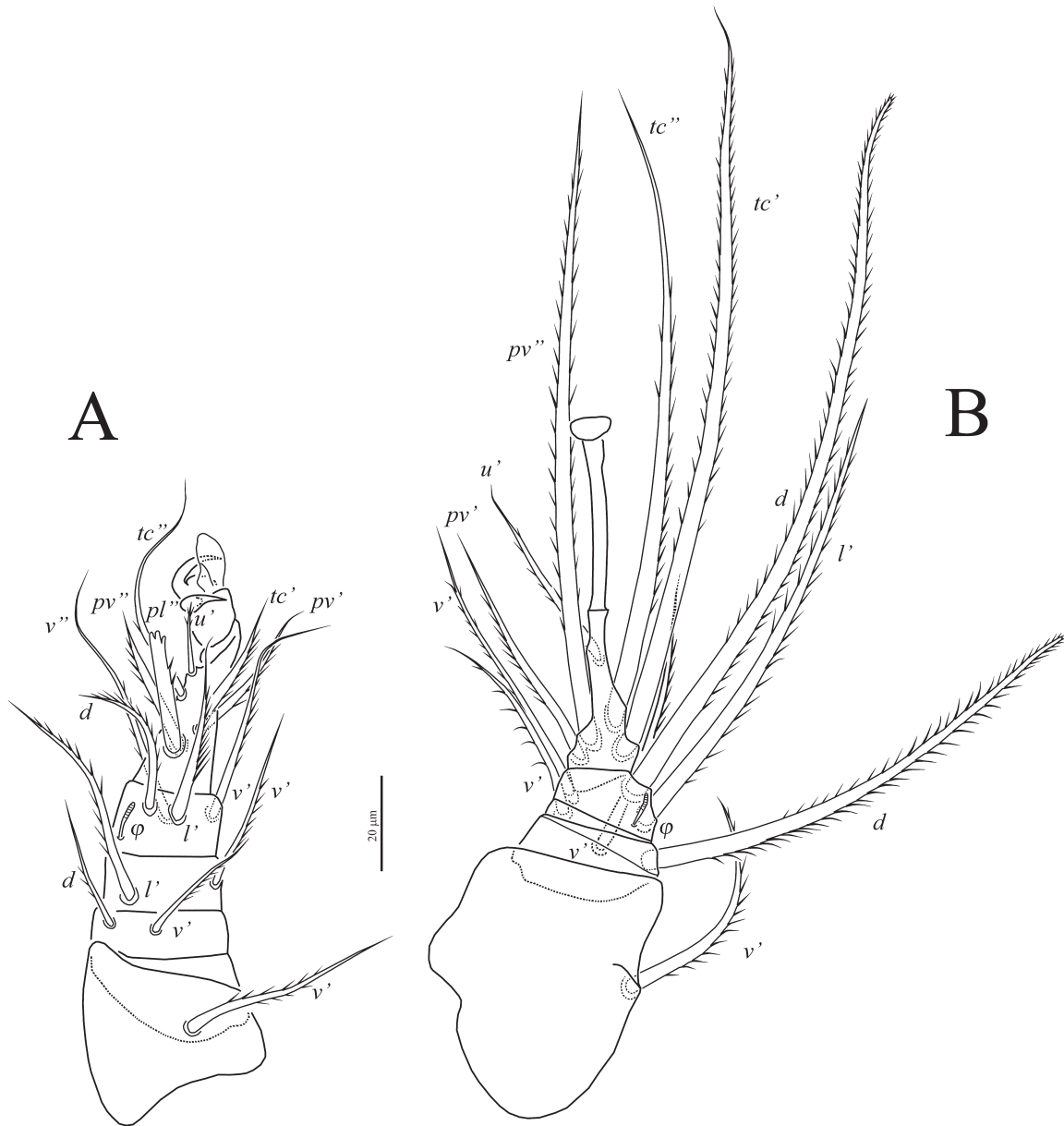


Fig. 4. *Coronipes speratii* Khaustov, Lee, Lee et Park sp. n., female: A—leg III, B—leg IV.

and telofemur. Length of tarsus IV 36 (35–37), length of pretarsus IV 36 (35–37).

Male and larva unknown.

Type material. Female holotype, slide #YL181114, from termite colony taken at Mt. Oseong and reared in Honam Regional Office, QIA, South Korea, 18.11.2014, from 186-1, Yebang-ri, Seongsan-myeon, Gunsan city, Jeonbuk Prov., South Korea, 28.05.2014; paratypes: 9 females, same date and locality.

Etymology. The species name *speratii* derived from the species name of its phoretic host, *Reticulitermes speratus*.

Differential diagnosis. The new species is most similar to *Coronipes samsinaki* (Mahunka,

1966), but differs by setae *e* slightly longer than *f* (vs. *e* distinctly shorter than *f* in *C. samsinaki*) and by setae *ps*₂ distinctly shorter than half length of setae *ps*₁ (vs. *ps*₂ distinctly longer than half length of setae *ps*₁ in *C. samsinaki*). The new species differs from *C. divergens* Mahunka, 1972 by setae *e* distinctly longer than *d* (vs. setae *d* and *e* subequal in *C. divergens*). The new species differs from *C. hauseri* Mahunka and Mahunka-Papp, 1988 by setae *e* only slightly shorter than *h*₂ (vs. *e* about two times shorter than *h*₂ in *C. hauseri*).

A key to females of the genus *Coronipes*

- 1. Setae *d* slightly longer or subequal to *e* 2
- Setae *d* distinctly shorter than *e* 3

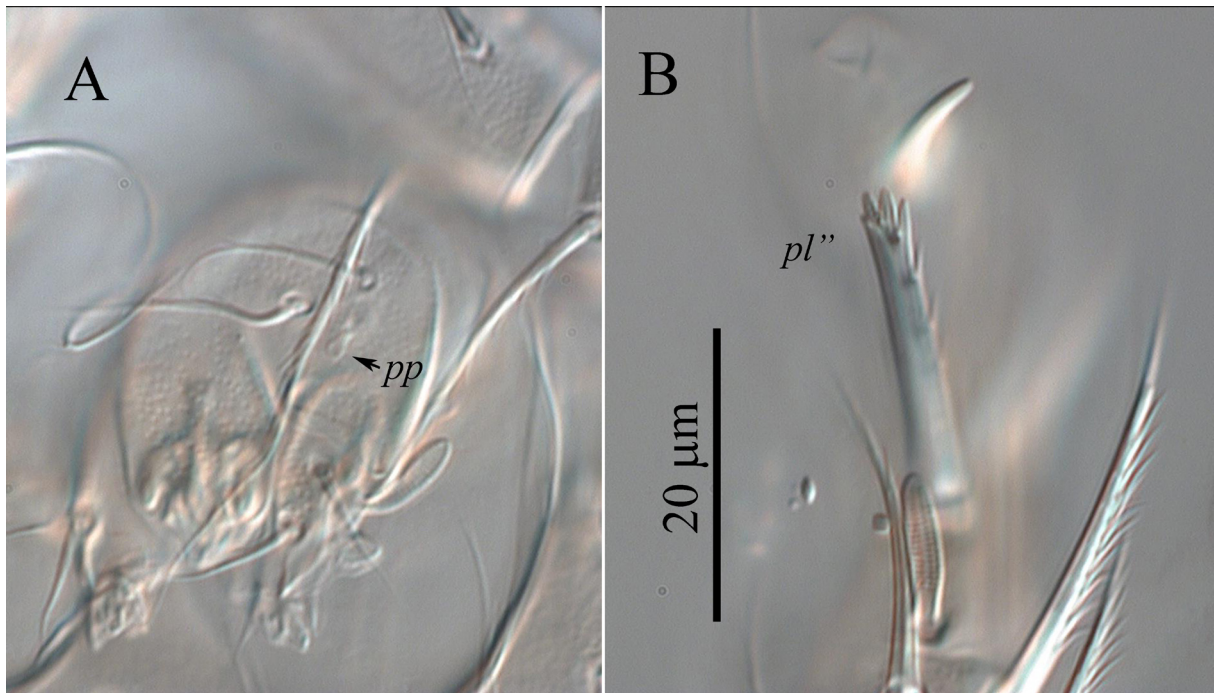


Fig. 5. *Coronipes speratii* Khaustov, Lee, Lee et Park sp. n., female, DIC micrographs: A—gnathosoma, B—tarsus II in dorsal view.



Fig. 6. *Coronipes speratii* Khaustov, Lee, Lee et Park sp. n., females phoretic on workers of *Reticulitermes speratus kyushuensis*. Stereo micrograph.

2. Setae ps_2 distinctly shorter than half length of setae ps_1 *C. divergens* Mahunka, 1972
 — Setae ps_2 distinctly longer than half length of setae ps_1 *C. samsinaki* (Mahunka, 1966)
3. Setae e only slightly shorter than h_2
 *C. sperati* sp. n.
 — Setae e about two times shorter than h_2
 *C. hauseri* Mahunka and Mahunka-Papp, 1988

DISCUSSION

Mites of the superfamily Pygmephoroida associated with termites are poorly studied. All data available to the authors are summarized in Table 1. Silvestri (1918) described *Imparipes termitophilus* Silvestri, 1918 (Scutacaridae) phoretic on termites *Pericapritermes appellans* Silvestri, 1914 from Western Africa. Mahunka (1964) described *Archidispus brevisetus* Mahunka, 1964 on termites *Odontotermes nolaensis* and *Imparipes angolensis* Mahunka, 1964 (Scutacaridae) on *Pseudacanthotermes spiniger* (Sjostedt) from Angola. He also described *Coronipes samsinaki* (Mahunka, 1966) (Scutacaridae) from China (Mahunka 1966) on termites *Coptotermes formosanus* Shiraki, 1909. Delfinado and Baker (1976) described *Imparipes adleri* Delfinado and Baker 1976 from colony of *Reticulitermes virginicus* (Banks, 1907). Cross (1965) reported the finding of *Parapygmephorus* sp. (Neopygmephoridae) and *Premicrodispus* sp. (Microdispidae) on *Reticulitermes flavipes* (Kollar, 1837) (Rhinotermitidae) in Indiana, USA. Cross and Moser (1971) reported the discovery of *Pygmephorellus* sp. from *Nasutitermes* sp. in Texas, USA. Mahunka (1981) described a new genus and species, *Luciaphorus hauseri* Mahunka, 1981 (Pygmephoridae) from termite nest in St. Lucia, Antilles. Costa-Leonardo and Soares (1993) recorded phoresy of *Pygmephorellus* sp. and *Luciaphorus hauseri* on *Heterotermes tenuis* (Hagen, 1858) in Brazil. Kurosa (1994, 2002) described *Nipponophorus ishikarai* (Kurosa, 1994) and *Mahunkania japonica* Kurosa, 2002 and recorded *Luciaphorus* sp. in the nest of *Reticulitermes speratus kyushuensis* Morimoto, 1968.

Among nine known families of Isoptera, pygmephoroid mites are recorded as associates of two families: Termitidae and Rhinotermitidae (Table 1). Females of pygmephoroid mites are phoretic on termites, mainly on workers (Costa-Leonardo and Soares 1993). Pygmephorid mites are usually attached to legs of termites (Costa-Leonardo and Soares 1993). We recorded phoresy of *Coronipes*

sperati sp. n. on termite body and also found it in rearing medium, also mainly on legs of workers of *Reticulitermes speratus kyushuensis* (Fig. 6).

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Table 1. Known associations of mites with termites according to literature data

Mite family	Mite species	Host termite		Locality	Reference
		Termite family	Termite species		
Scutacaridae	<i>Imparipes termitophilus</i> Silvestri, 1918	Termitidae	<i>Pericapritermes appellans</i> Silvestri, 1914	Western Africa	Silvestri 1918
	<i>Archidispus brevisetus</i> Mahunka, 1964		<i>Odontotermes nolaensis</i> Sjostedt, 1924	Angola	Mahunka 1964
	<i>Imparipes angolensis</i> Mahunka, 1964		<i>Pseudacanthotermes spiniger</i> (Sjostedt, 1900)	Angola	Mahunka 1964
	<i>Coronipes samsinaki</i> (Mahunka, 1966)	Rhinotermitidae	<i>Coptotermes formosanus</i> Shiraki, 1909	China	Mahunka 1966
	<i>Coronipes sperati</i> Khaustov, Lee, Lee et Park sp. n.		<i>Reticulitermes speratus kyushuenensis</i> Morimoto, 1968	South Korea	Present data
	<i>Imparipes adleri</i> Delfinado et Baker, 1976		<i>Reticulitermes virginicus</i> (Banks, 1907)	USA	Delfinado and Baker 1976
	Unknown genus and species		<i>Reticulitermes flavipes</i> (Kollar, 1837), <i>Coptotermes formosanus</i> Shiraki, 1909	China	Wang <i>et al.</i> 2002
Neopygmephoridae	<i>Parapygmephorus</i> sp.	<i>Reticulitermes flavipes</i> (Kollar, 1837)	USA	Cross 1965	
	<i>Nipponophorus ishikarai</i> (Kurosa, 1994)	<i>Reticulitermes speratus kyushuenensis</i> Morimoto, 1968	Japan	Kurosa 1994	

A new *Coronipes* (Acari: Scutacaridae) from Korea

Microdispidae	<i>Premicrodispus</i> sp.	Rhinotermitidae	<i>Reticulitermes flavipes</i> (Kollar, 1837)	USA	Cross 1965
	Unknown genus		<i>Reticulitermes flavipes</i> (Kollar, 1837)	USA	Wang <i>et al.</i> 2002
	Near <i>Unguidispus</i>		<i>Reticulitermes flavipes</i> (Kollar, 1837)	USA	Wang <i>et al.</i> 2002
Pygmephoridae	<i>Luciaphorus hauseri</i> Mahunka, 1981		Termite nest, <i>Heterotermes tenuis</i> (Hagen, 1858)	St. Lucia, Antilles, Brazil	Mahunka 1981; Costa-Leonardo and Soares 1993
	<i>Luciaphorus</i> sp.		<i>Reticulitermes speratus kyushuensis</i> Morimoto, 1968	Japan	Kurosa 1994
	<i>Mahunkania japonica</i> Kurosa, 2002		<i>Reticulitermes speratus kyushuensis</i> Morimoto, 1968	Japan	Kurosa 2002
	<i>Pygmephorellus</i> sp.	<i>Heterotermes tenuis</i> (Hagen, 1858)	Brazil	Costa-Leonardo and Soares 1993	
	<i>Pygmephorellus</i> sp.	Termitidae	<i>Nasutitermes</i> sp.	USA	Cross and Moser 1971