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Taxonomic study on the genus *Fissicepheus* (Acari: Oribatida: Otocepheidae) from China

LI-HAO ZHENG[1] & JUN CHEN[2,3]

[1]*Guang'an Science Park, Guang'an Vacational and Technical College, Guang'an 638000, China.*
[2]*Key Laboratory of Zoological Systematics and Evolution, Institute of Zoology, Chinese Academy of Sciences, Beijing 100101, China.*
[3]*Correspondent author. E-mail: chenj@ioz.ac.cn*

Abstract

Four new species of the genus *Fissicepheus* Balogh & Mahunka, 1967 from China are described on the basis of adults: *Fissicepheus (Fissicepheus) aokii* **sp. nov.**, types from Shanxi Province, *F. (F.) combicondylus* **sp. nov.**, from Guangdong Province, *F. (F.) confragosus* **sp. nov.**, from Sichuan Province, and *F. wangae* **sp. nov.** from Beijing City. A revised generic diagnosis and a key to the 26 known species worldwide of *Fissicepheus* are provided. Compared with the diagnosis of the subgenus *F. (Psammocepheus)* Aoki, 1970, *F. (P.) haradai* Choi, 1986 is moved to the nominotypical subgenus: *F. (F.) haradai* Choi, 1986.

Key words: new species, diagnostic key, oribatid mites, Tetracondylinae

Introduction

The oribatid mite family Otocepheidae Balogh, 1961 currently includes three subfamilies (Otocepheinae, Tetracondylinae, and Pseudotocepheinae) and nearly 470 known species in 39 genera (Aoki 1965, 1967; Grobler 1997; Norton & Behan-Pelletier 2009; Subías 2017). The genus *Fissicepheus* Balogh & Mahunka, 1967 is one of 13 genera of the subfamily Tetracondylinae.

In 1967, Balogh and Mahunka proposed the genus *Fissicepheus* with the new species *Fissicepheus elegans* from Vietnam as the type species. In 1970, Aoki proposed a new subgenus *Psammocepheus* with the type species *Fissicepheus (Psammocepheus) amabilis* Aoki, 1970 from Japan. Up to March 2017, a total of 22 species and two subspecies have been described in the two subgenera (Subías 2017). All species of this genus were reported from East Asia and Southeast Asia, except for one that was reported from Ukraine, namely *Fissicepheus sitnikovae* Sergienko, 1976.

Tseng (1982) reported *Fissicepheus coronarius* Aoki, 1967 from Taiwan, which was the first report of this genus in China. In 1990, Wen recorded *Fissicepheus clavatus* (Aoki, 1959) from Jilin, China, and afterwards this species was recorded at several sites of East and South China (Wen 1990, Wang & Hu 1992, Wang & Wang 1994, Wang *et al.* 2000, Wang *et al*. 2002, Chen *et al*. 2010). In 1993, Wen described two new species from China: *Fissicepheus chinensis* from Jiangsu and *Fissicepheus ornithorrhynchus* from Sichuan. In the same paper, *Fissicepheus mitis* Aoki, 1970 was also reported for the first time from China (Sichuan). To sum up, before the present paper, five species of the genus *Fissicepheus* were reported in China.

Based on the material of oribatid mites that have been collected continually from different regions of China since the 1980s and deposited in the National Zoological Museum of China, Institute of Zoology, Chinese Academy of Sciences, the authors performed a taxonomic study on the family Otocepheidae from China. The present paper represents part of these research results. A revised diagnosis of *Fissicepheus*, the descriptions of four new species and a key to all known species of the genus are provided.

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Material and methods

Measurements and descriptions are based on specimens mounted in temporary cavity slides. Terminology used in this paper follows Grandjean (1934), Aoki (1965, 1967), Norton & Behan-Pelletier (2009). The unit of measurement is micrometre (μm).

All type specimens are deposited in the Zoological Museum of China, Institute of Zoology, Chinese Academy of Sciences, Beijing.

Diagnosis of the genus *Fissicepheus* Balogh & Mahunka, 1967

The following diagnosis is based on Balogh and Mahunka (1967), Aoki (1967), with additional characters as discovered during our studies:

Lamellae broadly separated, distance between their outer margins at the level of apexes of pedotecta I accounting for 30–50% of distance between apexes of pedotecta I (Figs. 1a, 2a, 3a, 5a). Ten to fourteen pairs of notogastral setae present. Epimere II without seta, epimeral seta *4a* located posterolateral to *4b,* and well removed from *4c* (if *4c* present). A pair of aggenital condyles (*co.ag*) present between genital opening and discidium in most species (Figs. 1d, 2c, 3d, 5d). Genital plate not darker in color than ventral or anal plate. Adanal lyrifissure (*iad*) situated far from anal aperture, and located at level anterior to ad_3 (Figs. 1d, 2c, 3d, 5d). Anogenital setation: 4-1-2-3. Ultimate setae (*u*) of tarsi I–IV with flagelli-form tip (L-type).

Remarks: In 1970, Aoki proposed the subgenus *Psammocepheus*, and distinguished it from the nominate subgenus *Fissicepheus* mainly by absence of the aggenital condyles (*co.ag*). He also considered the presence of tubercles arranged on the posterior portion of prodorsum may possibly be another important diagnostic character of the subgenus *Psammocepheus*. In 1986, Choi described the second species of this subgenus, *F. (P.) haradai* Choi, 1986 from Korea. However, in this species, *co.ag* is present but tubercles on the posterior portion of prodorsum are absent. Therefore, *F. (P.) haradai* does not show the diagnostic characters of this subgenus and should be moved to the nominotypical subgenus: *F. (F.) haradai* Choi, 1986.

Description of new species

Fissicepheus (Fissicepheus) aokii sp. nov.

(Fig. 1)

Material examined: Holotype: adult (in alcohol, DW-12-17), CHINA: Shanxi Province: Jiaocheng County, Shishazhuang (37°38′50″N, 111°44′41″E), 1170m a.s.l., from litter under shrub, 17 Jun. 2012, leg. Wei Duan. Paratypes: 1 adult (in alcohol, DW-12-17), same data as holotype; 1 adult (mounted on slide, DW-12-106, SSNO: 31934), CHINA: Shanxi Province: Yicheng County, Dahe Village (35°25′58.45″N, 111°54′23.16″E), 1028m a.s.l., from litter under shrub, 19 Jul. 2012, leg. Wei Duan.

Etymology. The name of the new species is dedicated to Dr. Jun-ichi Aoki, who made an initial contribution to the study of the otocepheid mites.

Description. *Measurements*. Holotype: body length 590, width 300, notogastral length 388, setae lengths: *ss* 60, *in* 55, *le* 100, *ro* 90, *ex* 20, mutual distances of setae: *c-c* 115, *la-la* 175, *lm-lm* 130, *lp-lp* 225, h_2-h_2 165, h_1-h_1 125. Paratypes: body length 480–540, width 220–265.

Prodorsum (Fig. 1a). Rostrum rounded. Seta *ro* slightly barbed unilaterally, curved inward. Seta *le* inserted almost at tip of lamella, glabrous, curved inward, longer than *ro*. Fine foveolae present on lateral lamelliform expansion (*spa.l)*. Seta *in* distinctly barbed in distal third. Distance between outer margins of lamellae on level of apexes of pedotecta I accounting for ca. 47% (holotype) of distance between apexes of pedotecta I. Tutorium (*tu*) poorly developed. Posterolateral region of prodorsum densely granulate. Bothridium opening laterally, dorsal bothridial plate (*tbd*) curved inward. Sensillus (*ss*) club-shaped, head with many blunt thorns (Fig. 1c). Two pairs of prodorsal condyles present, lateral prodorsal condyles (*co.pl*) broadly triangular, median prodorsal condyles (*co.pm*) large and semicircular, well separated from each other.

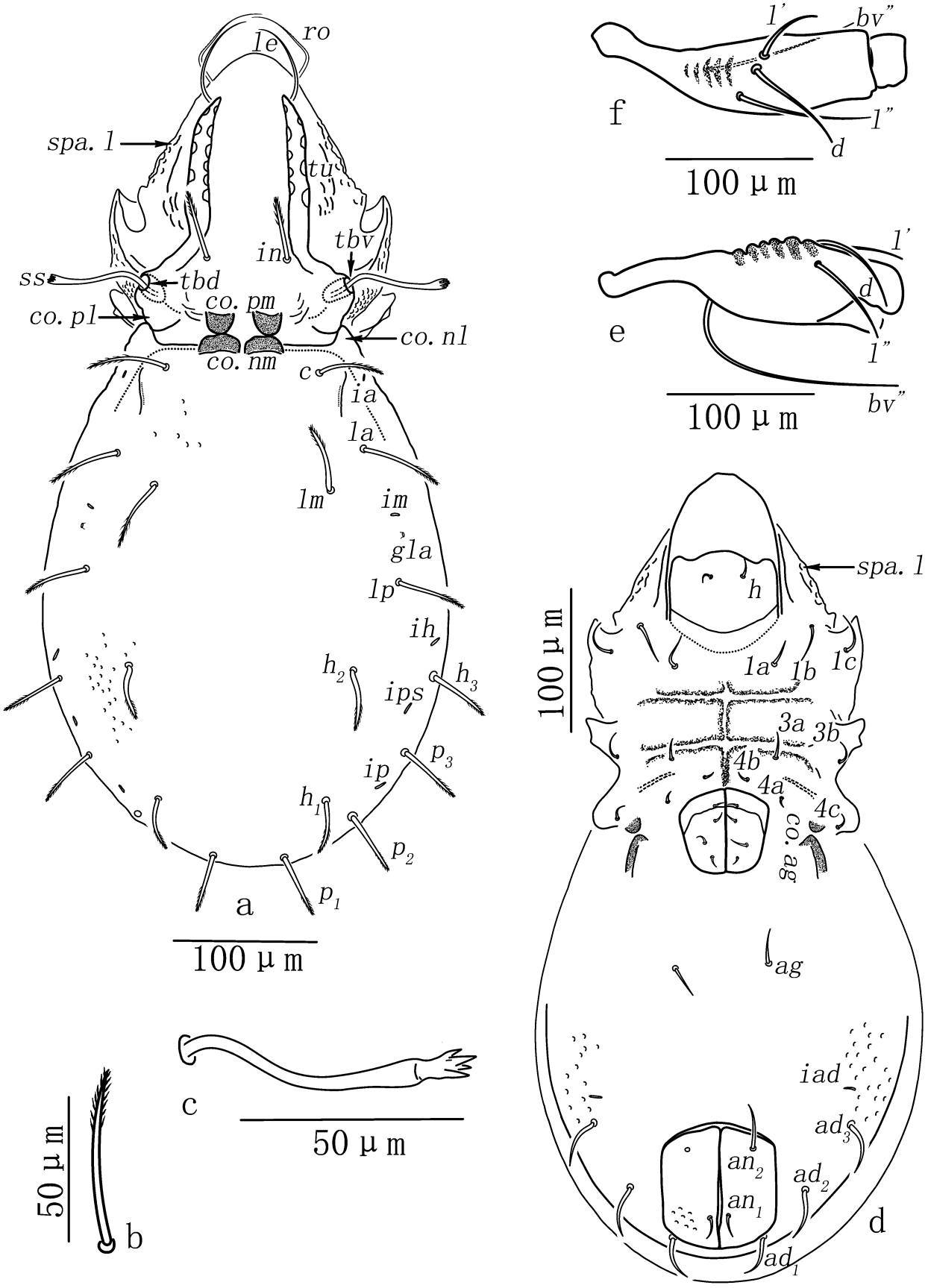

FIGURE 1. *Fissicepheus (Fissicepheus) aokii* **n. sp.**: a, dorsal aspect (legs removed); b, notogatral seta *la*; c, sensillus; d, ventral aspect (legs and mouthparts removed); e–f, femur I, right (e, antiaxial aspect; f, dorsal apsect).

Notogaster (Figs. 1a, 1b). Length/Width of notogaster about 1.3 (hotlotype). Surface of notogaster densely punctate. Two pairs of notogastral condyles present, opposed to prodorsal condyles, correspondingly; lateral notogastral condyles (*co.nl*) triangular, median notogastral condyles (*co.nm*) separated from each other, large and nearly rectangular. Ten pairs of notogastral setae (*c*, *la*, *lm*, *lp*, h_1, h_2, h_3, p_1, p_2, p_3) nearly same in length (range 50–60), and distinctly barbed in distal third (Fig. 1b). Faint, short ridge present lateral to insertion of seta *c*. Lyrifissure *ih* situated anterior to, and *ips* posterior to h_3.

Venter (Fig. 1d). One pair of seta *h* present on subcapitulum. Surface of ventral plate punctate. Epimeral setal formula: 3-0-2-3. *Apo.2* and *apo.sj* developed distinctly, *apo.3* short. Genital plate nearly smooth, with four pairs of genital setae, g_1, g_2, g_4 nearly lined along medial margin, g_3 removed to central part. Aggenital condyles (c*o.ag*) well developed, each with rounded tip. Anal plates punctate, with two pairs of anal setae, mutual distances an_1-an_1<an_2-an_2. Three pairs of adanal setae present, all weakly barbed, ad_3-ad_3 at level of anterior margin of anal opening. Adanal lyrifissure (*iad*) situated immediately anterior to ad_3.

Legs. All legs monodactyle, all ultimate setae L-type. Several pleats present on dorsal sides of all femora (Figs. 1e, 1f). Formulae of leg setation and solenidia: I (1-4-3-4-16) [1-2-2], II (1-4-3-3-16) [1-1-2], III (2-3-1-2-14) [1-1-0], IV (1-2-1-2-12) [0-1-0].

Remarks. This new species is similar to *Fissicepheus vicinus* Aoki, 1986 from Japan in having large and semicircular *co.pm*, similar shape of *ss*, and *le* inserted almost at tip of lamella. It differs from *F. vicinus* as follows: in *F. aokii*, notogastral setae distinctly barbed in distal third, lateral lamelliform expansion (*spa.l*) not fused to each other; in *F. vicinus*, notogastral setae glabrous and with fine tips, *spa.l* well developed, fused to each other to form a brim-like structure. This new species is also similar to *F. thaiensis* Mahunka, 2008 from Thailand in having distinctly barbed notogastral setae (in distal third). It differs from *F. thaiensis* as follows: in *F. aokii*, seta *le* glabrous, no tubercle present behind prodorsal condyles, two pairs of notogastral condyles present, *co.ag* well developed; in *F. thaiensis*, seta *le* peculiarly ciliate, some irregularly and weakly developed tubercles present behind prodorsal condyles, only lateral notogastral condyles present, *co.ag* weakly developed.

***Fissicepheus (Fissicepheus) combicondylus* sp. nov.**
(Fig. 2)

Material examined: Holotype: adult (in alcohol, LD-08-69), CHINA: Guangdong Province: Ruyang County, Babao Mt. (24°55'42.9"N, 113°0'57.3"E), 1030m a.s.l., 16 Jul., 2008, leg. Dong Liu.

Etymology. The specific epithet "*combi*" is from Latin for "combine, unite" and refers to the fused median notogastral condyles.

Description. *Measurements*. Holotype: body length 860, width 380, notogastral length 545, setae lengths: *ss* 40, *in* 60, *le* 100, *ro* 95, *ex* 20, mutual distances of setae: *c-c* 130, *la-la* 230, *lm-lm* 185, *lp-lp* 325, h_2- h_2 230, h_1-h_1 160.

Prodorsum (Fig. 2a). Fine foveolae present on prodorsum. Rostrum rounded. Seta *ro* and *le* glabrous, curved inward. *Le* inserted behind tip of lamella. *In* glabrous, shorter than their mutual distance. Distance between outer margins of lamellae at the level of apexes of pedotecta I accounting for ca. 36% of distance between apexes of pedotectae I. Tutorium well developed. Dense granules found posterlaterally on prodorsum. *Ss* peduncle short, with strongly expanded and rounded head (Fig. 2b). Two pairs of prodorsal condyles present, *co.pl* peach-shaped, *co.pm* semicircular. Mutual distance between ventral bothridial plate (*tbv*) larger than that between *co.pl*.

Notogaster (Fig. 2a). L/W of notogaster about 1.4. Surface of notogaster densely punctate. Two pairs of notogastral condyles present, *co.nl* triangular, *co.nm* wide, fused to each other, with broadly rounded apex. Ten pairs of notogastral setae (*c*, *la*, *lm*, *lp*, h_1, h_2, h_3, p_1, p_2, p_3) present with nearly equal length (range 50–75), and fine tips. Lyrifissures *ih* and *ips* situated anterior to h_3.

Venter (Fig. 2c) Subcapitulum with one pair of setae *h*. Surface of ventral plate punctate. Epimeral setal formula: 2-0-2-3. *Apo.2* and *apo.sj* developed distinctly, *apo.3* short. Surface of genital plate nearly smooth, with four pairs of genital setae, g_1, g_2, g_4 nearly lined along medial margin, g_3 removed to central part. *Co.ag* well developed. Anal plate conspicuously punctate, with two pairs of anal setae, mutual distance an_1-an_1<an_2-an_2. Three pairs of adanal setae present, ad_3 somewhat shorter than ad_2 and ad_1, ad_3 inserted at the level a little behind anterior margin of anal opening. Adanal lyrifissure (*iad*) situated not far anterior to ad_3.

Legs. All legs monodactyle, all ultimate setae L-type. Formulae of leg setation and solenidia: I (1-4-3-4-18) [1-2-2], II (1-4-3-3-16) [1-1-2], III (2-3-1-2-14) [1-1-0], IV (1-2-1-2-12) [0-1-0].

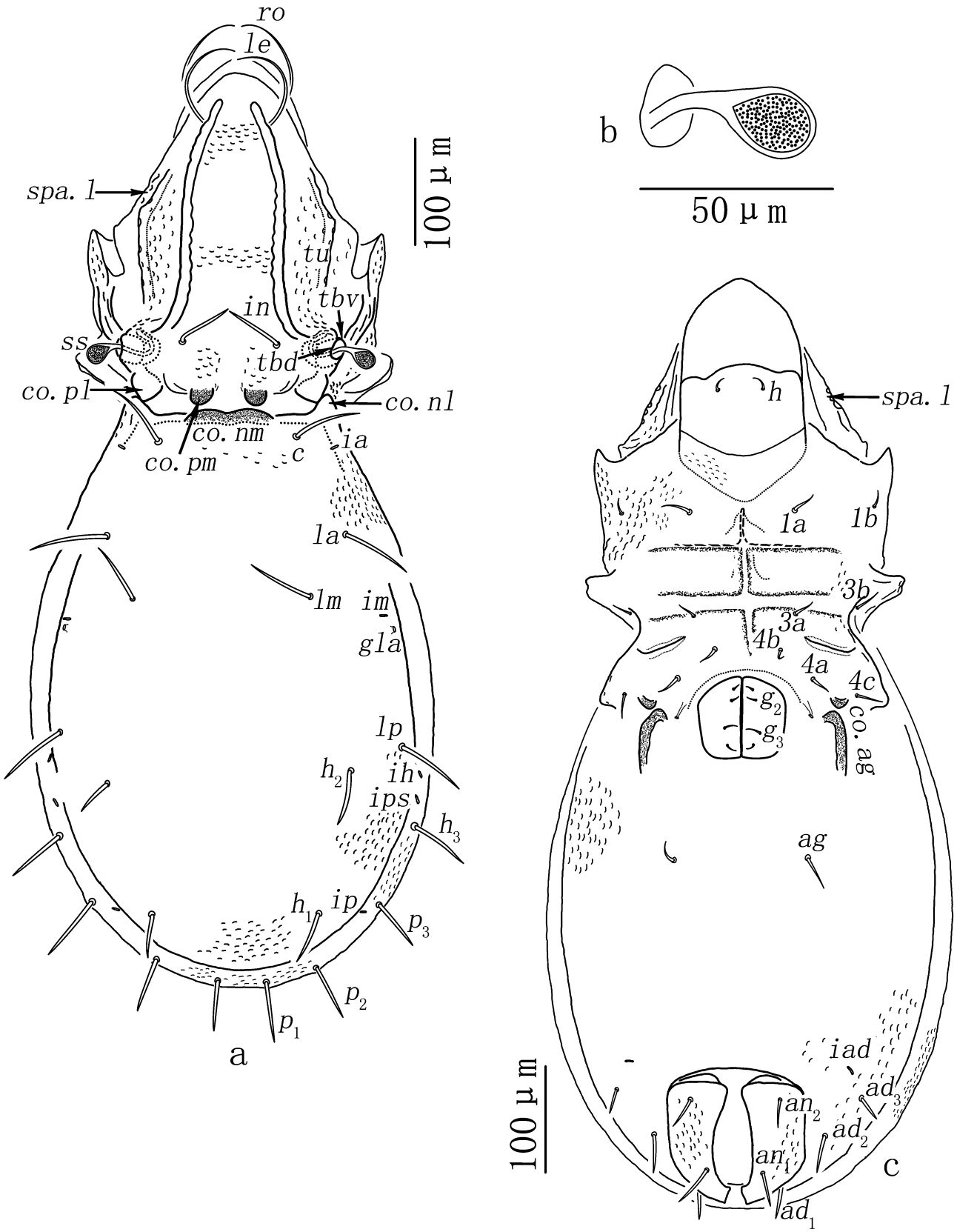

FIGURE 2. *Fissicepheus (Fissicepheus) combicondylus* **n. sp.**: a, dorsal aspect (legs removed); b, sensillus; c, ventral aspect (legs and mouthparts removed).

Remarks. This new species is close to *F. clavatus* from Japan in having four pairs of prodorsal and notogastral condyles and head of *ss* expanded and rounded. They can be distinguished by: in this new species, *spa.l* separated from each other, *co.nm* wide, fused to each other, with broadly rounded heads; in *F. clavatus*, *spa.l* well developed, fused to each other to form a brim-like structure, and *co.nm* well separated.

***Fissicepheus (Fissicepheus) confragosus* sp. nov.**
(Figs. 3–4)

Material examined (all the specimens were collected by Dong Liu from Sichuan Province, China)**:** Holotype: adult (in alcohol, LD-09-148), Batang County, Lanei Mt. (30°13'55.49"N, 99°14'25.55"E), 3510m a.s.l., from litter under shrub, 6 Jun., 2009. Paratypes: 30 adults (in alcohol, LD-09-148), same data as holotype; 29 adults (in alcohol, LD-09-147), same data as holotype; 1 adult (in alcohol, LD-09-12), Luding County, Moxi Town, Hailuogou (29°34'55.40"N, 102°1'18.30"E), 2800m a.s.l., from litter under forest, 15 May, 2009; 1 adult (in alcohol, LD-09-30), Luding County, Moxi Town, Gonga Mt. (29°33'4.39"N, 101°58'11.75"E), 3575m a.s.l., from moss, 18 May, 2009. Other specimens: 1 adult (in alcohol, LD-09-31), same data as LD-09-30; 12 adults (in alcohol, LD-09-60), Kangding County, Paoma Mt. (30°2'44.63"N, 101°57'57.78"E), 2703m a.s.l., from litter under shrub, 22 May, 2009; 3 adults (in alcohol, LD-09-76), Yajiang County, Qingdagou (30°12'55.04"N, 101°4'16.46"E), 2913m a.s.l., from litter under forest, 26 May, 2009; 33 adults (in alcohol, LD-09-90), Yajiang County, Bajiaolou Town (30°7'54.16"N, 101°11'17.95"E), 3013m a.s.l., 29 May, 2009, from litter under pine tree; 27 adults (in alcohol, LD-09-91), from litter under pine tree and shrub, same data as LD-09-90; 2 adults (in alcohol, LD-09-95), from litter under forest, same data as LD-09-90; 1 adult (in alcohol, LD-09-101), Litang County, Jiawa Town (29°33'48.74"N, 100°18'33.44"E), 4195m a.s.l., from litter under *Rhododendron* sp., 31 May, 2009; 1 adult (in alcohol, LD-09-136), Batang County, Cuola Town (30°25'30.68"N, 99°27'53.75"E), 3871m a.s.l., 4 Jun., 2009, from litter under shrub; 1 adult (in alcohol, LD-09-137), from litter under pine tree, same data as LD-09-136; 1 adult (in alcohol, LD-09-146), same data as holotype.

Etymology. The specific epithet "*confragosus*" is from Latin for "rough surface" and refers to granules on surface of trochanter and femur.

Description. *Measurements*. Holotype: body length 660, width 330, notogastral length 440, setae lengths: *ss* 70, *in* 50, *le* 100, *ro* 90, *ex* 10, mutual distances of setae: *c-c* 130, *la-la* 170, *lm-lm* 140, *lp-lp* 260, h_2-h_2 180, h_1-h_1 140. Paratypes (n=30): body length 590–750, width 230–370.

Prodorsum (Figs. 3a, 3c). *Spa.l* well developed, fused to each other to form a brim-like structure (Fig. 3c). Setae *ro* and *le* glabrous, curved inward. Seta *le* well removed backward from tip of lamella. Lamella thick, with distinct foveolae. Distance of outer margins of lamellae at the level of apexes of pedotecta I accounting for ca. 48% (holotype) of distance between apexes of pedotecta I. Seta *in* shorter than their mutual distance, with a blunt tip. Surface of prodorsum lateral to lamella with fine granules. *Ss* short, with a fusiform head. Two pairs of prodorsal condyles present, *co.pm* drop-shaped, with a rounded head. An arched swelling found between two *co.pl* and through under *co.pm*.

Notogaster (Figs. 3a–b). L/W of notogaster about 1.3 (holotype). Surface of notogaster densely punctate. Two pairs of notogastral condyles present, *co.nl* triangular, *co.nm* inserted on opposite position of *co.pm*, well separated. Ten pairs of notogastral setae (*c*, *la*, *lm*, *lp*, h_1, h_2, h_3, p_1, p_2, p_3) present, nearly same in length (range 45–53), thick and blunt at tip, mutual distance p_2-p_3>p_2-p_1. Lyrifissures *ih* and *ips* situated anterior to h_3 (fig. 3b).

Venter (Fig. 3d). One pair of subcapitular setae *h* present. Surface of ventral plate punctate. Epimeral setal formula: 2-0-2-3. *Apo.2* and *apo.sj* distinctly developed, *apo.3* short. Several poorly developed longitudinal wrinkles present on genital plate. Four pairs of genital setae, mutual distances g_1-g_1≈g_2-g_2≈g_4-g_4<g_3-g_3. *Co.ag* well developed, each with a rounded tip. Anal plate well punctate, with two pairs of anal setae, mutual distance an_1-an_1<an_2-an_2. Three pairs of adanal setae nearly equal in length, blunt at tip, ad_3-ad_3 at level of anterior margin of anal opening. Adanal lyrifissure (*iad*) situated anteromedially of ad_3.

Legs (Fig. 4). All legs monodactyle, all ultimate setae L-type. Surface of femur (leg I–IV) and trochanter (leg III–IV) densely granulated (Figs. 3b, Fig. 4). Formulae of leg setation and solenidia: I (1-4-3-4-16) [1-2-2], II (1-4-3-3-15) [1-1-2], III (2-3-1-2-14) [1-1-0], IV (1-2-1-2-12) [0-1-0].

Remarks. *F. confragosus* n. sp. is easily distinguished from other known species of this genus by having dense granules on the surface of femora I–IV and trochanters III–IV.

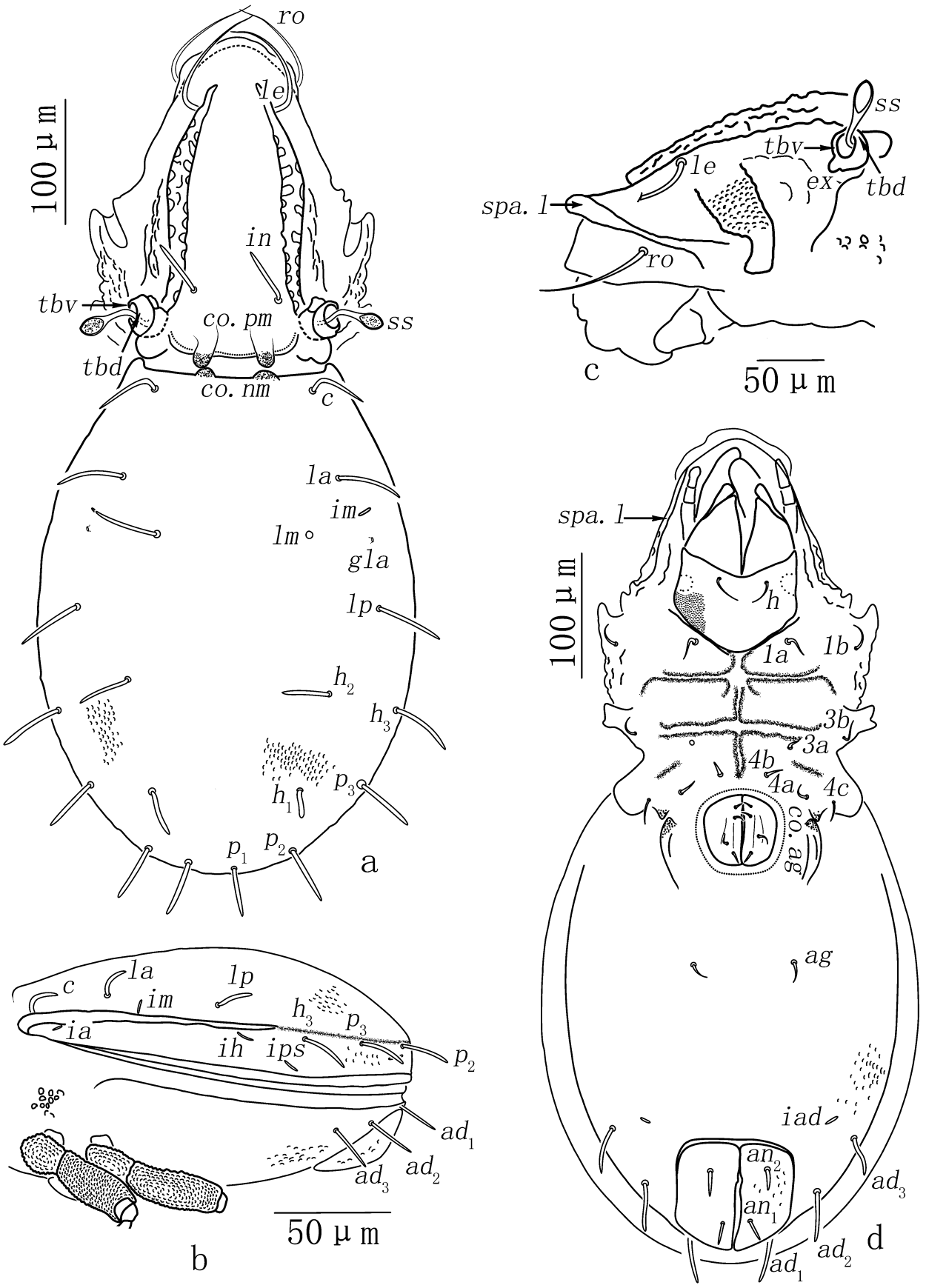

FIGURE 3. *Fissicepheus (Fissicepheus) confragosus* **n. sp.**: a, dorsal aspect (legs removed); b, lateral view of notogaster, with trochanters and femora of legs III–IV; c, lateral view of prodorsum; d, ventral aspect (legs removed).

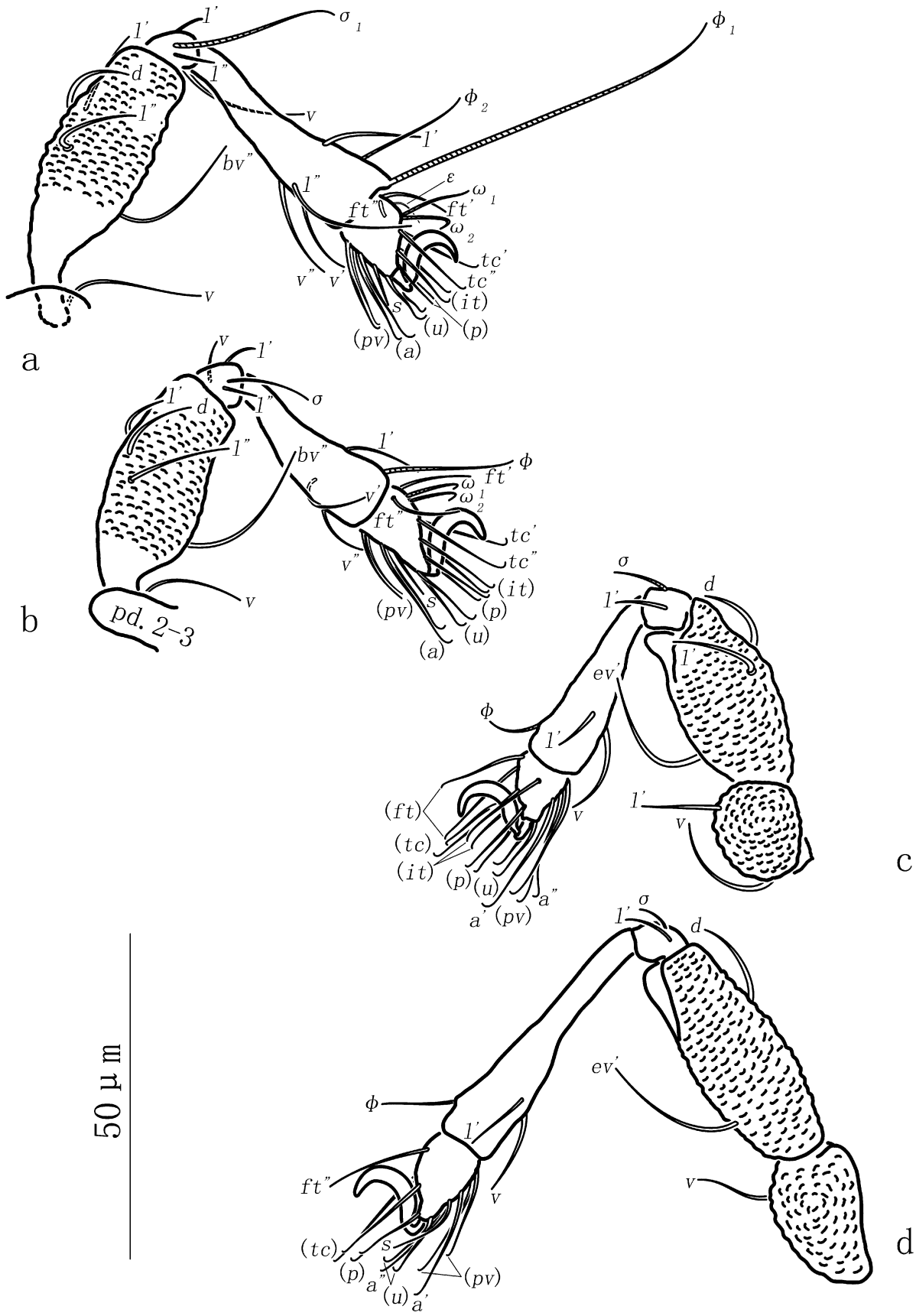

FIGURE 4. *Fissicepheus (Fissicepheus) confragosus* **n. sp.**: a, leg I, antiaxial view; b, leg II, antiaxial view; c, leg III, antiaxial view; d, leg IV, antiaxial view. Scal bars: a–d=50μm.

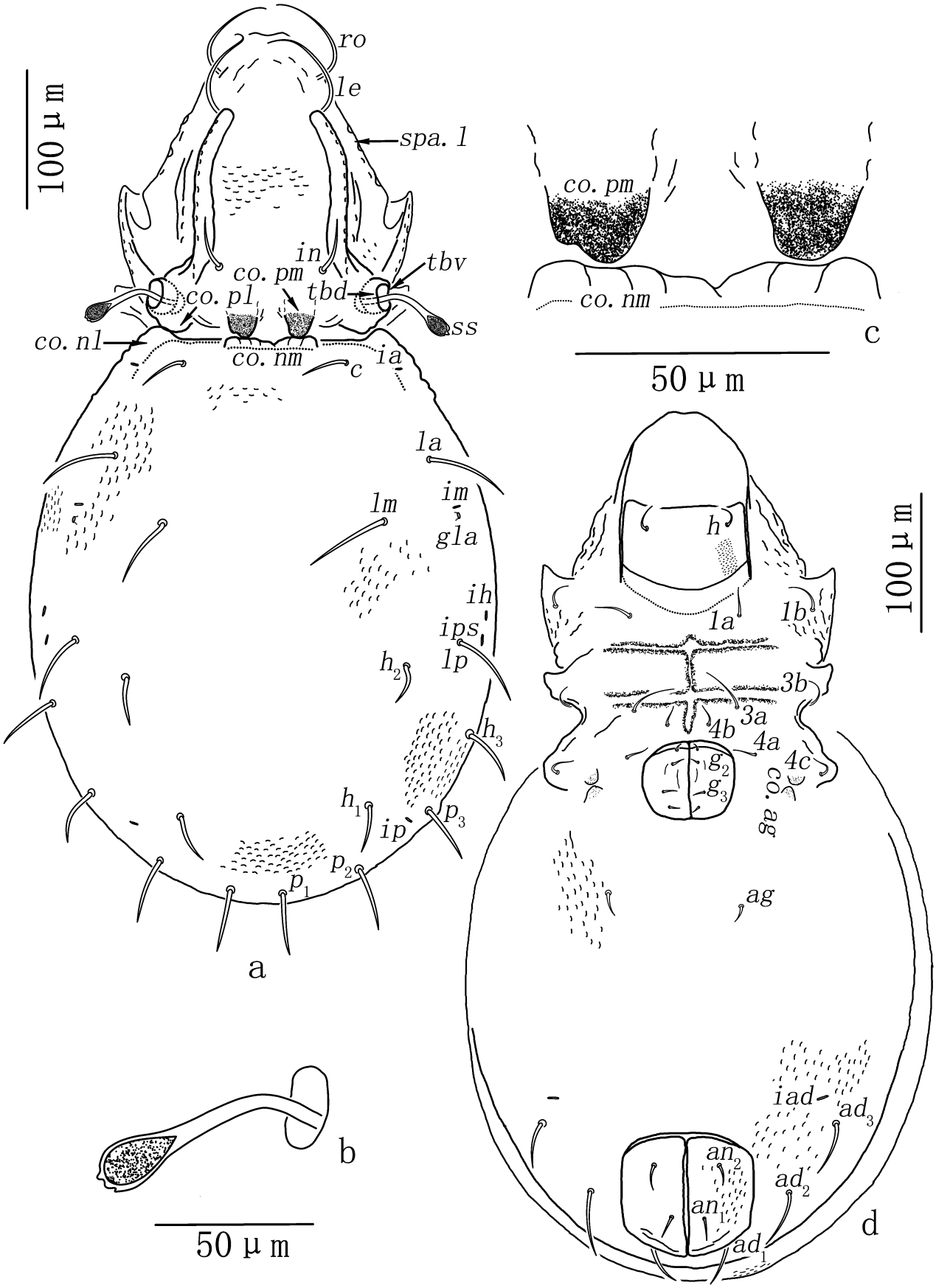

FIGURE 5. *Fissicepheus (Fissicepheus) wangae* **n. sp.**: a, dorsal aspect (legs removed); b, sensillus; c, prodorsal condyles and notogastral condyles; d, ventral aspect (legs and mouthparts removed).

***Fissicepheus (Fissicepheus) wangae* sp. nov.**
(Fig. 5)

Material examined: Holotype: adult (in alcohol, DW-12-09), CHINA: Beijing City, Songshan Mt. (40°29′26″N, 115°49′09″E), 680m a.s.l., 1 Jul., 2012, Wei Duan, from litter under shrub. Paratype: 1 adult (in alcohol, DW-12-09), same data as holotype.

Etymology. The name of the new species is dedicated to Prof. Hui-Fu Wang, one of the famous acarologists who made an important contribution to the study of oribatid mites in China.

Description. *Measurements*. Holotype: body length 630, width 340, notogastral length 400, setae lengths: *ss* 70, *in* 55, *le* 85, *ro* 70, *ex* 10, mutual distances of setae: *c*-*c* 117, *la*-*la* 225, *lm*-*lm* 160, *lp*-*lp* 280, h_2-h_2 205, h_1-h_1 115. Paratype: body length 530, width 275.

Prodorsum (Fig. 5a). Rostrum slightly notched medially. Seta *ro* and *le* curved inward, nearly smooth. Seta *le* inserted almost at tip of lamella. Interlamellar prodorsum with fine foveolae. Length of seta *in* shorter than their mutual distance. Distance of outer margins of lamellae at the level of apexes of pedotecta I accounting for ca. 48% (holotype) of distance between apexes of pedotecta I. Fine tubercles found on outer side of lamella. *Tbd* curved inward, *tbv* slightly curved inward. *Ss* with long peduncle and apical margin of swollen head somewhat jagged (Fig. 5b). Two pairs of prodorsal condyles present, *co.pm* distinctly projected backward. Mutual distance: *tbv*-*tbv*>*co.pl*-*co.pl*.

Notogaster (Figs. 5a, c). L/W of notogaster about 1.2 (holotype). Surface of notogaster densely punctate. Two pairs of notogastral condyles present, *co.nl* triangular with rounded tip, *co.nm* broad, connected with each other. Lateral margin of notogaster behind *co.nl* slightly waved. Ten pairs of notogastral setae (*c*, *la*, *lm*, *lp*, h_1, h_2, h_3, p_1, p_2, p_3) nearly same in length (range 45–60), smooth, with fine tips. Lyrifissures *ih* and *ips* situated anterior to h_3.

Venter (Fig. 5d). One pair of setae *h* present. Surface of ventral plate punctate. Epimeral setal formula: 2-0-2-3. *Apo.2* and *apo.sj* distinctly developed, *apo.3* short. Surface of genital plate nearly smooth. Four pairs of genital setae present, mutual distances g_1-g_1≈g_2-g_2≈g_4-g_4<g_3-g_3. *Co.ag* poorly developed, not so conspicuous. Anal plate well punctate, with two pairs of anal setae, mutual distance an_1-an_1<an_2-an_2, three pairs of adanal setae, ad_3-ad_3 at level before anterior margin of anal opening. Adanal lyrifissure (*iad*) situated right ahead of ad_3.

Legs. All legs monodactyle, all ultimate setae L-type. Formulae of leg setation and solenidia: I (1-4-3-4-16) [1-2-2], II (1-4-3-3-16) [1-1-2], III (2-3-1-2-14) [1-1-0], IV (1-2-1-2-12) [0-1-0].

Remarks. *F. wangae* n. sp. is most similar to *F. chinensis* from Jiangsu, China in having a swollen sensillar head, a less conspicuous *co.ag*, and *le* inserted at tip of lamella. These two species can be easily distinguished from each other as follows: in *F. chinensis*, *co.nm* absent, epimeral setal formula 2-0-1-3; in *F. wangae*, *co.nm* present, epimeral setal formula 2-0-2-3. It is also similar to *F. subclavatus* Mahunka, 1971 from Korea in having a swollen sensillar head, two pairs of prodorsal condyles and two pairs of notogastral condyles, *le* inserted at tip of lamella. It differs from the latter as follows: in *F. subclavatus*, seta *ex* long and can easily be seen in dorsal view, *co.nm* triangular and separated from each other; in *F. wangae*, seta *ex* short and invisible in dorsal view, *co.nm* broad and broadly connected with each other.

Key to the known species of the genus *Fissicepheus*.

1.	*Co.ag* absent	*F. (Psammocepheus.) amabilis* Aoki, 1970
-	*Co.ag* present	2
2.	Ten pairs of notogastral setae	3
-	Fourteen pairs of notogastral setae	23
3.	Anterior end of lamella conspicuously widened, petal-shaped	4
-	Anterior end of lamella not widened	5
4.	Notogastral setae with fine tips	*F. (Fissicepheus.) mitratus* Mahunka, 1971
-	Notogastral setae dilated	*F. (F.) coronarius* Aoki, 1967
5.	Developed tubercles present behind prodorsal condyles	*F. (F.) thaiensis* Mahunka, 2008
-	No tubercles present behind prodorsal condyles	6
6.	*Co.nm* present	7
-	*Co.nm* absent	18
7.	Notogastral setae bifid apically	*F. (F.) elegans* Balogh *et* Mahunka, 1967

- Notogastral setae not bifid apically 8
8. *Co.nm* connected with each other 9
- *Co.nm* separated from each other 11
9. *Spa.l* fused to each other to form a brim-like structure . . . . . *F. (F.) vicinus* Aoki, 1986
- *Spa.l* not fused to each other 10
10. Seta *le* inserted at tip of lamella . . . . . *F. (F.) wangae* **sp. nov.**
- Seta *le* inserted far from tip of lamella . . . . . *F. (F.) combicondylus* **sp. nov.**
11. Apical part of *ss* with strong spines 12
- *Ss* with relatively smooth margin 13
12. Notogastral setae strongly barbed in distal third . . . . . *F. (F.) aokii* **sp. nov.**
- Notogastral setae minutely barbed uniformly . . . . . *F. (F.) corniculatus* Aoki, 2009
13. *Spa.l* fused to each other to form a brim-like structure 14
- *Spa.l* not fused to each other 16
14. Surface of femora I–IV and trochanters III–IV densely granulated . . . . . *F. (F.) confragosus* **sp. nov.**
- Surfaces of legs without granules 15
15. *Co.pm* small, connected by a transverse ridge . . . . . *F. (F.) gracilis* Aoki, 2006
- *Co.pm* well developed, transverse ridge absent . . . . . *F. (F.) clavatus* (Aoki, 1959)
16. Interlamellar, notogastral and ano-adanal setae dilated in medial part . . . . . *F. (F.) striganovae* Ermilov *et* Anichkin, 2014
- Interlamellar, notogastral and ano-adanal setae with fine tips 17
17. Notogaster without a chitinous transversal band anterior to seta h_2 . . . . . *F. (F.) subclavatus* Mahunka, 1971
- Notogaster with a chitinous transversal band anterior to seta h_2 . . . . . *F. (F.) takenouchiensis* Fujikawa *et* Nishi, 2013
18. All notogastral setae dilated and leaf-like . . . . . *F. (F.) nakanei* Aoki, 1986
- Notogastral setae not leaf-like 19
19. *Co.pm* absent 20
- *Co.pm* present 22
20. Rostral apex deeply U-shaped incised . . . . . *F. (F.) steinmanni* Mahunka, 1971
- Rostral apex not excised 21
21. Head of *ss* with strong spines . . . . . *F. (F.) defectus* Aoki, 2006
- *Ss* with a finely roughened head, without spines . . . . . *F. (F.) haradai* Choi, 1986
22. *Ss* clavate; genital plate with 1or 2 longitudinal striae . . . . . *F. (F.) mitis* Aoki, 1970
- *Ss* with a rounded head; genital plate without striae . . . . . *F. (F.) chinensis* Wen, 1993
23. *Co.pm* and *co.nm* absent . . . . . *F. (F.) claviopsis* Mahunka, 1971
- *Co.pm* and *co.nm* present 24
24. Seta *le* inserted at tip of lamella . . . . . *F. (F.) sitnikovae* Sergienko, 1976
- Seta *le* inserted behind tip of lamella 25
25. Notogastral setae long and strongly curved . . . . . *F. (F.) curvisetosus* Kubota, 2001
- Notogastral setae short and almost straight . . . . . *F. (F.) ornithorrhynchus* Wen, 1993

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