

A CONTRIBUTION TO THE KNOWLEDGE OF THE ORIBATID MITE GENUS *FENICHELIA* BALOGH 1970 (ACARI, ORIBATIDA, MICREREMIDAE)

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The genus *Fenichelia* (Oribatida, Micreremidae) is recorded from the Oriental Region for the first time. A new species — *Fenichelia arborea* sp. n. — is described, based on adults collected from tree branches of *Dipterocarpus alatus* in the Cat Tien National Park, Vietnam. The morphology of the gnathosoma and the identification of leg setae and solenidia are presented for the first time for a representative of this genus. A revised generic diagnosis of, an identification key to, as well as distribution and habitat data for the known species of *Fenichelia* are provided.

Keywords: arboreal mites, taxonomy, generic diagnosis, morphology, identification key, distribution, habitat, Cat Tien National Park, Vietnam

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The genus *Fenichelia* (Acari, Oribatida, Micreremidae) was proposed from New Guinea by Balogh (1970), with *Fenichelia biroi* Balogh 1970 as type species. Later, two new species of the genus have been described from the Afrotropical Region: *F. latipilosa* Mahunka 1982 from Ethiopia and *F. porosa* (Mahunka, 1985) from South Africa.

During the taxonomic identification of arboreal oribatid mites collected from Vietnam, we found one new species belonging to *Fenichelia*; this is the first record of the genus from the Oriental Region. The main goals of our paper are: to describe this species based on adults; to revise the generic diagnosis; to present an identification key to the known species of *Fenichelia*; and to provide data on the distribution and habitats of the representatives of the genus.

MATERIALS AND METHODS

S p e c i m e n s. Samples of branches were collected via climbing trees (using spikes and other special equipment). Mites were subsequently extracted by high-pressure flushing and further heptane flotation in laboratory conditions. Detailed descriptions of ar-

boreal acarofauna collection and extraction techniques are presented in Salavatulin (2019).

Observation and documentation. For measurement and illustration, specimens were mounted in lactic acid on temporary cavity slides. All measurements are in micrometers (μm). Body length was measured in lateral view, from the tip of the rostrum to the posterior edge of the notogaster; other structures were oriented to avoid parallax errors. Notogastral width refers to the maximum width in dorsal aspect. Setal lengths were measured perpendicular to their long axes, accounting for curvature. Formulas for leg solenidia are given in square brackets according to the sequence genu-tibia-tarsus. Drawings were made with a camera lucida using a Leica DM 2500 light microscope.

Terminology and conventions. Morphological terminology used herein mostly stems from the following papers on Licneremaeoidea (Behan-Pelletier et al., 2005; Behan-Pelletier, Walter, 2007; Ermilov, 2020). Leg setal nomenclature follows Norton (1977); for overview see Norton and Behan-Pelletier (2009).

Abbreviations and notations. *Prodorsum*: *lc* = lateral carina; *dep* = depression; *ro*, *le*, *in*,

bs, ex = rostral, lamellar, interlamellar, bothridial, and exobothridial setae, respectively. *Notogaster*: *c, da, la, dm, lm, dp, lp, h, p* = setae; *Sa* = saccule; *ia, im, ip, ih, ips* = lyrifissures; *gla* = opisthonotal gland opening. *Gnathosoma*: *a, m, h* = subcapitular setae; *or* = adoral seta; *d, l, sup, inf, cm, acm, ul, su, vt, lt* = palp setae; ω = palp solenidion; *cha, chb* = cheliceral setae; *Tg* = Trägårdh's organ. *Epimeral and lateral podosomal regions*: *1a, 1b, 1c, 2a, 3a, 3b, 4a, 4c* = epimeral setae; *PdI, PdII* = pedotecta I, II, respectively; *z* = aperture of supracoxal gland. *Anogenital region*: *g, an, ad* = genital, anal and adanal setae, respectively; *iad* = adanal lyrifissure; *po* = preanal organ. *Legs*: *Tr, Fe, Ge, Ti, Ta* = trochanter, femur, genu, tibia, and tarsus, respectively; ω, ϕ, σ = solenidia; ε = famulus; *d, l, v, bv, ev, ft, tc, it, p, u, a, s, pv* = setae; *pa* = porose area.

Generic diagnosis of *Fenichelia*

With many main character states of Micreremidae (Sitnikova, 1975; Norton, Behan-Pelletier, 2009). *Measurements*: Small, length less than 350. *Integument*: Prodorsum smooth or with some rugosities/ridges; notogaster with polygonate pattern; ventral plate smooth or foveolate/rugose. *Prodorsum*: Rostrum rounded. Lamella, prolamella, translamella, sublamella, tutorium, and sublamellar porose area absent. Rostral seta setiform; lamellar and interlamellar setae phylliform; exobothridial seta as microseta; bothridial seta capitate. Bothridium cup-shaped. *Notogaster*: Anterior notogastral margin medially triangular or rounded. Notogaster posteriorly triangular. Octotaxic system with porose areas or sacculi. With 14 pairs of notogastral setae: *p₂, p₃* setiform or phylliform; other setae phylliform. *Gnathosoma*. Subcapitulum diarthric. Palp setation: 0–2–1–3–9(+ ω); solenidion bacilliform, attached to eupathidium medioidistally. Axillary sacculi absent. Chelicera chelate-dentate, with two setae. *Epimeral and lateral podosomal regions*: Epimeral setal formula: 3–1–2–1[2]. Humero-sejugal porose areas absent. Pedotecta I, II represented by small laminae. Discidium and circumpedal carina absent. *Anogenital region*: Four pairs of genital, two pairs of anal and two or three pairs of adanal setae; aggenital setae absent. Adanal lyrifissure located close and anterolateral to anal plate. Two oblique ridges fused into sharp angle, posterior to anal aperture. *Legs*: All legs homotridactylous. Porose area present on tarsi I–IV, femora I–IV and trochanters III, IV. Setation of all tarsi reduced. Solenidia ϕ on tibia IV terminating in flattened disc.

Fenichelia arborea Ermilov et Salavatulin sp. n.
(Figs 1, 2)

Type material. Holotype (σ) and seven paratypes (3 $\sigma\sigma$, 4 $\phi\phi$): Vietnam, Dong Nai Province,

Dong Nai Biosphere Reserve, Cat Tien National Park, 11°26'34.97" N 107°26'02.64" E, about 130 m a.s.l., branches from one tree *Dipterocarpus alatus* at the height of 25 m (sample: PrD6), 01.XII.2022–5.XII.2022 (collected by V.M. Salavatulin and A.A. Kudrin).

The holotype is deposited in the collection of the Senckenberg Museum of Natural History, Görlitz, Germany; seven paratypes are deposited in the collection of the Tyumen State University Museum of Zoology, Tyumen, Russia. All specimens are preserved in 70% solution of ethanol with a drop of glycerol.

Diagnosis. Body length: 210–232. Medial part of prodorsum with transverse and oblique rugosities; notogaster with large polygonate cells; medial part of anogenital region with comparatively large foveolae. Bothridial seta barbed. Distinct concavity anterior to bothridium. Anterior notogastral margin medially triangular. Notogastral setae *c₁, c₂, da, la, dm, dp, lm* shorter than *lp, h₁–h₃, p₁*. One pair of sacculi (*Sa*). Epimeral setal formula: 3–1–2–2. Three pairs of adanal setae; *ad₂* located slightly anterolateral to *ad₁*, *ad₃* distanced from anal aperture. Two oblique ridges fused posteriorly anal aperture into sharp angle. Leg solenidion ϕ on tibia IV terminating in flattened disc.

Description. Measurements. Body length: 210 (holotype), 210–225 (male paratypes), 225–232 (female paratypes); notogaster width: 105 (holotype), 97–105 (male paratypes), 120–135 (female paratypes).

Integument. Body brown, covered by thin layer of gel-like cerotegument, comprising tubercles. Prodorsum and epimeral region minutely and densely foveolate; medial part of prodorsum with transverse and oblique rugosities; notogaster with polygonal pattern comprising large cells; medial part of anogenital region with comparatively large foveolae (up to 6); subcapitular mentum and gena, genital and anal plates and lateral part of anogenital region with minute and medium-sized foveolae.

Prodorsum. Rostrum broadly rounded. Rostral seta (20–22) setiform, barbed; lamellar and interlamellar setae (11–15) phylliform, acuminate, barbed; exobothridial seta (4) setiform, thin, smooth; bothridial seta (22–26) capitate, barbed. Distinct concavity anterior to bothridium.

Notogaster. Anterior notogastral margin medially triangular, narrowly rounded. Setae *c₁, c₂, da, la, dm, dp* (11–13), *lm* (11–15), *lp, h₁–h₃, p₁* (15–19) phylliform, acuminate, barbed; *p₂, p₃* (7–9) setiform, slightly roughened. One pair of sacculi (*Sa*) observed. Opisthonotal gland opening and all lyrifissures well visible.

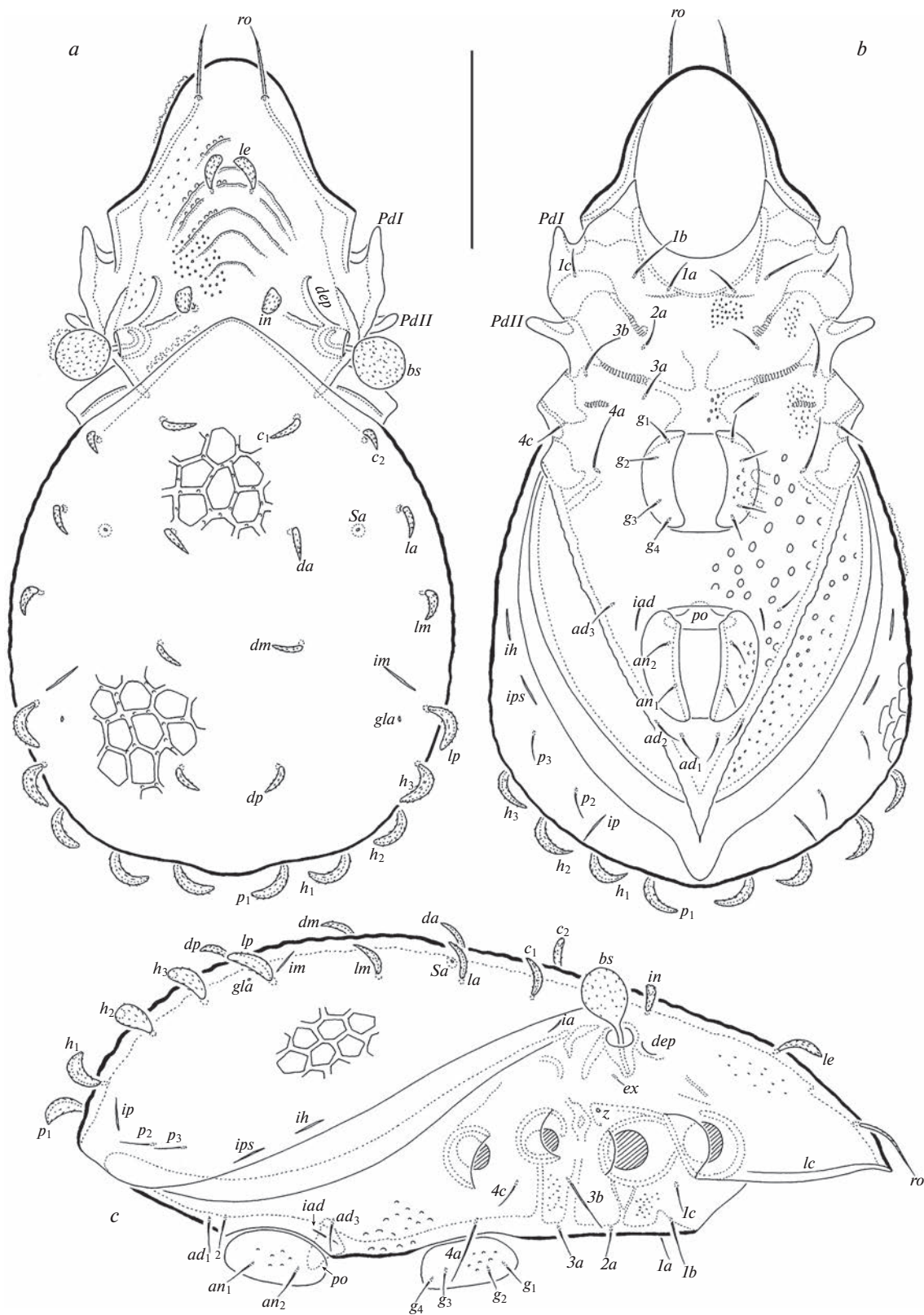


Fig. 1. *Fenichelia arborea* sp. n., adult (gnathosoma and legs not shown): *a* – dorsal view, *b* – ventral view, *c* – right lateral view. Scale bar 50 μ m.

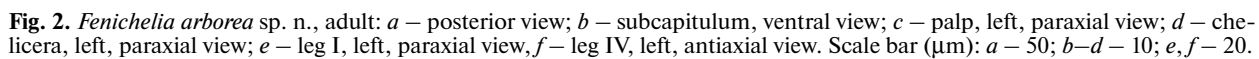


Table 1. Leg setation and solenidia of adult *Fenichelia arborea* sp. n.

Leg	<i>Tr</i>	<i>Fe</i>	<i>Ge</i>	<i>Ti</i>	<i>Ta</i>
I	v'	d, l', bv'', v''	l', σ	$(l), (v), \phi$	$(fi), (tc), (it), (p), (u), (a), s, \varepsilon, \omega_1, \omega_2$
II	v'	d, l', bv'', v''	l', σ	$(l), (v), \phi$	$fi', (tc), (it), (p), (u), (a), s, \omega$
III	l', v'	d, l', ev'	l'	$l', (v), \phi$	$(fi), (tc), (p), (u), (pv)$
IV	v'	d, ev'	d, l'	$l', (v), \phi$	$ff'', (tc), (p), (u), (pv)$

Notes. Roman letters refer to normal setae, Greek letters – to solenidia (except ε = famulus). Single prime (') marks setae on the anterior and double prime (") – setae on the posterior side of a given leg segment. Parentheses refer to a pair of setae.

Gnathosoma. Subcapitulum size: 45–49 × 37–41; all subcapitular setae (11) setiform, thin, roughened; both adoral setae (6) setiform, slightly barbed. Palp length: 37–41; postpalpal seta (4) spiniform, slightly roughened. Chelicera length: 49–52; setae (*cha*: 17–19; *chb*: 11) setiform, barbed.

Epimeral region. Epimeral setal formula: 3–1–2–2; setae (*1b*, *3b*, *4a*: 19–26; others: 7–9) setiform, thin, slightly roughened.

Anogenital region. Genital, anal and adanal (three pairs) setae (7–9) setiform, slightly roughened; ad_2 located slightly anterolateral to ad_1 , ad_3 distanced from anal aperture. Adanal lyrifissure distinct.

Legs. Median and lateral claws strong, slightly barbed on dorsal side. Tarsal pulvillus comparatively long. All tibiae with anterodorsal apophysis bearing solenidium. Dorsoparaxial porose area on femora I, II and on trochanters III, IV; proximal porose area on bulge of femora III, IV; proximoventral porose area on tarsi I–IV with; ventrodistal porose area on tibiae I–IV not observed. Formulas of leg setation and solenidia: I (1–4–1–4–14) [1–1–2], II (1–4–1–4–12) [1–1–1], III (2–3–1–3–10) [0–1–0], IV (1–2–2–3–9) [0–1–0]; homology of setae and solenidia indicated in Table 1. Solenidia ω_2 on tarsus II and ϕ_2 on tibia I not observed; solenidia ω_1 , ω_2 on tarsus I and ω on tarsus II long, setiform; ϕ on tibiae I, II and IV very long, subflagellate; ϕ on tibia III and σ on genua I, II medium-sized, bacilliform; ϕ on tibia IV terminating in flattened disc.

Comparison. *Fenichelia arborea* sp. n. is similar to *Fenichelia biroi* Balogh 1970 in having notogastral saccules and a notogaster with polygonal pattern comprising large cells. However, the new species differs from *F. biroi* in: smaller body size (210–232 × 97–135 versus 304 × 157); presence (versus absence) of rugosities in the medial part of the prodorsum; the length of notogastral setae c_1 , c_2 , da , la , dm , lm , dp (shorter than lp , h_1 – h_3 , p_1 versus similar to lp , h_1 – h_3 ,

p_1); ornamentation of anogenital region (foveolate versus rugose); presence of three (versus two) pairs of adanal setae (ad_3 present in the new species).

Etymology. The specific epithet *arborea* is Latin for “tree” and alludes to the habitat of the new species.

GENERAL REMARKS

The monotypic genus *Porofenichelia* was described by Mahunka (1985), with *Porofenichelia porosa* Mahunka 1985 as type species. It differs from the related genus *Fenichelia* mostly in the presence of notogastral porose areas instead of sacculi. The generic diagnosis has been supported by several authors (e.g., Balogh, Balogh, 1998; Norton, Behan-Pelletier, 2009). Subías (2004) synonymized *Porofenichelia* with *Fenichelia*. We support his opinion because both genera are morphologically very similar in their main characters. Also, the presence of a different octotaxic system within the same genus is known in other genera of Oribatida (e.g., *Anachipteria* Grandjean 1932; *Peloptulus* Berlese 1908; *Oribatella* Banks 1895).

KEY TO SPECIES OF *FENICHELIA*

1 Prodorsum and anogenital region polygonate; notogaster with porose areas (sacculi absent); notogastral setae p_1 , p_2 and adanal setae ad_1 , ad_2 phylliform; body length: 324 *Fenichelia porosa* (Mahunka 1985)

– Prodorsum and anogenital region not polygonate; notogaster with sacculi (porose areas absent); notogastral setae p_1 , p_2 and adanal setae ad_1 , ad_2 setiform 2

2 Interbothridial region with one transverse and two oblique strong ridges forming trapezoid structure; anterior notogastral margin medially broadly rounded; notogastral polygonate cells of notogaster small;

body length: 322 *Fenichelia latipilosa* Mahunka 1982

– Interbothridial region without ridges forming trapezoid structure; anterior notogastral margin medially triangular; notogastral polygonate cells of notogaster large 3

3 Medial part of prodorsum with rugosities; notogastral setae c_1 , c_2 , da , la , dm , lm , dp shorter than lp , h_1 – h_3 , p_1 ; anogenital region foveolate; three pairs of adanal setae (ad_3 present); body length: 210–232 *Fenichelia arborea* sp. n.

– Medial part of prodorsum without rugosities; notogastral setae c_1 , c_2 , da , la , dm , lm , dp , lp , h_1 – h_3 , p_1 similar in length; anogenital region rugose; two pairs of adanal setae (ad_3 absent); body length: 304 *Fenichelia biroi* Balogh 1970

DISTRIBUTION AND HABITAT OF *FENICHELIA*

Species of *Fenichelia* are collectively known from the Australasian, Afrotropical and Oriental regions; three species (out of four) have a highly circumscribed geographic distribution, i.e., they are endemic to a single country.

Fenichelia biroi was collected from New Guinea (from a thin layer of litter and roots in an alpine forest; Balogh, 1970). *Fenichelia latipilosa* was described from Ethiopia (from decaying wood in an alpine forest; Mahunka, 1982); also, this species was recorded from Zaire (from woodland and dense forest soil; Noti et al., 1996). *Fenichelia porosa* was registered from South Africa (from moss; Mahunka, 1985). A new species (*F. arborea*) has been collected from Vietnam (canopy branches of *Dipterocarpus alatus* in a tropical forest; data from this paper).

According to the data summarized above, three representatives of *Fenichelia* (*F. biroi*, *F. latipilosa*, *F. porosa*) prefer to inhabit soil/litter/moss microhabitats; one species (*F. arborea*) is arboreal.

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К ИЗУЧЕНИЮ ПАНЦИРНЫХ КЛЕЩЕЙ РОДА *FENICHELIA* BALOGH 1970 (ACARI, ORIBATIDA, MICREREMIDAE)

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Род *Fenichelia* (Oribatida, Micreremidae) впервые зарегистрирован в Ориентальной области. Описан новый вид (*Fenichelia arborea* sp. n.), собранный с ветвей дерева *Dipterocarpus alatus* в национальном парке Кат Тьен, Вьетнам. Впервые для рода представлены описание морфологии ротового аппарата и идентификация щетинок и соленидиев ног. Приведены родовой диагноз, идентификационный ключ, распространение и местообитание для известных видов *Fenichelia*.

Ключевые слова: арбореальные клещи, таксономия, родовой диагноз, морфология, идентификационный ключ, распространение, местообитание, Национальный парк Кат Тьен, Вьетнам