

REVISION OF THE ORIBATID MITE GENUS *AMBOROPPIA* (ACARI, ORIBATIDA, OPPIIDAE), WITH DESCRIPTION OF A NEW SUBGENUS AND SPECIES FROM MEXICO

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A new oribatid mite subgenus of the genus *Amboroppia* (Oribatida, Oppiidae) – *A. (Quintanoppia)* subgen. n., with *A. (Quintanoppia) defectofossulata* sp. n. as type species – is described, based on material collected from Mexico. It can be distinguished from the nominate subgenus by the absence of concavities between rostrum and transcostula and behind transcostula, and the presence of strong teeth on lateral sides of prodorsum. A revised generic diagnosis, identification key and data on distribution and habitats of representatives of *Amboroppia* are presented.

Key words: oppiid mites, taxonomy, generic diagnosis, morphology, identification key, distribution, habitat, Neotropical region.

INTRODUCTION

The oribatid mite genus *Amboroppia* Ermilov et Starý, 2022 (Acari, Oribatida, Oppiidae) was proposed by ERMILOV and STARÝ (2022), based on material from Bolivia, with *Amboroppia bayartogtokhi* Ermilov et Starý, 2022 as type species. Later, ERMILOV *et al.* (2022) described the second representative of the genus (*A. andensis* Ermilov, Subías, Shtanchaeva et Friedrich, 2022), based on material from Peru, and supplemented the generic diagnosis. Thus, at present, *Amboroppia* comprises two species, which are distributed collectively in the Neotropical region.

During faunistic study of oribatid mites collected from Mexico, we found a new species belonging to the new subgenus of *Amboroppia*. The main goals of our paper are: to describe *A. (Quintanoppia)* subgen. n., with *A. (Quintanoppia) defectofossulata* sp. n. as type species, based on adults; to revise generic diagnosis; to present an identification key and data on distribution and habitats of representatives of *Amboroppia*.

MATERIAL AND METHODS

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 – Morphological terminology used in this paper follows that of GRANDJEAN (see TRAVÉ & VACHON 1975 for references), ERMILOV *et al.* (2021), ERMILOV and RYBALOV (2022); NORTON (1977) for leg setal nomenclature; NORTON and BEHAN-PELLETIER (2009) for overview.

Abbreviations – *Prodorsum*: *ctc* = costular-transcostular complex; *ro*, *le*, *in*, *bs*, *ex* = rostral, lamellar, interlamellar, bothridial, and exobothridial setae, respectively; *exv* = vestige of the second exobothridial seta; *lpc* = lateral prodorsal carina. *Notogaster*: *c*, *la*, *lm*, *lp*, *h*, *p* = setae; *ia*, *im*, *ip* = lyrifissures; *gla* = opisthonotal gland opening. *Gnathosoma*: *a*, *m*, *h* = subcapitular setae; *or* = adoral seta; *d*, *l*, *v*, *cm*, *ul*, *su*, *vt*, *lt* = palp setae; ω = palp solenidium; *cha*, *chb* = cheliceral setae; *Tg* = Trägårdh's organ. *Epimeral and lateral podosomal regions*: *1a–1c*, *2a*, *3a–3c*, *4a–4c* = epimeral setae; *Pdl* = pedotectum I; *dis* = discidium. *Anogenital region*: *g*, *ag*, *an*, *ad* = genital, aggenital, anal, and adanal setae, respectively; *iad* = adanal lyrifissure; *po* = preanal organ. *Legs*: *Tr*, *Fe*, *Ge*, *Ti*, *Ta* = trochanter, femur, genu, tibia, and tarsus, respectively; *pa* = porose area; ω , ϕ , σ = solenidia; ε = famulus; *d*, *l*, *v*, *bv*, *ev*, *ft*, *tc*, *it*, *p*, *u*, *a*, *s*, *pv*, *pl* = setae.

TAXONOMY

Family Oppiidae Sellnick, 1937

Subfamily Arcoppiinae Balogh, 1983

Genus *Amboroppia* ERMILOV et STARÝ, 2022

Type species: *Amboroppia bayartogtokhi* Ermilov et Starý, 2022, by original designation

Revised generic diagnosis

(after ERMILOV & STARÝ 2022)

Adult. With main traits of Oppiidae (NORTON & BEHAN-PELLETIER 2009). *Size*: Medium-sized to large; length about 400–700. *Integument*. Prodorsum and its lateral side partially densely tuberculate. *Prodorsum*. Rostrum tripartite. Transcostula and short costulae forming small arch-like or trapezoid complex. Lateral prodorsal carina present. Typical pairs of interbothridial and postbothridial tubercles absent. Interbothridial muscle sigillae absent or present. Rostral, lamellar and interlamellar setae long, setiform; *le* located on the costular-transcostular complex or nearly to it; bothridial seta very long,

spindle-form, with narrowly elongate dilated mediobasal part, barbed (without ciliae); exobothridial seta well developed. *Notogaster*. Anterior border convex medially. Without humeral tooth and crista. Ten pairs of setiform setae, *c* distinctly shorter than others, *la* inserted posterolaterally to *lm*. *Gnathosoma*. Subcapitulum diarthric; both adoral setae present. Palp setation: 0–2–1–3–9(+1 ω); solenidion long, bacilliform, appressed to the tarsus surface. Chelicera chelate-dentate. *Epimeral and lateral podosomal regions*. Epimeral border IV present. Epimere III+IV longitudinally elongate, distance between acetabula III–IV longer than I–III. Epimeral setal formula: 3–1–3–3; setae setiform; *1b* and *1c* inserted comparatively close to each other. Epimeral and ventrosejugal tubercles absent. Pedotectum I represented by small lamina. Discidium developed. *Anogenital region*. Six pairs of genital, one pair of aggenital, two pairs of anal, and three pairs of setiform adanal setae; all adanal setae lateral to anal plate, distance between *ad*₃–*ad*₃ longer than *ag*–*ag* and *ad*₂–*ad*₂. Three pairs of genital papillae medium-sized, similar in size. Adanal lyrifissure parallel and close to anal aperture. *Legs*. Setae *l*'' and *v*' present on tarsus I, *l*'' present on tarsus II; setae *p*', *p*'' on tarsi II–IV represented by strong teeth; tarsus II with two solenidia.

Subgeneric diagnosis of *Amboroppia* (*Amboroppia*) Ermilov et Starý, 2022

Type species: *Amboroppia bayartogtokhi* Ermilov & Starý, 2022, by original designation

Adult. With character states of *Amboroppia* (as above) but: lateral side of the prodorsum without additional teeth; longitudinally elongate concavity between rostrum and transcostula present; concavity behind costular-transcostular complex present.

Subgeneric diagnosis of *Amboroppia* (*Quintanoppia*) subgen. n.

Type species: *Amboroppia* (*Quintanoppia*) *defectofossulata* sp. n.
<http://zoobank.org/C0FD6560-341A-47E4-A53A-21573F0C58C0>

Adult. With character states of *Amboroppia* (as above) but: lateral sides of the prodorsum with strong additional teeth; concavities between rostrum and transcostula and behind costular-transcostular complex absent.

Etymology. The subgeneric name *Quintanoppia* refers to the place of origin, the Free and Sovereign State of Quintana Roo + '*oppia*', a common suffix for generic/subgeneric names in Oppiidae.

Amboroppia (Quintanoppia) defectofossulata sp. n.

<http://zoobank.org/00344FBE-BB9C-48C2-A45C-E1626F741D74>

(Figs 1, 2)

Material examined – Holotype (male) and six paratypes (four males and two females): Mexico, 20°33'N, 87°13'W, Quintana Roo, Municipio de Solidaridad, vicinities of Playa del Carmen, leaf litter under trees and bushes in secondary semi-evergreen tropical forest (data and collector unknown; collection of the Tyumen State University Museum of Zoology, Tyumen, Russia).

Type deposition – The holotype is deposited in the collection of the Senckenberg Museum of Natural History, Görlitz, Germany; six 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: 600–660. Three distal teeth of rostrum well separated. Five to seven teeth on lateral side of prodorsum. Costulae and transcostula forming trapezoid structure. Relative length of prodorsal setae: $in > ro = le > ex$; all setae setiform, barbed; *le* inserted on costulae; bothridial seta long, spindle-form, with narrowly elongate dilated mediiodistal part, barbed. Notogastral seta *c* short, setiform, sparsely barbed; others long, barbed. Epimeral and anogenital (except slightly barbed genital setae) setiform, barbed.

Description of adult – *Measurements*. Body length: 660 (holotype), 630–660 (paratypes); notogaster width: 375 (holotype), 345–375 (paratypes). No difference between males and females in body size.

Integument (Figs 1A, C). Body color light brown to brown. Body surface microporose (visible only under high magnification in dissected specimen, $\times 1000$). Dorsal and lateral (between bothridium and acetabula I–III) parts of prodorsum partially tuberculate (diameter of tubercles up to 6).

Prodorsum (Figs 1A, C). Rostrum of typical form, tripartite; median and lateral teeth well separated. Lateral side of prodorsum with five to seven strong teeth. Costulae and transcostula forming small trapezoid structure. Rostral (75–90), lamellar (75–90) and interlamellar (124–142) setae setiform, barbed; exobothridial seta (30–34) setiform, slightly barbed; *ex* thinner than others; *le* inserted on costula; bothridial seta (195–210) of typical morphology: spindle-form, with narrowly elongate dilated mediiodistal part, barbed. Interbothridial muscle sigillae absent. Basal part of prodorsum with two or three pairs of tuberculate thickenings.

Notogaster (Figs 1A, C). Seta *c* (41–45) setiform, thin, sparsely barbed; others (p_1 – p_3 : 90–112; *la*, *lm*, *lp*, h_1 – h_3 : 157–176) thicker, barbed. Opisthotal gland opening and lyrifissures *ia*, *im*, *ip* distinct; *ih* and *ips* not observed.

Gnathosoma (Figs 2A–D). Subcapitulum size: 169–180 \times 127–135; subcapitular setae (*a*: 34–37; *m*, *h*: 49–57) setiform, slightly barbed; both adoral setae (15–17) bush-shaped. Chelicera length: 135–139; seta *cha* (45–49) setiform, barbed, *chb* (28–30) setiform, indistinctly thickened in mediiodistal part, barbed. Palp length: 82–90; postpalpal seta (8) spiniform, roughened.

Epimeral and lateral podosomal regions (Figs 1B, C). Epimeral border IV well visible, oblique. All epimeral setae (*1a*, *2a*, *3a*: 41–52; *1c*, *3b*, *4a*, *4b*: 60–75; *1b*, *4c*: 75–90; *3c*: 90–101) setiform, barbed. Discidium triangular.

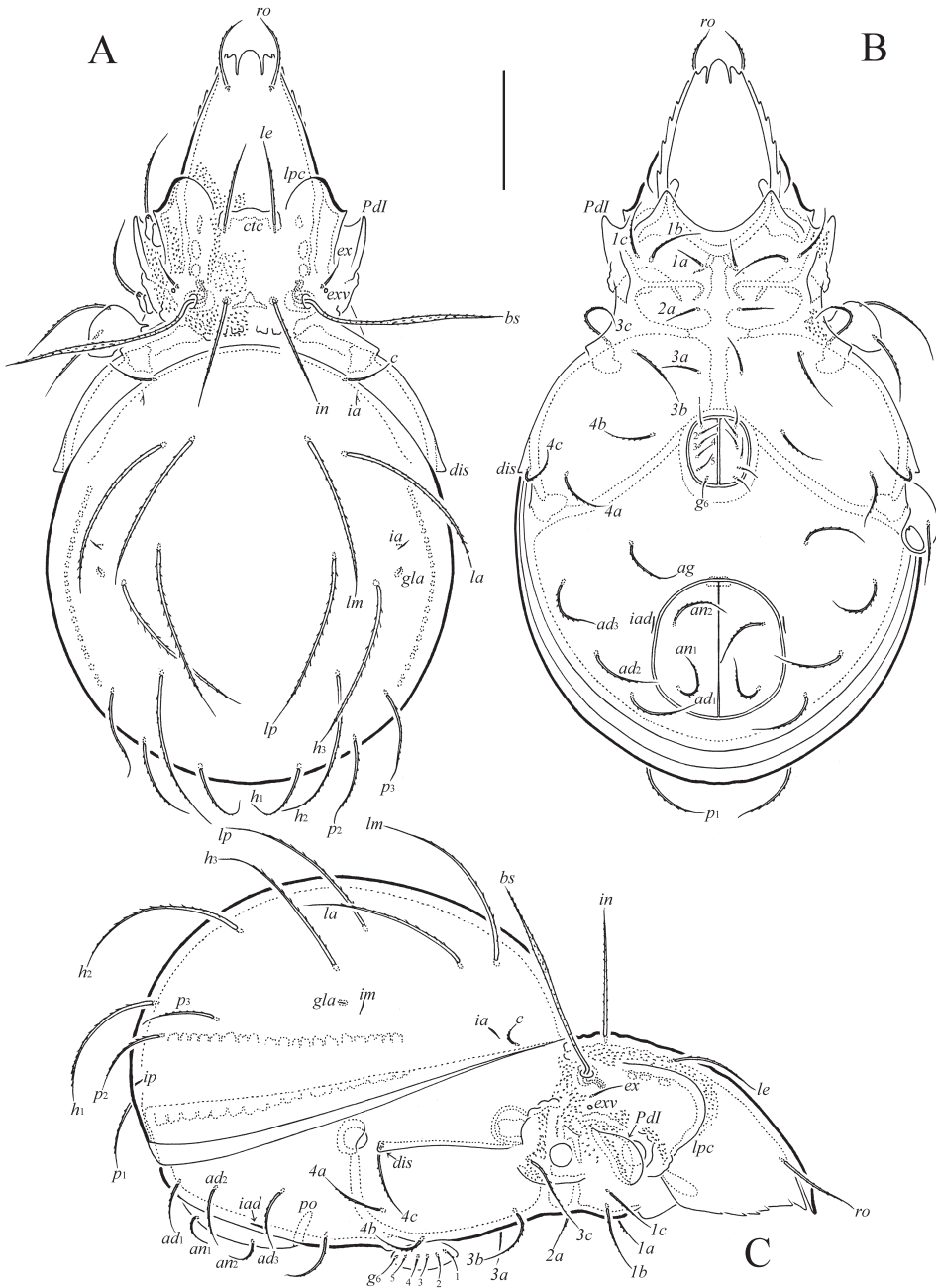


Fig. 1. *Amboroppia (Quintanoppia) defectofossulata* sp. n., adult: A = dorsal view (legs not shown); B = ventral view (gnathosoma and legs not shown); C = right lateral view (gnathosoma and legs not shown). Scale bar: 100 μ m

Table 1. Leg setation and solenidia of adult *Amboroppia* (*Quintanoppia*) *defectofossulata* sp. n.

Leg	Tr	Fe	Ge	Ti	Ta
I	<i>v'</i>	<i>d</i> , (<i>l</i>), <i>bv''</i> , <i>v''</i>	(<i>l</i>), σ	(<i>l</i>), (<i>v</i>), φ_1 , φ_2	(<i>ft</i>), (<i>tc</i>), (<i>it</i>), (<i>p</i>), (<i>u</i>), (<i>a</i>), <i>s</i> , (<i>pv</i>), (<i>pl</i>), <i>l''</i> , <i>v'</i> , ε , ω_1 , ω_2
II	<i>v'</i>	<i>d</i> , (<i>l</i>), <i>bv''</i> , <i>v''</i>	(<i>l</i>), σ	(<i>l</i>), (<i>v</i>), φ	(<i>ft</i>), (<i>tc</i>), (<i>it</i>), (<i>p</i>), (<i>u</i>), (<i>a</i>), <i>s</i> , (<i>pv</i>), <i>l''</i> , ω_1 , ω_2
III	<i>l'</i> , <i>v'</i>	<i>d</i> , <i>l'</i> , <i>ev'</i>	<i>l'</i> , σ	<i>l'</i> , (<i>v</i>), φ	(<i>ft</i>), (<i>tc</i>), (<i>it</i>), (<i>p</i>), (<i>u</i>), (<i>a</i>), <i>s</i> , (<i>pv</i>)
IV	<i>v'</i>	<i>d</i> , <i>ev'</i>	<i>d</i> , <i>l'</i>	<i>l'</i> , (<i>v</i>), φ	<i>ft''</i> , (<i>tc</i>), (<i>p</i>), (<i>u</i>), (<i>a</i>), <i>s</i> , (<i>pv</i>)

Note: Roman letters refer to normal setae; Greek letters to solenidia (except ε = famulus). Single quotation mark (') designates seta on the anterior and double quotation mark (") seta on the posterior side of a given leg segment. Parentheses refer to a pair of setae.

Legs (Figs 2E–H). Leg IV obviously longer than legs I–III. Claw of all legs roughened on dorsal side. Trochanter III with one posterior tooth. All femora with large ventral porose area. Formulas of leg setation and solenidia: I (1–5–2–4–20) [1–2–2], II (1–5–2–4–16) [1–1–2], III (2–3–1–3–15) [1–1–0], IV (1–2–2–3–12) [0–1–0]; homology of setae and solenidia indicated in Table 1. Famulus of tarsus I inserted anterolateral to solenidium ω_1 ; seta *s* on tarsus I eupathidial; solenidia φ_1 on tibia I, φ of tibia II and σ on genua I long, subflagellate, others medium-sized, slightly bacilliform or rod-like.

Remarks – Distinctive characters of the new species compared with other members of *Amboroppia* can be found in the identification key below.

Etymology – The species name (“lack” and “pit” in Latin) refers to the lack of an elongate concavity between rostrum and transcostula.

GENERAL REMARKS

The subgenus *Amboroppia* (*Quintanoppia*) differs mainly from the nominate subgenus by the absence concavities between rostrum and transcostula and behind transcostula, and the presence of strong teeth on lateral sides of prodorsum.

Theoretically, it can be assumed that the presence/absence of prodorsal concavities and lateral teeth of the rostrum may be species traits. However, firstly, concavities were found in both species of the genus (*A. andensis*, *A. bayartogtokhi*), therefore, we believe that their presence are stable supraspecific traits; secondly, the presence of strong lateral teeth is an unusual trait in Oppiidae and may be considered as an apomorphy. Thus, based on these listed above traits, support for the new subgenus is justified. We offer only a new subgenus (not a genus) because *A. (Amboroppia)* and *A. (Quintanoppia)* are similar in numerous generic characteristics.

KEY TO KNOWN SPECIES OF *AMBOROPPIA*

1. Lateral side of the prodorsum with several strong teeth; longitudinally elongate concavity between rostrum and transcostula and a concavity behind costular-transcostular complex absent; interbothridial muscle sigillae not observed; basal part of prodorsum with some tuberculate thickenings; notogastral setae *la* and *lm* located comparatively close to each other; dorsal notogastral setae longer (*la* clearly beyond the insertion of h_3); notogastral lyrifissures *ih* and *ips* not observed; body length: 600–660
A. (Quintanoppia) defectofossulata sp. n.
- Lateral side of the prodorsum without teeth; longitudinally elongate concavity between rostrum and transcostula and a concavity behind costular-transcostular complex present; interbothridial muscle sigillae visible; basal part of prodorsum without tuberculate thickenings; notogastral setae *la* and *lm* distant from each other; dorsal notogastral setae shorter (*la* not beyond the insertion of h_3); notogastral lyrifissures *ih* and *ips* distinct 2
2. Three distal rostral teeth touching tightly; lamellar seta located before costular-transcostular complex; lamellar seta longer than exobothridial seta and notogastral seta *c*; dorsal notogastral setae longer (*la* reaching the insertion of h_3); body length: 398–415
A. (Amboroppia) bayartogtokhi Ermilov et Starý, 2022
- Three distal rostral teeth well separated; lamellar seta located on costular-transcostular complex; lamellar seta similar in length to exobothridial seta and notogastral seta *c*; dorsal notogastral setae shorter (*la* not reaching the insertion of h_3); body length: 614–680
A. (Amboroppia) andensis Ermilov, Subías, Shtanchaeva et Friedrich, 2022

DISTRIBUTION AND HABITATS
OF REPRESENTATIVES OF *AMBOROPPIA*

Species of *Amboroppia* are known only from the Neotropical region and have a highly circumscribed geographic distribution, i.e., are endemic to a single country.

The type species, *A. (A.) bayartogtokhi* was collected from sifting leaf litter in rain forest in Bolivia; *A. (A.) andensis* was found from upper soil and leaf litter in primary mountain forest in Peru; the new species, *A. (Q.) defectofossu-*

lata, was recorded from leaf litter in secondary semi-evergreen tropical forest in Mexico.

According to the summarized data, representatives of *Amboroppia* prefer mainly the upper soil and litter in forest ecosystems.

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