

# New faunistic and taxonomic data on oribatid mites of Nepal

(Acari, Oribatida)

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The present study is based on oribatid mite material collected in 1988 from soil litter in *Quercus* forests of two localities in Nepal. A list of identified taxa, including 57 species/subspecies from 43 genera and 31 families is provided; of these, 16 species/subspecies, six genera and three families are recorded for the first time in the fauna of Nepal; four species/subspecies are recorded for the first time in the fauna of the Oriental (Indo-Malay) region. A new species of *Galumna* (Oribatida, Galumnidae) – *Galumna* (*Galumna*) *paravaria* sp. nov. – is described.

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## Introduction

This work is part of our study of oribatid mites (Acari, Oribatida) of Nepal (e. g., Ermilov & Martens 2021) which were collected during several zoological expeditions in the 80s of the 20th century. The primary goal of our paper is to present a list of the identified taxa with notes on new findings (new records).

The secondary goal of the paper is to describe and illustrate a new species belonging to *Galumna* Heyden, 1826 (Galumnidae). This genus was described by Heyden (1826), with *Notaspis alatus* Hermann, 1804 as type species, and comprises three subgenera and more than 200 species (see Ermilov & Klimov 2017) which have collectively a cosmopolitan distribution (Subías 2004, online version 2021). The generic and subgeneric diagnoses were presented by Ermilov & Klimov (2017). An identification key to the known species of *Galumna* from the Oriental region (includ-

ing Nepalese species) has been published by Ermilov & Starý (2017). Earlier, two species of the genus have been recorded from Nepal (Ermilov et al. 2014): *Galumna* (*Galumna*) *granalata* Aoki, 1984; and *G.* (*G.*) *tetraporosa* Ermilov, Martens & Tolstikov, 2014.

## Material and methods

**Specimens.** Substrate samples (field no. 306,414) containing oribatid mites were collected from the Jochen Martens Expeditions to Nepal in 1988<sup>1</sup> by the following method, i. e. leaf litter and upper layer of soil were collected by hand, sieved by means of a “Käfersieb”, larger arthropods were sorted out by hand on a large white plastic sheet and the remainder of sieved substrate filled into a number of small, easily transportable Berlese funnels, each containing a vial filled about half with 75 % alcohol; all samples were extracted in open field conditions during three days/nights; no special

<sup>1</sup> Results of the Himalaya Expeditions of J. Martens from 1969–2004, No. 292. Jochen Martens was sponsored by DAAD and DFG.

warming was applied except for sunshine radiation. To protect the funnels overnight against rain, they were placed in a tent. Final sorting out of the samples as to different arthropod groups was done in the Mainz laboratory of the Martens group. Localities:

1) No. 306: Nepal, Katmandu Distr., Sheopuri Mt., 27°47' N, 85°23' E, 2100–2300 m a.s.l., soil-litter in *Quercus semecarpifolia* forest, 25.VI.1988 (collected by J. Martens and W. Schawaller).

2) No. 414: Nepal, Sankhua Sabha District, Arun Valley, Chichila, 27°27.02' N, 87°13.13' E, 1900–2000 m a.s.l., leaf litter and upper layer of soil under bushes in degraded *Quercus* forest near village, 18–20.VI.1988 (collected by J. Martens and W. Schawaller).

**Observation and documentation.** Specimens were mounted in lactic acid, on temporary cavity slides for measurement and illustration. Body length was measured in lateral view, from the tip of the rostrum to the posterior edge of the notogaster. Notogastral width refers to the maximum width of the notogaster in dorsal view (behind pteromorph). Lengths of body setae were measured in lateral aspect. All body measurements are presented in micrometers. Formulas for leg setation are given in parentheses according to the sequence trochanter-femur-genu-tibia-tarsus (famulus included). 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 transmission light microscope “Leica DM 2500”.

**Terminology.** Morphological terminology used in this paper follows that of Grandjean (see Ermilov & Klimov 2017 for review and application).

**Abbreviations.** Prodorsum: *L* = lamellar line; *S* = sublamellar line; *N* = prodorsal leg niche; *E*, *T* = lateral ridges of prodorsum; *ro*, *le*, *in*, *bs* = rostral, lamellar, interlamellar, and bothridial seta, respectively; *Ad* = dorsosejugal porose area; *D* = dorsophragma; *P* = pleurophragma. Notogaster: *c*, *la*, *lm*, *lp*, *h*, *p* = notogastral setal alveoli; *Aa*, *A1*, *A2*, *A3* = notogastral porose areas; *ia*, *im*, *ip*, *ih*, *ips* = lyrifissures; *gla* = opisthonotal gland opening. Gnathosoma: *a*, *m*, *h* = subcapitular setae; *or* = adoral seta; *sup*, *inf*, *d*, *l*, *cm*, *acm*, *ul*, *su*, *vt*, *l* *t* = palp setae;  $\omega$  = palp solenidium; *as* = axillary sacculcule; *cha*, *chb* = cheliceral setae; *Tg* = Trägårdh's organ. Epimeral and lateral podosomal regions: *1a*, *3b*, *4a*, *4b* = epimeral setae; *PdI*, *PdII* = pedotectum *I*, *II*, respectively; *dis* = discidium; *cp* = circumpedal carina. Anogenital region: *g*, *ag*, *an*, *ad* = genital, aggenital, anal, and adanal seta, respectively; *iad* = adanal lyrifissure; *po* = preanal organ. Legs: *Tr*, *Fe*, *Ge*, *Ti*, *Ta* = trochanter, femur, genu, tibia, and tarsus, respectively;  $\omega$ ,  $\varphi$ ,  $\sigma$  = solenidia;  $\varepsilon$  = famulus; *d*, *l*, *v*, *bv*, *ev*, *ft*, *tc*, *it*, *p*, *u*, *a*, *s*, *pv*, *pl* = setae; *pa* = porose area.

## Faunistic data

During taxonomic identification, we found 57 species/subspecies from 43 genera and 31 families. Of these, 16 species/subspecies, six genera and three families are recorded for the first time in the fauna of Nepal; four species/subspecies are recorded for the first time in the fauna of the Oriental region (see below).

### List of identified oribatid mite taxa<sup>2</sup>

#### Trhypochthoniidae

*Trhypochthonius tectorum* (Berlese, 1896): 414 (4 ex.).  
Distribution: Semicosmopolitan.

#### Nothridae

*Nothrus gracilis* Hammer, 1961: 306 (4 ex.), 414 (3 ex.).  
Distribution: Neotropical and Oriental regions. New record of the species in Nepal.

#### Crotoniidae

*Platynothrus peltifer* (Koch, 1839): 306 (2 ex.), 414 (16 ex.).  
Distribution: Semicosmopolitan.

#### Hermanniellidae

*Hermanniella granulata* (Nicolet, 1855): 414 (2 ex.).  
Distribution: Holarctic and Oriental regions.

*Hermanniella* sp.: 306 (1 ex.).

#### Nanhermanniidae

*Nanhermannia thaiensis* Aoki, 1965: 306 (1 ex.), 414 (2 ex.).  
Distribution: Oriental region.

#### Hermanniidae

*Phyllhermannia berlessei* Mondal, 1984: 414 (4 ex.).  
Distribution: Oriental region.

#### Damaeidae

*Tectodamaeus* sp.: 414 (10 ex.).

#### Cepheidae

*Sadocepheus* sp.: 414 (1 ex.).

*Tritegeus* sp.: 306 (6 ex.), 414 (2 ex.).

#### Gustaviidae

*Gustavia microcephala* (Nicolet, 1855): 306 (6 ex.).  
Distribution: Palaearctic and Oriental regions, Mexico.

#### Li acaridae

*Li acarus coracinus* (Koch, 1841): 414 (2 ex.).  
Distribution: Palaearctic and Ethiopian regions. New record of the species in the Oriental region.

<sup>2</sup> Distribution: mostly from Subías (online version 2021). Ptyctimous mites: not included. References for original descriptions of species are not presented in the References section. All examined specimens (except holotype and some paratypes) are deposited in the collection of the Tyumen State University Museum of Zoology, Tyumen, Russia.

*Liacarus xylariae* (Schrank, 1803): 306 (6 ex.). Distribution: Palaearctic region, Nepal.

### **Peloppiidae**

*Ceratoppia bipilis* (Hermann, 1804): 414 (3 ex.). Distribution: Holarctic, Oriental and Neotropical regions.

### **Eremobelbidae**

*Eremobelba bellicosa* Balogh & Mahunka, 1967: 306 (22 ex.), 414 (3 ex.). Distribution: Oriental region.

### **Oppiidae**

*Arcoppia robustia* (Berlese, 1913): 306 (1 ex.). Distribution: Oriental region. New record of the species in Nepal.

*Arcoppia varia* Hammer, 1979: 306 (3 ex.). Distribution: Oriental region, Brazil. New record of the species in Nepal.

*Cycloppia* sp.: 306 (2 ex.).

*Lasiobelba* sp.: 306 (14 ex.).

### **Granuloppiidae**

*Hammerella (Varioppia) sufflata* (Franklin & Woas, 1992): 306 (20 ex.). Distribution: Neotropical region. New record of the subgenus and species in the Oriental region.

### **Otocephidae**

*Dolicheremaeus nepalensis* Aoki, 1967: 306 (7 ex.), 414 (1 ex.). Distribution: Oriental region.

*Dolicheremaeus porcinolus* Aoki, 1967: 414 (4 ex.). Distribution: Nepal.

*Otocephus (Acrotocephus) vietnamicus* Ermilov & Anichkin, 2011: 306 (15 ex.), 414 (26 ex.). Distribution: Oriental region.

*Pseudotocephus gobletus* Chakrabarti & Mondal, 1978: 306 (11 ex.), 414 (1 ex.). Distribution: India. New record of the genus and species in Nepal.

### **Carabodidae**

*Carabodes palmifer* Berlese, 1904: 306 (1 ex.). Distribution: Holarctic, Oriental and Neotropical regions. New record of the family, genus and species in Nepal.

### **Tectocephidae**

*Tectocephus knuellei* Vaněk, 1960: 306 (1 ex.). Distribution: Palaearctic region. New record of the species in Nepal.

*Tectocephus velatus sarekensis* Trägårdh, 1910: 414 (3 ex.). Distribution: Cosmopolitan.

### **Nippobodidae**

*Leobodes praeconcaucus* Chen & Wang, 2007: 306 (5 ex.). Distribution: China. New record of the species in Nepal.

*Leobodes* sp.: 414 (4 ex.).

### **Zetorchestidae**

*Zetorchestes saltator* Oudemans, 1915: 306 (3 ex.). Distribution: Palaearctic and Oriental regions. New record of the family, genus and species in Nepal.

### **Phenopelopidae**

*Eupelops acromios* (Hermann, 1804): 306 (6 ex.), 414 (9 ex.). Distribution: Semicosmopolitan.

### **Unduloribatidae**

*Unduloribates hebes* Aoki, 1965: 414 (1 ex.). Distribution: Himalayas, central-western Asia.

### **Achipteriidae**

*Parachipteria orientalis* (Mondal & Kundu, 1999): 306 (1 ex.), 414 (1 ex.). Distribution: India. New record of the genus and species in Nepal.

### **Oribatellidae**

*Oribatella berleseii* (Michael, 1898): 414 (1 ex.). Distribution: Holarctic region. New record of the species in the Oriental region.

*Oribatella paraumaetluisorum* Ermilov & Martens, 2014: 306 (1 ex.). Distribution: Nepal.

*Oribatella* sp.: 306 (1 ex.).

### **Punctoribatidae**

*Punctoribates punctum* (Koch, 1839): 306 (1 ex.). Distribution: Semicosmopolitan.

### **Drymobatidae**

*Drymobatoides asiatica* (Yamamoto & Aoki, 2000): 306 (28 ex.), 414 (17 ex.). Distribution: Oriental region. New record of the family, genus and species in Nepal.

### **Humerobatidae**

*Diapterobates altimontanus* Hammer, 1977: 414 (1 ex.). Distribution: Pakistan, Nepal.

### **Haplozetidae**

*Acutozetes* cf. *chibai* Aoki, 1976: 306 (21 ex.), 414 (27 ex.). Distribution: Malaysia. New record of the species in Nepal.

*Peloribates palawanus* Corpuz-Raros, 1981: 306 (1 ex.), 414 (1 ex.). Distribution: Philippines. New record of the species in Nepal.

*Protoribates gracilis* (Aoki, 1982): 414 (9 ex.). Distribution: Japan, Vietnam. New record of the genus and species in Nepal.

*Protoribates paracapucinus* (Mahunka, 1988): 306 (3 ex.). Distribution: Tropical and Subtropical regions. New record of the species in Nepal.

### Scheloribatidae

*Perscheloribates surigaoensis* Corpuz-Raros, 1980: 306 (1 ex.). Distribution: Philippines. New record of the species in Nepal.

*Scheloribates praeincisus interruptus* (Berlese, 1916): 306 (24 ex.), 414 (29 ex.). Distribution: Oriental, Australian, Neotropical and southern Holarctic regions. New record of the subspecies in Nepal.

*Scheloribates* sp. 1 (*fimbriatus*-group): 306 (14 ex.), 414 (18 ex.).

*Scheloribates* sp. 2 (*fimbriatus*-group): 306 (11 ex.), 414 (14 ex.).

### Parakalummidae

*Neoribates aurantiacus* (Oudemans, 1914): 306 (3 ex.), 414 (3 ex.). Distribution: Holarctic and Oriental regions.

*Neoribates parabulanovae* Ermilov & Martens, 2014: 306 (57 ex.), 414 (13 ex.). Distribution: Nepal.

### Galumnidae

*Allogalumna beatae* Ermilov & Martens, 2021: 306 (2 ex.), 414 (32 ex.). Distribution: Nepal.

*Anomalogalumna dungeri* Ermilov & Martens, 2021: 414 (31 ex.). Distribution: Nepal.

*Galumna* cf. *granulata* Aoki, 1984: 306 (4 ex.), 414 (4 ex.). Distribution: Japan, Oriental region.

*Galumna paravaria* sp. nov.: 306 (12 ex.). Distribution: Nepal.

*Pergalumna minituberculata* Ermilov & Martens, 2014: 306 (30 ex.), 414 (17 ex.). Distribution: Nepal.

*Pergalumna magnipora capillaris* Aoki, 1961: 306 (22 ex.), 414 (4 ex.). Distribution: southeastern Palaearctic and Oriental regions.

*Trichogalumna nipponica* (Aoki, 1966): 414 (2 ex.). Distribution: Semicosmopolitan.

### Galumnellidae

*Porogalumnella* sp.: 414 (1 ex.).

## Taxonomy

### Family Galumnidae

Genus *Galumna* Heyden, 1826

Subgenus *Galumna* (*Galumna*) Heyden, 1826

Type species: *Notaspis alatus* Hermann, 1804

### *Galumna* (*Galumna*) *paravaria* sp. nov.

Figs 1–3

**Diagnosis.** Body size: 680–713 × 481–531. Rostrum rounded. Lamellar and sublamellar lines parallel, curving backwards. Rostral, lamellar and interlamellar setae long, setiform, barbed. Bothridial seta nearly bacilliform, with indistinct, elongate lanceolate, barbed head. Dorsosejugal porose area and median pore present. Four pairs of porose areas: *Aa* elongate triangular, transversely oriented; *A1* oval; *A2* elongate oval or band-like; *A3* band-like. Epimeral and anogenital setae short, setiform, thin, roughened. Circumpedial carina of medium length, reaching level of acetabulum IV. Aggenital seta located between genital and anal apertures and equally distanced from them. Postanal porose area very long, band-like. Leg solenidion on tibia IV inserted in the anterior part of the segment.

### Description

Measurements. Large species. Body length: 680 (holotype: male), 680–697 (10 male paratypes), 713 (one female paratype); notogaster width: 498 (holotype), 481–514 (10 male paratypes), 531 (one female paratype).

Integument. Body colour brown. Surface microfoveolate (visible under high magnification in dissected specimens). Leg femora I–IV and trochanters III, IV partially tuberculate.

Prodorsum. Rostrum rounded. Lamellar and sublamellar lines parallel, curving backwards; *L* thicker than *S*. Rostral (73–82), lamellar (73–82) and interlamellar (86–94) setae setiform, barbed; *in* erect. Bothridial seta (123–131) nearly bacilliform, with indistinct (usually poorly observed), elongate lanceolate, barbed head. Dorsosejugal porose area present, oval, located posterolaterally to insertion of interlamellar seta. Dorsophragma distinctly elongate longitudinally.

Notogaster. Dorsosejugal suture complete, strong. Ten pairs of setal alveoli and four pairs of porose areas (*Aa* elongate triangular, transversely oriented; *A1* oval; *A2* elongate oval or band-like; *A3* band-like) developed; *Aa* located close to pteromorphical hinge, anterior to *la*. Median pore comparatively large, located between *A2*. Opisthonotal gland opening and all lyrifissures (except *ip*) distinct:

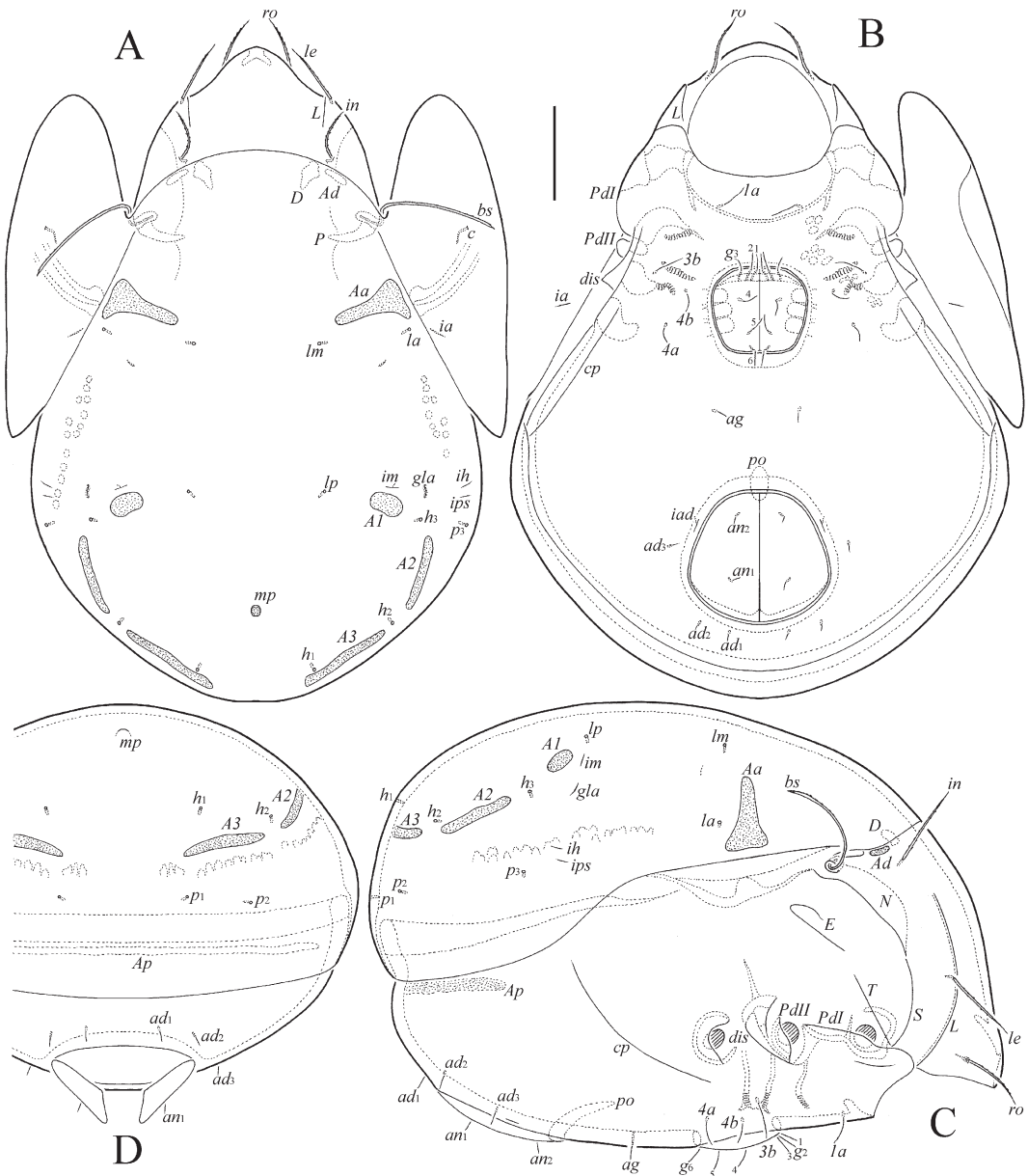


Fig. 1. *Galumna paravaria* sp. nov., adult: A. dorsal view; B. ventral view (not shown: gnathosoma, legs and right pteromorph); C. right lateral view (not shown: gnathosoma, legs and right pteromorph); D. posterior view. Scale bar 100  $\mu$ m.

*gla* located anterolateral and close to *A1*; *im* anterior and close to *A1*; *ih* and *ips* close to each other, anterior to *p*<sub>3</sub>.

Gnathosoma. Size of subcapitulum: 159–164 × 143–151. Subcapitular setae setiform, *h* (32–36) barbed; *a* (32–36) and *m* (20–24) slightly barbed;

*h* thickest, *m* thinnest. Adoral seta (16) setiform, barbed. Length of chelicera: 188–196. Cheliceral setae (*cha*: 61; *chb*: 41–45) setiform, barbed. Length of palp: 123–127. Postpalpal seta (8) spiniform, smooth.

Epimeral and lateral podosomal regions. Epimeral setal formula: 1-0-1-2. Setae (*1a*: 28–32; *3b*: 32–36;

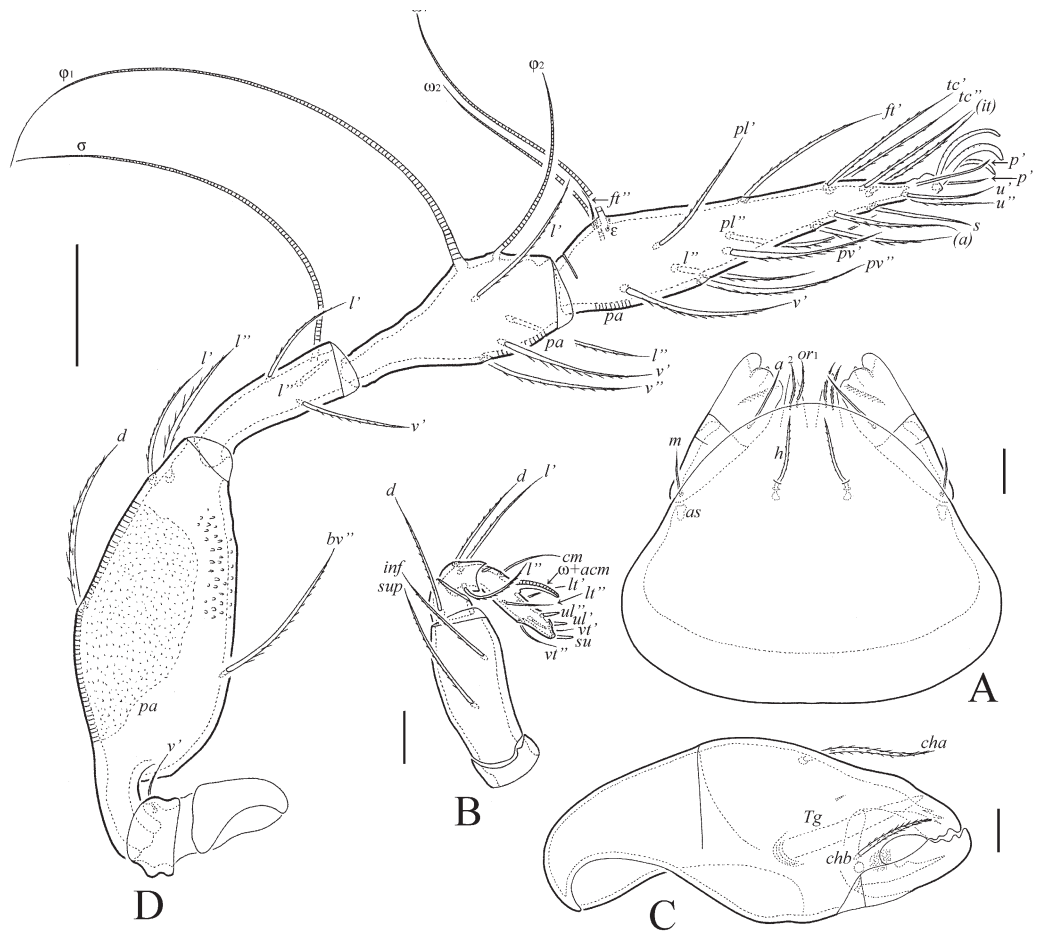


Fig. 2. *Galumna paravaria* sp. nov., adult: A. subcapitulum, ventral view; B. palp, right, antiaxial view; C. chelicera, right, antiaxial view; D. leg I, right, paraxial view. Scale bar 50  $\mu$ m (A, C, D), 20  $\mu$ m (B).

4a, 4b: 20–24) setiform, thin, roughened. Pedotectum II rounded in ventral aspect. Discidium triangular. Circumpedal carina of medium length, reaching level of acetabulum IV.

Anogenital region. Genital (20–24), aggenital (12–14), anal (12–14), and adanal (12–14) setae setiform, thin, roughened. Anterior edge of genital plate with three setae. Aggenital seta located between genital and anal apertures and equally distanced from them. Adanal lyrifissure located close and parallel to anal plate. Adanal setae  $ad_1$  and  $ad_2$  posterior,  $ad_3$  lateral to anal plate; distance  $ad_1$ – $ad_2$  shorter than  $ad_2$ – $ad_3$ . Postanal porose area very long, band-like. Ovipositor elongated (277  $\times$  49), three blades (118) shorter than length of distal section (beyond middle fold; 159). Setae  $\psi_1$  and  $\tau_1$  (73) rod-like;  $\psi_2$ ,  $\tau_a$ ,  $\tau_b$ ,  $\tau_c$  (32) and  $k$  (12) narrowly thorn-like.

Legs. Median claw thicker than lateral claws, all slightly barbed on dorsal side. Formulas of leg setation and solenidia: I (1-4-3-4-20) [1-2-2], II (1-4-3-4-15) [1-1-2], III (1-2-1-3-15) [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 stickform, slightly swollen and blunt-ended apically, inserted between solenidia  $\omega_1$  and  $\omega_2$ . Seta  $s$  of tarsus I eupathidial, located before setae  $a$ . Solenidia  $\omega_1$  and  $\omega_2$  on tarsus II and  $\sigma$  on genu III bacilliform, other solenidia setiform, pointed or rounded apically. Solenidion on tibia IV inserted in the anterior part of the segment.

**Material examined.** Holotype and 11 paratypes: Nepal, Katmandu Distr., Sheopuri Mt., 27°47' N, 85°23' E, 2100–2300 m a.s.l., soil-litter in *Quercus semecarpifolia* forest, 25.VI.1988 (collected by J. Martens and W. Schawaller).

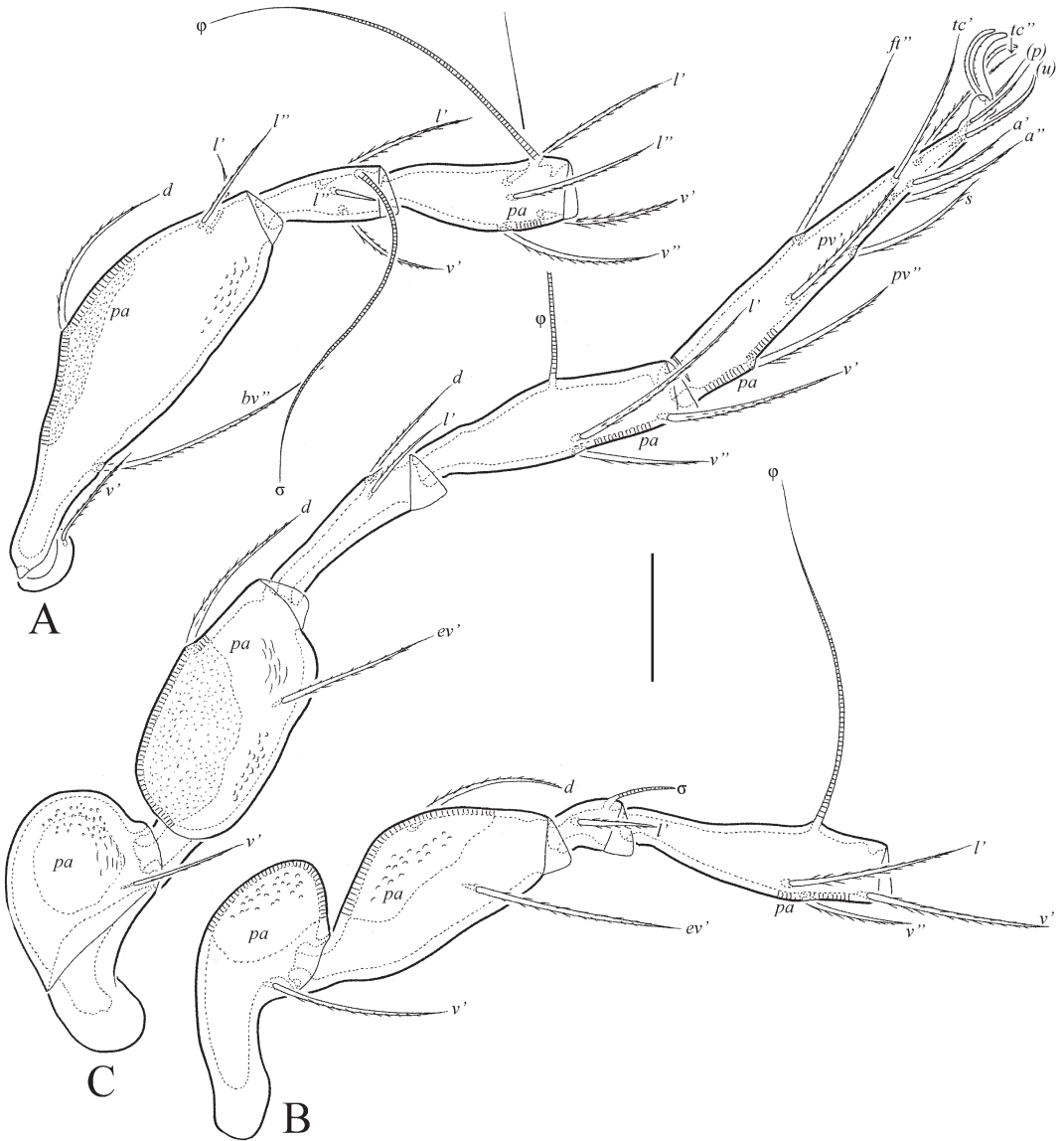


Fig. 3. *Galumna paravaria* sp. nov., adult: A. leg II (without tarsus), right, antiaxial view; B. leg III (without tarsus), left, antiaxial view; C. leg IV, left, antiaxial view. Scale bar 50  $\mu$ m.

**Table 1.** Leg setation and solenidia of *Galumna paravaria* sp. nov. Roman letters refer to normal setae, Greek letters to solenidia (except  $\epsilon$  = famulus); single quotation mark (') designates setae on the anterior and double quotation mark (") setae on the posterior side of a given leg segment; parentheses refer to a pair of setae.

Leg	Tr	Fe	Ge	Ti	Ta
I	$v'$	$d, (l), bv''$	$(l), v', \sigma$	$(l), (v), \varphi_1, \varphi_2$	$(ft), (tc), (it), (p), (u), (a), s, (pv), v', (pl), l'', \epsilon, \omega_1, \omega_2$
II	$v'$	$d, (l), bv''$	$(l), v', \sigma$	$(l), (v), \varphi$	$(ft), (tc), (it), (p), (u), (a), s, (pv), \omega_1, \omega_2$
III	$v'$	$d, ev'$	$l', \sigma$	$l', (v), \varphi$	$(ft), (tc), (it), (p), (u), (a), s, (pv)$
IV	$v'$	$d, ev'$	$d, l'$	$l', (v), \varphi$	$ft'', (tc), (p), (u), (a), s, (pv)$

**Type deposition.** The holotype and two paratypes are deposited in the collection of the Senckenberg Museum of Natural History, Görlitz, Germany; nine paratypes are deposited in the collection of the Tyumen State University Museum of Zoology, Tyumen, Russia. All specimens are preserved in ethanol with a drop of glycerol.

**Etymology.** The species name *paravaria* refers to the similarity between the new species and *Galumna varia* Mahunka, 1995.

**Remarks.** *Galumna paravaria* sp. nov. is morphologically most similar to *Galumna varia* Mahunka, 1995 from Thailand in main morphological traits (rostrum rounded; rostral, lamellar and interlamellar setae long; bothridial seta with lanceolate head; dorsosejugal porose area, median pore and postanal porose area present; four pairs of notogastral porose areas, including triangular *Aa*; ventral setae short), but differs by the larger body (680–713 versus 548–592), indistinct (versus well developed) head of bothridial seta, band-like/elongate oval (versus oval) notogastral porose area *A2* and band-like notogastral porose area *A3* (versus oval) and postanal porose area (versus elongate oval).

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