

## Further new and little known species of ptyctimous mites (Acari, Oribatida) from Cameroon

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**Abstract:** Nineteen species of ptyctimous mites were found in 20 samples collected in Cameroon: 15 samples from the Southwest region, near the ocean, and 5 samples from the Northwest region, inland. Two new species: *Euphthiracarus (Pocsia) inaequatus* sp. n. and *Steganacarus (Rhacaplacarus) alius* sp. n. are described and figured. Six species are new to Cameroon. The so far unknown instars of *Mesoplophora (Mesoplophora) invisitata* Niedbała, 1983: larva, proto-, deuto-, and tritonymph are described. The deutonymph and tritonymph of *M. (M.) invisitata* are compared with the corresponding stages of the related species. The tritonymph of the species of both subgenera, *Mesoplophora* and *Parplophora*, differ in the number of setae on the anal and adanal plates, which is an additional morphological character differentiating these subgenera. Two previously known species, *Phthiracarus parabaloghi* Niedbała, 1983 and *Protophthiracarus diatropos* Niedbała and Starý, 2014, show some morphological differences compared to their holotypes.

**Key words:** Oribatid, ptyctimous mites, Mesoplophoridae, Phthiracaroida, Euphthiracaroida, new species, morphology, taxonomy, Cameroon

### 1. Introduction

The current paper presents a continuation of the study of the ptyctimous mite fauna from 2 regions in Cameroon: the Northwest and Southwest regions (Niedbała and Starý, 2014). So far, 26 species have been identified including 1 Mesoplophoridae, 7 Euphthiracaroida, and 18 Phthiracaroida. In the material under study, 19 species were found; 2 of them belong to Mesoplophoridae, 5 to Euphthiracaroida, and 12 to Phthiracaroida. Two species are new to science: *Euphthiracarus (Pocsia) inaequatus* sp. nov. and *Steganacarus (Rhacaplacarus) alius* sp. nov., and 6 are newly recorded for Cameroon.

### 2. Materials and methods

The material consists of 15 samples courtesy of Dr J Starý and 5 samples collected during the expedition by Prof T Osiejuk. The first 15 samples (ranked by increasing altitude) come from environments relatively close to the ocean in the Southwest region of Cameroon; the other 5 samples (ranked by harvest date) were collected inland in the Northwest region. The samples from the Southwest region were collected from the slopes of Mt Cameroon, starting from the lowland forest at sea level through midlevel and upper montane forest to the summit. The samples from the Northwest region were collected only

in the upper montane forest. The upper montane forest in these 2 regions is characterized by cool climate, high humidity, and high numbers of endemic plant, vertebrate, and insect species. Mt Cameroon is characterized by extremely high rainfall (up to 10,000 mm per year at the foot of the mountain) while in inland forest habitats, the rainfall is much lower (average annual rainfall is only over 2400 mm). Montane forest on Mt Cameroon could be found at relatively low elevations, generally above 800 m, but even as low as 500 m on its south slopes. In the inland study site, the areas below 1600 m a.s.l. are deforested. The montane forest grows only between 1600 and 2100 m a.s.l. (Thomas, 1986; Tye, 1986).

Soil samples were collected using the leaf litter sifting method. All mite specimens were preserved in 85% ethanol, cleared on slides with 80% lactic acid, and then mounted on temporary slides with glycerol. Observations, figures, and measurements were made under a standard light microscope equipped with a drawing attachment. Body measurements are presented in micrometers. Length of body setae was measured in lateral aspect. The terminology used is based on that given by Niedbała (2000). Types of new species are preserved at the Department of Animal Taxonomy and Ecology, Adam Mickiewicz University in Poznan, Poznan, Poland.

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### 3. Taxonomic part

#### 3.1. List of identified species

##### Mesoplophoridae

*Mesoplophora (Mesoplophora) africana* Balogh, 1958 (new for Cameroon)

*Mesoplophora (M.) invisitata* Niedbała, 1983

##### Euphthiracaroida

*Euphthiracarus (Pocsia) inaequatus* Niedbała sp. nov

*Acrotritia ardua* (C. L. Koch, 1841)

*Acrotritia furca* Niedbała and Starý, 2014

*Acrotritia rustica* (Niedbała, 1991)

*Acrotritia spiculifera* (Mahunka, 1991) (new for Cameroon)

##### Phthiracaroida

*Phthiracarus ochthus* Niedbała 2001 (new for Cameroon)

*Phthiracarus parabaloghi* Niedbała, 1983

*Hoplophthiracarus kumboensis* Niedbała and Starý, 2014

*Hoplophthiracarus spinus* Niedbała and Starý, 2014

*Protophthiracarus diatropos* Niedbała and Starý, 2014

*Protophthiracarus korupensis* Niedbała and Starý, 2014

*Protophthiracarus venustus* (Niedbała, 1983)

*Steganacarus (Rhacaplacarus) alius* Niedbała sp. nov.

*Atropacarus (Hoplophorella) andrei* (Balogh, 1958) (new for Cameroon)

*Atropacarus (Hoplophorella) gibbus* Niedbała and Starý, 2014

*Atropacarus (Hoplophorella) hamatus* (Ewing, 1909) (new for Cameroon)

*Atropacarus (Atropacarus) striculus* (C.L. Koch, 1836) (new for Cameroon)

#### 3.2 Descriptions of new species

*Euphthiracarus (Pocsia) inaequatus* Niedbała sp. nov.

(Figures 1A–1E)

zoobank.org:act:0875A208-3C6B-4220-B281-586867C0FEA1

**Material:** Holotype. CMR-017.

**Description:** Measurements of holotype: prodorsum: length 255, width 190, height 182, setae: *ss* 83, *in* 121, *le* 83, *ro* 101, *ex* 25, *in-in/le-le* = 1.4; notogaster: length 485, width 303, height 318, setae: *c*<sub>1</sub> 48, *c*<sub>3</sub> 15, *cp* 71, *h*<sub>1</sub> 61, *ps*<sub>1</sub> 53, *c*<sub>1</sub>/*c*<sub>1</sub>-*d*<sub>1</sub> = 0.5; genitoaggenital region 195 × 76, anoadanal region 185 × 53, *g*<sub>6</sub> 17, *ag* 28.

Species of medium size. Color brown. Surface of body punctate, only integument of prodorsum and ventral plates with small, indistinct concavities.

Prodorsum with two pairs of parallel lateral carinae, lower carinae long, upper carinae half the lower's lengths. Sensilli long, with swollen head, covered with some minute spines. Interlamellar and lamellar setae attenuate, covered with some minute cilia, rostral setae also attenuate, rough; *in* > *ro* > *le* = *ss* > *ex*. Distance *in-in* slightly greater than *le-le*.

Notogaster with rather short (*c*<sub>1</sub> < ½ *c*<sub>1</sub>-*d*<sub>1</sub>) setae covered sparsely with minute cilia. Setae *c*<sub>3</sub> shortest, *cp* longest. Setae *c*<sub>1-3</sub> remote from anterior margin, setae *c*<sub>1</sub> considerably more remote than setae *c*<sub>3</sub>.

Ventral region. Genitoaggenital plates with 6 pairs of genital setae and 2 pairs considerably longer aggenital setae. Anoadanal plates with anal setae longer and attenuate, adanal setae rigid and shorter.

Tarsi of legs monodactylous.

Subcapitulum and legs not examined because only the holotype was available.

**Etymology:** The specific name *inaequatus* is Latin for "unequal" and alludes to the unequal length of the lateral carinae of the prodorsum.

**Comparison:** From the afrotropical *Pocsia* species only two: *E. (P.) bicarinatus* Starý, 1991 and *E. (P.) disparilis* Niedbała, 1998 have two pairs of long lateral carinae of the prodorsum and the distance between the interlamellar setae is considerably larger than that between the lamellar setae.

*E. (P.) bicarinatus* has equally long lateral carinae, 8 pairs of genital setae and setae *ag*<sub>1</sub> longer than *ag*<sub>2</sub>; *E. (P.) disparilis* has equally long lateral carinae, thin, rod-like sensilli without any spines, gradually tapering and 7 pairs of genital setae (versus upper carinae shorter than lower carinae, sensilli with swollen head, covered with minute spines, aggenital setae similar in length and the presence of 6 pairs of genital setae in *E. (P.) inaequatus* sp. nov.).

*Steganacarus (Rhacaplacarus) alius* Niedbała sp. nov.

(Figures 2A–2E)

zoobank.org:act:69C06583-7B6A-473A-9BB6-5A2F5E93955C

**Material:** Holotype: CMR-017.

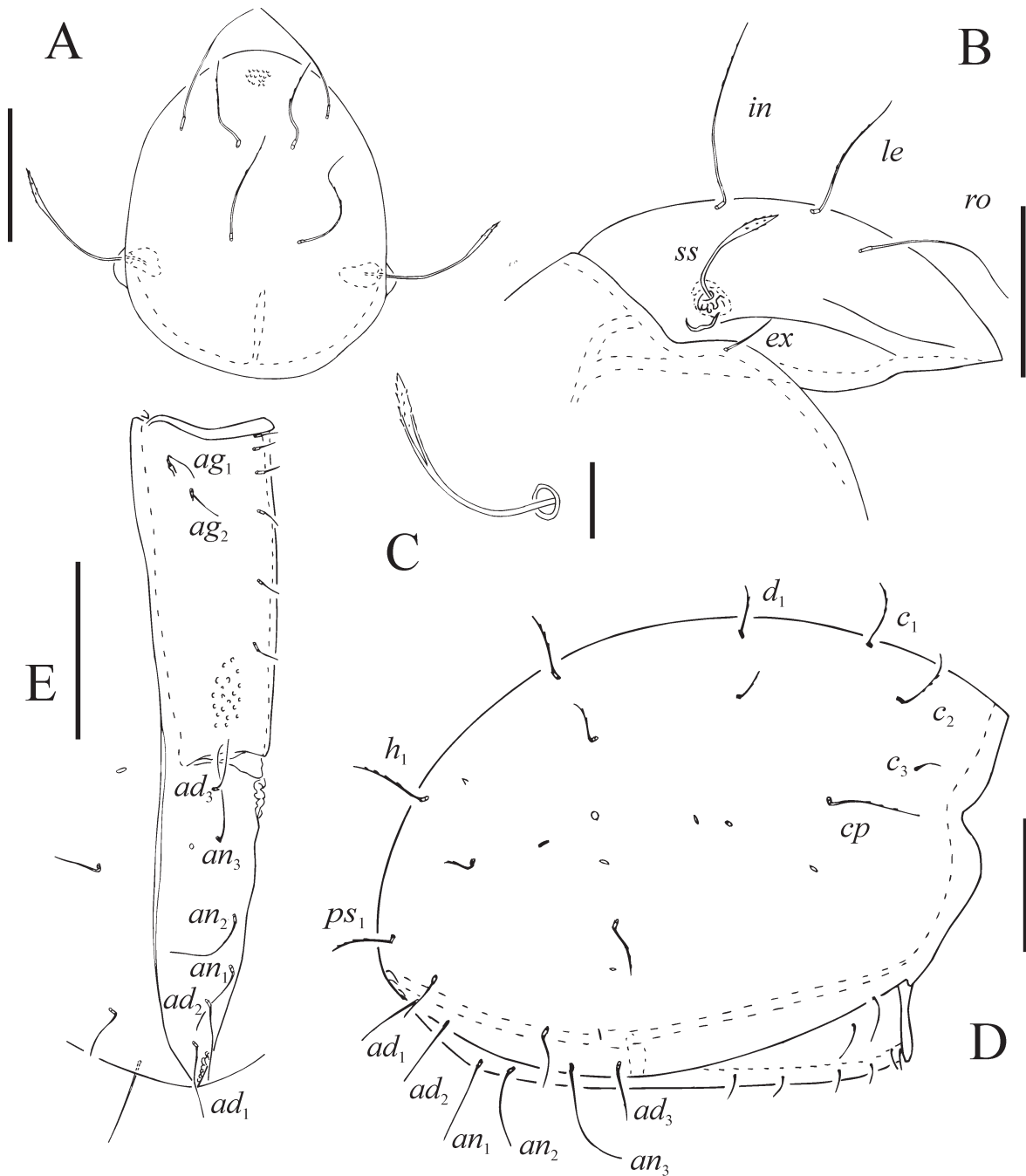
**Description:** Measurements of holotype: prodorsum: length 230, width 177, height 101, setae: *ss* 51, *in* 43, *le* 18, *ro* 40; notogaster: length 449, width 303, height 298, setae: *c*<sub>1</sub> 73, *c*<sub>1</sub>/*c*<sub>1</sub>-*d*<sub>1</sub> = 0.7, *c*<sub>3</sub> 48, *h*<sub>1</sub> 61, *ps*<sub>1</sub> 58; genitoaggenital region 121 × 81, anoadanal region 162 × 78.

Species of medium size. Color brown. Body surface with strong cerotegument covered with feeble concavities.

Prodorsum with short lateral carinae. Posterior furrows distinct, sigillar fields invisible. Sensilli of medium length, club-like, with rounded, rough head. Interlamellar and lamellar setae short, spiniform, rough, rostral setae stronger, rough, directed inwards; *ss* > *in* > *ro* > *le*.

Notogaster with 15 pairs of rigid, rather short (*c*<sub>1</sub> < *c*<sub>1</sub>-*d*<sub>1</sub>) setae, covered with small spines and with blunt end in distal half. Only setae *c*<sub>3</sub> situated near anterior margin spiniform, slender and smooth, setae *c*<sub>1</sub> slightly remote from anterior margin, setae *c*<sub>2</sub> far from margin. Vestigial setae *f*<sub>1</sub> anterior of *h*<sub>1</sub> setae. Two pairs of lyrifissures *ia* and *im* present.

Ventral region. Formula of genital setae: 6(4 + 2) : 3. Anoadanal plates each with 5 pairs of rigid, rough setae, setae *ad*<sub>2</sub> longest and thickest.



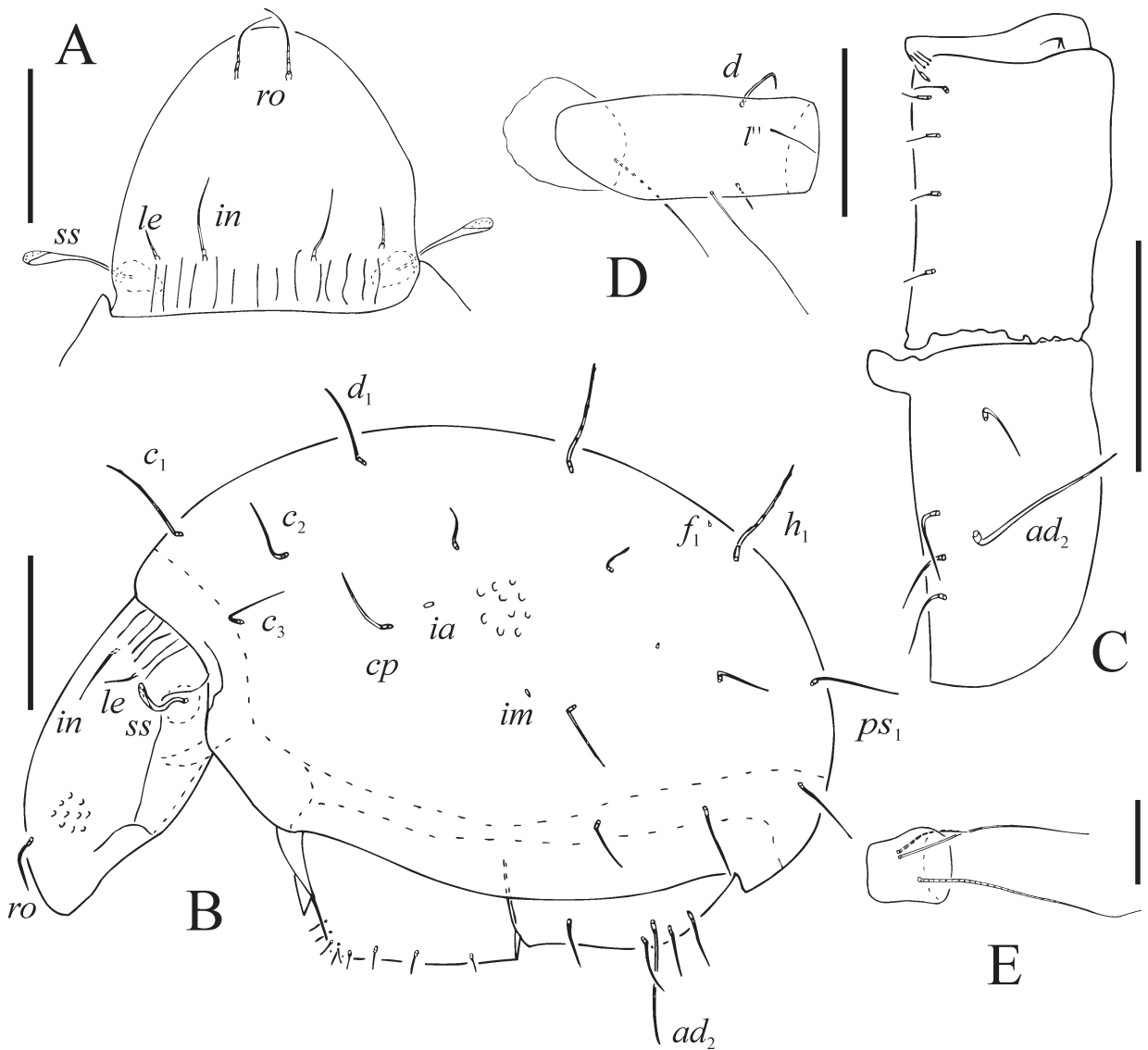
**Figure 1.** *Euphthiracarus (Pocsia) inaequatus* Niedbala sp. nov. (holotype). A, prodorsum, dorsal view; B, prodorsum, lateral view; C, sensillus; D, opisthosoma, lateral view; E, right ventral region. Scale bars 100  $\mu$ m (A, B, D, E), 25  $\mu$ m (C).

Chaetome of legs complete. Setae *d* on femora I remote from distal end of article, more remote than setae *l*<sup>o</sup>.

**Etymology:** The specific epithet *aliaus* is Latin for “another, other, different” and alludes to the different shape of setae *c*<sub>3</sub> compared to the other setae of the notogaster.

**Comparison:** Another afro-tropical species of the subgenus *Rhacaplacarus* with setae *c*<sub>3</sub> of similar shape is

*S. (R.) pervigens* (Niedbala, 1988), but the new species has shorter interlamellar and lamellar setae (*in* and *le* < *ss*) (versus longer, *in* and *le* > *ss*), invisible sigillar fields (versus distinct narrow fields), shorter (*c*<sub>1</sub> < *c*<sub>1</sub>-*d*<sub>1</sub>) notogastral setae (versus longer *c*<sub>1</sub> = *c*<sub>1</sub>-*d*<sub>1</sub>), two pairs of lyrifissures (versus four pairs), setae *l*<sup>o</sup> of femora I situated anteriorly of setae *d* (versus posteriorly).



**Figure 2.** *Steganacarus (Rhacaplacarus) alius* Niedbała sp. n. (holotype). A, prodorsum, dorsal view; B, lateral view of body; C, left genitoaggenital and anoadanal plates; D, trochanter and femur of leg I; E, tibia IV. Scale bars 100 µm (A–C), 50 µm (D), 25 µm (E).

**3.3. Descriptions of juvenile instars (previously unknown)**

*Mesoplophora (M.) invisitata* Niedbała, 1983

(Figures 3–7; Table 1)

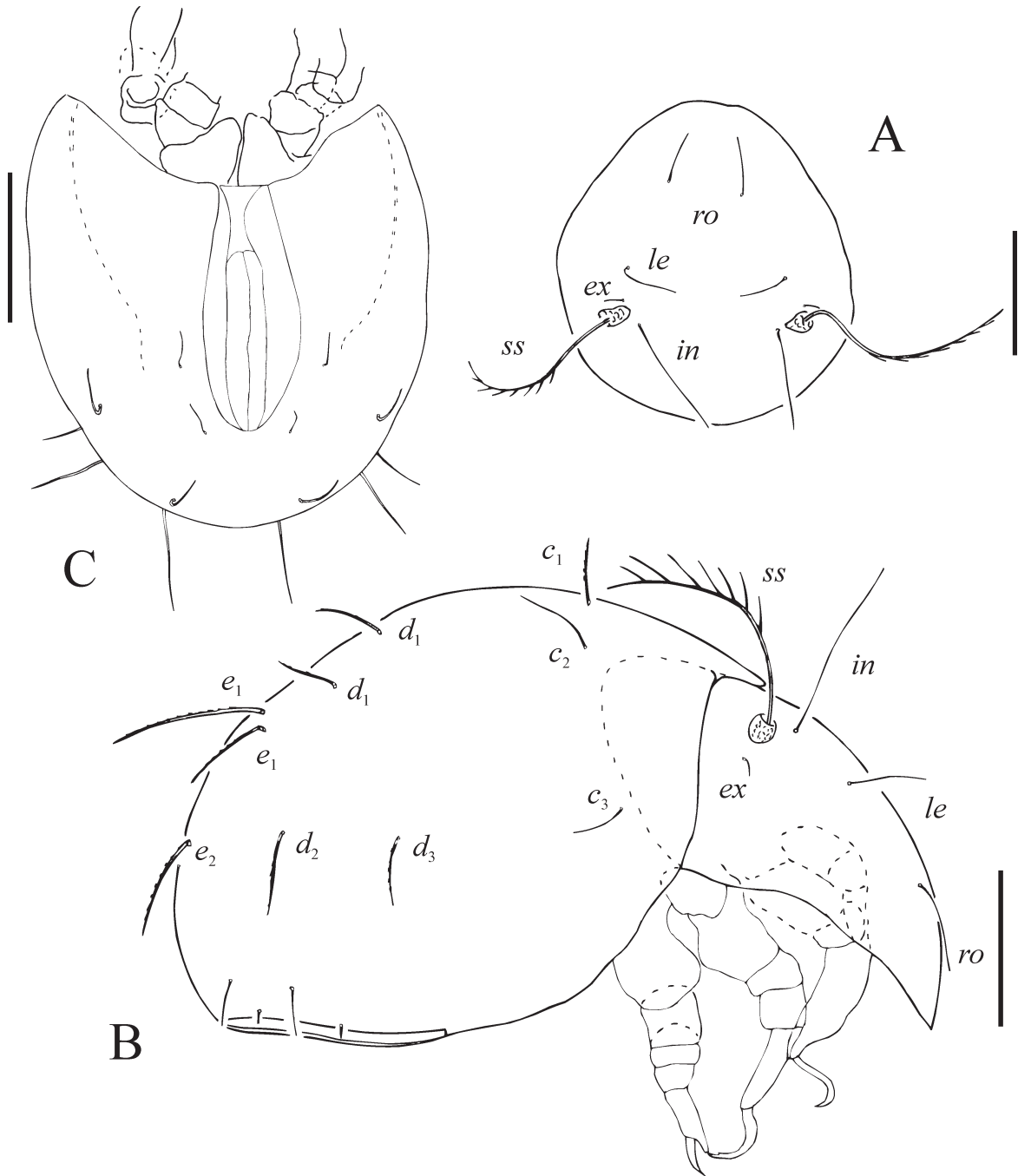
Measurements of larva from sample CMR-002 (Figures 3A–3C); prodorsum: length 126, width 111, height 61; setae: *ss* 68, *in* 48, *le* 23, *ro* 28, *ex* 15; bothridium diameter 18, *ex/bothridium* = 0.8; notogaster: length 180, width 144, height 142; setae: *c*<sub>1</sub> and *d*<sub>1</sub> 25, *e*<sub>1</sub> 45, *c*<sub>1</sub>/*c*<sub>1</sub>-*d*<sub>1</sub> = 0.5; length of anal plate 63.

Color light yellow. Prodorsum without lateral carinae; sensilli with 7 cilia, other setae fine, smooth, *in* > *ro* > *le* > *ex*; exobothridial setae slightly smaller than diameter of bothridia. Notogaster with 8 pairs of setae, most of them covered with small spines with exception of smooth setae

*c*<sub>2</sub>, *c*<sub>3</sub>. Ventral plate with 4 pairs of setae, anadal and anal plates without setae.

Measurements of protonymph from sample CMR-007 (Figures 4A–4E); prodorsum: length 177, width 129, height 81; setae: *ss* 53, *in* 43, *le* and *ro* 28, *ex* 5; diameter of bothridium 13, *ex/bothridium* = 0.4; notogaster: length 248, width 185, height 149; setae: *c*<sub>1</sub> 30, *e*<sub>1</sub> 25, *c*<sub>3</sub> 28, *c*<sub>1</sub>/*c*<sub>1</sub>-*d*<sub>1</sub> = 0.4; length of genital plate 61, length of anal plate 82.

Color light yellow. Prodorsum without lateral carinae; sensilli with 5–6 cilia on one side and 3–5 on the other side, other setae smooth; exobothridial setae smaller than diameter of bothridia. Notogaster with 8 pairs of smooth setae, only setae *e*<sub>1</sub> rough and thicker than others. Ventral plate with 4 pairs of setae; plate Q with 1 pair of setae; plate



**Figure 3.** *Mesoplophora (M.) invisitata* Niedbała, 1983, larva from sample CMR-002. A, prodorsum, dorsal view; B, lateral view of body; C, ventral side. Scale bars 50  $\mu$ m (A–C).

*P* without setae. Genital plates with 1 pair of setae; anal plates without any setae, adanal plates with 2 pairs of setae. Plates *Q*, anal and adanal not pointed in posterior end.

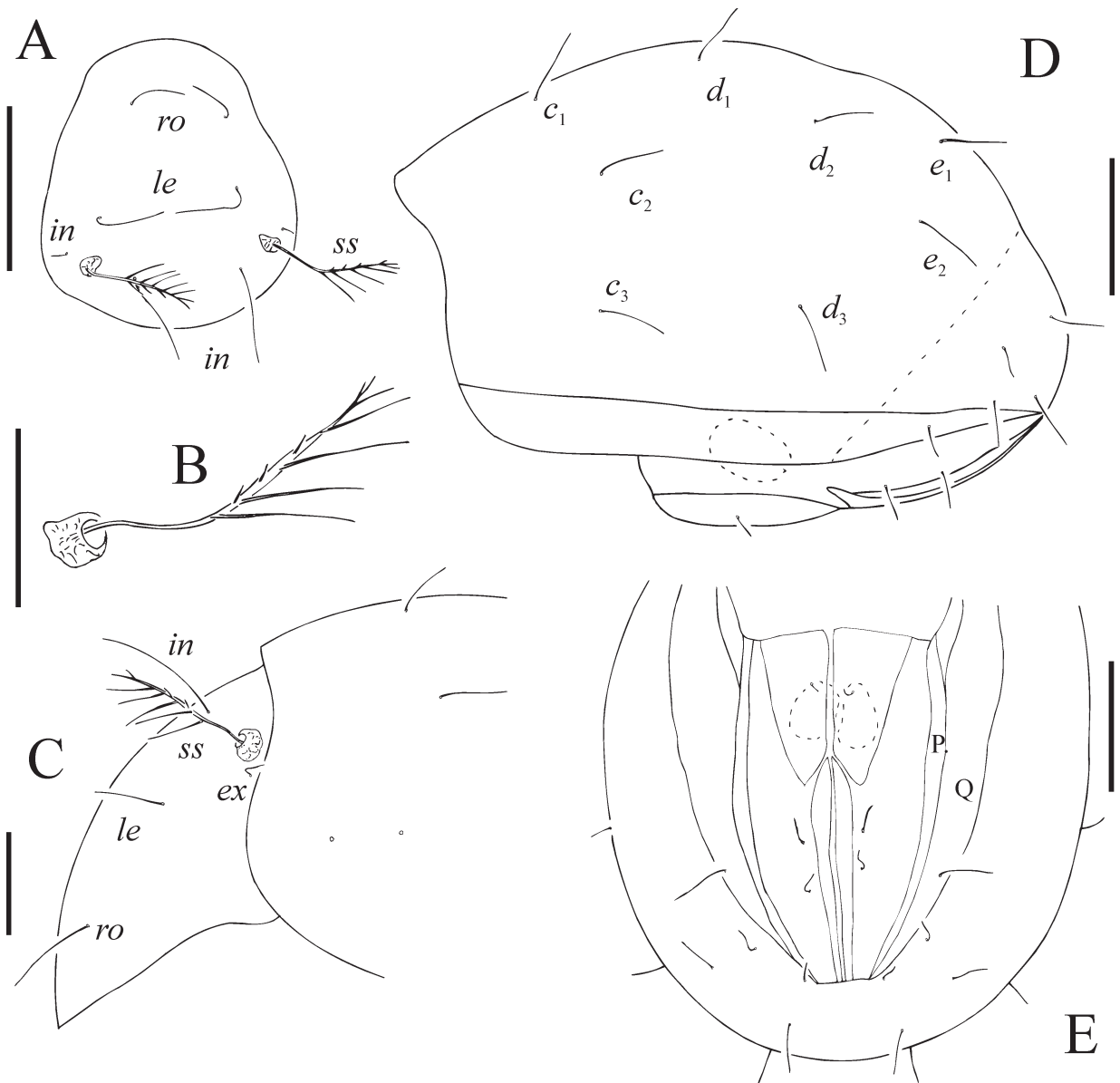
Measurements of deutonymph from sample CMR-016 (Figures 5A–5D); specimen 1: prodorsum: length 248, width 180, height 116; setae: *ss* 83, *in* 71, *le* 38, *ro* 35, *ex* 13; diameter of bothridium 15; notogaster: length 313,

width 283, height 232; setae: *c*<sub>1</sub> and *e*<sub>1</sub> 33, *c*<sub>3</sub> 46,  $c_1/c_1-d_1 = 0.3$ ; genital plate 94 × 30, anal and adanal plates 111 × 25; specimen 2: prodorsum: length 217, height 81; notogaster: length 353, height 237.

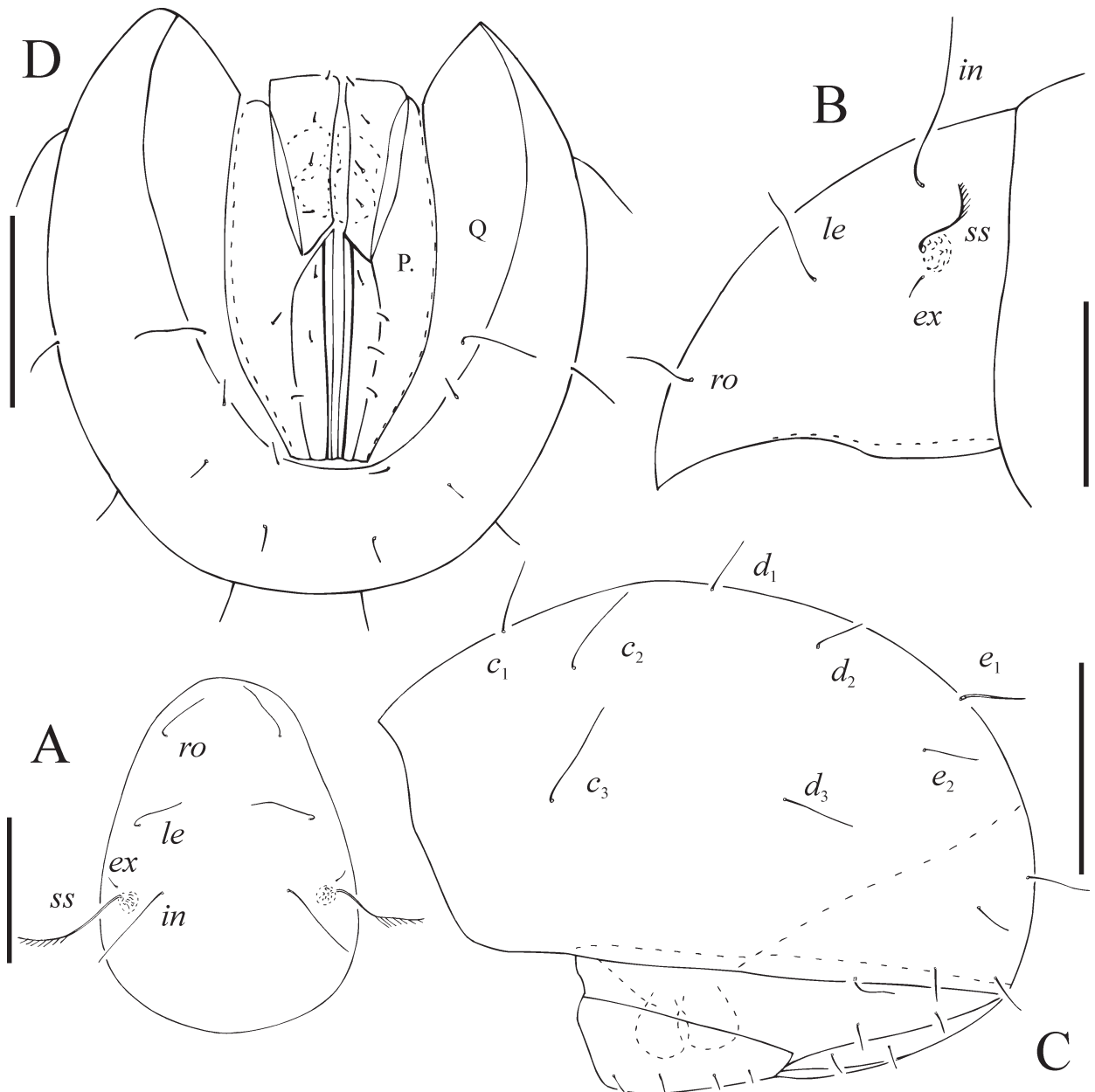
Color light yellow. Prodorsum without lateral carinae; sensilli with 7 cilia but longer than in adult, other setae smooth, exobothridial setae slightly shorter than diameter

**Table 1.** Morphological diagnoses of instars of *M. (M.) invisitata* Niedbała, 1983 (A, length of prodorsum; B, length of notogaster; C, number of cilia on sensilli; D, covering of the notogastral setae; E, number of ventral setae; F, number of setae on plate Q; G, number of setae on plate P; H, number of genital setae; I, number of anal setae; J, number of adanal setae).

Characters	A	B	C	D	E	F	G	H	I	J
larva	126	180	7	smooth	4	0	0	0	0	0
protonymph	177	248	5, 6	rough	4	1	1	1	0	2
deutonymph	248	313	7	rough	4	1	2	4	0	2
tritonymph	293	444	8	with cilia	4	1	2	6	2	2



**Figure 4.** *Mesoplophora (M.) invisitata* Niedbała, 1983, protonymph from sample CMR-007. A, prodorsum, dorsal view, B, sensillus, C, prodorsum with anterior side of notogaster, lateral view; D, opisthosoma, lateral view; E, ventral side. Scale bars 100  $\mu$ m (A), 50  $\mu$ m (C–E), 25  $\mu$ m (B).



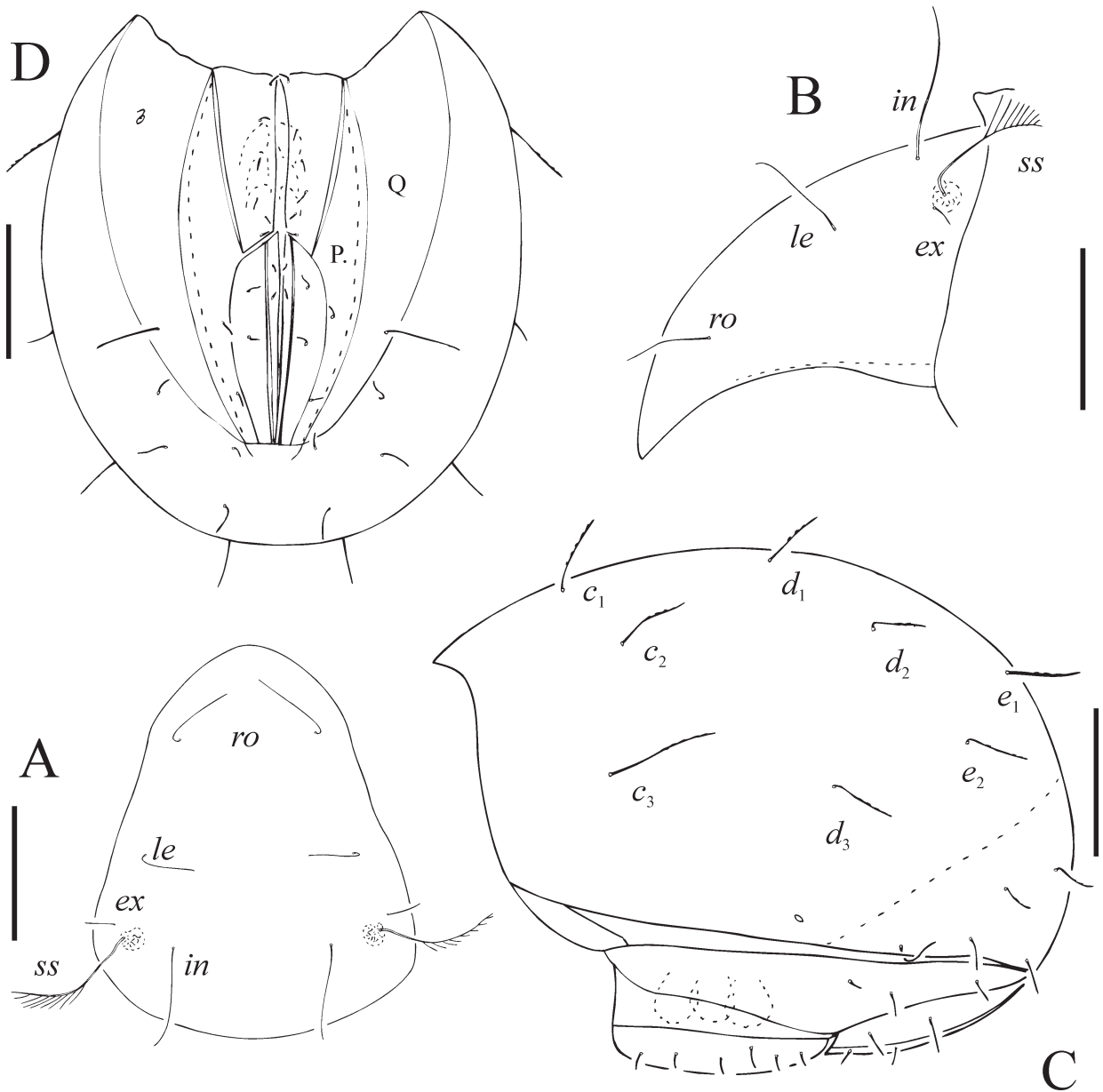
**Figure 5.** *Mesoplophora (M.) invisitata* Niedbała, 1983, deutonymph from sample CMR-016. A, prodorsum, dorsal view; B, prodorsum, lateral view, C, opisthosoma, lateral view, D, ventral side. Scale bars 100 µm (A–D).

of bothridia. Notogaster with 8 pairs of rough setae, setae  $c_3$  longer than others, setae  $e_1$  thicker than others. Ventral plate with 4 pairs of setae; plate Q with 1 pair of setae; plate P with 2 pairs of setae. Genital plates with 4 pairs of setae; anal plates without any setae, adanal plates with 2 pairs of setae. Plates Q, anal and adanal as in tritonymph not pointed in posterior end.

Measurements of tritonymph from sample CMR-016 (Figures 6A–6D); specimen 1: prodorsum: length 293, width 232, height 126; setae:  $ss$  81,  $in$  89,  $le$  and  $ro$

51,  $ex$  19; diameter of bothridium 19; notogaster: length 444, width 343, height 252; setae:  $c_1$  and  $e_1$  51,  $c_3$  56,  $c_1/c_1-d_1 = 0.4$ ; genital plate  $124 \times 30$ , anal and adanal plates  $152 \times 35$ , specimen 2: prodorsum: length 252, height 126; notogaster: length 424, height 288.

Color light yellow. Prodorsum without lateral carinae; sensilli with 8 cilia longer than in adult, other setae smooth, exobothridial setae as long as diameter of bothridia. Notogaster with 8 pairs of setae covered with small cilia, setae  $c_3$  longer than others, setae  $e_1$  thicker than



**Figure 6.** *Mesoplophora (M.) invisitata* Niedbała, 1983, tritonymph from sample CMR-016, specimen 1. A, prodorsum, dorsal view; B, prodorsum, lateral view; C, opisthosoma, lateral view; D, ventral side. Scale bars 100  $\mu$ m (A–D).

others. Ventral plate with 4 pairs of setae; plate Q with 1 pair of setae; plate P with 2 pairs of setae. Genital plates with 6 pairs of setae; anal plates with 2 pairs and adanal plates with 2 pairs of setae. Plates Q, anal and adanal flat, not pointed in posterior end.

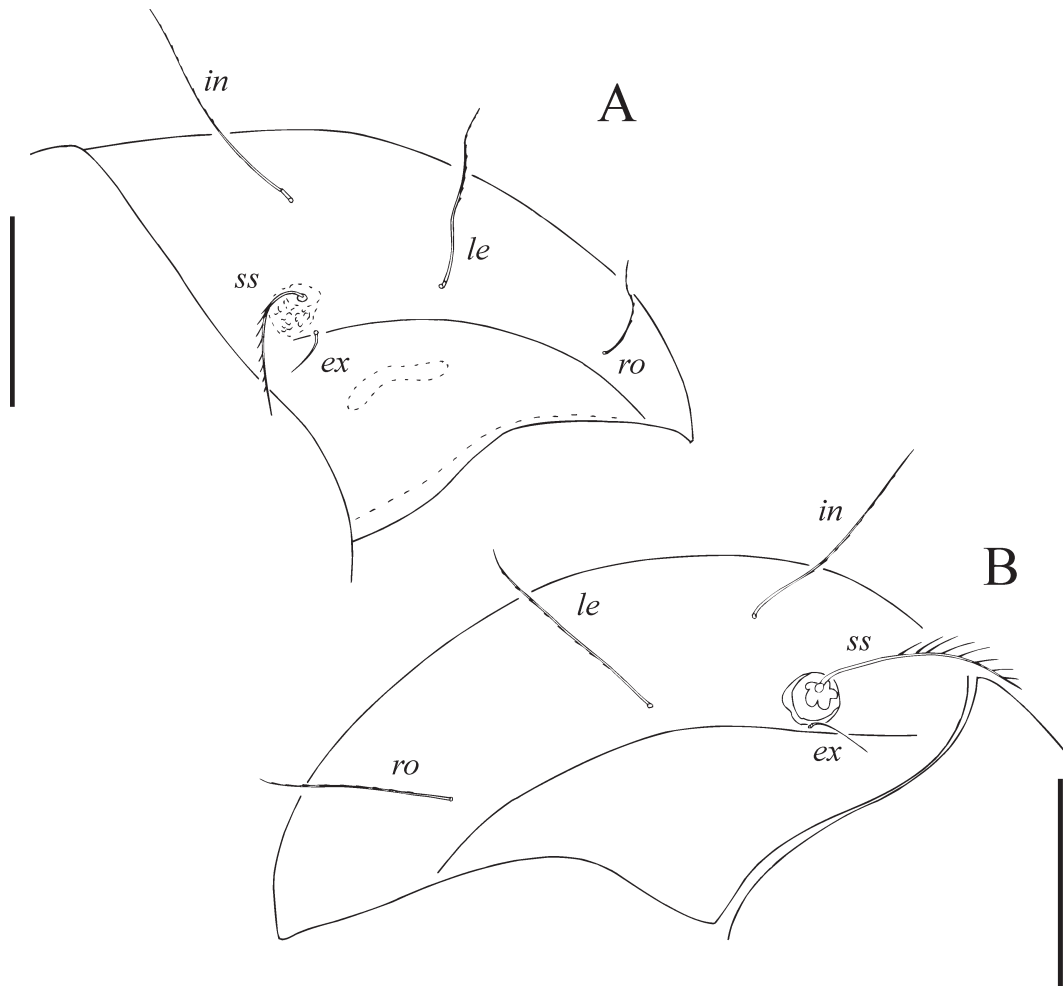
Measurements of adult from sample MRC-016 (Figures 7A and 7B); specimen 1: prodorsum: length 338, height 192; setae: *ss* 142, *in* 127, *le* 88, *ro* 63, *ex* 23; diameter of bothridium 23; notogaster: length 505, height 353; setae:  $c_1$  96,  $c_3$  134;  $c_1/c_1-d_1 = 0.6$ ; specimen 2: prodorsum: length 353, height 141; setae: *ss* 120, *in* 109, *le* 104, *ro* 88,

*ex* 30; diameter of bothridium 23; notogaster: length 480, height 303.

Adult specimens from Cameroon are bigger than the holotype (prodorsum 267, notogaster 363) from Uganda (Niedbała, 1983)

**Comparisons:** The larva of *Mesoplophora (Mesoplophora) invisitata* is similar to that of *Mesoplophora (Parplophora) pulchra* Sellnick, 1928 (Grandjean 1934), except on the weakly expressed ventral plate P, there is 1 seta in *M. (P.) pulchra*, while it is absent in *M. (M.) invisitata*.





**Figure 7.** *Mesoplophora (M.) invisitata* Niedbała, 1983, adults from sample CMR-016, A, specimen 1, prodorsum, lateral view; B, specimen 2, prodorsum, lateral view. Scale bars 100  $\mu\text{m}$  (A, B).

The deutonymph of *M. (M.) invisitata* is almost identical to that of *M. (M.) quasigavae* Niedbała (Ermilov et al., 2016), the only difference is that the posterior end of plates Q, anal and adanal are straight in *M. (M.) invisitata* and pointed in *M. (M.) quasigavae*. The common character of deutonymphs of *M. (M.) invisitata*, *M. (M.) quasigavae*, and *M. (P.) pulchra* is the presence of 4 pairs of genital setae and the absence of setae on the anal plates.

The tritonymph of *M. (M.) invisitata* is identical with that of *M. (M.) quasigavae* Niedbała (Ermilov et al., 2016). It is very similar to the tritonymph of *M. (M.) michaeliana* Berlese, 1904 (Niedbała, 2014), distinguishable only by the shape of sensilli covered with long (sometimes longer than distances between them) cilia versus shorter cilia (as long as distances between them in *M. michaeliana*), exobothridial setae as long as diameter of bothridia, versus shorter than diameter of bothridia and posterior end of plates Q, anal and adanal straight, versus pointed.

All the known tritonymphs of the subgenus *Mesoplophora* have 2 pairs of anal and 2 pairs of adanal setae. The known tritonymphs of the subgenus *Parplohora*: *M. (Parplohora) subtilis* Niedbała, 1981 (Niedbała 1981) and *M. (P.) pulchra* Sellnick, 1928 (Grandjean 1933) (both with posterior end of plates Q, anal and adanal pointed) has 3 pairs of anal and 3 pairs of adanal setae.

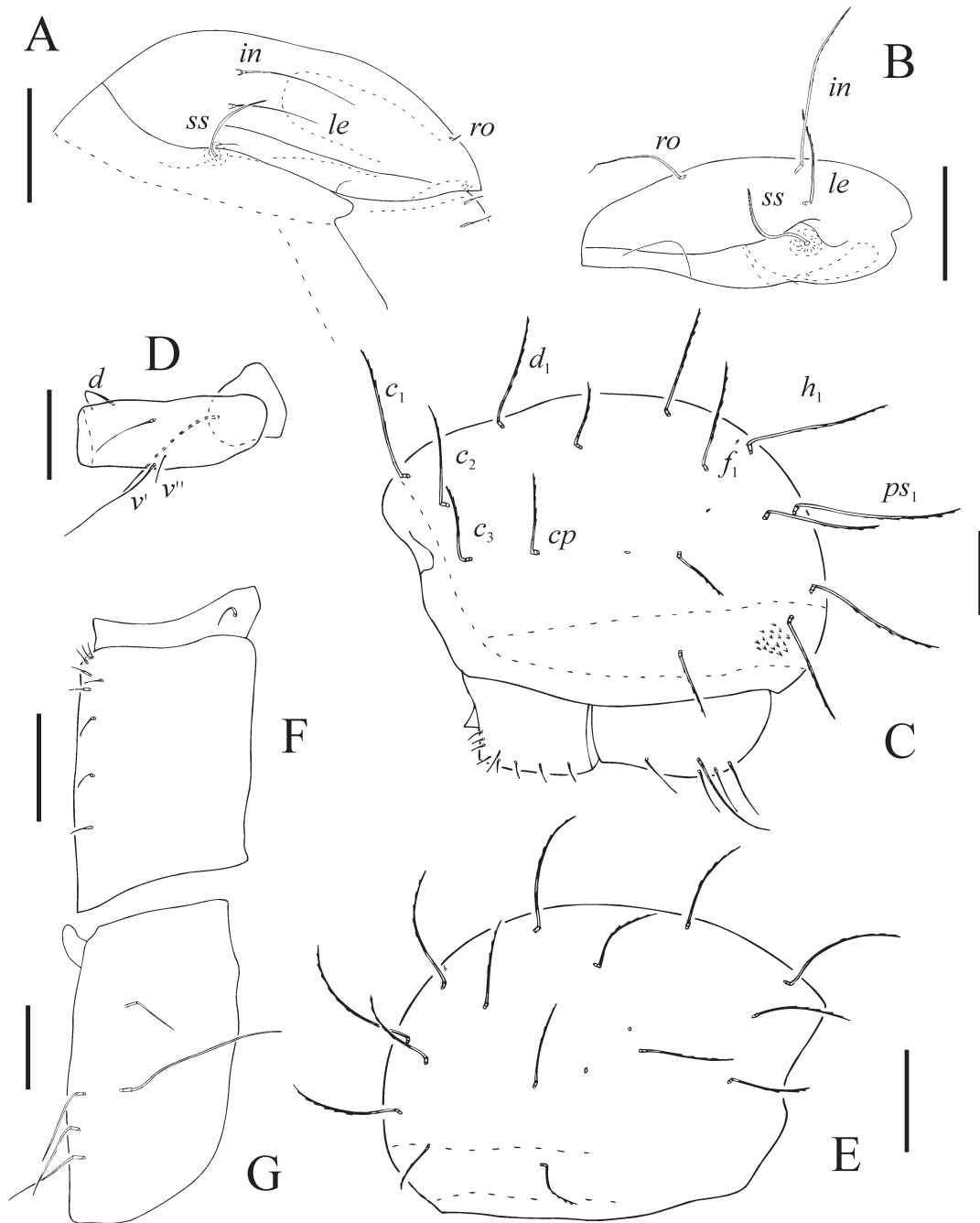
The presence of 2 pairs of anal and 2 pairs of adanal setae in the tritonymphs of the subgenus *Mesoplophora* and 3 pairs of anal and 3 pairs of adanal setae in tritonymphs of the subgenus *Parplohora* is a new distinguishing character between these subgenera.

In the proto-, deuto-, and tritonymph of *M. (M.) invisitata* the posterior end of plates Q, anal and adanal are straight, not pointed, while in the deutonymph of *M. (M.) quasigavae* and tritonymph of *M. (M.) michaeliana* the posterior ends are pointed.

**3.4. Comparisons of some rare species with the holotypes**  
*Phthiracarus parabaloghi* Niedbała, 1983  
 (Figure 8A)

Measurements of specimen from sample CMR-002:  
 prodorsum: length 353, height 141; setae: *ss* 83, *ro* 15;  
 notogaster: length 596, height 363.

Almost all morphological characters are similar to those of the holotype. The only differences are the twice longer sensilli, similar in length to lamellar setae (sensilli shorter than lamellar setae in the holotype), the presence of all lyrifissures *ia*, *im*, *ip*, *ips* (versus only 2 pairs: *ia* and *im* in the holotype). The specimen from sample



**Figure 8.** A, *Phthiracarus parabaloghi* Niedbała, 1983 (specimen from sample CMR-002) prodorsum, lateral view; B–G, *Protophthiracarus diatropos* Niedbała and Starý, 2014, B–D, specimen from sample CMR-013: B, prodorsum, lateral view; C, opisthosoma, lateral view; D, trochanter and femur of leg I; E–G, specimen from sample CMR-016: E, notogaster, lateral view; F, left genitoaggenital plate; G, left anoadanal plate. Scale bars 100  $\mu\text{m}$  (A–C, E), 50  $\mu\text{m}$  (D, F, G).

**Table 2.** List of localities, species, and number of specimens found. (Name of collector: CMR-001 to 015: M Devetter; CMR-016 to CMR-020: T Osiejuk)

Sample no.	Locality	Coordinates	Altitude m a.s.l.	Habitat	Sample of	Date	Species and number of specimens
CMR-001	Mt Cameroon, ±2.5 km NE of Bimbia	3°58'40.62"N, 9°16'03.54"E	32	Lowland forest	Litter and soil	12.11.2013	<i>A. (H.) hamatus</i> – 2
CMR-002	Mt Cameroon, ±2.5 km NE of Bimbia	3°58'48.06"N, 9°15'56.28"E	91	Lowland forest	Litter and soil	12.11.2013	<i>M. (M.) invisitata</i> – 2 (1 larva and 1 deutonymph), <i>A. spiculifera</i> – 1, <i>P. parabaloghi</i> – 1
CMR-003	Mt Cameroon, about 2.5 km NE of Bimbia	3°58'40.86"N, 09°16'04.32"E	177	Lowland forest	Litter and soil	12.11. 2013	<i>A. rustica</i> – 1, <i>A. (H.) hamatus</i> – 1
CMR-004	Mt Cameroon, south slope, Mount Cameroon National Park, about 3.5 km NNE of Bakingili	4°5'31.98"N, 9°3'7.80"E	385	Lowland forest	Litter and soil	27.11.2013	<i>P. venustus</i> – 1, <i>A. (H.) andrei</i> – 1
CMR-005	Mt Cameroon, south slope, Mount Cameroon National Park, about 3.5 km NNE of Bakingili	4°5'23.04"N, 9°3'6.60"E	391	Lowland forest	Litter and soil	27.11. 2013	<i>M. (M.) africana</i> – 1, <i>P. venustus</i> – 3, <i>A. (H.) hamatus</i> – 1
CMR-006	Mt Cameroon, south slope, Mount Cameroon National Park, about 5 km NNE of Bakingili	4°5'56.04"N, 9°3'49.50"E	630	Deciduous forest	Litter and soil	24.11.2013	<i>P. diatropos</i> – 9 (population 1), <i>A. (H.) andrei</i> – 3
CMR-007	Mt Cameroon, south slope, Mount Cameroon National Park, about 5 km NNE of Bakingili	4°6'8.16"N, 9°3'39.12"E	681	Deciduous forest	Litter and soil	24.11.2013	<i>M. (M.) invisitata</i> – 7 (2 adults, 3 protonymphs, 2 deutonymphs), <i>P. parabaloghi</i> – 1, <i>P. korupensis</i> – 3, <i>A. (H.) andrei</i> – 2, <i>A. (H.) gibbus</i> – 2
CMR-008	Mt Cameroon, south slope, Mount Cameroon National Park, about 7 km NNE of Bakingili	4°7'1.26"N, 9°4'18.36"E	1104	Foggy deciduous forest	Litter and soil	26.11.2013	<i>A. rustica</i> – 2
CMR-009	Mt Cameroon, south slope, Mount Cameroon National Park, about 11 km NNE of Bakingili	4°8'50.94"N, 9°5'9.66"E	1836	Sparse foggy forest with very dense herbaceous vegetation	Litter and soil	03.12.2013	<i>H. kumboensis</i> – 1, <i>P. diatropos</i> – 1 (population 2)
CMR-010	Mt Cameroon, south slope, Mount Cameroon National Park, about 11 km NNE of Bakingili,	4°8'54.60"N, 9°5'9.54"E	1854	Sparse foggy forest with very dense herbaceous vegetation	Litter and soil	03.12.2013	<i>M. (M.) invisitata</i> – 2 (1 protonymph and 1 tritonymph)
CMR-011	Mt Cameroon, south slope, Mount Cameroon National Park, about 13 km NNE of Bakingili	4°8'31.50"N, 9°6'58.92"E	2180	Sparse mountain forest	Litter and soil	03.12.2013	<i>A. furca</i> – 2, <i>P. diatropos</i> – 1 (population 2)

Table 2. (Continued).

CMR-012	Mt Cameroon, south slope, Mount Cameroon National Park, about 13 km NNE of Bakingili	4°8'40.86"N, 9°6'50.10"E	2208	Sparse mountain forest	Litter and soil	03.12.2013	<i>A. vestita</i> – 2
CMR-013	Mt Cameroon, south slope, Mount Cameroon National Park, about 13 km NNE of Bakingili	4°8'35.94"N, 9°7'8.58"E	2242	Sparse mountain forest	Litter and soil	03.12.2013	<i>P. diatropos</i> – 8 (population 2)
CMR-014	Mt Cameroon, Mount Cameroon National Park, summit parts of Mt. Cameroon, about 23 km NNE of Bakingili	4°13'3.48"N, 9°10'16.62"E	3992	Mountain afro-alpine greensward with dense mosses and crusts	Litter and soil	01.12.2013	<i>A. (A.) striculus</i> – 1
CMR-015	Mt Cameroon, Mount Cameroon National Park, summit parts of Mt. Cameroon, about 23 km NNE of Bakingili	4°13'3.36"N, 9°10'21.36"E	4019	Mountain afro-alpine greensward with dense mosses and crusts	Litter and soil	01.12.2013	<i>A. (A.) striculus</i> – 1
CMR-016	Bamenda-Banso Highlands, ca. 20 km from Bamenda, near Big Babanki locality	6°5'24"N, 10°17'52"E	2128	Mountain rain forest	Litter	09.12.2014	<i>M. (M.) invisitata</i> – 6 (2 adults, 2 tritonymphs, 2 deutonymph), <i>A. ardua</i> – 2, <i>A. furca</i> – 2, <i>H. kumboensis</i> – 11, <i>P. diatropos</i> – 5 (population 2)
CMR-017	Bamenda-Banso Highlands, ca. 20 km from Bamenda, near Big Babanki locality	6°5'9"N, 10°17'33"E	2039	Mountain rain forest	Litter	09.12.2015	<i>M. (M.) invisitata</i> – 1, <i>E. (P.) inaequatus</i> sp. n. – 1, <i>A. furca</i> – 12, <i>H. kumboensis</i> – 32, <i>S. (R.) alius</i> sp. n. – 1, <i>P. diatropos</i> – 6 (population 2)
CMR-018	Bamenda-Banso Highlands, ca. 20 km from Bamenda, near Big Babanki locality	6°5'9"N, 10°17'33"E	2039	Mountain rain forest	Litter	05.03.2016	<i>M. (M.) invisitata</i> – 1, <i>A. furca</i> – 12, <i>P. ochthus</i> – 4, <i>H. kumboensis</i> – 64, <i>H. spinus</i> – 1, <i>P. diatropos</i> – 5 (population 2)
CMR-019	Bamenda-Banso Highlands, ca. 20 km from Bamenda, near Big Babanki locality	6°5'9"N; 10°17'33"E	2039	Mountain rain forest	Litter	03.12.2016	<i>M. (M.) invisitata</i> – 3 (1 deutonymph), <i>A. furca</i> – 8, <i>P. ochthus</i> – 1, <i>H. kumboensis</i> – 34, <i>H. spinus</i> – 5, <i>P. diatropos</i> – 3 (2 specimens - population 1, 1 specimen - population 2)
CMR-020	Bamenda-Banso Highlands, ca. 20 km from Bamenda, near Big Babanki locality	6°5'20"N, 10°17'45"E	2104	Mountain rain forest	Litter	03.12.2017	<i>A. furca</i> – 1, <i>H. kumboensis</i> – 8, <i>P. diatropos</i> – 2 (population 2)

CMR-007 is almost identical in size with the holotype (prodorsum 252, notogaster 485) but the specimen from CMR-002 is slightly bigger than the holotype.

*Protophthiracarus diatropos* Niedbała and Starý, 2014 (Figures 8B–8G)

Measurements of specimen from sample CMR-013: prodorsum: length 293, height 116; setae: *ss* 86, *in* 159, *le* 96, *ro* 86; notogaster: length 525, height 344; setae:  $c_1$  172,  $d_1$  73,  $h_1$  185,  $h_3$  83,  $ps_1$  205,  $c_1/c_1-d_1 = 1.4$ ,  $h_1/\text{length of notogaster} = 0.35$ .

This specimen differs from the holotype (length of prodorsum 328, length of notogaster 707, setae:  $c_1$  167,  $ps_1$  172) in the presence of considerably longer notogastral setae. The other characters are the same, in particular the morphological details of the prodorsum, genitoaggenital plates and femora I and the location of setae *v* posterior to setae *v*'.

All 8 specimens from sample 013, all specimens from samples 009, 011, 016, 017, 018, 020, and one specimen from sample 019 have the notogastral setae longer ( $h_1/\text{length of notogaster} = 0.30\text{--}0.35$  (population 2) than those of the holotype, all 9 specimens from sample CMR-006 and 2 specimens from sample CMR-019 with shorter notogastral setae, similar to those of the holotype ( $h_1/\text{length of notogaster} = 0.21\text{--}0.23$ ) (population 1).

No differences in the environment or geographic distribution were noted apart from the observation that the specimens of population 2 occurred above 1800 m.

Among the 5 specimens found in sample CMR-016, 2 are smaller in size (specimens 1 and 2) and 3 are distinctly bigger (specimens 3–5). Specimen 1: notogaster: length 454, height 298; setae:  $c_1$  114,  $d_1$  94,  $h_1$  and  $ps_1$  138,  $ps_4$  63,  $h_1/\text{length of notogaster} = 0.30$ ,  $h_1/\text{length of notogaster} = 0.28$ ; specimen 2: notogaster: length 434, height 283; specimen 3: notogaster: length 626, height 475; setae:  $c_1$  202,  $h_1$  228,  $h_1/\text{length of notogaster} = 0.36$ ; specimen 4: notogaster: length 525, height 404; setae:  $c_1$  182,  $h_1$  207,  $h_1/\text{length of notogaster} = 0.35$ ; specimen 5: notogaster: length 584, height 438. Among the 6 specimens from sample CMR-017, 5 are bigger (length of notogaster >500) and one is smaller (length of notogaster <470). Two specimens from sample CMR-020 are bigger, length of notogaster 530 and 545. However, despite the difference in size, all these specimens have longer notogastral setae (population 2).

#### 4. Summary

In 20 samples (Table 2), 19 species are found, including 2 new to science: *Euphthiracarus (Pocsia) inaequatus* sp. n. and *Steganacarus (Rhacaplacarus) alius* sp. n. and 6 species are newly recorded for Cameroon. *Hoplophthiracarus spinus* is only found in Cameroon and so far only above 2000 m a.s.l. There are no

major differences in the ptyctimous mite fauna in the environments of the Northwest and Southwest regions. *Phthiracarus ochthus* is the only species from the Bamenda-Banso Highlands not found in the Southwest region. This species is a disjunctive afrotropical species (Niedbała and Liu, 2018).

Two species belong to Mesoplophoridae, 5 to Euphthiracaroidae, and 12 to Phthiracaroidae.

All previously unknown instars of *Mesoplophora (Meseoplophora) invisitata* Niedbała, 1983: larva, proto-, deuto-, and tritonymph are described. The deutonymph is compared to the deutonymphs of *M. (M.) quasigavae* and *M. (P.) pulchra*. The tritonymph is compared to the tritonymphs of *M. (M.) quasigavae*, *M. (M.) michaeliana*, *M. (P.) subtilis* and *M. (P.) pulchra*. The presence of 2 pairs of anal and 2 pairs of adanal setae in tritonymphs of *Mesoplophora*, and 3 pairs of anal and 3 pairs of adanal setae in tritonymphs of *Parploplophora* are new additional characters distinguishing these 2 subgenera.

Two species described earlier showed some morphological differences when compared with their holotypes.

*Phthiracarus parabaloghi* Niedbała, 1983 has longer sensilli and 4 pairs of lyrifissures and among *Protophthiracarus diatropos* Niedbała and Starý, 2014, 2 different populations are distinguished, 1 consistent with the holotype, the other differing from it by longer notogastral setae.

Currently, the fauna of ptyctimous mites of Cameroon is represented by 35 species: 2 Mesoplophoridae, 10 Euphthiracaroidae, and 23 Phthiracaroidae; 23% are endemics, 17% indigenous, 29% Afrotropical, and 31% widely distributed, pantropical, and semicosmopolitan.

In comparison with the fauna of Madagascar (Niedbała, 2017a) and Tanzania (Niedbała 2017b), the number of ptyctimous species associated with Cameroon is low, 14 (40%), when compared with the high number of endemic and indigenous species in Madagascar and Tanzania, 88% and 81%, respectively.

#### Nomenclatural acts:

This work and the nomenclatural acts it contains have been registered in ZooBank. The ZooBank Life Science Identifier (LSID) for this publication is: <http://zoobank.org/urn:lsid:zoobank.org:pub:BFE0547F-C4DC-4D25-B94A-9A1DCE175732>

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