

## THE FIRST FINDINGS AND SUPPLEMENTARY DESCRIPTION OF *PERGALUMNA EMARGINATA* (ACARI, ORIBATIDA, GALUMNIDAE) FROM RUSSIA

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**ABSTRACT:** The oribatid mite species, *Pergalumna emarginata* (Oribatida, Galumnidae), is recorded for the first time in Russia. It is redescribed and illustrated in detail on the basis of Russian specimens collected from bog mosses in the European part and an ant hill in western Siberia. The morphological differences relate to cuticular sculpturing between populations in Russia and U.S.A. are listed.

**KEY WORDS:** oribatid mites, *Pergalumna emarginata*, supplementary description, new record, moss, ant hill, Russia

### INTRODUCTION

The oribatid mite species *Pergalumna emarginata* (Banks) (Acari, Oribatida, Galumnidae) was described by Banks (1895) based on material from sphagnum moss in New York State (U.S.A.). At present, this species is known to be widely distributed in the Nearctic region (data summarized by Marshall et al. 1987), however, it is known also from Norway (as *Pergalumna emarginata europaeus*<sup>1</sup> – see Berlese 1914). Jacot (1935*a, b*) proposed two subspecies of *P. emarginata* recorded from U.S.A., *P. emarginata coscobensis* (Jacot, 1935*a*) and *P. emarginata laevis* (Jacot, 1935*b*).

Adults of *P. emarginata* were redescribed and illustrated by several authors, including Berlese (1914), Jacot (1935*a*), Kates and Runkel (1948), Rockett and Woodring (1966; as *P. omniphagous*), and Nevin (1978). Biological information and descriptions of the larva and tritonymph of *P. emarginata* were presented by Rockett and Woodring (1966). All these data were based on specimens from Nearctic region.

In the course of taxonomic studies of the oribatid mite fauna in Russia we found *P. emarginata* in two localities: mosses in a bog in the European part and ant hill in western Siberia. These comprise the first reports of this species in Russia. The main goal of our paper is to redescribe and illustrate *P. emarginata* in detail, based on this material.

### MATERIAL AND METHODS

Specimens of *P. emarginata* were collected in two localities in Russia (Fig. 38):

1) Locality 1: 12 specimens (six females and six males), European part of Russia, 56°12'50"N, 43°21'17"E, Nizhny Novgorod region, Volodarsky District, southwest of Dzerzhinsk city, mixed forest (mostly *Pinus silvestris*), in bog mosses (*Sphagnum* sp.), 25 June 2006, collected by S.G. Ermilov;

2) Locality 2: six specimens (two females and four males), western Siberia, 56°55'10"N, 65°09'58"E, Tyumen region, southwest of Tyumen city, pine forest (*Pinus silvestris*), in ant hill (*Formica rufa*), 26 July 2014, collected by V.M. Salavatulin.

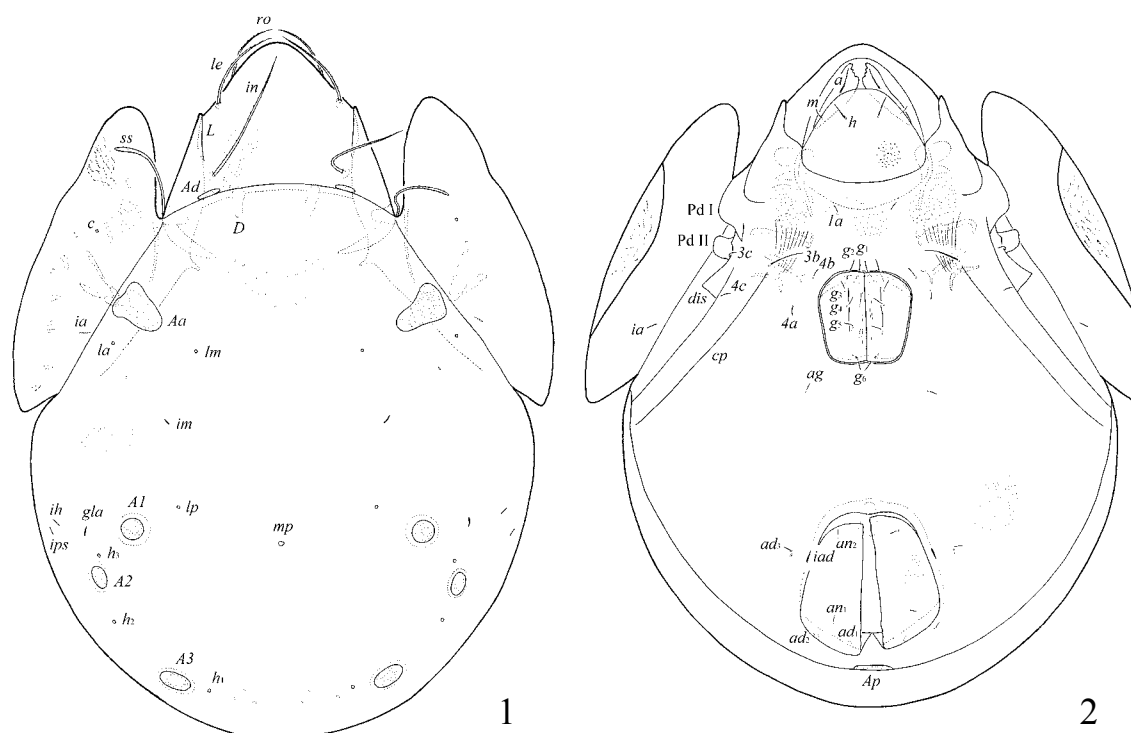
Nearctic specimens of *P. emarginata*, identified and contributed by R.A. Norton, were compared to the Russian material; they were collected at two localities:

1) Locality 82–63: 12 specimens, U.S.A., 42°59'32"N, 76°7'56"W, New York, Onondaga County, Syracuse, Lafayette Experiment Station, mixed forest, in litter, May 1963, collected by R.M. Reeves;

2) Locality 11–28: 15 specimens, U.S.A., 43°6'25"N, 76°14'29.34"W, New York, Onondaga County, Baldwinsville Beaver Lake Nature Center, fern and shrub litter and root mats from top of hummocks, 18 November 2011, collected by R.A. Norton.

Specimens were mounted in lactic acid on temporary cavity slides for measurement and illustration. The body length was measured in lateral view, from the tip of the rostrum to the posterior edge of the ventral plate. Notogastral width refers to the maximum width in dorsal aspect. Lengths of body setae were measured in lateral as-

<sup>1</sup> Marshall et al. (1987) considered *Pergalumna emarginata europaeus* as a junior synonym of *Pergalumna emarginata*, but Subías (2004) considered it as an independent species, *Pergalumna europaea* (Berlese, 1914).



Figs 1–2. *Pergalumna emarginata* (Banks, 1895), adult from Russia: 1 — dorsal view; 2 — ventral view (legs not illustrated). Scale bar 100  $\mu$ m.

pect. 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. General terminology used in this paper follows that of Grandjean (summarized by Norton and Behan-Pelletier 2009). Drawings were made with a drawing tube using a Carl Zeiss transmission light microscope “Axioskop-2 Plus”. Images were obtained with an AxioCam ICc3 camera using a Carl Zeiss transmission light microscope “Axio Lab.A1”.

### SUPPLEMENTARY DESCRIPTION

#### *Pergalumna emarginata* (Banks, 1895)

(description based on specimens from Russia)

Figs 1–27

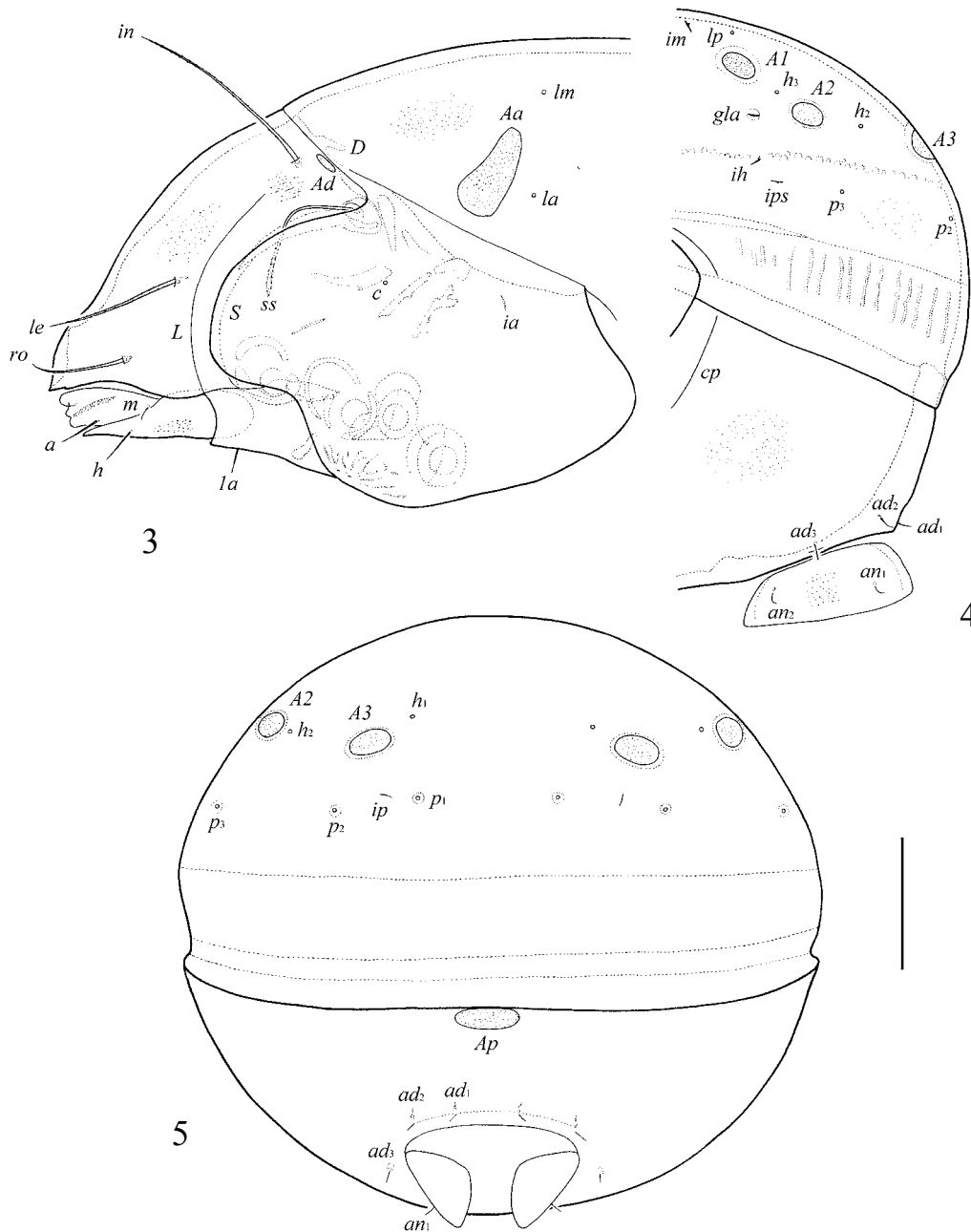
Measurements. Body length: 647–697 (12 specimens: six females and six males); notogastral width: 464–514 (12 specimens). Range for females and males similar, but males usually slightly smaller.

Integument (Figs 1–4, 7, 18–25). Body color brown. Body surface, pteromorphs, subcapitular mentum and legs finely porose (well visible under high magnification in dissected specimens).

Prodorsum (medial part), subcapitular mentum and epimeral region with sculpturing of oval and elongated tubercles. Basal part of prodorsum and medio-lateral parts of epimeres with longitudinal striae. Lateral parts of pteromorphs with strong striae, sometimes forming vague reticulate pattern. Medial parts of genital plates with one strong (near genital setae  $g_2$ – $g_4$ ) and some very weak (near inner margins) longitudinal striae.

Prodorsum (Figs 1, 3, 6, 14–19). Rostrum pointed, usually with small lateral tooth on each side; two teeth on right side (Fig. 14) registered in two specimens. Lamellar (*L*) and sublamellar (*S*) lines distinct, parallel, curving backwards. Rostral setae (*ro*, 77–90), lamellar (*le*, 106–114) and interlamellar (*in*, 139–155) setae simple, barbed. Bothridial setae (*ss*, 118–135) with long stalk and shorter, slightly developed, elongated, barbed head. Exobothridial setae and their alveoli absent. Porose areas *Ad* elongate oval, transversally oriented (24–32  $\times$  4–8).

Notogaster (Figs 1, 3–5, 20–22). Notogastral margin completely developed anteriorly, slightly convex. Dorsophragmata (*D*) of medium size, elongated longitudinally. Notogastral setae represented by 10 pairs of alveoli. Four pairs of porose areas well visible, with distinct margins: *Aa* triangular, transversally oriented (length: 53–77); *A1*



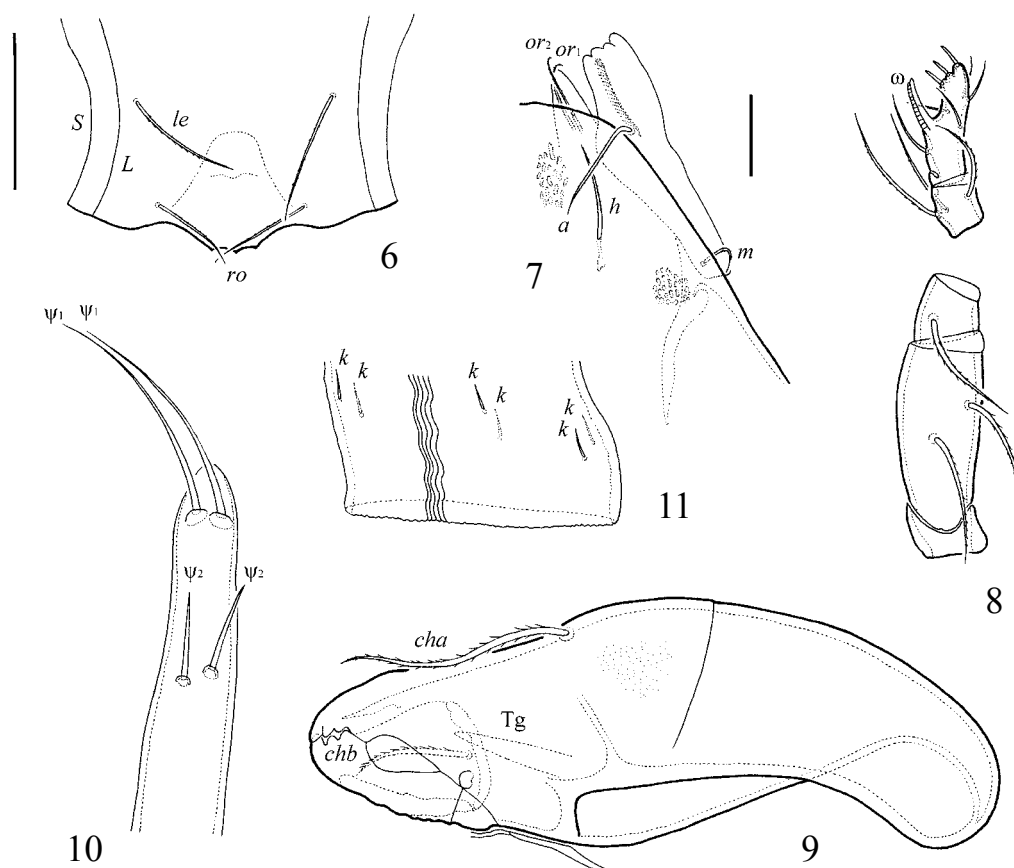
Figs 3–5. *Pergalumna emarginata* (Banks, 1895), adult from Russia: 3 — lateral view of anterior part of body (legs not illustrated); 4 — lateral view of posterior part of body; 5 — posterior view. Scale bar 100  $\mu$ m.

(24–36  $\times$  16–24), *A2* (24–28  $\times$  16–20) and *A3* (24–36  $\times$  16–28) oval. Setal alveoli *la* inserted posteriorly to *Aa*. Median pore present, located between *A1*. All lyrifissures (*ia*, *im*, *ip*, *ih*, *ips*) distinct; *im* located between *lm* and *A1*. Opisthotal gland openings (*gla*) located laterally to *A1*.

Gnathosoma (Figs 2, 3, 7–9, 23). Subcapitulum longer than wide: 151–159  $\times$  123–131. Subcapitular setae setiform, slightly barbed; *a* (32–36) longer than *h* (28–32) and *m* (12). Two pairs of adoral setae (*or<sub>1</sub>*, *or<sub>2</sub>*, 20) setiform, hook-like distally, barbed. Palps (118–123) with setation 0–2–1–3–

9(+ $\omega$ ). Solenidion attached to eupathidium, both located on dorsal tubercle. Chelicerae (180–184) with two simple, barbed setae; *cha* (65) longer than *chb* (32–36). Trägårdh's organ (Tg) long, tapered.

Epimeral and lateral podosomal regions (Figs 2, 3, 24, 25). Anterior tectum of epimere I smooth. Apodemes 1, 2, sejugal and 3 well visible. Six pairs of simple, indistinctly barbed epimeral setae observed; setal formula: 1–0–2–3. Setae *1a*, *3c*, *4a*, *4b* and *4c* (20–24) shorter than *3b* (32–36). Pedotecta I (Pd I) and II (Pd II) scale-like in lateral view. Discidia (*dis*) sharply triangular. Cir-



Figs 6–11. *Pergalumna emarginata* (Banks, 1895), adult from Russia: 6 — rostrum, dorso-frontal view; 7 — subcapitulum, left antero-lateral part, ventral view; 8 — palp; 9 — chelicera, paraxial view; 10 — blade of ovipositor; 11 — basal part of cylindrical distal part of ovipositor. Scale bars 100  $\mu\text{m}$  (6), 20  $\mu\text{m}$  (7–11).

Table 1.  
Leg setation and solenidia of *Pergalumna emarginata* (Banks, 1895)

Leg	Trochanter	Femur	Genu	Tibia	Tarsus
I	v'	d, (l), bv''	(l), v', $\sigma$	(l), (v), $\phi_1, \phi_2$	(ft), (tc), (it), (p), (u), (a), s, (pv), v', (pl), l'', $\varepsilon, \omega_1, \omega_2$
II	v'	d, (l), bv''	(l), v', $\sigma$	(l), (v), $\phi$	(ft), (tc), (it), (p), (u), (a), s, (pv), $\omega_1, \omega_2$
III	v'	d, ev'	l', $\sigma$	l', (v), $\phi$	(ft), (tc), (it), (p), (u), (a), s, (pv)
IV	v'	d, ev'	d, l'	l', (v), $\phi$	ft'', (tc), (p), (u), (a), s, (pv)

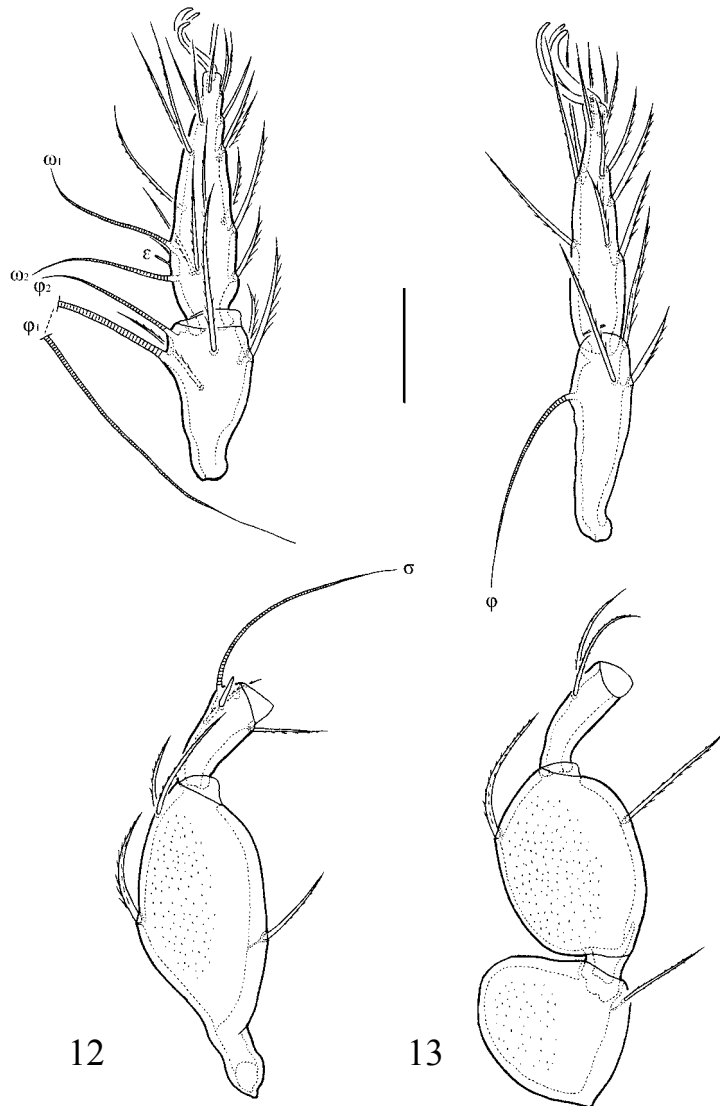
Roman letters refer to normal setae ( $\varepsilon$  to famulus), Greek letters to solenidia. Single prime (') marks setae on anterior and double prime (') setae on posterior side of the given leg segment. Parentheses refer to a pair of setae.

cumpedal carinae (cp) distinct, directed posterior of setae 3b.

Anogenital region (Figs 2, 4, 5, 10, 11, 25–27). Six pairs of genital ( $g_1$ – $g_6$ , 20), one pair of aggenital (ag, 12–16), two pairs of anal ( $an_1, an_2$ , 12–16) and three pairs of adanal ( $ad_1$ – $ad_3$ , 16–20) setae thin, indistinctly barbed. Two setae on anterior edge of each genital plate. Adanal setae  $ad_3$  inserted laterally to adanal lyrifissures (iad). Postanal porose area (Ap) present, elongate oval, transversally oriented (36–49  $\times$  16). Ovipositor elongated (250–266  $\times$  61–65), blades (127–139) comprise

about half length of distal section (beyond middle fold; 127–139). Each of three blades with four smooth setae,  $\psi_1 \approx \tau_1$  (61–65) setiform, with attenuate tip, longer than straight  $\psi_2 \approx \tau_a \approx \tau_b \approx \tau_c$  (20–24). Six coronal straight, smooth setae (k, 8) present.

Legs (Figs 12, 13). Claws smooth. Formulae 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. Solenidion  $\phi$  of tibiae IV inserted dorsally at about 2/3 length of segment.



Figs 12–13. *Pergalumna emarginata* (Banks, 1895), adult from Russia: 12 — leg I, without trochanter, right, antiaxial view; 13 — leg IV, left, antiaxial view. Scale bar 50  $\mu$ m.

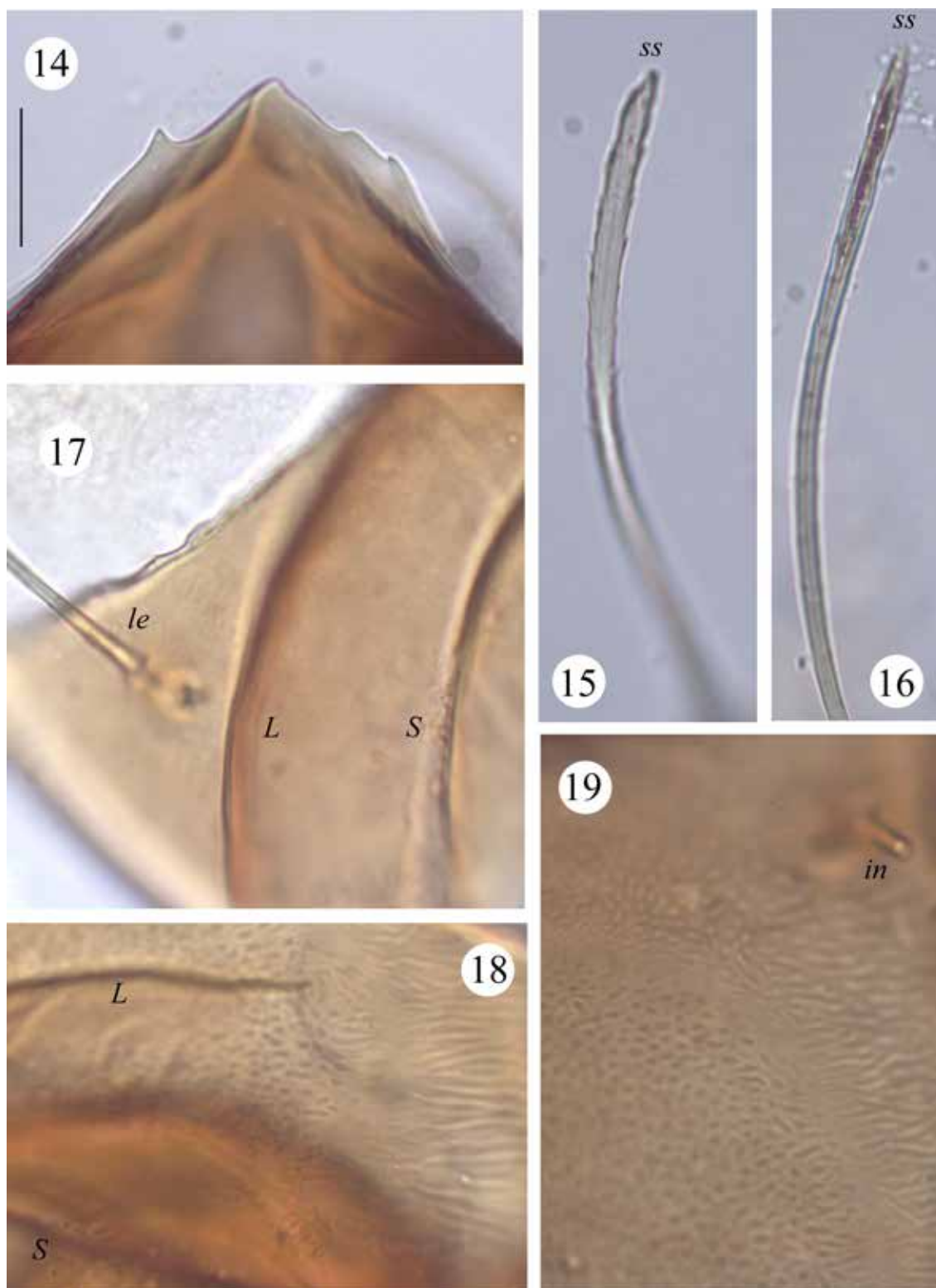
**Remarks.** The specimens of *P. emarginata* from Nizhny Novgorod and Tyumen regions of Russia are identical morphologically. These specimens are similar in general appearance to those from the Nearctic region according to the redescription (for example, Berlese 1914, Jacot 1935a, Kates and Runkel 1948, Rockett and Woodring 1966, Nevin 1978). However, detailed comparison of the Russian specimens with those Norton revealed differences in the following characters:

1) Ornamentation on lateral part of pteromorphs. Russian specimens have striate ornamentation; these striae long, strong, thickened, sometimes forming vague reticulate pattern (Figs 20–22). American specimens from locality 11–28 also have striate ornamentation, but striae are

short, weak, thin (Figs 34, 35). American specimens from locality 82–62 have no striate ornamentation, but very small, rounded or slightly elongated microtubercles (possibly representing reduced striae) are present (Figs 30–32).

2) Ornamentation in medio-lateral parts of epimeres. Russian specimens have longitudinal striae and elongated tubercles (Figs 2, 24). American specimens from locality 11–28 have no striate ornamentation; only oval or weakly elongated microtubercles are present (Fig. 36). American specimens from locality 82–62 have striate ornamentation, but it is only slightly developed and often represented by thin, elongated tubercles (Fig. 32).

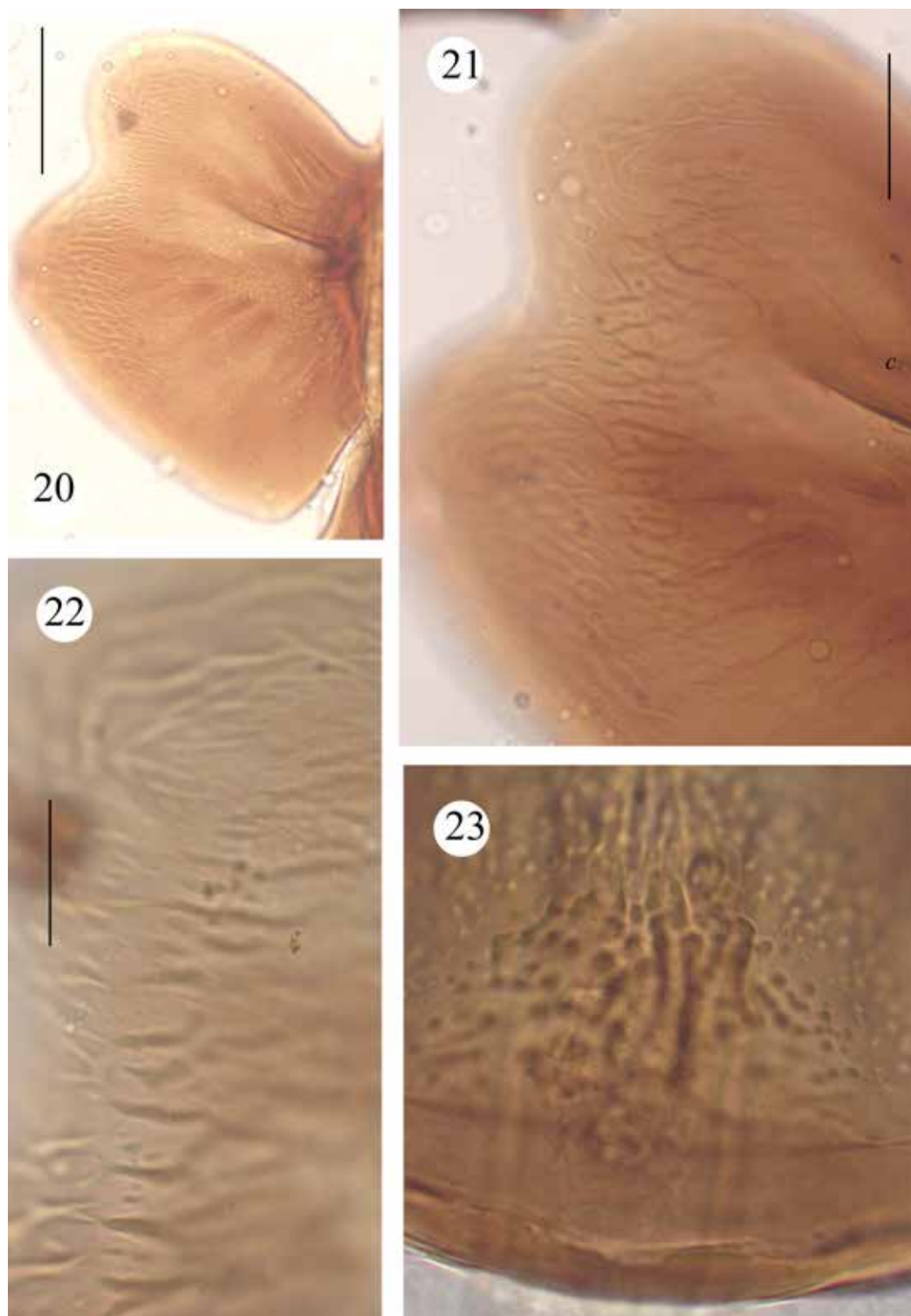
3) Ornamentation of subcapitular mentum. Russian specimens have strong, oval and elongated tubercles; these sometimes form a vague reticu-



Figs 14–19. *Pergalumna emarginata* (Banks, 1895), dissected adult from Russia, microscope images: 14 — rostrum; 15, 16 — bothridial seta; 17 — medial parts of lamellar and sublamar lines and basal part of lamellar seta, all left, lateral view; 18, 19 — surface of basal part of prodorsum, dorso-lateral view. Scale bar 20  $\mu$ m.

late pattern (Fig. 23). American specimens from both localities have no distinct ornamentation on the mentum. In our opinion, the above listed differences are intraspecific and perhaps can be ex-

plained as population variation. Hence, this possibility of geographic variability should be considered in any future identification of *P. emarginata*.

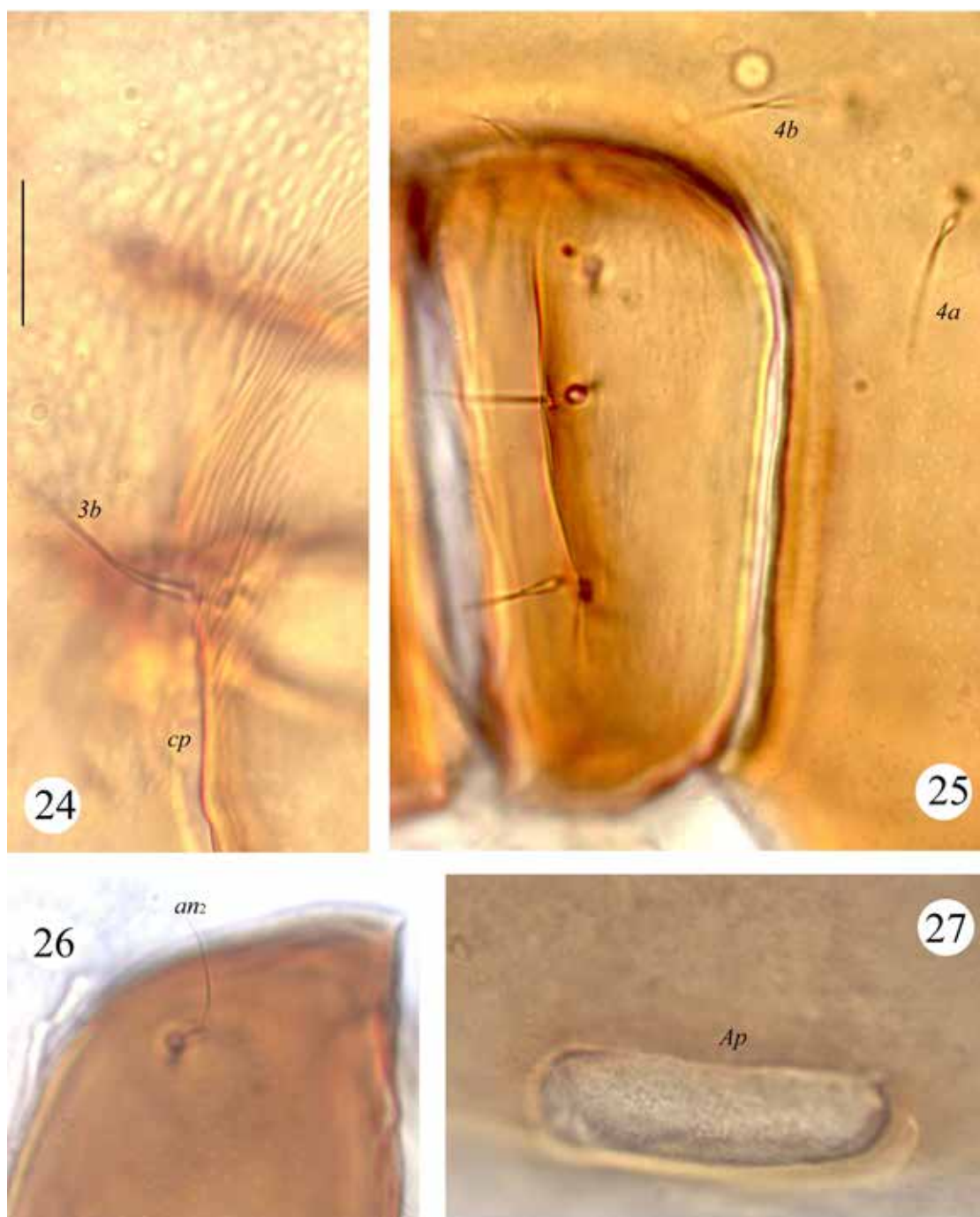


Figs 20–23. *Pergalumna emarginata* (Banks, 1895), dissected adult from Russia, microscope images: 20 — pteromorph, left, dorsal view; 21 — pteromorph, without posterior part, left, dorsal view; 22 — surface of lateral part of pteromorph, left, dorsal view; 23 — surface of medio-basal part of subcapitulum, ventral view. Scale bars 100  $\mu\text{m}$  (20), 50  $\mu\text{m}$  (21), 20  $\mu\text{m}$  (22, 23).

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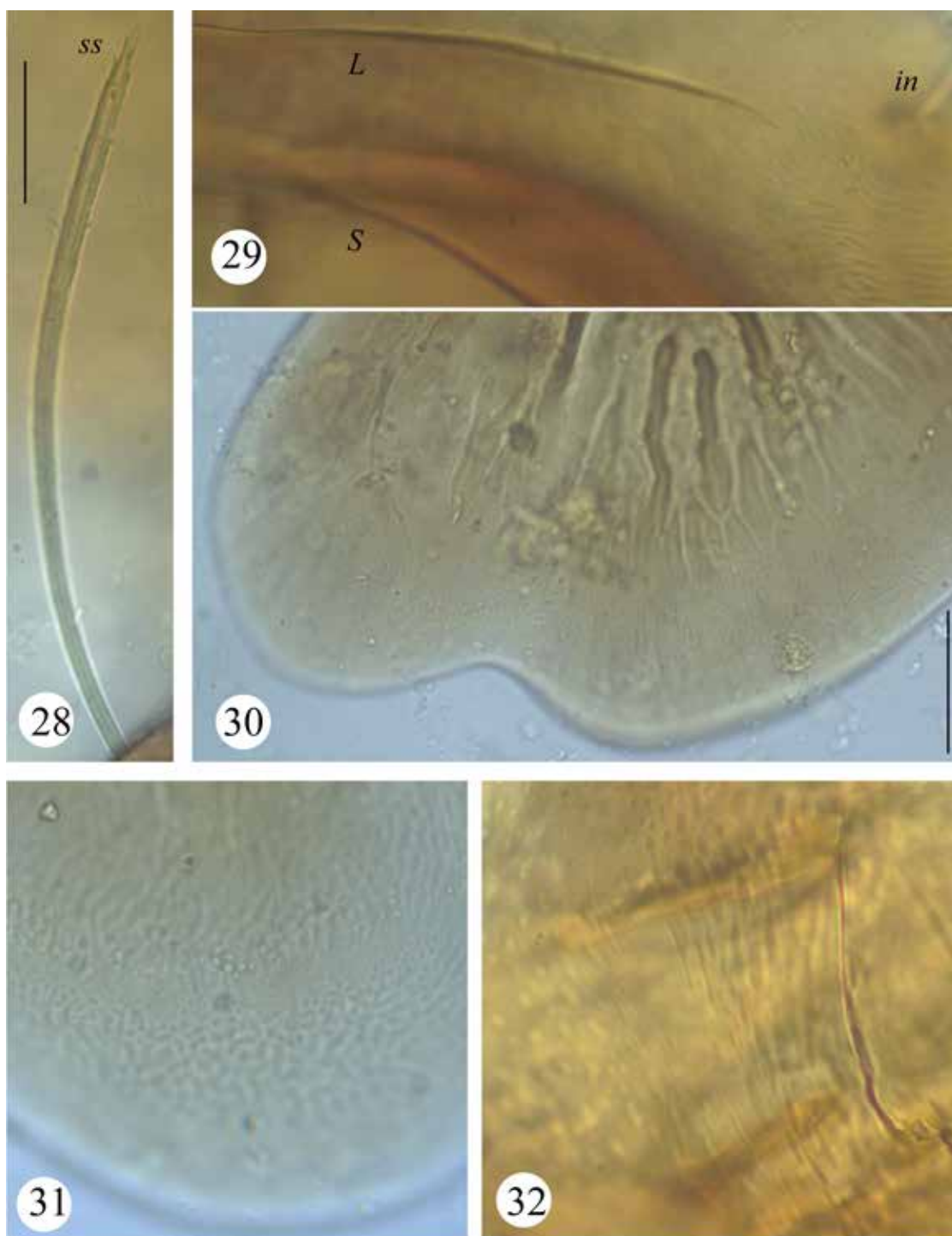


Figs 24–27. *Pergalumna emarginata* (Banks, 1895), dissected adult from Russia, microscope images: 24 — surface in right part of epimeral region; 25 — genital plate, left, ventral view, and epimeral setae 4a and 4b; 26 — anterior part of right anal plate, ventral view; 27 — Postanal porose area. Scale bar 20  $\mu$ m.

Complutense de Madrid, Madrid, Spain) and Prof. Dr. Gerd Weigmann (Free University of Berlin, Institute of Zoology, Berlin, Germany) for studying of *Pergalumna*-species (*P. altera* (Oudemans, 1915) and *P. bryani* (Jacot, 1934)), which are very similar morphologically to *Pergalumna emarginata*, from their personal collections, and Andrey A. Yurtaev (Tyumen State University, Tyumen, Russia) for consultations.

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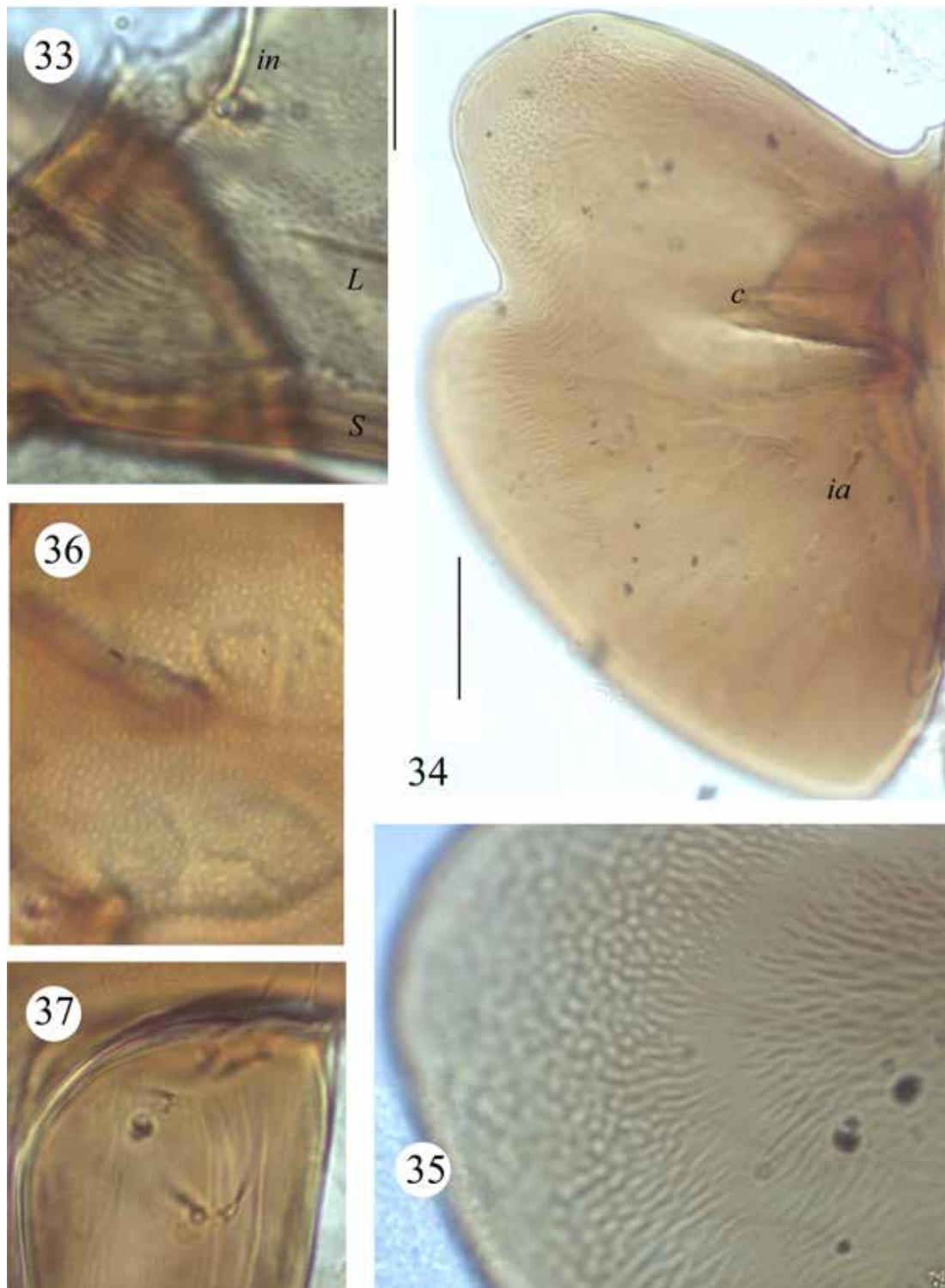




Figs 28–32. *Pergalumna emarginata* (Banks, 1895), dissected adult from USA (RAN 82–63), microscope images: 28 — bothridial seta; 29 — basal parts of lamellar and sublamellar lines and interlamellar seta, all left, dorso-lateral view; 30 — medio-lateral part of left pteromorph, without posterior part, dorsal view; 31 — surface of lateral part of left pteromorph, dorsal view; 32 — surface in left part of epimeral region. Scale bar 20  $\mu$ m.

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Figs 33–37. *Pergalumna emarginata* (Banks, 1895), dissected adult from USA (RAN 11–028), microscope images: 33 — basal parts of lamellar and sublammellar lines and interlamellar seta, all right, dorso-lateral view; 34 — pteromorph, left, dorsal view; 35 — surface of lateral part of left pteromorph, dorsal view; 36 — surface in right part of epimeral region; 37 — anterior part of right genital plate, ventral view. Scale bars 20 µm (33, 35–37), 100 µm (34).

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Fig. 38. Map of Western Russia with marked of localities 1 and 2 of *Pergalumna emarginata* (Banks, 1895).

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