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Distribution and ecology of the subterranean amphipod *Crangonyx chlebnikovi* Borutzky, 1928 (Crustacea: Crangonyctidae), with lectotype designation and comments on morphology of the lateral cephalic lobe

Распространение и экология подземного бокоплава *Crangonyx chlebnikovi* Borutzky, 1928 (Crustacea: Crangonyctidae), с обозначением лектотипа и с комментариями о морфологии боковой лопасти головы

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KEY WORDS: Amphipoda, *Crangonyx chlebnikovi*, distribution, ecology, caves.
КЛЮЧЕВЫЕ СЛОВА: Amphipoda, *Crangonyx chlebnikovi*, распространение, экология, пещеры.

ABSTRACT. This paper redescribes the stygobiont amphipod *Crangonyx chlebnikovi* Borutzky, 1928 known from the subterranean waters of the Priuralye. Redescription is based on the syntype series and a lectotype of *C. chlebnikovi* is designated. The affinity with the related groups, distribution and ecology of the species is revised. The morphology of the lateral cephalic lobe for several other Palearctic species in the genera *Crangonyx*, *Amurocrangonyx*, *Synurella* and *Lyurella* of the family Crangonyctidae is discussed.

РЕЗЮМЕ. В статье переописывается стигобионтный бокоплав *Crangonyx chlebnikovi* Borutzky, 1928 ранее описанный из подземных вод Приуралья. Переописание основано на серии синтипов, обозначен лектотип для *C. chlebnikovi*. Пересмотрены взаимоотношения с родственными группами, распространение и экология вида. Обсуждается морфология боковой лопасти головы ряда палеарктических видов представителей родов *Crangonyx*, *Amurocrangonyx*, *Synurella* и *Lyurella* (сем. Crangonyctidae).

Introduction

Crangonyx chlebnikovi Borutzky, 1928 was described on the basis of an undisclosed number of specimens collected at Kungur District of Ural, in the Great Mechka Cave near Urmy, Russia, by the author. However it is possible to assume that more than one specimen was examined because it is stated in the original description: "... die Länge ist 12–20 mm." (German), indicating that the largest specimen examined had 20 mm of body length (without specifying of measurement method). The syntype-series was originally deposited at the Zoological Museum of Moscow State University (Borutzky's employment place) under the catalog number Mb-127 (series in collection with record in the catalog book of MSU).

Taking into account that a subspecies was described (*Crangonyx chlebnikovi maximovitshi* Pankov, Pankova, 2004) and a neotype was designated for nominative *Crangonyx chlebnikovi* Borutzky, 1928 [Pankov, Pankova, 2004], we believe it is advisable to select a syntype female of *C. chlebnikovi* and designate it as the lectotype. This will prevent any future confusion regarding the identity of this species, and will thus maintain taxonomic stability as recommended by the Commission on Zoological Nomenclature in Code [2004: 129, 132] (Article 74.7, 75.8).

The genus *Crangonyx* has a Holarctic distribution with taxonomic prevalence in the North America where about 42 species are known [Zhang, Holsinger, 2003]. In the Palaearctic to date 5 species are described: *C. subterraneus* Bate, 1859 (Great Britain, continental part; France, Germany, Poland and Czechoslovakia), *C. chlebnikovi* Borutzky, 1928 (Russia), *C. paxi* Schellenberg, 1935 (Germany, Poland), *C. africanus* Messouli, 2006 (Morocco) and *C. islandicus* Svavarsson et Kristjánsson, 2006 (Iceland). Also scarce information

was presented by H. Milne-Edwards in 1840 about the collecting of amphipod named as *Gammarus ermanni* in the thermal spring waters in Kamchatka by M. Ermann. In 1862 Bate gave a short description of this species with images based on the original specimens preserved in the Muséum Jardin des Plantes, Paris and attributed it to the genus *Crangonyx* [see Bate, 1862: 179], but to the moment no further details have been received on the existence of *C. ermanni* (H. Milne-Edwards) in Kamchatka.

C. chlebnikovi, the only one inhabitant of the Ural caves with obvious presence of troglomorphism (lack of eyes and pigmentation), was also recently found in the wells and springs in south-eastern part of the region. The literature contains scattered references relating to the biology of this species [Pankov, Kadebskaya, 2005]. Here we have presented a detailed redescription of *C. chlebnikovi* with accumulated data about geographic distribution and ecology of the species.

Material and Methods

The syntype series of *C. chlebnikovi* and a new collection from the Priuralye Karst Province were utilized in the present study (Fig. 1). The new samples were collected in the Great Mechka Cave — GMC, in the Kungur Ice Cave — KIC (Dlinny and Druzhby Narodov grottos) and in the Babinogorskaya Cave (Kungur Distr.), in the driven well in Brekhovo and in spring near Verkh-Suksun (Suksun Distr.), and finally in the Orda Cave (Orda Distr.).

In the cave and spring specimens were sampled by a common hand net with a 250-μm mesh size and in the driven well species was sampled with assistance of baited traps. The traps were produced from a common plastic bottle with two inverted necks as represented on the site [url: http://www.offtop.ru/biospeleo/v4_694353.php]. The samples were preserved in 70% ethanol.

The body length of the amphipods was recorded by holding the specimen straight and measuring the distance along the dorsal side of the body from the base of the first antennae to the base of the telson. A Lomo MBS-9 stereomicroscope with a scaled micrometer eyepiece was used to make this measurement and appendages were drawn using a Carl Zeiss NU-2 compound microscope equipped with a drawing device as modified by Gorodkov [1961]. The permanent preparations were made using polyvinyl lactophenol (PVL) and a methylene blue staining solution as mounting medium. The entire body and appendages were used for scanning electron microscopy (SEM) and they were dehydrated in 99% acetone and dried to critical point with a Bal-Tec CPD 030. Appendages were coated with palladium-gold before being photographed with a Carl Zeiss Evo 40. A lens adapter LSN-23D by Zarf Enterprises for Nikon CoolPix 995 was used for digital photomicrography of the lateral cephalic lobes and appendages.

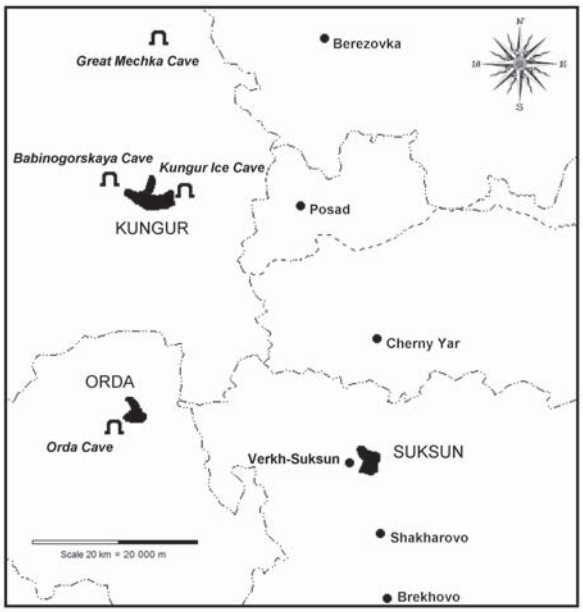


Fig. 1. Map-scheme indicating geographic distribution of *Crangonyx chlebnikovi* Borutzky in Kungur, Orda and Suksun Discricts (Perm Prov., Russia).

Рис. 1. Карта-схема, отражающая географическое распространение *Crangonyx chlebnikovi* Borutzky в Кунгурском, Ординском и Суксунском районах (Пермский край, Россия).

In the descriptions, utilization of the descriptive term "defining angle" of the gnathopod propodi refers to the "angle" formed at the end of the palm and beginning of the posterior margin [see Holsinger, 1974]; term "recess" at defining angle pertains to the pouch at which the tip of the dactyl may be submerged. The nomenclature for setal patterns on article 3 of the mandibular palp follows the standard introduced by Karaman [1970]. The descriptive terminology follows a classification system based on the homology concept proposed by Watling [1989].

The following description is based on the type series, and the material examined is deposited in the Zoological Museum of Moscow State University (MSU) and Zoological Museum of the Far East State University, Vladivostok (FESU).

Taxonomy

Order Amphipoda Latreille, 1816

Family Crangonyctidae Bousûeld, 1973 (emended 1977)

Genus *Crangonyx* Bate, 1859

Crangonyx chlebnikovi Borutzky, 1928
Figs 2–38, 39b.

Crangonyx chlebnikovi Borutzky 1928: 253, Figs 1–15 (original description). — Pankov, Pankova 2004: 142, Fig. 1 (neotype designated).

Crangonyx chlebnikovi maximovitshi Pankov, Pankova 2004: 143, Fig. 2.

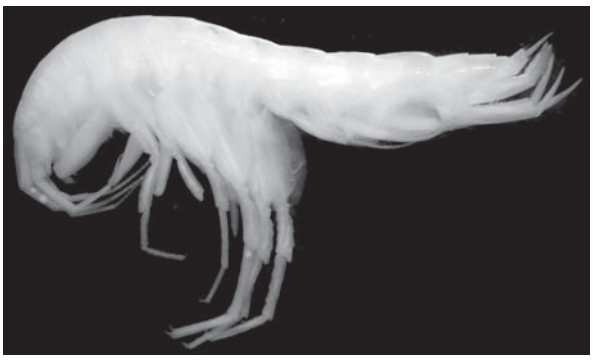


Fig. 2. *Crangonyx chlebnikovi* Borutzky, from left side, female 15.5 mm, KIC.

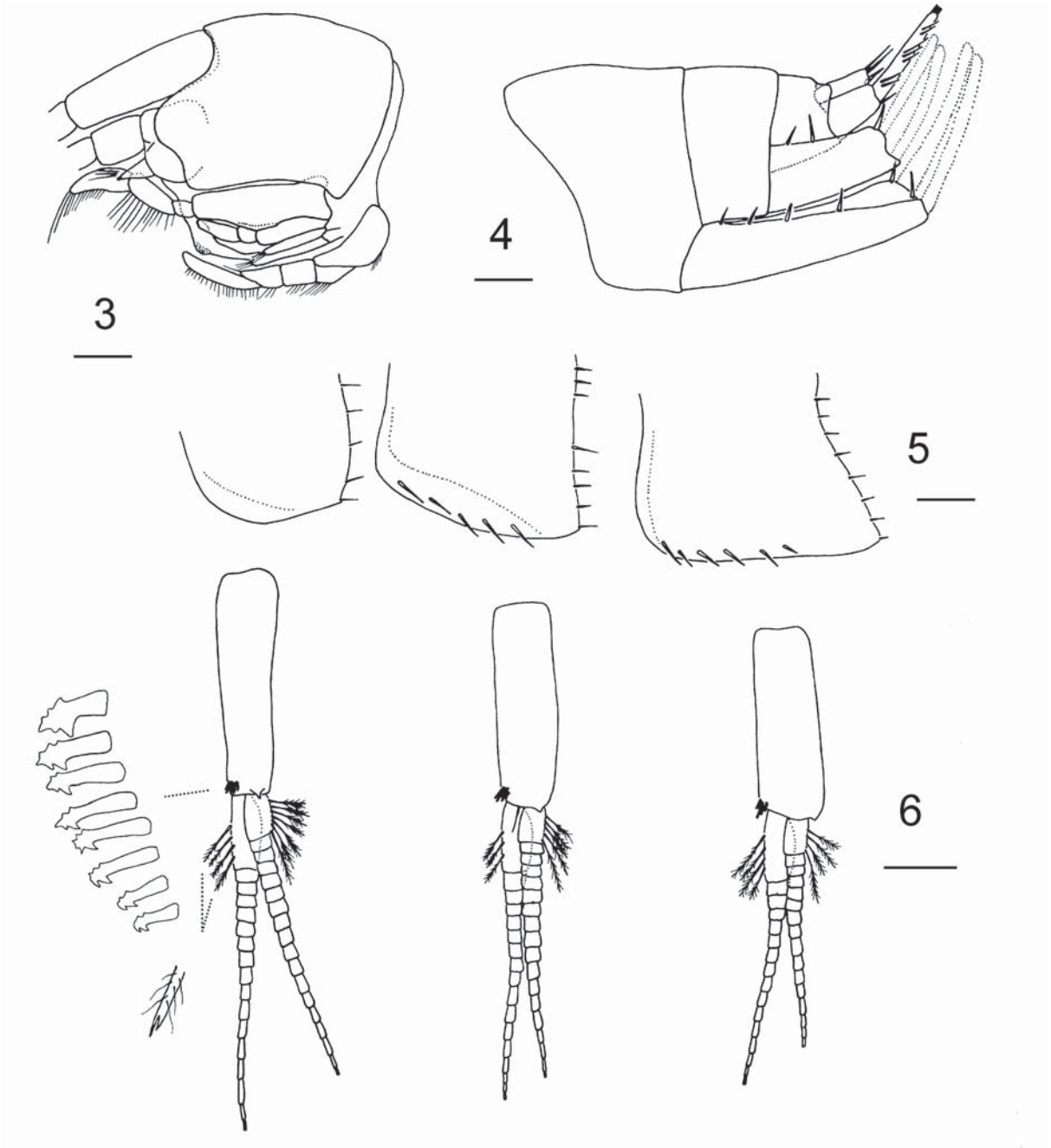
Рис. 2. *Crangonyx chlebnikovi* Borutzky, слева, самка 15,5 мм, КЛП.

DIAGNOSIS. Large-sized species without marked secondary sexual dimorphism. Dorsal surface of body segments smooth (Fig. 2) without cuticular projections or robust setae. Eyes absent. Body unpigmented. Inferior antennal sinus moderate (Figs 3, 39b). Antenna 1 comprises 65% length of body. Gnathopod 2 larger than gnathopod 1 in both sexes. Pereopod 6 the longest. Sternal gills arrangement as following: pereonite 6 (1-1), pereonite 7 (1-1), pleonite 1 (1-1). Telson entire. Body length 10.0–19.0 mm (females), 10.0–10.5 mm (males).

MATERIAL EXAMINED. Lectotype: female (oöstegites non-setose) 15.5 mm, completely dissected and mounted on a single slide [MSU Tb-1144], Russia, Perm Province, Kungur Disctrict, ~ 1 km SE of Zaspalovo, Great Mechka Cave, Mechka River basin (right tributary of the Silva River), 26 Jul 1927, collected by E.V. Borutzky. Paralectotypes: 2 females, both completely dissected and mounted on single slides [MSU Tb-1145], 17.2 mm (oöstegites non-setose), 14.0 mm (oöstegites non-setose), with same data as lectotype.

ADDITIONAL MATERIAL EXAMINED. Russia, Perm Province. All specimens completely dissected and mounted on a single slide [FESU X34905/Cr-1405], 5 females, 3 males: female (oöstegites developed, setose) 19.0 mm, Babinogorskaya Cave, 28 Mar 2007, collected by S.V. Sukhorev; female (oöstegites non-setose) 15.5 mm, Kungur Ice Cave, 21 Jul 2003, collected by N.N. Pankov; female (oöstegites non-setose) 13.4 mm, well in Brekhovo, 02 Sept 2006, collected by A.B. Krasheninnikov; female (oöstegites developed, setose) 11.0 mm, Orda Cave, 08 Jan 2008, collected by N.N. Pankov; female (oöstegites developed, setose) 10.0 mm, spring in Verkh-Suksun, 25 Dec 2010, collected by A.B. Krasheninnikov; male 10.5 mm, Kungur Ice Cave, 21 Jul 2003, collected by N.N. Pankov; male 10.5 mm, Babinogorskaya Cave, 25 Mar 2011, collected by A.I. Andreev; male 10.0 mm, Orda Cave, 27 Mar 2011, collected by N.N. Pankov.

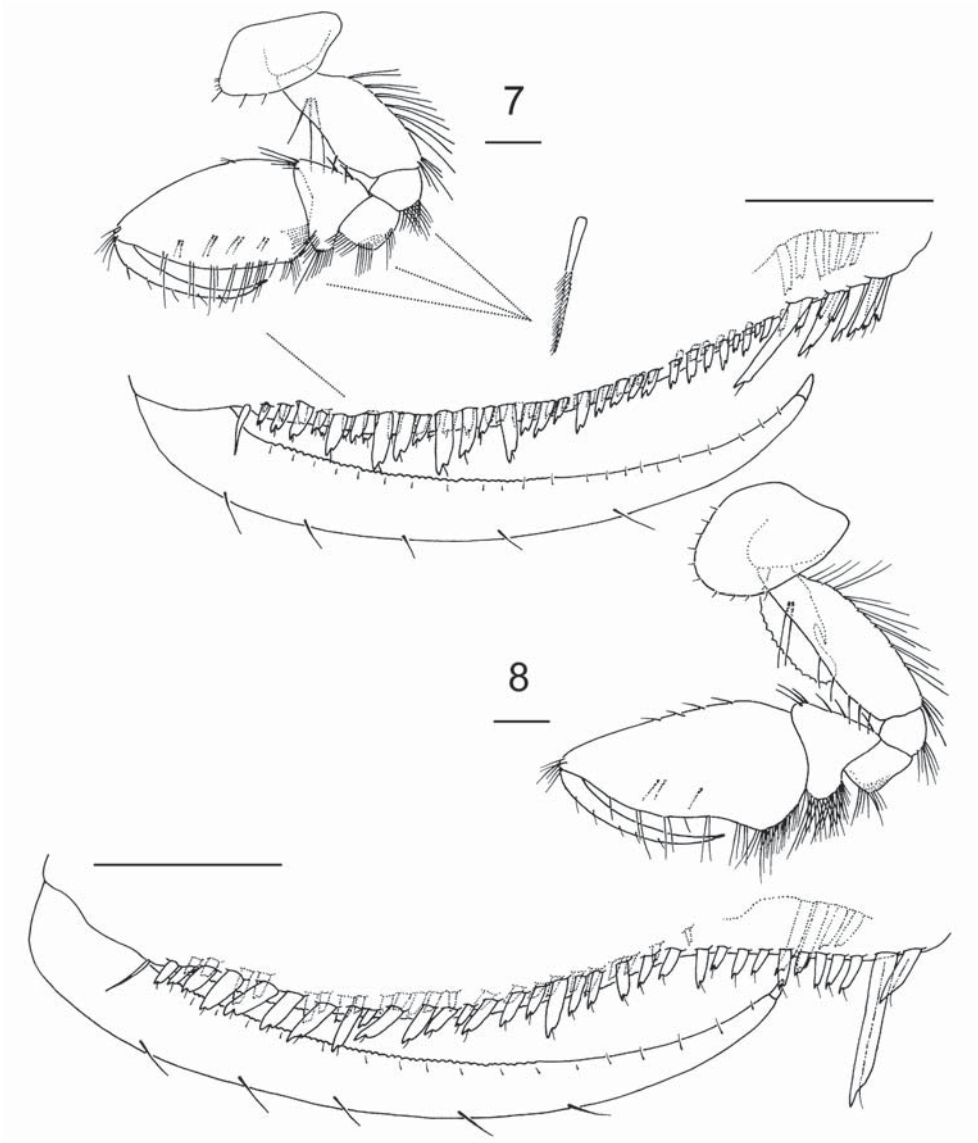
DESCRIPTION. *Female* (15.5 mm, lectotype MSU Tb-1144). **Head**. *Antenna 1* (Fig. 9): 65% length of body, approximately twice length of antenna 2; peduncular articles 1–3 with a length ratio of 1:0.8:0.5, articles 1 and 2 with stiff notched setae on medial margin; primary flagellum with 33 articles, last 20 flagellar articles bearing lanceolate aesthetascs accompanied by setae; accessory ûagellum two-articulate, longer than accompanying flagellar article. *Antenna 2* (Fig. 10): gland cone elongate; peduncular article 4 as long as article 5, both densely setose with stiff simple setae; flagellum with 9 articles, calceoli absent. *Upper lip* (Fig. 16): sub-ovoid, with minute setae at apex. Mandibles subequal: *left mandible* (Fig. 17) with incisor 5-dentate, lacinia mobilis 5-dentate, setal row with 8 serrated setae, triturative molar strong, without seta; incisor of *right mandible* (Fig. 18) 5-dentate, lacinia mobilis trifurcate, both parts with serrations, setal row with 8 serrated setae, two of which are comb-shaped, molar with long plumose seta; palp article 1 28% length of adjacent article; palp article 2 as long as article 3 with a mixture of 6 rather long and 11 short setae on inner margin, palp article 3 with 3 A-setae, 2 B-setae, 3 C-setae, 7 E- setae and row of about 18 D-setae. *Lower lip* (Fig. 15): outer lobes broad, densely setose with setules, mandibular lobes tapered with pointed tips, inner lobes present, vestigial. *Maxilla 1* (Figs 12–14): inner plate with 9 long plumose setae; outer plate with 7 pectinate robust setae; palp articles 1–2 have a length ratio of 0.3:1, article 2 bearing 7 stiff rastellate setae apically and 4 simple setae sub-apically. *Maxilla 2* (Fig. 11): inner plate little broader than outer plate, with oblique row of 8 plumose setae; outer plate with 14 slender setae on apex; both plates densely setose with setules. *Maxilliped* (Figs 24–26): inner plate with 3 strong peg-like setae, 5 stiff plumose and 1 serrate setae on apex, 5 plumose setae extending from inner margin to apex; outer plate with a row of 7 medial robust pectinate setae, 17 simple setae of different length, two of which are plumose and extending from inner margin to apex, 5 short stiff setae on medio-ventral face; palp quadriarticulate, palp articles 1–4 have a length ratio of 0.4:1:0.6:0.4, article 1 with plumose setae on outer margin, article 2 stout with a row of rather long simple setae on inner margin and 2 setae on outer margin one of which is plumose, article 3 narrow with 1 simple setae on outer margin; dactylus without setae along inner margin, nail short with 3 minute setae at hinge. **Pereon.** *Coxal plate 1* shallow, sub-rectangular (Fig. 7) with several marginal setae; *coxal plate 2* moderate (Fig. 8) about as deep as broad with 10 short marginal setae; *coxal plates 3–4* (Figs 27, 28) 60% deeper than broad, coxa 3 narrowly rounded with 2 stiff short setae and 10 setules on distal margin, coxa 4 expanded and broadly convex distally, posterior margin with prominent excavation, distal margin with 15 short setae; *coxal plates 5–6* (Figs 29, 30) weakly bilobate, posterior lobes larger than anterior ones and armed with 1 short setae on posterior margin, coxa 6 much smaller; *coxal plate 7* small, semilunar (Fig. 31) with 2 short setae on posterior margin. *Gnathopod 1* (Fig. 7) smaller than G2; basis stout with 2 short setae on anterior margin, 3 long setae on inner face and 5 short and 11 long, thread-like setae (some in twos) on posterior margin; carpus 0.35x as long as propodus, carpal lobe tapered bearing plumose setae; propodus smaller than propodus of G2, sub-triangular, stout, subchelate, palm convex with cutting margin developed and armed with row of 34 distally notched robust setae on inside and 29 on outside, deep recess (or pouch) surrounded by 12 long (1 of them very long) distally notched robust setae at defining angle, posterior margin short with 1 set of simple setae; dactylus long, ribbed, with row of 22 minute setules on inner and 5



Figs 3–6. *Crangonyx chlebnikovi* Borutzky, lectotype [MSU Tb-1144]: 3 — cephalosome; 4 — urosome; 5 — epimera 1–3; 6 — pleopods 1–3. Scale bars 0.4 mm.

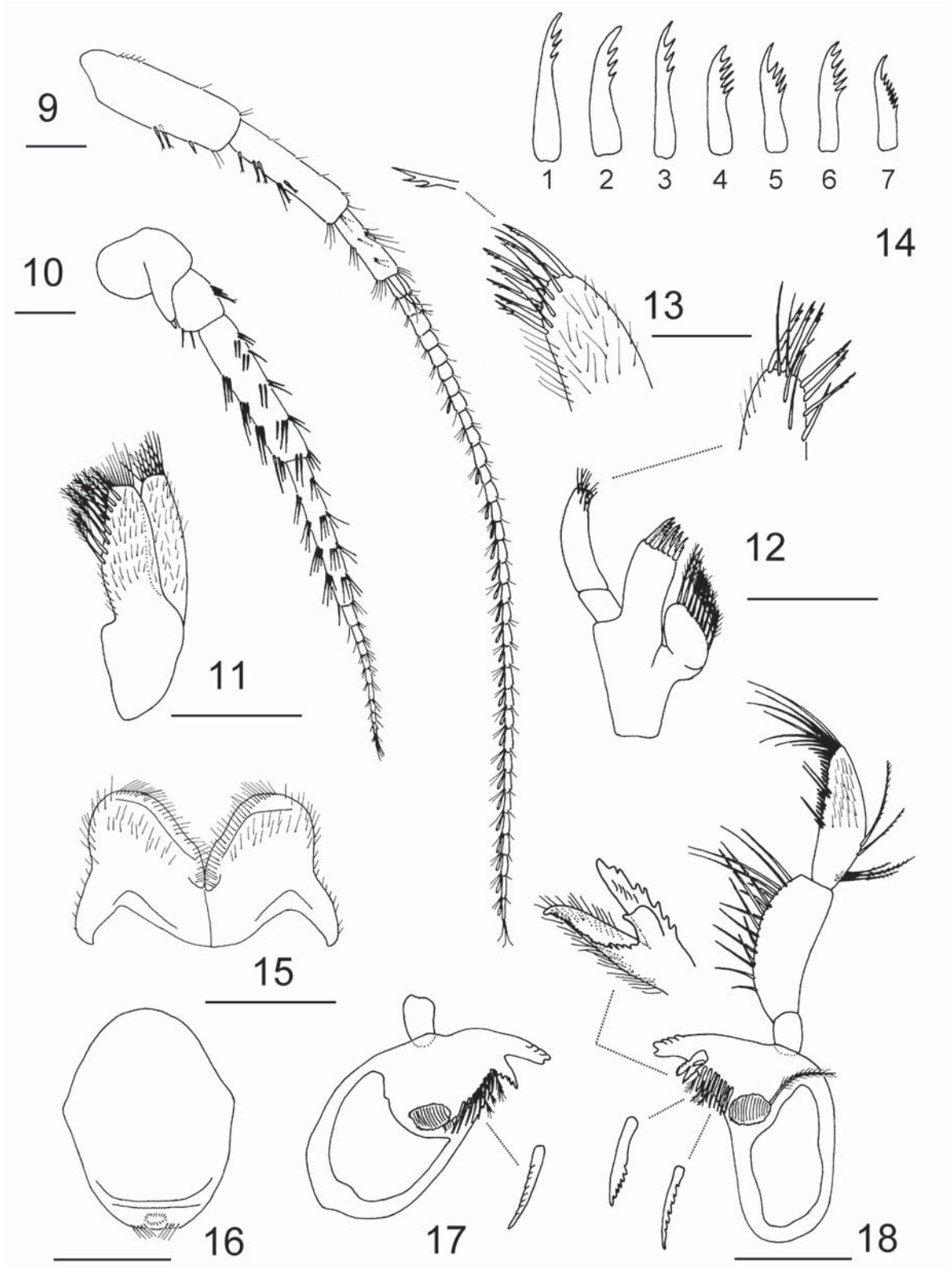
Рис. 3–6. *Crangonyx chlebnikovi* Borutzky, лектотип [MSU Tb-1144]: 3 — цефалосома; 4 — уросома; 5 — эпимеры 1–3; 6 — плеоподы 1–3. Линейки 0,4 мм.

setae on outer margins, nail very short without setules at hinge. *Gnathopod* 2 (Fig. 8): basis stout with 5 short setae on anterior margin, 2 long setae on inner face and with 15 long, thread-like setae (some in twos) on posterior margin; carpus 0.30x as long as propodus, carpal lobe broad and tapered bearing plumose setae; propodus larger than propodus of G2, sub-triangular, stout, subchelate, palm S-shaped with cutting margin developed, armed with row of 23 distally notched robust setae on inside and 31 on outside, deep recess (or pouch) surrounded by 6 long (1 of them very long) distally notched robust setae at defining angle, posterior margin convex and about tierce as long as palm with row of simple setae; dactylus long, ribbed, with row of 17 minute setules on inner and 5 setae on outer margins, nail very short without setules at hinge. *Pereopods 3* and *4* (Figs 27, 28) sub-equal in length; bases sub-linear bearing long, thread-like setae on both mar-



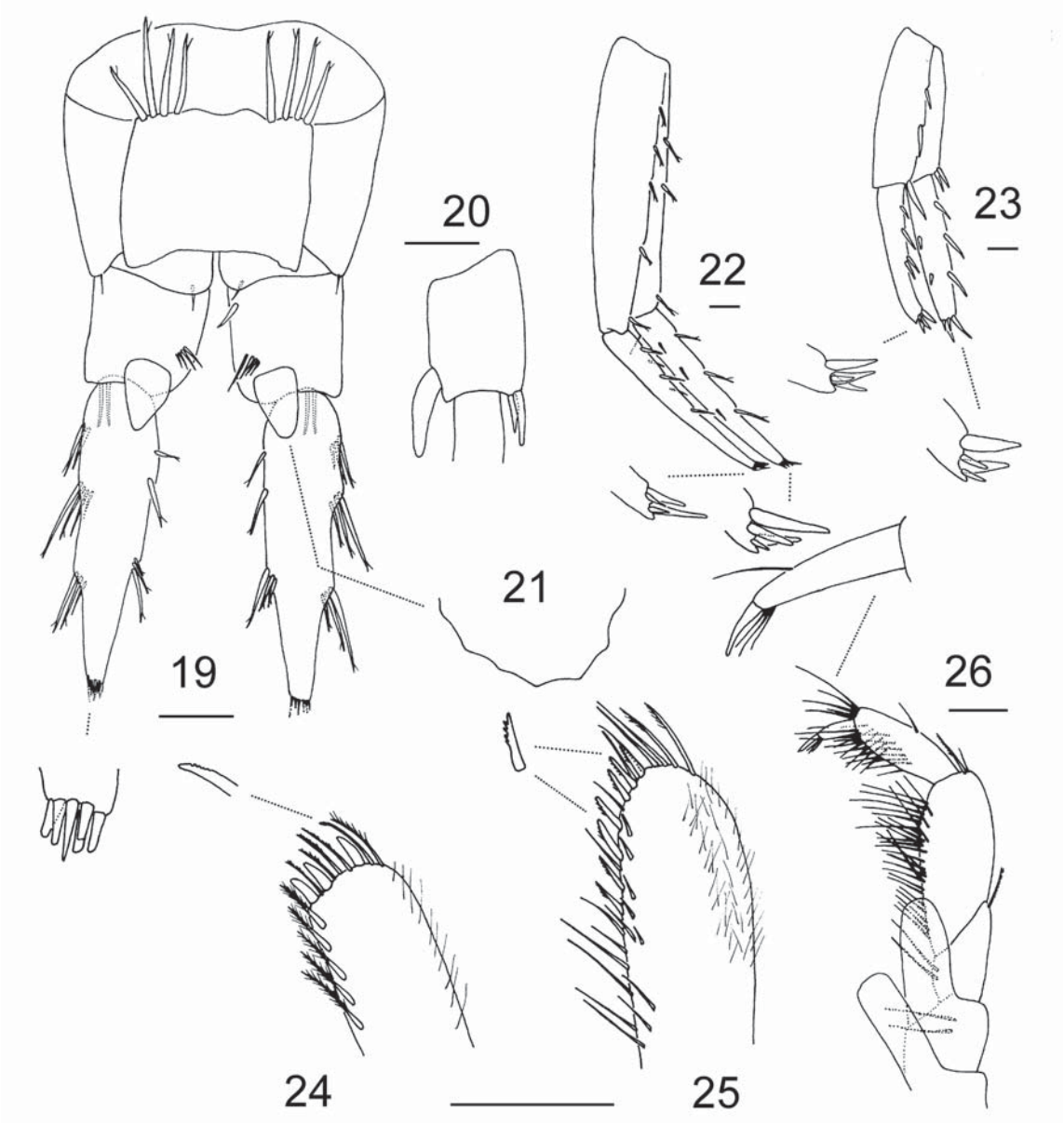
Figs 7–8. *Crangonyx chlebnikovi* Borutzky, lectotype [MSU Tb-1144]: 7 — gnathopod 1; 8 — gnathopod 2. Scale bars 0.4 mm.
Рис. 7–8. *Crangonyx chlebnikovi* Borutzky, лектотип [MSU Tb-1144]: 7 — гнатопод 1; 8 — гнатопод 2. Линейки 0,4 мм.

gins; dactyli long about 50% length of corresponding propodi. *Pereopods 5–7* (Figs 29–31): pereopod 7 97% length of pereopod 6 but bases equal in length; bases of pereopod 5–7 broader proximally that distally, margins serrated with setules, distoposterior lobes poorly developed; dactyli relatively short about 25% length of corresponding propodi. *Coxal gills 2–7* (Fig. 30) stalked and sub-ovate, coxal gill 7 very small. *Oösteg-ites 2–5* on G2 and pereopods 3–5 (Figs 8, 28, 29) slightly expanded distally, without setae, distinctly smaller on pereopod 5. Lateral *sternal gills* present on pereonites 6–7 and pleonite 1. **Pleon.** *Epimera 1–3* (Fig. 5): posterior margin of plate 1 convex (but almost straight in plates 2 and 3) with 5 or 8 small setae; distoposterior corner rounded and sub-acute in plate 1, tiny and acute in plate 2, acute in plate 3; ventral margin of plate 1 nearly straight without setae, those of plates 2 and 3 convex and straight correspondingly and bearing 5 or 6 stiff sub-marginal setae. *Pleopods 1–3* (Fig. 6): sub-equal, peduncular articles with 6–8 retinacula each and a blunt process on distal margin along outer face; proximal article of inner rami fringed with 3–4 bifurcate, plumose setae; inner rami longer in length with 16–17 articles, outer rami with 16–18 articles, both rami fringed with plumose setae. *Urosome* (Figs 2, 4): urosomites free (not coalesced), lacking dorsal armament; urosomite 3 (Fig. 19) with a pair of small setae on distolateral corners. *Uropod 1* (Figs 2, 22): peduncle with 5 setae on outer margin and 3 setae on inner margin; outer ramus slightly shorter than inner ramus, approximately 72% length of peduncle; both rami armed with 2 or 3 setae



Figs 9–18. *Crangonyx chlebnikovi* Borutzky, lectotype [MSU Tb-1144]: 9 — antenna 1; 10 — antenna 2; 11 — maxilla 2; 12 — maxilla 1; 13 — palp apex of right maxilla 1; 14 — setae of maxilla 1, outer plate; 15 — lower lip; 16 — upper lip; 17 — mandible, left; 18 — mandible, right. Scale bars 0.4 mm, for 13 0.1 mm.

Рис. 9–18. *Crangonyx chlebnikovi* Borutzky, лектотип [MSU Tb-1144]: 9 — антенна 1; 10 — антенна 2; 11 — максилла 2; 12 — максилла 1; 13 — апекс щупика правой максиллы 1; 14 — щетинки внешней пластинки максиллы 1; 15 — нижняя губа; 16 — верхняя губа; 17 — мандибула, левая; 18 — мандибула, правая. Линейки 0,4 мм, для 13 — 0,1 мм.

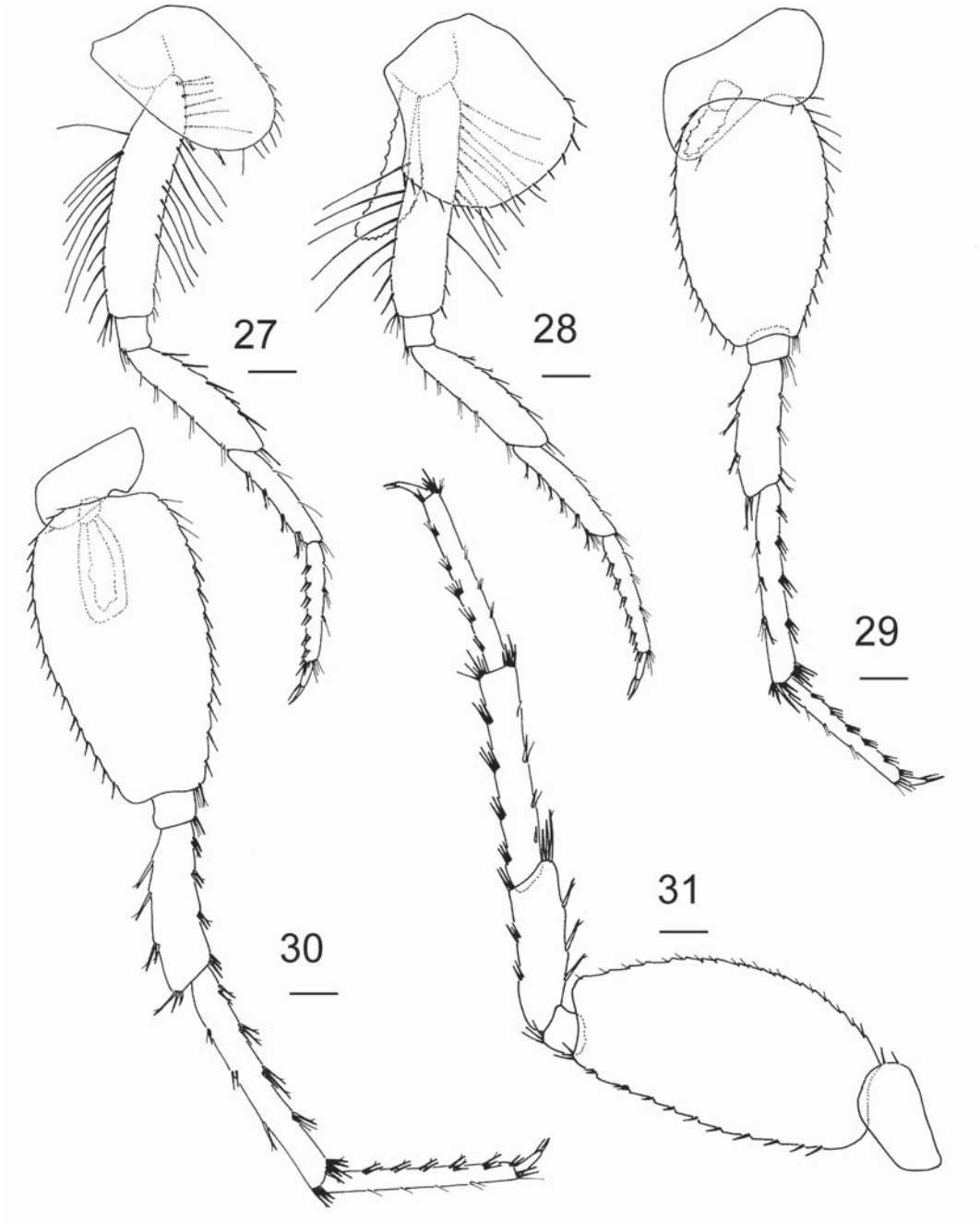


Figs 19–26. *Crangonyx chlebnikovi* Borutzky, lectotype [MSU Tb-1144]: 19 — uropod 3 with turned back telson; 20 — uropod 3 peduncle, lateral view; 21 — tip of uropod 3, inner ramus; 22 — uropod 1; 23 — uropod 2; 24 — maxilliped, inner plate; 25 — maxilliped, outer plate; 26 — maxilliped, entire. Scale bars 0.2 mm.

Рис. 19–26. *Crangonyx chlebnikovi* Borutzky, лектотип [MSU Tb-1144]: 19 — уропод 3 с отогнутым тельсоном; 20 — педункулюм уропода 3 peduncle, сбоку; 21 — кончик внутренней ветви уропода 3; 22 — уропод 1; 23 — уропод 2; 24 — ногочелюсть, внутренняя пластинка; 25 — ногочелюсть, внешняя пластинка; 26 — ногочелюсть, полностью. Линейки 0,2 мм.

on both margins, with 4 setae on apices. *Uropod 2* (Figs 2, 23): peduncle with 3 setae on outer margin and 2 distal short (corner) seta on inner margin; outer ramus slightly shorter than inner ramus, approximately 90% length of peduncle; both rami armed with 2 or 3 setae on both margins, with 4 setae on apices. *Uropod 3* (Figs 2, 4, 19–21): peduncle with set of fine setae on distodorsal corner and 1 stiff setae on proximodorsal face; outer ramus 2.8x as long as peduncle, armed with 6 sets of notched setae on both margins, with 6 simple small setae apically. *Telson* (Fig. 19): 0.3x broader than long, entire but with small notch and with 2 clusters of strong notched setae on apex.

DIMORPHISM. Comparison based on 10.5 mm male, KIC, FESU X34905/Cr-1405. No significant differences were observed between sexes other than the males are smaller. *Antenna 2* lacking calceoli. *Gnathopod 1* (Fig. 32) smaller than G2; basis more stout and bottle-shaped; propodus bearing sparse long thin setae on palm. *Gnathopod* 2 (Fig. 33): carpus bearing strong rastellate setae on carpal lobe; propodus sub-triangu-



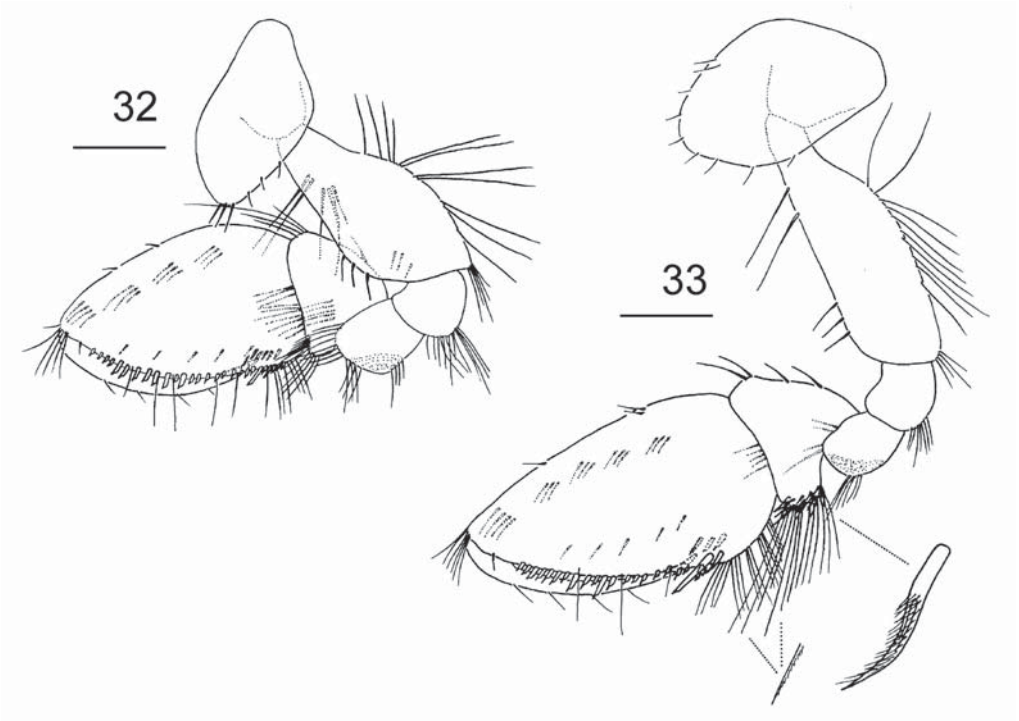
Figs 27–31. *Crangonyx chlebnikovi* Borutzky, lectotype [MSU Tb-1144]: 27 — pereopod 3; 28 — pereopod 4; 29 — pereopod 5; 30 — pereopod 6; 31 — pereopod 7. Scale bars 0.4 mm.

Рис. 27–31. *Crangonyx chlebnikovi* Borutzky, лектотип [MSU Tb-1144]: 27 — переопод 3; 28 — переопод 4; 29 — переопод 5; 30 — переопод 6; 31 — переопод 7. Линейки 0,4 мм.

lar, palm non S-shaped with sparse long thin setae. *Pereopods 5–7* (Figs 34–36): bases shorter than those of female.

VARIABILITY. The specimens from the caves Great Mechka, Babinogorskaya and Kungurskaya have a greater body length than the specimens from the Orda Cave, well in Brekhovo and spring from the Verkh-Suksun. In general, the morphology of the appendages and their armament is not extremely variable for the species. The examined specimens have variations in setation pattern of uropod 3 and in number of the apical setae of telson. Pleopods 1–3 bears 6–8 retinacula. The number of articles in primary flagellum of antenna 2 varies between 30–35. Uropod 3 with 4–6 sets of notched setae on both margins. Telson bears 4 or 5 setae in each cluster on apex.

TYPE LOCALITY. Cave lake in the Great Mechka Cave, Perm Province, Russia (see Fig. 1).



Figs 32–33. *Crangonyx chlebnikovi* Borutzky, male 10.5 mm, KIC [FESU X34905/Cr-1405]: 32 — gnathopod 1; 33 — gnathopod 2. Scale bars 0.4 mm.

Рис. 32–33. *Crangonyx chlebnikovi* Borutzky, самец 10,5 мм, КЛП [FESU X34905/Cr-1405]: 32 — гнатопод 1; 33 — гнатопод 2. Линейки 0,4 мм.

DISTRIBUTION. Besides the Great Mechka Cave (type loc.), the species inhabits Kungur Ice Cave, Babinogorskaya Cave (Kungur District), Orda Cave (Orda District) and wells in Brekhovo, springs in Shakharovo (A.B. Krasheninnikov, pers. comm.) and Verkh-Suksun (Suksun District) (see Fig. 1).

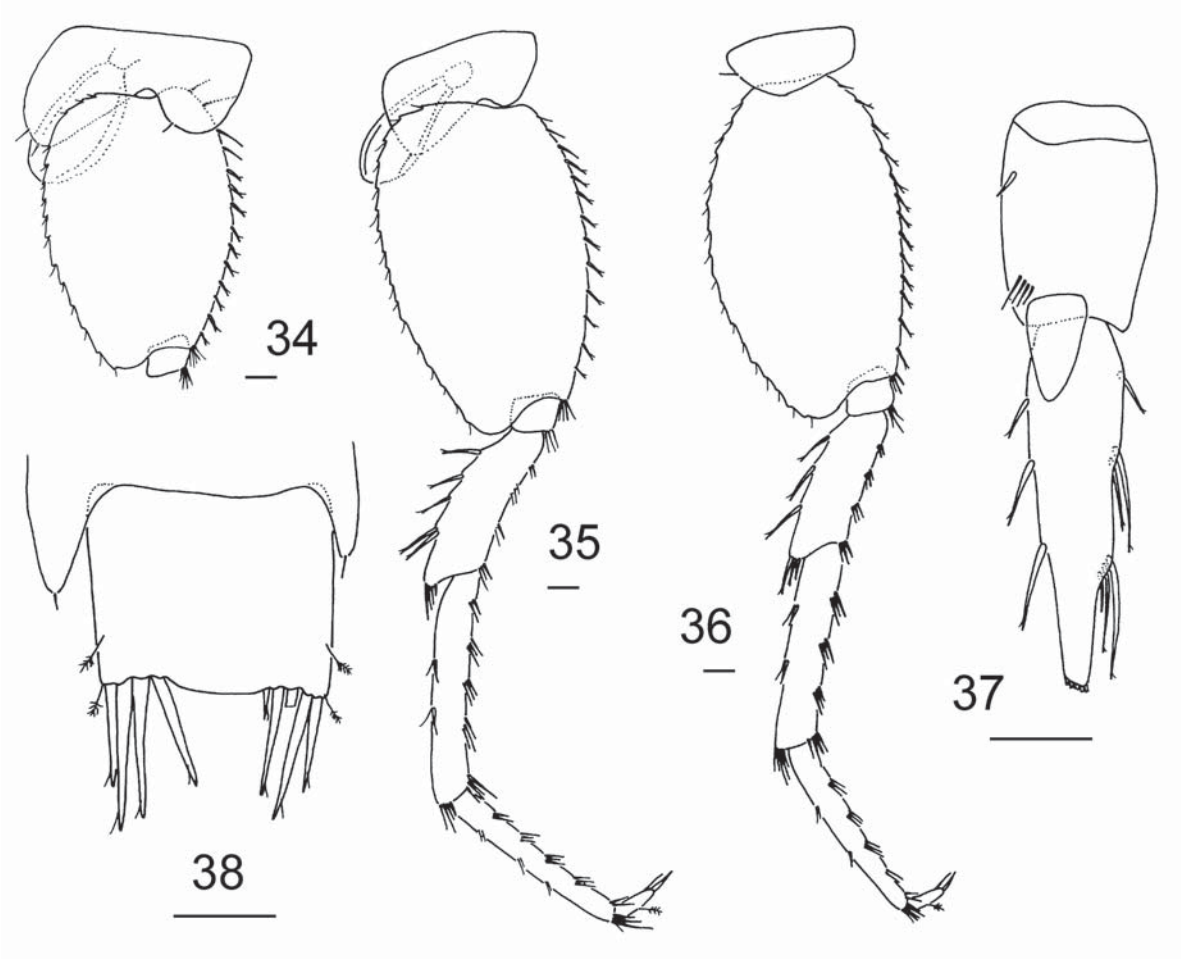
The distribution area of *C. chlebnikovi* does not go beyond the above-mentioned administrative districts of the Perm Province. In geomorphological terms this area represents the northern extremity of the Ufa Plateau, known as the Sylvensky Ridge. It is an elevated peneplain with an altitude up to 420 m, and folded from the surface of gypsum, anhydrite, limestones and dolomites of the Lower Permian of the Kungurian Stage. There is significant distribution of karst forms of relief observed on the territory of the Sylvensky Ridge, represented by the classical sulfate and sulfate-carbonate types [Meshcheryakov, 1965]. The groundwaters have calcium sulfate or sulfate magnesium-calcium composition and are characterized by the high salinity (≥2.5 g/l) [Kadebskaya, Maximovitch, 2009].

ECOLOGY. *C. chlebnikovi* dwells on the clayey substrate of the spacious cave lakes where their density was recorded equal ~0.34–67.0 spec./m^2 [Pankov, Pankova, 2004]. Besides caves the species was recently collected in the driven well and a several small springs (seeps) formed owing to the diffuse groundwater discharge but non hypotelminorheic in sensu described by Culver et al. [2006]. *C. chlebnikovi* seems to avoid flowing water inasmuch as they have never been seen in the streams of the GMC. However, in lakes they are very numerous.

Under natural conditions the species lives under a constant low water temperature (0 to 5.5 °C). It was experimentally shown that the final selected thermopreferendum (FST or final thermopreferendum) for these crustacean are in a warmer zone is changing during the day from 12.1–13.0 to 17.0–17.4 °C [Andreev et al., 2011].

It is typical of *C. chlebnikovi* to have high mortality in the egg stage and in the first year of life; at this age mortality averages 85.4% of the primary cohort. With maturing the mortality of species declines rapidly, reaching minimum values in the third and fourth years of life (9.6...15.8%). In the sixth year of life mortality increases dramatically, again approaching to 95%. At this time amphipods are presented largely by the senile forms and mass death in the final period of their ontogeny is natural. The maximum lifetime rarely exceeds 8 years and reaches the age of ~8.5 years [Pankov et al., 2005].

C. chlebnikovi is characterized by the periodic type of reproduction. Oviposition is confined to the spring flood time. Reproduction takes the part among individuals of the third–fifth years of life [Pankov, 2008]. An absolute fecundity of the crustacean varies from 8–20 eggs per female. The weight of new clutches varies between 2.4–6.0 mg, which is consistent at about 5.9–11.4% of the individual females weight. Egg incubation in the brood pouches of females lasts about a month. After this period the eggs hatch out the young



Figs 34–38. *Crangonyx chlebnikovi* Borutzky, male 10.5 mm, KIC [FESU X34905/Cr-1405]: 34 — pereopod 5, part; 35 — pereopod 6; 36 — pereopod 7; 37 — uropod 3; 38 — telson. Scale bars 0.2 mm.

Рис. 34–38. *Crangonyx chlebnikovi* Borutzky, самец 10.5 мм, КЛП [FESU X34905/Cr-1405]: 34 — переопод 5, часть; 35 — переопод 6; 36 — переопод 7; 37 — уропод 3; 38 — тельсон. Линейки 0,2 мм.

crustaceans, which after 1.0–1.5 months lead an independent life. Thus, from the time of eggs laying to the independent life no more than 2.0–2.5 months elapse [Pankov & Starova, 2009].

TAXONOMIC COMMENTS. *Crangonyx chlebnikovi* in form of the lateral cephalic lobe, propodi of both gnathopods with densely armed palmar margins and a large body size is more closely related to the North American genus *Bactrurus* Hay, 1902 but differs clearly from this genus by the shape of uropod 3 [see Koenemann & Holsinger, 2001: 3].

Within the genus *Crangonyx*, *C. chlebnikovi* is related to the North American *C. richmondensis* group but differs in the form of the lateral cephalic lobe which has a clear inferior antennal sinus.

In absence of the sternal gills/processes on pereonal segments 2–3, *C. chlebnikovi* is similar to *C. subterraneus* and also to several species of the genus *Bactrurus*. In particular, it is identical by sternal gills arrangement with *B. mucronatus* and *B. hubrichti*.

Discussion

Diagnosis of the genus *Crangonyx* given by Zhang & Holsinger [2003] indicates that the genus has broadly rounded lateral cephalic lobe without inferior sinus or rarely narrowly rounded with weak inferior antennal sinus. However, *C. subterraneus* (type species of the genus) and *C. chlebnikovi* have the clearly visible inferior antennal sinus (Fig. 39b, c) with outstanding interantennal lobe, which is particularly evident in *C. chlebnikovi*. Here we suggest that in the family Crangonyctidae a certain heterogeneity is strongly presented owing to the different shape of the front head edge and species are definitely united into a several taxonomical variegated groups following this feature. In particular, the monotypic genus *Amurocrangonyx* (Fig. 39e) and the species of the North American *Synurella* [cf. Shoemaker, 1920: 17] form a group characterized by broadly rounded lateral cephalic lobe. Also, accordingly to results of an analysis of the *cox1* gene [Sidorov, in prep.], *Amurocrangonyx* revealed the stable phyloge-

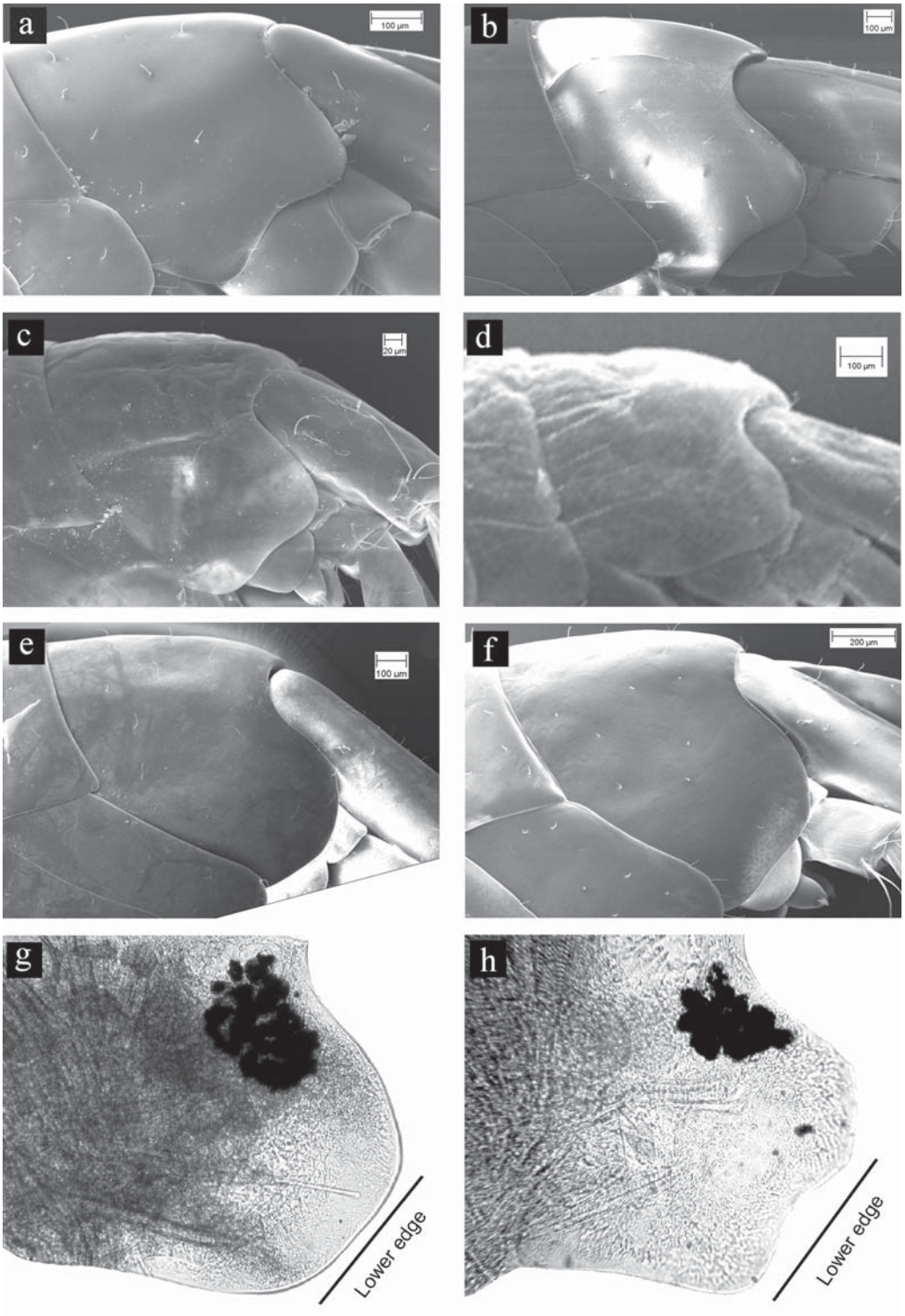


Fig. 39. The lateral cephalic lobes of Crangonyctidae family: a — *Bactrurus mucronatus*, White County, Indiana, U.S.A.; b — *Crangonyx chlebnikovi*, Kungur Ice Cave, Russia; c — *Crangonyx subterraneus*, Corfe Mullen, Great Britain; d — *Stygobromus anastasiae*, Irkutsk, Russia; e — *Amurocrangonyx arsenjevi*, Khabarovsk, Russia; f — *Synurella derzhavini*, Saratov, Russia; g — *Synurella* cf. *intermedia*, Ribnica, Slovenia; h — *Lyurella hyrcana*, Lenkoran, Azerbaijan. a–f — SEM; g, h — Digital Photomicrography.

Рис. 39. Боковая лопасть головы представителей семейства Crangonyctidae: a — *Bactrurus mucronatus*, Вайт Каунти, Индиана, США; b — *Crangonyx chlebnikovi*, Кунгурская Ледяная пещера, Россия; c — *Crangonyx subterraneus*, Корф Муллен, Великобритания; d — *Stygobromus anastasiae*, Иркутск, Россия; e — *Amurocrangonyx arsenjevi*, Хабаровск, Россия; f — *Synurella derzhavini*, Саратов, Россия; g — *Synurella* cf. *intermedia*, Рибница, Словения; h — *Lyurella hyrcana*, Ленкорань, Азербайджан. a–f — СЭМ; g, h — цифровая фотомикрография.

netic propensity to the North American *Synurella* more than with representatives of the genus *Crangonyx*. Whereas, the lateral cephalic lobe of the European species of the genus *Crangonyx* (*C. chlebnikovi* and *C. subterraneus*) show an evident resemblance to the genus *Bactrurus* (Fig. 39a) [Sidorov et al., 2010]. This group of three species have the clearly visible inferior antennal sinus with inter-antennal lobe narrowing and tapered (compare with *Lyurella* characterized by obtuse inter-antennal lobe) (Fig. 39h). The several members of the European group of the genus *Synurella* (*S. derzhavini*, *S.* cf. *intermedia* and *S. ambulans*) have a rounded lateral cephalic lobe some similar to *Amurocrangonyx* and North American *Synurella* but with the straight lower edge (Fig. 39g) or even with a weak invagination as for *S. derzhavini* (Fig. 39f). However, another representative of the European *Synurella*, viz. *S. osellai* Ruffo, 1974 [see Ruffo, 1974: 393] have the distinct inferior antennal sinus that is comparable to those of *Lyurella hyrcana* Derzhavin, 1939. *Stygobromus anastasiae* known from springs in Irkutsk revealed a specific form of the head (Fig. 39d) that differs largely in truncated lower edge. Within the Palaearctic species of the genera *Crangonyx* and *Synurella* there is a certain sequence from broadly rounded shape to the shape with conspicuous inferior antennal sinus: *C. africanus – C. islandicus – C. subterraneus – C. chlebnikovi* and *S. ambulans – S. intermedia – S. derzhavini – S. osellai – L. hyrcana*, respectively. In other words, the morphology of the lateral cephalic lobes is generally determined by the condition of the lower edge, being convex, straight or concave. As a rule most of the Crangonyctidae taxa differ by a relatively small size and unpigmented body. This makes it difficult to accurately produce the morphology of the lateral cephalic lobe, and moreover it can significantly deform under dissection. Thus, better results are obtained only by using the SEM especially for the delicate specimens and photomicrography. In our opinion further investigation of this feature deserves more intensive attention.

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