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Diversity of the Caucasian genus *Diasynurella* Behning, 1940 (Amphipoda: Crangonyctidae) with description of four new species

Разнообразие кавказского рода *Diasynurella* Behning, 1940 (Amphipoda: Crangonyctidae) с описанием четырех новых видов

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KEY WORDS: Crustacea, Amphipoda, Crangonyctidae, *Diasynurella*, diversity, phylogeny, hypogean, Caucasus, Palaearctic.

КЛЮЧЕВЫЕ СЛОВА: Crustacea, Amphipoda, Crangonyctidae, *Diasynurella*, разнообразие, филогения, подземный, Кавказ, Палеарктика.

ABSTRACT. Four new species of the Caucasian crangonyctid genus *Diasynurella* Behning, 1940 (Crustacea: Amphipoda: Crangonyctidae) are described from stygobiotic habitats of the Russian Federation, Georgia and Armenia based on an integrative approach. The interspecific genetic divergence (by COI mtDNA gene marker) between newly discovered species of the genus vary from 17 to 31%, which indicate long-time isolation, starting at least since the Pliocene. The article discusses the morphology, phylogeny and distribution of these species, as well as a differential key for all species is provided. DNA barcoding data are presented for all species of the genus for the first time.

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РЕЗЮМЕ. На основе интегративного подхода из подземных (родниковых) местообитаний Российской Федерации, Грузии и Армении описаны четыре новых вида кавказских амфипод-крангониктид рода *Diasynurella* Behning, 1940 (Crustacea: Amphipoda: Crangonyctidae). Межвидовая генетическая дивергенция (по генному маркеру COI мтДНК) между вновь обнаруженными видами рода варьирует от 17 до 31%, демонстрируя долгосрочную изоляцию, начиная, по крайней мере, с Плиоцена. В статье обсуждаются морфология, филогения и распространение, а также приводится дифференциальный ключ для всех видов. Данные штрихкодирования ДНК для всех видов рода представлены впервые.

Introduction

The family Crangonyctidae Bousfield, 1973 (Crustacea: Amphipoda) currently includes 13 valid genera with more than 230 species of groundwater or epigean fresh water amphipods widely distributed in the Palaearctic and Nearctic [Horton *et al.*, 2020; Palatov, Marin, 2020, 2021; Marin, Palatov, 2021a, b, 2022a, b; Cannizzaro *et al.*, 2021]. About half of crangonyctid genera, and to be precise, five genera (namely, Caucasian *Diasynurella* Behning, 1940, Central Eurasian *Volgonyx* Marin et Palatov, 2021 and *Uralocrangonyx* Marin et Palatov, 2022, Far Eastern *Amurocrangonyx* Sidorov et Holsinger, 2007 and North American *Stygonyx* Bousfield et Holsinger, 1989), are known as monotypic [Behning, 1940; Bousfield, Holsinger, 1989; Sidorov, Holsinger, 2007; Marin, Palatov, 2021a, 2022a]. Also, it was suggested that *Crangonyx islandicus* Svavarsson et Kristjánsson, 2006 represents a separate lineage of the generic level [Marin, Palatov, 2022a]. At the same time, an undescribed hidden diversity is proposed for some of these genera [Marin, Palatov, 2022a], and they are still insufficiently studied, especially in the Palearctic.

The only known Caucasian species of the crangonyctid genus *Diasynurella* Behning, 1940, *D. wachuschtii* Behning, 1940, was described from single spring on the Tskhra-Tskharo pass way near the mountain road from Bakuriani to Tabitskuri (Samtskhe-Javakheti, Georgia) [Behning, 1940]. Lately, Karaman [1974] synonymized *Diasynurella* with the genus *Synurella* Wrześniowski, 1877, while recent molecular genetic studies showed the validity of the former genus [Palatov, Marin, 2020; Marin, Palatov, 2021a, b]. In some phylogenetic reconstructions, it is sometimes consid-

ered as a sister clade of the genus *Pontonyx* Palatov et Marin, 2021 [Marin, Palatov, 2021a]. However, the phylogenetic position of both genera is currently not obvious [Copilaş-Ciocianu *et al*., 2019; Palatov, Marin, 2020; Marin, Palatov, 2021a, b]. The only presented time-calibrated phylogeny [Copilaş-Ciocianu *et al.*, 2019] showed that the genus *Diasynurella* separated from the related taxa in the Cretaceous, about 80–100 Mya, what is related with the time of the division of Laurasia, while speciation within the genus has been occurring since the end of the Paleogene, about 40 Mya.

Currently described stygobiotic crangonyctid diversity from the Caucasus is recently increasing, and already includes more than 19 endemic species [Behning, 1940; Derzhavin, 1945; Marin, Palatov, 2021a, b, 2022b; Palatov, Marin, 2021; Marin, Palatov, in press], while the actual diversity of the family Crangonyctidae is still far from being completely studied. There are some difficulties of collecting these crustaceans due to their very small size: the body length of adults rarely exceeds 4.5 mm. In the course of the extensive zoological studies of stygobiotic fauna in 2011–2022 years, numerous specimens of the genus *Diasynurella* were found in several highly geographically remote areas, i.e. Rostov area (Northern Black/Azov Sea Lowland) and Samur forest in Dagestan (northwestern Hyrcania) in Russian Federation, coastal habitats of the western Georgia (Colchis Lowland) and mountainous part of Armenia. An integrative approach showed that our material includes four undescribed lineages, which are well separated by morphology and genetically, and the aim of this communication is to describe them as new species.

Material and methods

SAMPLE COLLECTION AND PROCESSING. Amphipods were collected using hand net in various epigean and subterranean water resources of the Ciscaucasian Plain, the southern slope of the Great Caucasian Ridge and the Lesser Caucasus in 2011–2022 years. All samples were fixed in 90% solution of ethanol. Photographs of alive coloration *in situ* were made using digital camera CanonG16. Photographs of morphological features were made with digital camera attached to light microscope Olympus ZX10 and Olympus CX21. The scanning electron microscopy (SEM) images were made using the Vega 3 Tescan microscope in the Yu.A. Orlov Paleontological Museum of the Paleontological Institute of the Russian Academy of Sciences, Moscow. Amphipods were placed in 95% ethanol, cleaned in an ultrasonic cleaner then dehydrated with acetone, critical-point dried (CPD), fixed on specimen stubs with double-sided and coated with gold by sputtering using Polaron PS 100.

The body length (bl., mm), the dorsal length from the distal margin of head to the posterior margin of telson, without uropod III and both antennas, is used as standard measurement. The type material is deposited at the collection of Zoological Museum of Moscow State University, Moscow, Russia (ZMMU). Additional material is deposited in the author's personal collection at the A.N. Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences, Moscow, Russia (LEMMI).

AMPLIFICATION AND DNA SEQUENCING. The mitochondrial cytochrome oxidase c subunit I (COI mtDNA) gene has been proving as extremely informative in previous studies at both population and species level [Avise, 1993; Palatov, Marin, 2020; Marin, Palatov, 2021a, b]. Total genomic DNA was extracted from muscle tissue using the innuPREP DNA Micro Kit (Analitik Jena, Germany). The COI mtDNA gene marker was amplified with the using of the universal primers LCO1490 (5'–GGTCAACAAATCATAAAGATATTGG–3') and HC02198 (5'–TAAACTTCAGGGTGACCAAAAAATCA–3') under the standard protocol conditions [Folmer *et al*., 1994]. PCR products were then sequenced using Genetic Analyzer ABI 3500 (Applied Biosystems, USA) and BigDye 3.1 (Applied Biosystems, USA) with forward and reverse primers. Dataset of aligned sequences of COI mtDNA gene markers, about 617 base pairs in length used in the study were taken from GenBank (NCBI) (Table 1) and the personal database of authors.

Pairwise genetic divergences (*p*-distances) and standard errors (S.E.) were calculated based on available sequences of COI mtDNA gene marker using MEGA 7.0 with the Kimura 2-Parameter (K2P) model of evolution [Kimura, 1980].

PHYLOGENETIC ANALYSIS. Dataset of consensus sequence was obtained with MEGA 7.0. The best evolutionary substitution model was determined using MEGA 7.0 [Kumar *et al.*, 2016] and jModeltest2.1.141 (Diego Darriba, Universidade da Coruña as part of the Computer Architecture Group (GAC), Coruña, Spain) on XSEDE via the CIPRES (Cyber Infrastructure for Phylogenetic Research) Science Gateway V.3.3 (http://www.phylo.org/). Phylogenetic analysis was conducted using PhyML 3.0 [Guindon *et al.*, 2010] with several models based on BIC (Bayesian Information Criterion) and AIC (Akaike Information Criterion). All obtained trees were used only to satisfy the phylogenetic position of the genus within the family Crangonyctidae. They are not presented in the article being identical to the time-calibrated phylogenetic tree presented on Fig. 21.

MOLECULAR CLOCK ANALYSIS was performed based on Bayesian Inference (BI) trees generated with the BEAST2 package [Bouckaert *et al*., 2014]. Maximum Clad Credibility Tree was obtained using Tree Annotator v2.5.1, with 10% burn-in and selected mean node height [Bouckaert *et al.*, 2014, 2019]. The resulting trees were visualized with FigTree v1.4.3. Calibration points were chosen based on the adapted time-scale [McInerney *et al.*, 2014] and the analysis of historical events [Popov *et al.*, 2004, 2006].

ABBREVIATIONS: Mx — maxilla; Gn — gnathopod; P — pereopod; Pp — pereopods; Pl — pleopod; Ep — epimeral plate; U — uropod.

Results

Taxonomic part

Order Amphipoda Latreille, 1816
Infraorder Gammarida Latreille, 1802
Family Crangonyctidae Bousfield, 1973
Diasynurella Behning, 1940

INCLUDED SPECIES. *Diasynurella wachuschtii* Behning, 1940 (the type species), *D. kiwi* Marin et Palatov sp.n., *D. dzhamirzoevi* Palatov et Marin sp.n., *D. cavatica* Palatov et Marin sp.n. and *D. khalabensis* Palatov et Marin sp.n.

DIAGNOSIS. Size relatively small, up to 3–4.5 mm in females, which are larger than males. Body smooth, not pigmented (troglomorphic), urosomites partly fused, with marked suture between segments, without dorsal spines. Urosomite I free, urosomites II and III completely fused or free. Head without rostrum, lateral lobe rounded anteriorly; black eye (ommatidia) or yellow spots absent on head. Antenna I longer than antenna II; primary segments of flagellum without aesthetascs; accessory flagellum 2-segmented. Antenna II with small calceoli in males. Upper lip rounded apically, margin not incised. Mandible with well-developed incisor process and *lacinia mobilis* and underlying row of spines; molar process triturative; palp 3-segmented. Maxilla I: inner plate with 2–4 long plumose setae apically; outer plate with seven robust serrate spines apically; palp 2-segmented, with short setae and spines apically. Maxilla II: inner plate oval, broader than outer plate, with oblique row of long plumose setae along inner margin; both plates with numerous setae apically. Maxilliped: inner plate with numerous spines and stiff-like setae apically; outer plate with short stiff-like setae on apex and along inner margin; palp 4-segmented. Lower lip with well-developed outer lobes; inner lobes small; lateral processes rather short, usually narrowly rounded distally. Gnathopods I–II robust, unequal in size and dissimilar shape (GnI smaller than GnII); palm of GnI mostly trapezoidal in shape, while palm of GnII close to rectangular-like form; palmar margin in both gnathopods with double row of typically distally notched spines. Pereopods III–IV mostly subequal, pereopod V shorter than pereiopods VI and VII. Coxal gills on pereopods II–VI moderately small, pedicellate, oblong. Posterior corners of epimeral plates I–II sharp, posterior margins with few short setae, ventral margins with few spines, differing in size. Pleopods biramous, subequal in length, with two coupling hooks in retinacula. Uropods I–II biramous, rami and peduncles armed with strong simple spines; uropod I greatly with equal rami; uropod II with equal rami, about as long as length of peduncle; uropod III uniramous, with short non-segmented ramus. Telson rectangular in shape, distal margin with deep V-shaped distal notch, reaching almost 1/2 of length of telson.

DIFFERENTIAL DIAGNOSIS. The genus *Diasynurella* is well distinguished from all other Palearctic genera of the family Crangonyctidae by the following features: 1) free urosomal segment I (fused in *Pontonyx*, *Synurella* and *Lyurella*); 2) fused urosomal segments II and III with distinct sutures (vs. free urosomal segments in *Amurocrangonyx*, *Crangonyx*, *Uralocrangonyx* and *Palearcticarellus*; completely fused urosomal segments without suture in *Synurella*); 3) well developed inner lobes of labium (vs. almost completely reduced in *Eosynurella*); 4) subquadrate propodus of gnathopods I (vs. oval propodus of pereopod I in *Amurocrangonyx*, *Crangonyx*, *Uralocrangonyx* and *Palearcticarellus*); 5) elongated propodus of gnathopod II (mostly oval in *Pontonyx, Amurocrangonyx*, *Crangonyx*, *Uralocrangonyx* and *Palearcticarellus*); 6) simple endopodite of uropod I (vs. paddle-like endopodite of uropod I in *Volgonyx*); 7) well-developed two-segmented uropod III (vs. rudimentary two-segmented uropod III in *Pontonyx* and *Synurella*; and mostly reduced unsegmented uropod III in *Lyurella*); 8) the absence of an additional terminal knob on peduncle of uropod III (vs. present in *Pontonyx*); 9) with single additional spine-like setae on dactyli of pereopods III–VII (vs. *Amurocrangonyx*, *Eosynurella* and *Lyurella*); 10) two coupling hooks in retinacules of pleopods (vs. more than two hooks in *Amurocrangonyx*, *Synurella*, *Palearcticarellus*, *Crangonyx*, *Uralocrangonyx* and *Volgonyx*).

ECOLOGICAL REMARKS. All species of the genus are characterized by number of the following common ecological features: 1) mature adults have very small body sizes (3.0–4.5 mm of total body length); 2) females of all species carry only one–two eggs, which are very large and occupy the entire volume of marsupial cavity; and 3) it is obvious that these crustaceans are not able to spread beyond water resources of spring or spring/cave system, since all currently known species are found only in single spring or cave watercourse.

Diasynurella wachuschtii Behning, 1940

Diasynurella wachuschtii Behning, 1940: 37, figs. 17, 18 [type locality — Tskhra-Tskharo, Georgia].

DIAGNOSIS. Only females are known. Body small (up to 4.5 mm), unpigmented. Distal article of accessory flagellum of antenna I is about 2.3X shorter than basal one. Inner plate of maxilla I with two plumose marginal setae. Inner plate of maxilla II with row of two plumose setae. Gnathopod I with palm about 1.5X as long as wide, gnathopod II subrectangular, with palm about 2.0X as long as wide in females. Coxal gills VII absent. Epimeral plate I with distinct produced distally, pointed, without spines. Epimeral plate II distally produced and sharply pointed, ventral margin armed with one spine. Epimeral plate III subtrapezoidal, blunted distally, ventral margin armed with one spine. Pleopod peduncles with two coupling hooks in retinacula. Urosomite I completely free, urosomites II and III fused. Basal article (peduncle) of uropod III with one distal spines, ramus without lateral spines. Telson with triangular distal notch, reading about 0.3X of its length.

REMARKS. Currently, males are known only for one species, *Diasynurella kiwi* Marin et Palatov sp.n. (see below), but we believe that they simply cannot be caught because of their very small body size (about 2 mm), even smaller than females of known species.

GENBANK ACCESSION NUMBERS. LK028565, LK028566.

DISTRIBUTION. The species was described and is still currently known only from the Samtskhe-Javakheti region in southern Georgia (SW Caucasus), from spring on the Tskhra-Tskharo mountain pass near the road from Bakuriani to Tabitskuri [Behning, 1940].

Diasynurella kiwi Marin et Palatov **sp.n.**
Figs 1–5.

MATERIAL EXAMINED. Holotype ♀ (bl. 3.0 mm), ZMMU Mb-1248 Russian Federation, Ciscaucasia, Rostov Oblast', Rostov-on-Don, Proletarskiy district, 47°13′59.9″N 39°47′00.1″E, about 40 m a.s.l., small spring on shore of Kiziterinka river, hand net sampling, 18 May 2022, coll. D. Palatov et I. Marin. Paratypes 1♀ (bl. 3.0 mm), 1♂ (bl. 2.0 mm), ZMMU Mb-1249, same locality and data as for holotype.

Additional material: 4♀♀, LEMMI, same locality and data as for holotype.

ETYMOLOGY. The name of the species comes from the endemic New Zealand flightless ground-dwelling bird *Apteryx australis* Shaw, 1813, usually called "*kiwi"*, which also bears only single egg, occupying most of the female's body. Females of *Diasynurella kiwi* Marin et Palatov sp.n., similar to other representatives of the genus *Diasynurella*, usually bears only two large eggs, but outwardly they look like a single mass (Fig. 6), resembling one large egg of this unusual bird. Also similar to this bird is due to their ende-

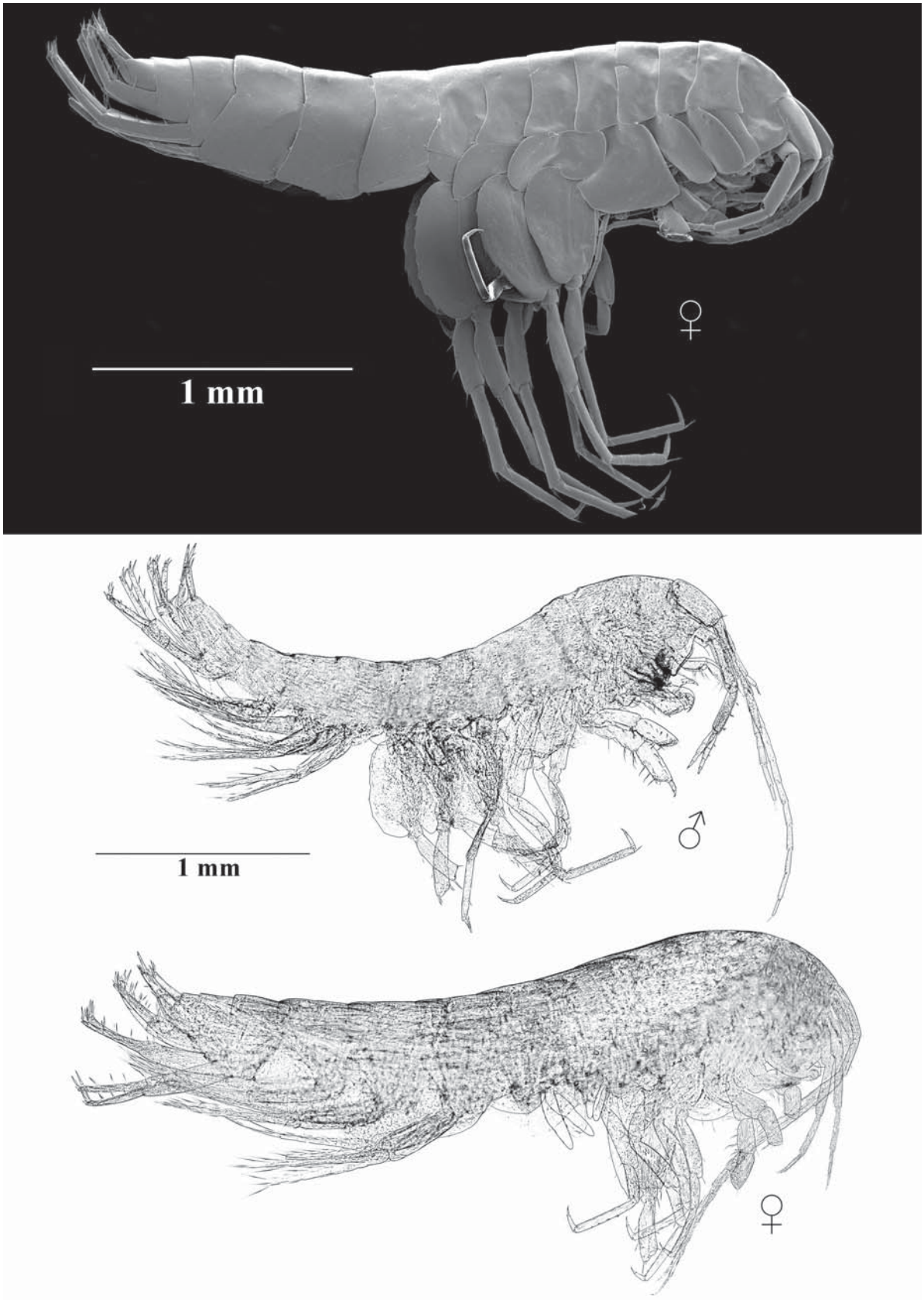

Fig. 1. *Diasynurella kiwi* Marin et Palatov sp.n., Russia, Rostov Oblast', Rostov-on-Don; general view.
Рис. 1. *Diasynurella kiwi* Marin et Palatov sp.n., Россия, Ростовская область, город Ростов-на-Дону; общий вид.

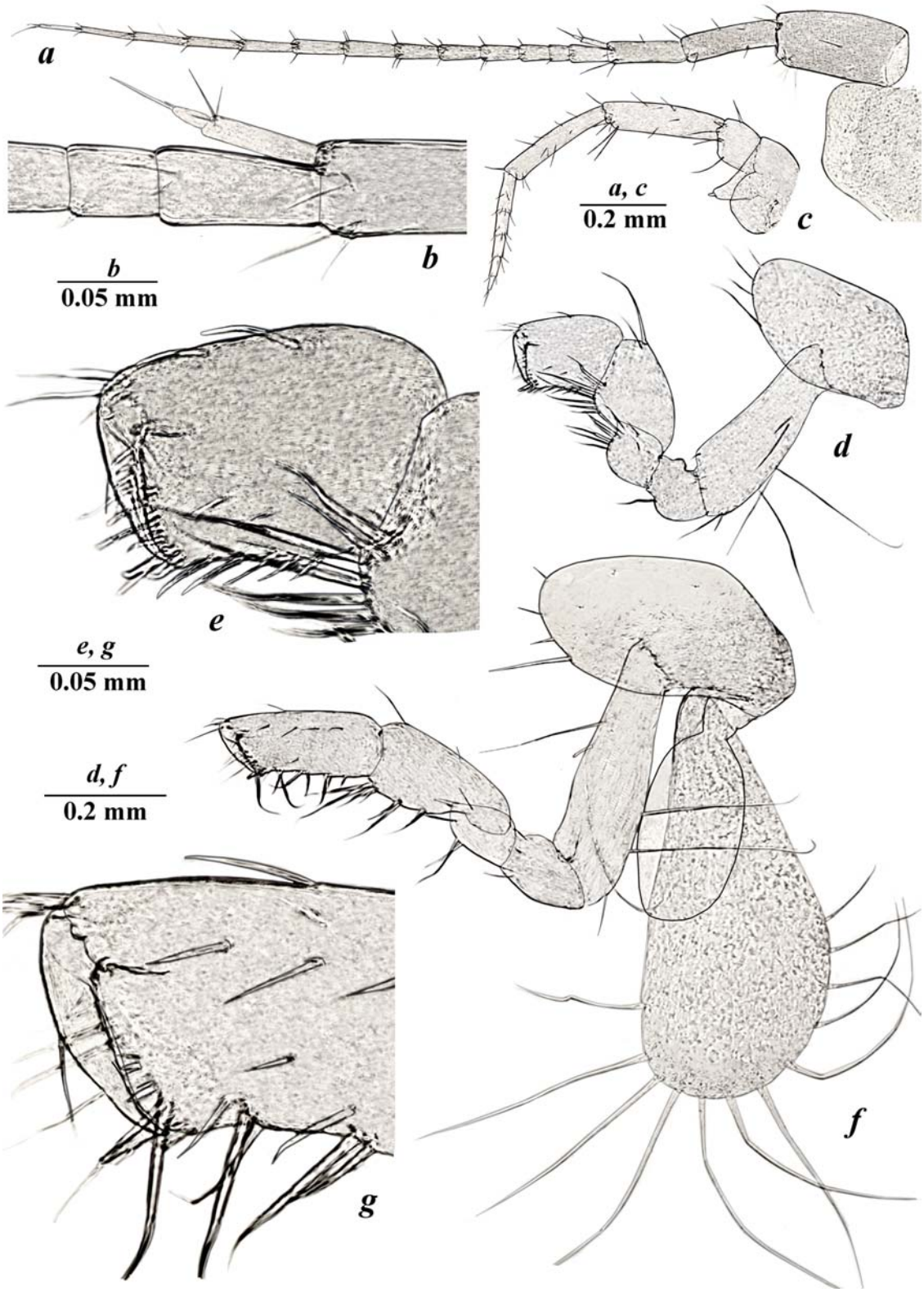

Fig. 2. *Diasynurella kiwi* Marin et Palatov sp.n., Russia, Rostov Oblast', Rostov-on-Don: *a* — antenna I; *b* — accessory flagellum of antenna I; *c* — antenna II; *d* — gnathopod I; *e* — distoventral palmar margin of chela of GnI; *f* — gnathopod II; *g* — distoventral palmar margin of chela of GnII.

Рис. 2. *Diasynurella kiwi* Marin et Palatov sp.n., Россия, Ростовская область, Ростов-на-Дону: *a* — антенна I; *b* — вспомогательный жгутик антенны I; *c* — антенна II; *d* — гнатопода I; *e* — дистовентральный край ладони клешни GnI; *f* — гнатопода II; *g* — дистовентральный край ладони клешни GnII.

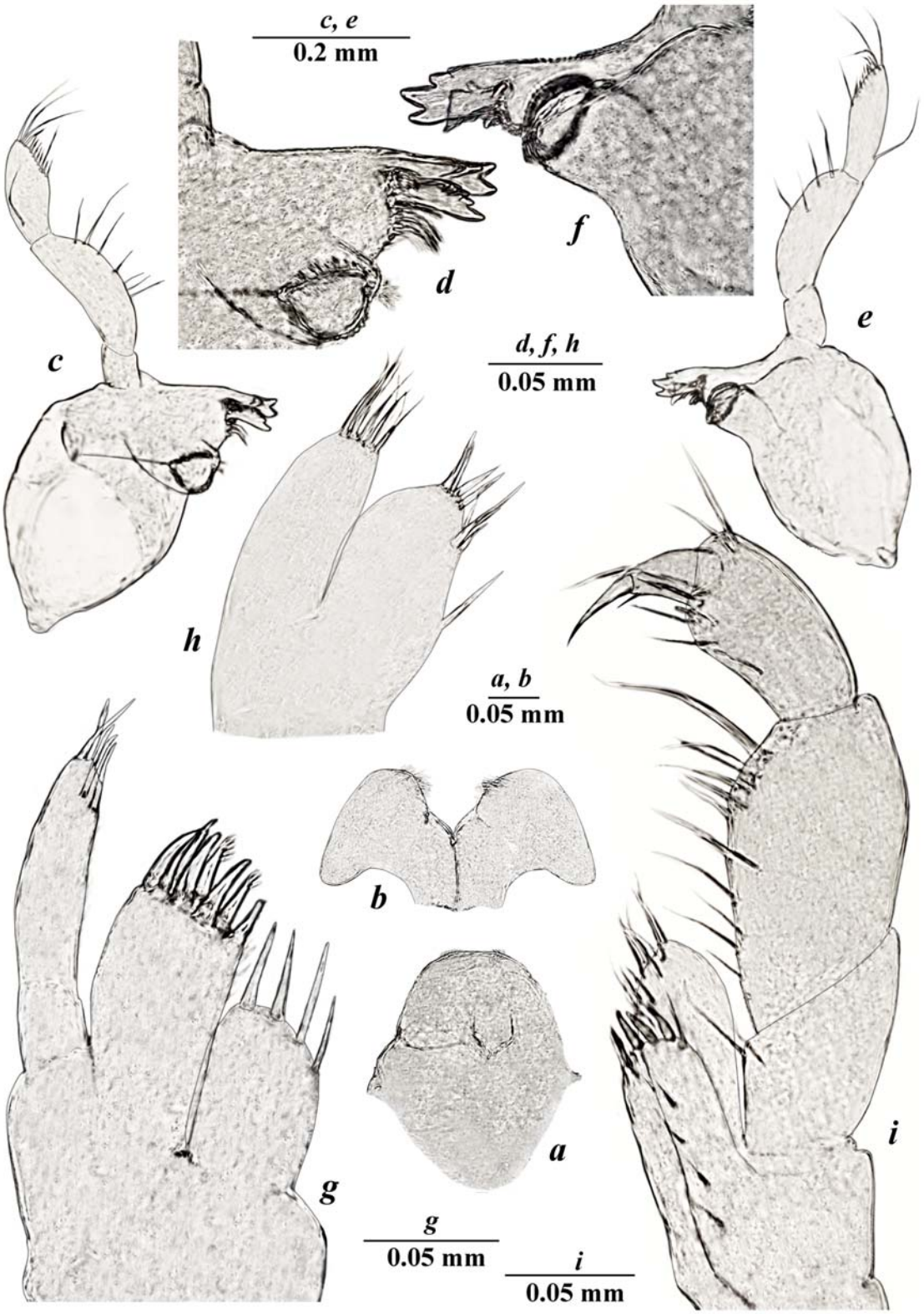

Fig. 3. *Diasynurella kiwi* Marin et Palatov sp.n., Russia, Rostov Oblast', Rostov-on-Don: *a* — labrum (upper lip); *b* — labium (lower lip); *c* — left mandible; *d* — same, incisor process and pars incisiva; *e* — right mandible; *f* — same, incisor process and pars incisiva; *g* — maxilla I; *h* — maxilla II; *i* — maxilliped.

Рис. 3. *Diasynurella kiwi* Marin et Palatov sp.n., Россия, Ростовская область, Ростов-на-Дону: *a* — верхняя губа; *b* — нижняя губа; c — левая мандибула; *d* — то же самое, резцовый отросток и pars incisiva; *e* — правая мандибула; *f* — то же самое, резцовый отросток и pars incisiva; *g* — максилла I; *h* — максилла II; *i* — максиллипед.

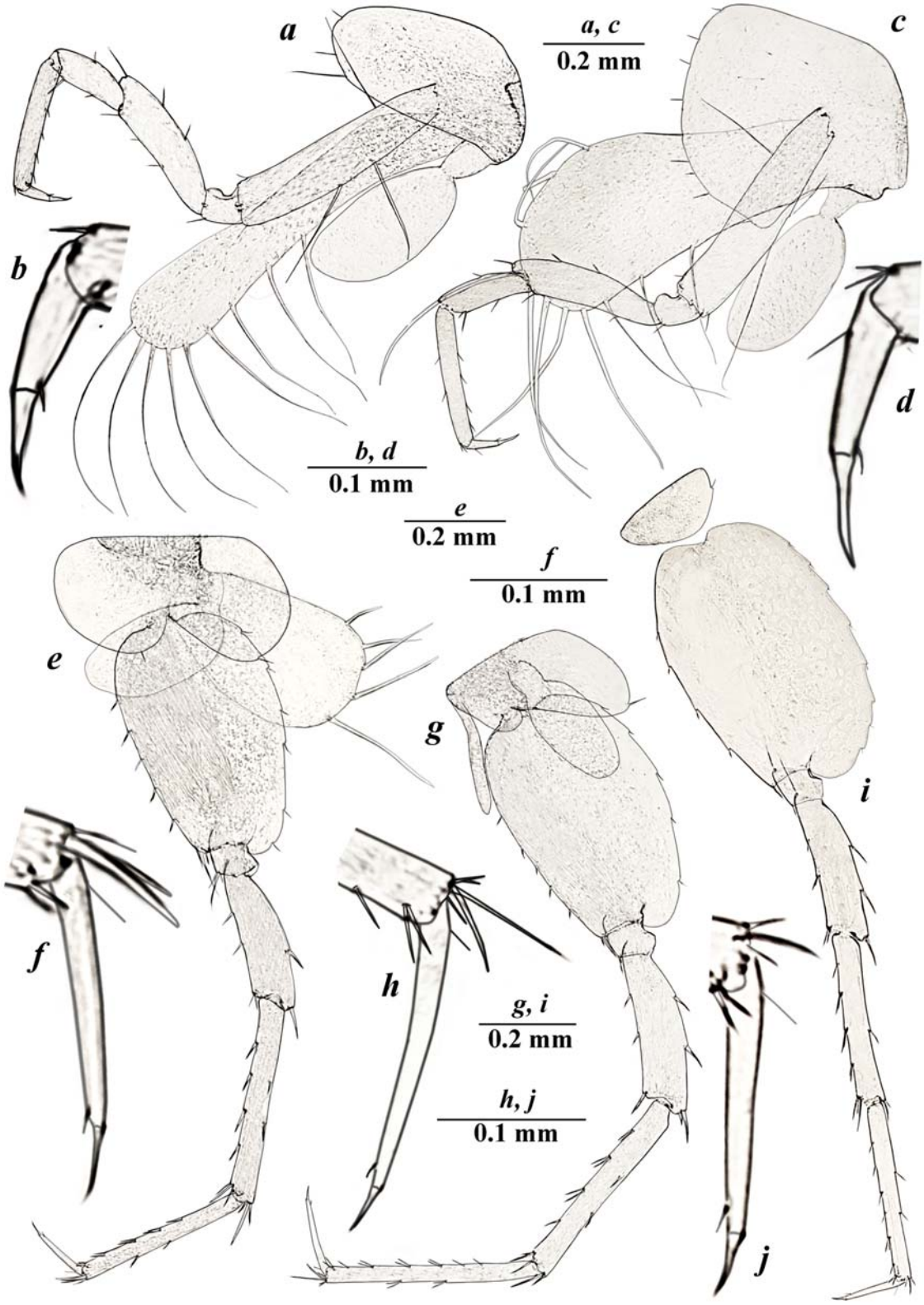

Fig. 4. *Diasynurella kiwi* Marin et Palatov sp.n., Russia, Rostov Oblast', Rostov-on-Don: *a* — pereopod III; *b* — dactylus of PIII; *c* — pereopod IV; *d* — dactylus of PIV; *e* — pereopod V; *f* — dactylus of PV; *g* — pereopod VI; *h* — dactylus of PVI; *i* — pereopod VII; *j* — dactylus of PVII.

Рис. 4. *Diasynurella kiwi* Marin et Palatov sp.n., Россия, Ростовская область, Ростов-на-Дону: *a* — переопода III; *b* — дактилус PIII; *c* — переопода IV; *d* — дактилус PIV; *e* — переопода V; *f* — дактилус PV; *g* — переопода VI; *h* — дактилус PVI; *i* — переопода VII; *j* — дактилус PVII.

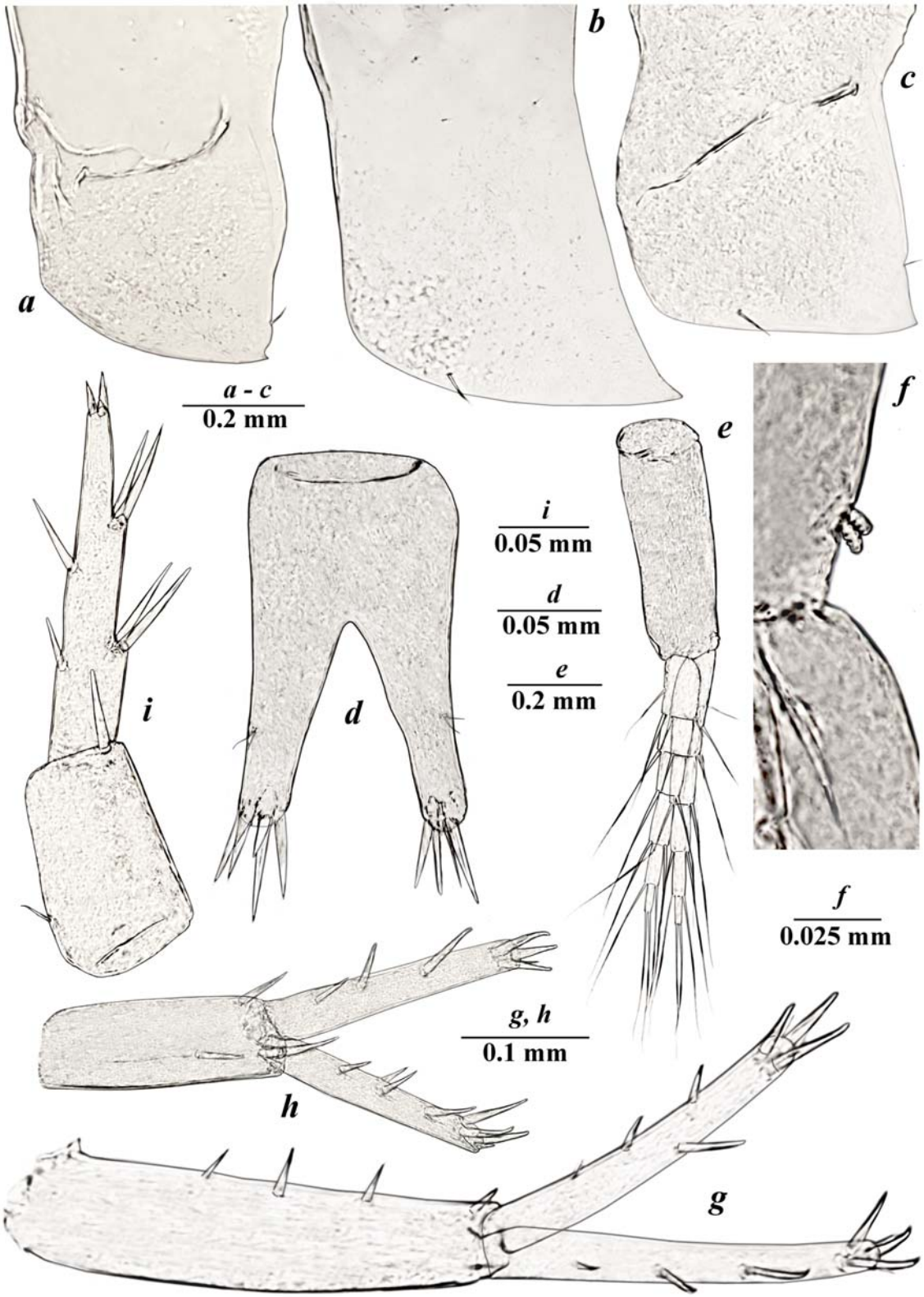

Fig. 5. *Diasynurella kiwi* Marin et Palatov sp.n., Russia, Rostov Oblast', Rostov-on-Don: *a* — epimeral plate I; *b* — epimeral plate II; *c* — epimeral plate III; *d* — telson; *e* — pleopod III; *f* — hooks of retinacula of pleopod II; *g* — uropod I; *h* — uropod II; *i* — uropod III.

Рис. 5. *Diasynurella kiwi* Marin et Palatov sp.n., Россия, Ростовская область, Ростов-на-Дону: *a* — эпимеральная пластинка I; *b* — эпимеральная пластинка II; *c* — эпимеральная пластинка III; *d* — тельсон; *e* — плеопода III; *f* — крючки ретнакулы плеопод II; *g* — уропода I; *h* — уропода II; *i* — уропода III.

micity, and the inability of the crustacean to leave its spring or group of nearby springs ("island") and spread over long distances (flightless). Thus, the inability to fly (escape) to another place closer these crustaceans to kiwi birds, and we would like to keep this name for one of the species of the genus *Diasynurella*.

DESCRIPTION. Female. Body (Fig. 1): moderately stout; largest collected ♀ has bl. 3.0 mm. Head with wide rounded and little concave anteroventral lobe (Fig. 11*b*).

Antenna I (Fig. 2*a*) about 55% of body length, about 2.1X longer than antenna II; primary flagellum with 13 segments, with aesthetascs on distal segments; accessory flagellum 2-segmented, distal segment about 3.1X shorter than basal one (Fig. 2*b*).

Antenna II (Fig. 2*c*): gland clone distinct, distally pointed; peduncle about 2.0–2.3X longer than flagellum, with robust setae tightly covering segments III–IV; peduncle of segment IV about 1.1X longer than segment V; flagellum 5-segmented.

Mandible (Fig. 3*c–f*): left mandible (Fig. 3*c, d*) incisor 5-dentate, *lacinia mobilis* 5-dentate, with 3–4 robust plumose accessory setae; molar process with single seta. Right mandible (Fig. 3*e*, *f*) incisor 4-dentate, *lacinia mobilis* toothed, triturative, lobes with numerous protuberances; underlying with row of three robust plumose setae; molar process similar to left mandible. Palp 3-segmented, segment II with four–seven setae; segment III about 2.5X longer than wide, with seven–eight separate D-setae, single C-seta, single B-seta and three–four separate E-setae (Fig. 3*c, e*).

Labrum (upper lip) (Fig. 3*a*): oval, apical margin with numerous small fine setae.

Labium (lower lip) (Fig. 3*b*): inner lobes feebly developed.

Lateralia with eight strong pectinate setae.

Maxilla I (Fig. 3*g*): inner plate with four plumose marginal setae, outer plate with seven apical comb-spines; palp 2-segmented, distal segment pubescent, about 3X of basal segment, apical margin of distal segment with seven simple setae.

Maxilla II (Fig. 3*h*): inner and outer plates covered in pubescent setae, subequal in length; outer plate weakly narrowing distally, with nine apical setae; inner plate narrowing explicitly distally, with group of dense short setae on apex, with oblique row of two short plumose setae.

Maxilliped (Fig. 3*i*): inner plate much shorter than outer plate, with four spines and single simple seta apically, and two–three simple setae laterally; outer plate narrow, with row of 12–14 medial stiff simple setae of different length; palp quadriarticulate, article I with two simple setae on inner margin, article II with row of 13–15 simple setae on inner margin and without setae on outer margin, article III subquadrate; dactylus with single seta on outer margin and without setae at inner margin, nail long, slender, with two thin setae at hinge.

Gnathopod I (Fig. 2*d*, *e*): smaller than GnII; coxal plate suboval, slightly narrowing distally, with rounded corners and with four apical and numerous facial setae, width/depth ratio 0.66–0.67/1; basis width/length ratio is 0.38/1, without setae on anterior margin, two long setae on inner face and three–five long setae on posterior margin; merus with eight–nine distal setae; carpus is 0.53X of basis and subequal of propodus in length, with six–eight serrated setae in inner margin and three simple setae in outer margin; propodus 1.5X longer than broad, with one–three simple setae in anterior margin and five serrated single setae in posterior margin; distal margin of palm (Fig. 2*e*) almost straight, slightly oblique, with double row of four inner and three outer robust setae; palmar groove (depression) feebly developed, with two inner and two outer robust setae; dactylus with single outer seta.

Gnathopod II (Fig. 2*f*, *g*): coxal plate sub-rectangular or subovate, with four apical and numerous facial setae, width/depth ratios is 0.6/1; basis width/length ratio is 0.3/1, with several (two–three) long setae inserted along posterior margin and with two long simple setae in anterior margin; ischium with single short simple seta; merus with four distal setae; carpus is 0.62X of length of basis and 0.96X of propodus, with two anterior simple setae and three groups of plumose posterior setae; propodus 2.4X longer than broad, with single simple anterior seta, four superior medial, three inferior medial and four groups of posterior setae; palm oblique with double row of four inner and three outer robust setae of different size; palm groove (depression) feebly developed, palmar corner (Fig. 2*g*) with two strong palmar spiniform setae, single supporting spiniform seta on inner surface; dactylus with single seta along anterior margin and few short setae along inner margin.

Pereopod III (Fig. 4*a*): coxal plate oval or subrectangular, with three apical and numerous facial setae, width/depth ratio is 0.6/1; basis about 4.5X as long as wide, with long anterior and posterior simple setae; merus about 0.65X of basis, about 1.70X of carpus and about 1.12X of propodus in length; carpus about 0.66X of propodus in length; dactylus (Fig. 4*b*) about 0.40X of propodus, with single plumose seta on outer margin and single additional spine accompanying with seta along ventral margin.

Pereopod IV (Fig. 4*c*): subequal to PIII in length; coxal plate expanded and broadly convex distally, posterior margin with shallow excavation, distal margin with eight–nine apical short setae and numerous facial setae, width/depth ratio is 0.94/1; basis about 4.6X as long as wide, with long anterior and posterior simple setae; merus about 0.63X of basis, about 1.67X of carpus and about 1.05X of propodus in length; carpus about 0.63X of propodus in length; dactylus (Fig. 4*d*) about 0.36X of propodus, with plumose seta on outer margin and single additional spine accompanying with seta along ventral margin.

Pereopods V, VI, VII with length ratio 1/1.20/1.26.

Pereopod V (Fig. 4*e*): coxal plate large, bilobate, with distinct anterior and posterior lobes; posterior and anterior lobes with 1 margin simple seta each, with numerous facial setae; basis about 1.60X as long as wide, with numerous facial setae, posterior margin slightly convex, armed with 6 shallow serrations, with distinct distal corner, anterior margin with five split-tipped robust and four distal setae; merus about 0.63X of basis, 0.75X of carpus and 0.90X of propodus in length; dactylus (Fig. 4*f*) approximately 0.44X of propodus, with single plumose seta on outer margin and 1 additional spine accompanying with seta along ventral margin.

Pereopod VI (Fig. 4*g*): coxal plate bilobate, with distinct posterior and vestigial anterior lobes; anterior lobe without setae, posterior lobe with single margin seta, each with numerous facial setae; basis about 1.60X as long as wide, with numerous facial setae, posterior margin convex, armed with five shallow serrations, anterior margin with five split-tipped robust and three distal setae; merus about 0.70X of basis, 0.83X of carpus and 0.82X of propodus in length; dactylus (Fig. 4*h*) approximately 0.41X of propodus, with single plumose seta on outer margin and single additional spine accompanying with seta along ventral margin.

Pereopod VII (Fig. 4*i*): coxal plate small, semi-lunar, with single posterior seta; basis about 1.56X as long as wide, with numerous facial setae, posterior margin convex, armed with eight serrated setae, with distal corner; anterior margin with four split-tipped robust and three distal setae; merus about 0.57X of basis, about 0.90X of carpus and about 0.89X of propodus in length; dactylus (Fig. 4*j*) approximately 0.43X of propodus in length, with single plumose seta on outer margin and single additional spine accompanying with single seta along ventral margin.

Gills, brood plates (Fig. 4): coxal gills on somites II–VI, somites V–VIII with lanceolate sternal gill on each. Coxal gills of pereiopods II–VI ovoid, gills/bases ratios are 0.83/1, 0.72/1, 0.58/1, 0.41/1 and 0.45/1, respectively.

Pleopods (Fig. 5*e*): pleopod I peduncle with two coupling hooks in retinacula, without lateral setae; outer and inner rami with six and seven segments, respectively; basal segment of outer ramus with single clothes-pin seta. Pleopods II–III with peduncle bearing two coupling hooks in retinacula (Fig. 5*f*), without setae; outer and inner rami with six segments; basal segment of outer ramus with single clothes-pin seta.

Epimera. Epimeral plate I (Fig. 5*a*) weakly produced distally, almost straight, pointed, ventral margin with one spine, posterior margin convex, with singlee seta. Epimeral plate II (Fig. 5*b*) distally produced and sharply pointed, ventral margin armed with single spine, posterior margin oblique, without setae. Epimeral plate III (Fig. 5*c*) weakly produced distally, almost straight, and slightly pointed, ventral margin armed with single spine, posterior margin slightly convex, with single seta.

Urosomites completely free (Figs 1, 11*a*).

Uropod I (Fig. 5*g*): peduncle about 4.3X as long as wide, with dorsoexternal row of three thin short spines and single subdistal short spine; exopodite subequal of endopodite in length; endopodite not paddle-like, with three dorsal, single ventrolateral and five apical spines; exopodite with three dorsal and five apical spines.

Uropod II (Fig. 5*h*): peduncle about 2.7X as long as wide, subequal of endopodite in length, with three short dorsoexternal spines; exopodite about 0.9X of endopodite in length, with four dorsal and five apical robust spines; endopodite with three dorsal and five apical robust spines.

Uropod III (Fig. 5*i*): uniramous, peduncle cone-shaped, about 1.6X as long as wide, without terminal "pointed knob" and single simple seta on lateral margin and single spine on apical margin; peduncle about 0.6X of ramus in length; inner margin of ramus armed with two single spines, outer margin of ramus armed of two groups of spines with two spines each, apical margin armed with three spines.

Telson (Fig. 5*d*): clearly expanding distally, with narrow lobes, elongate, 0.57X as long as broad, significantly shorter as uropod III; apical margin cleft about 0.65X of total length; with five apical spines and two additional submarginal plumose setae on each lobe.

REMARKS. Sexual dimorphism is feebly marked; males are slightly smaller in size (Fig. 1); with small and elongated calceoli on peduncle and flagellum of antenna II; and slightly elongated plam of gnathopods I–II.

COLORATION. The body and appendages unpigmented, without well-developed pigmented eyes.

GENBANK ACCESSION NUMBERS. OQ533591, OQ533592.

TAXONOMIC REMARKS. Most phylogenetically basal and morphologically distinct species within the genus. *Diasynurella kiwi* Marin et Palatov sp.n. can be clearly separated from all other species of the genus *Diasynurella*, by the following features: 1) all urosomites completely free vs. urosomites II–III fused in other species; 2) uropod III is much longer than telson vs. uropod III is subequal to telson in length or shorter; 3) inner plate of maxilla I with four plumose marginal setae vs. inner plate of maxilla I with two plumose marginal setae; 4) telson clearly expanding distally, with narrow lobes vs. telson subrectangular, with wide lobes.

DISTRIBUTION AND ECOLOGY. Currently, the species is known only from single spring on the slope of the Kiziterinka River in the Proletarskiy district (Nakhichevan) within the borders of the city of Rostov-on-Don. We assume that the species may live in other nearby springs, which apparently have one pool of catchment. At the same time, the collecting this species is rather difficult due to its very small size (about 2.5–3 mm of body length for adults), as well as habitat in the thickness of pebbles covering the bottom of springs and wells. Other stygobiotic amphipods found in the same spring are *Synurella odessana* (Martynov, 1919) and undescribed species of the genus *Niphargus* Schiödte, 1849 (Niphargidae) [Marin, Palatov, in press].

Diasynurella dzhamirzoevi Palatov et Marin **sp.n.**
Figs 6–11.

MATERIAL EXAMINED. Holotype ♀ (bl. 4.0 mm), ZMMU Mb-1250, Russian Federation, Samur-Divichi lowland, Dagestan, Magaramkent district, Samur forest, about –1 m a.s.l., 41°50′35.5″N, 48°33′31.2″E, in small forest spring, hand net sampling, 31 December 2021, coll. D. Palatov. Paratypes 2♀♀ (bl. 4.0 mm), ZMMU Mb-1251, same locality and data as for holotype.

Additional material: 2♀♀, LEMMI, same locality and data as for holotype.

ETYMOLOGY. The species is named after the famous Dagestan scientist Dr. Gadzhibek S. Dzhamirzoev ("Dagestansky" State Natural Reserve).

DESCRIPTION. Female. Body (Fig. 6): moderately stout; largest collected ♀ has bl. 4.5 mm. Head with wide rounded and little concave or straight anteroventral lobe (Figs 7*a*, 11*d*).

Antenna I (Fig. 7*a*) about 55% of body length, about 2.0X longer than antenna II; primary flagellum with thirteen segments, with aesthetascs on distal segments; accessory flagellum 2-segmented, distal segment about 3.0X shorter than basal one (Fig. 7*b*).

Antenna II (Fig. 7*c*): gland clone distinct, distally pointed; peduncle about 2.0–2.3X longer than flagellum, with robust setae tightly covering segments III and IV; peduncle of segment IV about 1.1–1.2X longer than segment V; flagellum 6-segmented.

Mandible (Fig. 8*c–f*): left mandible (Fig. 8*c*, *d*) incisor 5-dentate, *lacinia mobilis* 5-dentate, with three robust plumose accessory setae; molar process with single seta. Right mandible (Fig. 8*e*, *f*) incisor 4-dentate, *lacinia mobilis* toothed, triturative, lobes with numerous protuberances; underlying with row of three robust plumose setae; molar process similar to left mandible. Palp 3-segmented, segment II with six–seven setae; segment III about 3.2–3.5X longer than wide, with seven–eight separate D-setae, single B-seta and four separate E-setae (Fig. 8*c*, *e*).

Labrum (upper lip) (Fig. 8*a*): oval, apical margin with numerous small fine setae.

Labium (lower lip) (Fig. 8*b*): inner lobes feebly developed.

Lateralia with 8 strong pectinate setae.

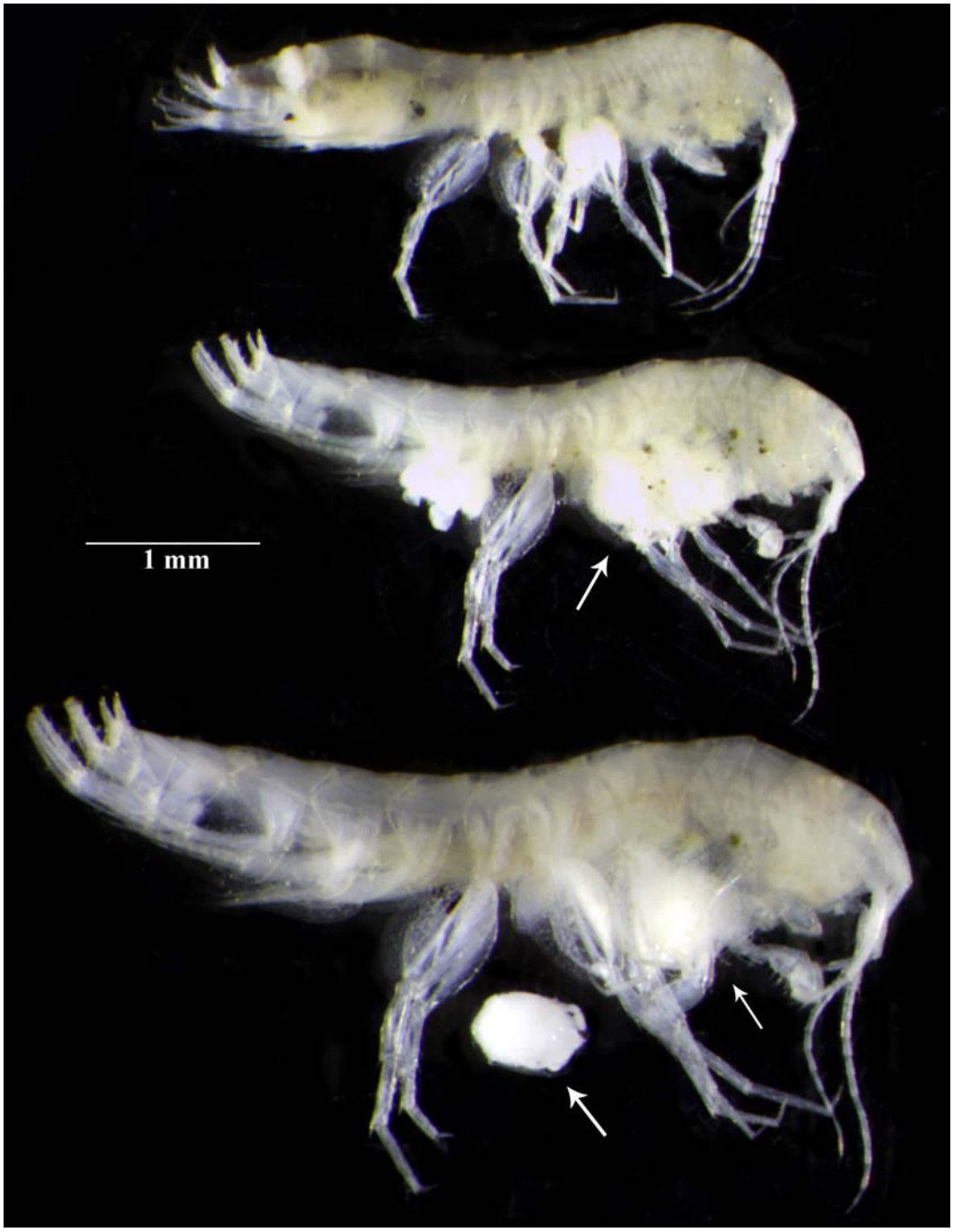

Fig. 6. *Diasynurella dzhamirzoevi* Palatov et Marin sp.n., Russia, Dagestan, Magaramkent district, Samur forest: general view of freshly fixed specimens. The arrows indicate eggs.

Рис. 6. *Diasynurella dzhamirzoevi* Palatov et Marin sp.n., Россия, Дагестан, Магарамкентский район, Самурский лес: общий вид свежефиксированных образцов. Стрелки указывают на яйцо.

Maxilla I (Fig. 8*g*): inner plate with two plumose marginal setae, outer plate with seven apical comb-spines; palp 2-segmented, distal segment pubescent, about 3X of basal segment, apical margin of distal segment with nine simple setae.

Maxilla II (Fig. 8*h*): inner and outer plates covered in pubescent setae, subequal in length; outer plate weakly narrowing distally, with eleven apical setae; inner plate narrowing explicitly distally, with group of dense short setae on apex, with oblique row of short plumose setae.

Maxilliped (Fig. 8*i*): inner plate much shorter than outer plate, with four spines and single simple seta apically, and 2–3 simple setae laterally; outer plate narrow, with row of 15–16 medial stiff simple setae of different length; palp quadriarticulate, article I with two simple setae on inner margin, article II with row of 16–18 simple setae on inner

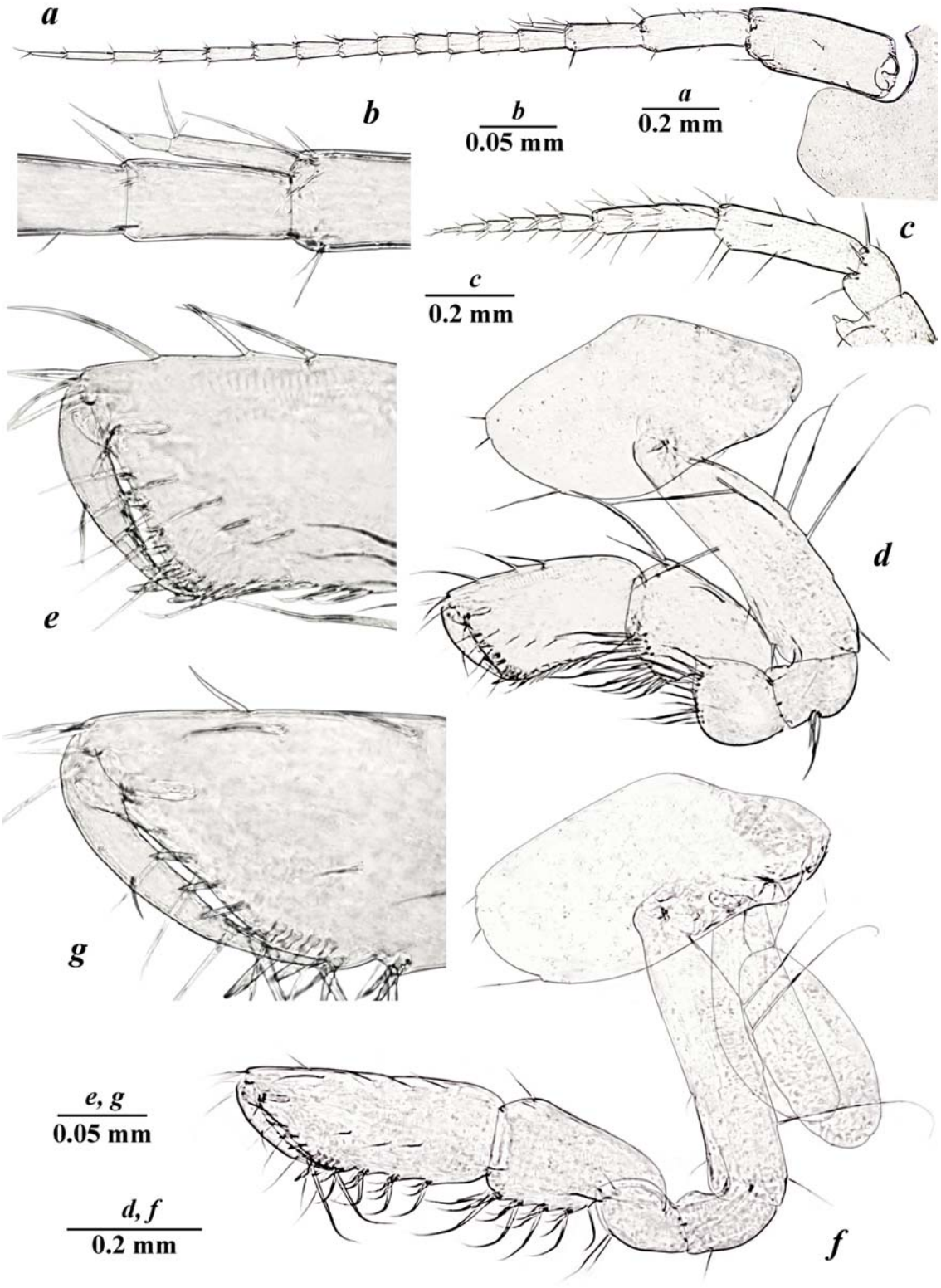

Fig. 7. *Diasynurella dzhamirzoevi* Palatov et Marin sp.n., Russia, Dagestan, Magaramkent district, Samur forest: *a* — antenna I; *b* — accessory flagellum of antenna I; *c* — antenna II; *d* — gnathopod I; *e* — distoventral palmar margin of chela of GnI; *f* — gnathopod II; *g* — distoventral palmar margin of chela of GnII.

Рис. 7. *Diasynurella dzhamirzoevi* Palatov et Marin sp.n., Россия, Дагестан, Магарамкентский район, Самурский лес: *a* — антенна I; *b* — вспомогательный жгутик антенны I; *c* — антенна II; *d* — гнатопода I; *e* — дистовентральный край клешни GnI; *f* — гнатопода II; *g* — дистовентральный край клешни GnII.

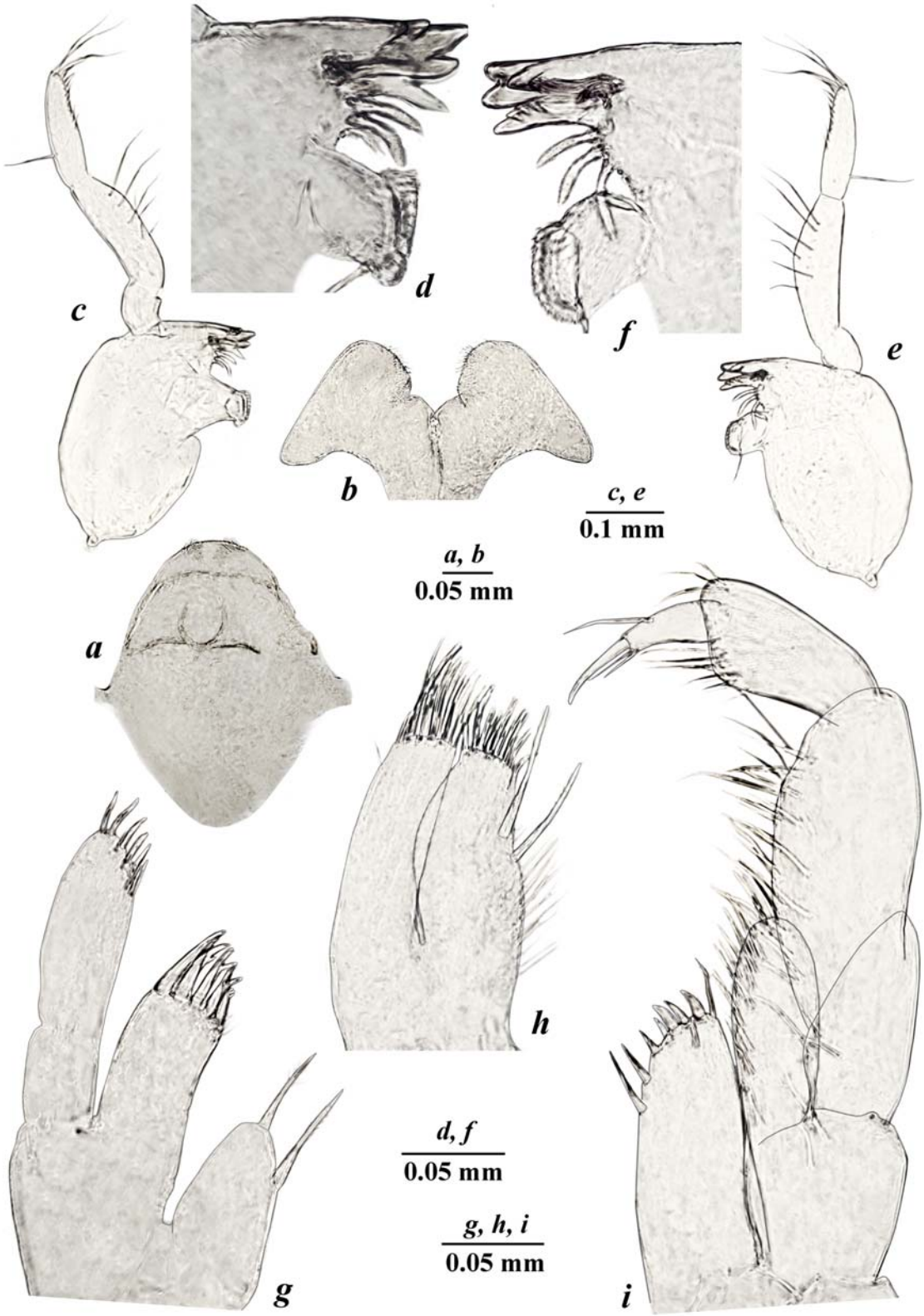

Fig. 8. *Diasynurella dzhamirzoevi* Palatov et Marin sp.n., Russia, Dagestan, Magaramkent district, Samur forest: *a* — labrum (upper lip); *b* — labium (lower lip); *c* — left mandible; *d* — same, incisor process and pars incisiva; *e* — right mandible; *f* — same, incisor process and pars incisiva; *g* — maxilla I; *h* — maxilla II; *i* — maxilliped.

Рис. 8. *Diasynurella dzhamirzoevi* Palatov et Marin sp.n., Россия, Дагестан, Магарамкентский район, Самурский лес: *a* — верхняягуба; *b* — нижняя губа; *c* — левая мандибула; *d* — то же самое, резцовый отросток и pars incisiva; *e* — правая мандибула; *f* — то же самое, резцовый отросток и pars incisiva; *g* — максилла I; *h* — максилла II; *i* — максиллипед.

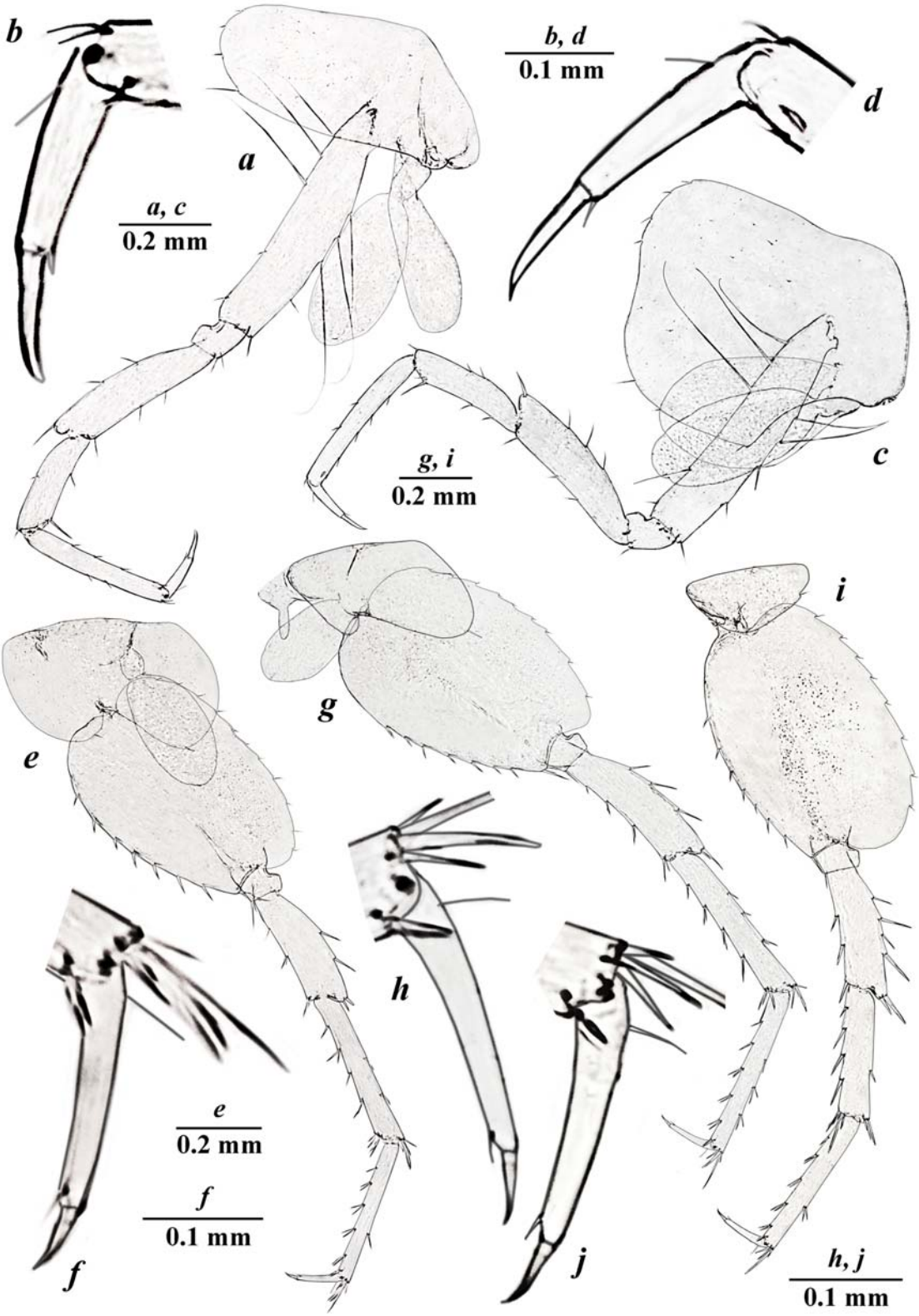

Fig. 9. *Diasynurella dzhamirzoevi* Palatov et Marin sp.n., Russia, Dagestan, Magaramkent district, Samur forest: *a* — pereopod III; *b* — dactylus of PIII; *c* — pereopod IV; *d* — dactylus of PIV; *e* — pereopod V; *f* — dactylus of PV; *g* — pereopod VI; *h* — dactylus of PVI; *i* — pereopod VII; *j* — dactylus of PVII.

Рис. 9. *Diasynurella dzhamirzoevi* Palatov et Marin sp.n., Россия, Дагестан, Магарамкентский район, Самурский лес: *a* — переопода III; *b* — дактилус PIII; *c* — переопода IV; *d* — дактилус PIV; *e* — переопода V; *f* — дактилус PV; *g* — переопода VI; *h* — дактилус PVI; *I* — переопода VII; *j* — дактилус PVII.

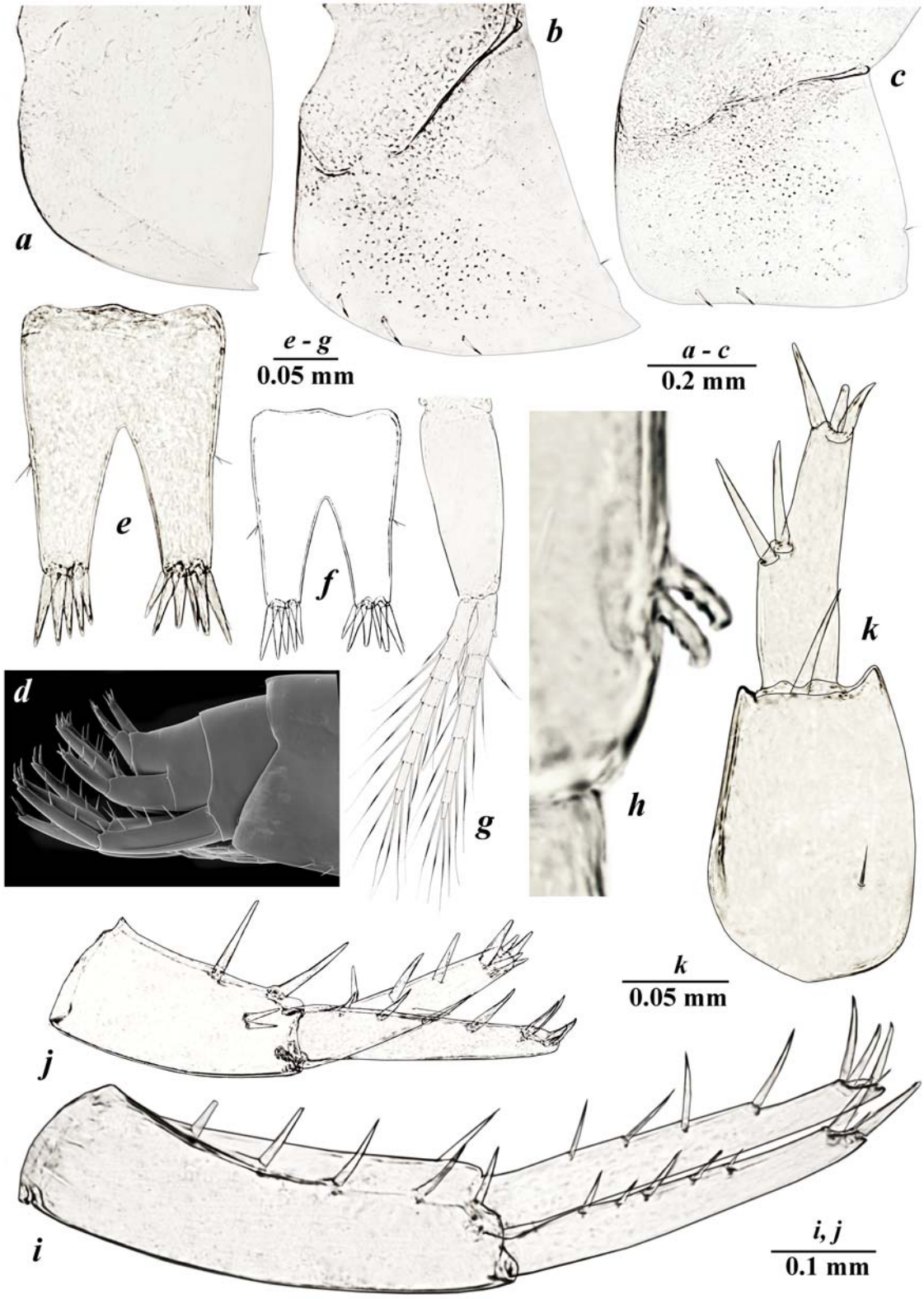

Fig. 10. *Diasynurella dzhamirzoevi* Palatov et Marin sp.n., Russia, Dagestan, Magaramkent district, Samur forest: *a* — epimeral plate I; *b* — epimeral plate II; *c* — epimeral plate III; *d* — urosomal segments, lateral view; *e, f* — telson; *g* — pleopod III; *h* — hooks of retinacula of pleopod II; *i* — uropod I; *j* — uropod II; *k* — uropod III.

Рис. 10. *Diasynurella dzhamirzoevi* Palatov et Marin sp.n., Россия, Дагестан, Магарамкентский район, Самурский лес: *a* — эпимеральная пластинка I; *b* — эпимеральная пластинка II; *c* — эпимеральная пластинка III; *d* — уросомальные сегменты, вид сбоку; *e, f* — тельсон; *g* — плеопода III; *h* — крючки ретинакулы плеоподы II; *i* — уропода I; *j* — уропода II; *k* — уропода III.

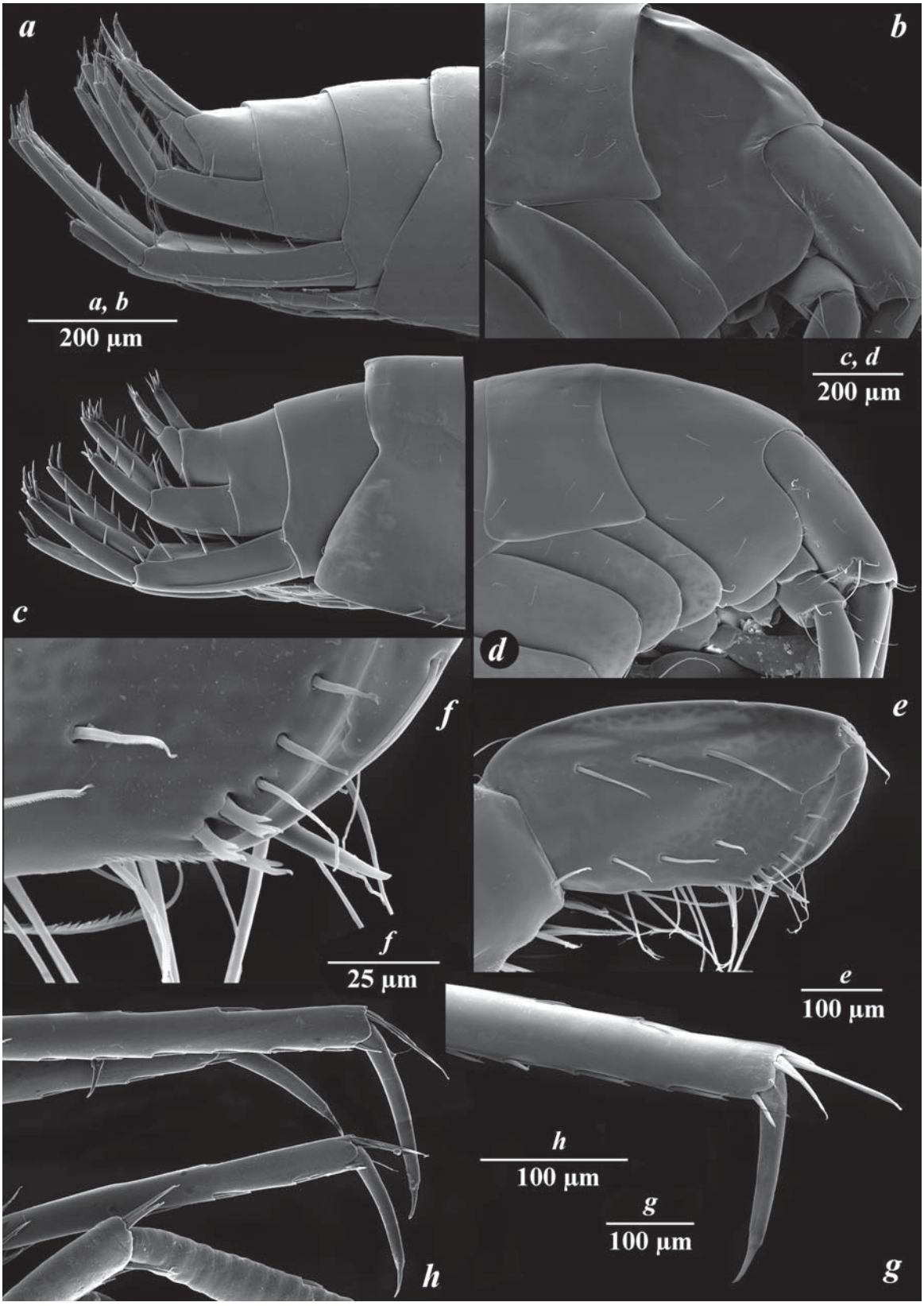

Fig. 11. *Diasynurella kiwi* Marin et Palatov sp.n. (*a, b, h*) and *D. dzhamirzoevi* Palatov et Marin sp.n. (*c–g*): *a*, *c* — urosomal segments, lateral view; *b*, *d* — head; *e* — gnathopod I; *f* — chela of gnathopod I; *g, h* — dactyli of ambulatory pereiopods (legs).

Рис. 11. *Diasynurella kiwi* Marin et Palatov sp.n. (*a, b, h*) и *D. dzhamirzoevi* Palatov et Marin sp.n. (*c–g*): *a*, *c* — уросомальные сегменты, вид сбоку; *b*, *d* — голова; *e* — гнатопод I; *f* — клешня гнатоподы I; *g, h* — дактилусы амбулаторных переопод (ног).

margin and without setae on outer margin, article III subquadrate; dactylus with single seta on outer margin and without setae at inner margin, nail long, slender, with one–two thin setae at hinge.

Gnathopod I (Fig. 7*d*, *e*): smaller than GnII; coxal plate subtrapezoidal or suboval, slightly narrowing distally, with rounded corners and with three apical and numerous facial setae, width/depth ratio 0.67–0.69/1; basis width/length ratio is 0.31/1, with single long and two short setae on anterior margin, two long setae on inner face and four long setae on posterior margin; merus with 10–11 distal setae; carpus is 0.55X of basis and 0.80X of propodus in length, with ten serrated setae in inner margin and three simple setae in outer margin; propodus 1.86X longer than broad, with four simple setae in anterior margin and seven serrated single setae in posterior margin; distal margin of palm (Fig. 7*e*) distinctly or slightly oblique, with double row of four inner and three outer robust setae; palmar groove (depression) feebly developed, with four inner and three outer robust setae; dactylus with single outer seta.

Gnathopod II (Fig. 7*f*, *g*): coxal plate subovate, with three apical and numerous facial setae, width/depth ratios is 0.6/1; basis width/length ratio is 0.27/1, with several (three–four) long setae inserted along posterior margin and with two short simple setae in anterior margin; ischium with single short simple seta; merus with three–four distal setae; carpus is 0.62X of length of basis and 0.70X of propodus, with two anterior simple setae and four groups of plumose posterior setae; propodus 2.8X longer than broad, with single simple anterior seta, three–four superior medial, four inferior medial and four groups of posterior setae; palm distinctly oblique with double row of four inner and five outer spiniform setae of different size; palm groove (depression) feebly developed, palmar corner (Fig. 7*g*) with three strong palmar spiniform setae, four supporting bifurcate setae on inner surface; dactylus with single seta along anterior margin and few short setae along inner margin.

Pereopod III (Fig. 9*a*): coxal plate oval or sub-rectangular, with four apical and numerous facial setae, width/depth ratio is 0.5/1; basis about 4.7X as long as wide, with long anterior and posterior simple setae; merus about 0.67X of basis, about 1.52X of carpus and about 1.13X of propodus in length; carpus about 0.74X of propodus in length; dactylus (Fig. 9*b*) about 0.37X of propodus, with single plumose seta on outer margin and single additional spine accompanying with single seta along ventral margin.

Pereopod IV (Fig. 9*c*): subequal to PIII in length; coxal plate expanded and broadly convex distally, posterior margin with shallow excavation, distal margin with seven apical short setae and numerous facial setae, width/depth ratio is 0.86/1; basis about 5.0X as long as wide, with long anterior and posterior simple setae; merus about 0.64X of basis, about 1.36X of carpus and about 1.04X of propodus in length; carpus about 0.77X of propodus in length; dactylus (Fig. 9*d*) about 0.42X of propodus, with single plumose seta on outer margin and single additional spine accompanying with single seta along ventral margin.

Pereopods V, VI, VII with length ratio 1/1.17/1.04.

Pereopod V (Fig. 9*e*): coxal plate large, bilobate, with distinct anterior and posterior lobes; posterior and anterior lobes with single marginal simple seta each, with numerous facial setae; basis about 1.48X as long as wide, with numerous facial setae, posterior margin slightly convex, armed with 11 shallow serrations, with distinct distal corner, anterior margin with seven split-tipped robust and four distal setae; merus about 0.63X of basis, 0.91X of carpus and subequal of propodus in length; dactylus (Fig. 9*f*) approximately 0.40X of propodus, with single plumose seta on outer margin and single additional spine accompanying with single seta along ventral margin.

Pereopod VI (Fig. 9*g*): coxal plate bilobate, with distinct posterior and vestigial anterior lobes; anterior lobe without setae, posterior lobe with single margin seta, each with numerous facial setae; basis about 1.49X as long as wide, with numerous facial setae, posterior margin convex, armed with nine shallow serrations, anterior margin with seven tipped robust and three distal setae; merus about 0.66X of basis, 0.92X of carpus and 0.94X of propodus in length; dactylus (Fig. 9*h*) approximately 0.38X of propodus, with single plumose seta on outer margin and an additional spine accompanying with single seta along ventral margin.

Pereopod VII (Fig. 9*i*): coxal plate small, semi-lunar, with single posterior seta; basis about 1.56X as long as wide, with numerous facial setae, posterior margin convex, armed with eight serrated setae, with distal corner; anterior margin with seven split-tipped robust and three distal setae; merus about 0.66X of basis, about 1.28X of carpus and about 1.10X of propodus in length; dactylus (Fig. 9*j*) approximately 0.40X of propodus in length, with single plumose seta on outer margin and an additional spine accompanying with single seta along ventral margin.

Gills, brood plates (Fig. 9): coxal gills on somites II–VI, somites V–VIII with lanceolate sternal gill on each. Coxal gills of pereopods II–VI ovoid, gills/bases ratios are 0.73/1, 0.64/1, 0.67/1, 0.55/1 and 0.43/1, respectively.

Pleopods (Fig. 10*g*): pleopods I–II with peduncles bearing two coupling hooks in retinacula (Fig. 10*h*), without lateral setae; outer and inner rami with seven and eight segments, respectively; basal segments of outer ramus with single clothes-pin seta. Pleopod III peduncle with two coupling hooks in retinacula, without setae; outer and inner rami with six and seven segments, respectively; basal segment of outer ramus with single clothes-pin seta.

Epimera. Epimeral plate I (Fig. 10*a*) weakly produced distally, almost straight, pointed, ventral margin without spines, posterior margin convex, with single seta. Epimeral plate II (Fig. 10*b*) distally produced and sharply pointed, ventral margin armed with three spines, posterior margin oblique, with single seta. Epimeral plate III (Fig. 10*c*) subtrapezoidal, blunted distally, ventral margin armed with two spines, posterior margin slightly oblique, with singleseta.

Urosomites fused partially: Urosomite I completely free, urosomites II and III fused, with distinct suture (Fig. 10*d*).

Uropod I (Fig. 10*i*): peduncle about 3.5X as long as wide, with dorsoexternal row of four short spines, 1 subdistal short spine and single dorsointernal spine; exopodite about 0.9X of endopodite in length; endopodite not paddle-like, with four dorsal and five apical spines; exopodite with five short dorsal and five apical spines.

Uropod II (Fig. 10*j*): peduncle about 2.1X as long as wide, subequal of endopodite in length, with two long dorsoexternal spines; exopodite about 0.88X of endopodite in length, with three dorsal and five apical robust spines; endopodite with four dorsal and five apical robust spines.

Uropod III (Fig. 10*k*): uniramous, peduncle cone-shaped, about 1.2X as long as wide, with rudimentary terminal "knob", single simple seta on lateral margin and single spine on apical margin; peduncle about 1.1X of ramus in length; inner margin of ramus without spines, outer margin of ramus

armed of single group of spines with two spines, apical margin armed with three spines.

Telson (Fig. 10*e*, *f*): slightly narrowing distally, elongate, 0.75X as long as broad, slightly shorter as uropod III; apical margin cleft about 0.55X of total length; with five–six apical spines and two additional submarginal plumose setae on each lobe.

COLORATION. The body and appendages unpigmented, without well-developed pigmented eyes.

GENBANK ACCESSION NUMBERS. OQ534007, OQ534008.

TAXONOMIC REMARKS. The species can be most easily separated from *D. waschuschtii* by the following features: 1) apical margin cleft of telson is more than half of its total length (Fig. 10*e*, *f*) vs. apical margin cleft of telson is clearly less than half of its total length [Behning, 1940: fig. 17o]; 2) ramus and peduncle of uropod III approximately equal in length (Fig. 10*k*) vs. ramus is significantly smaller than peduncle in length [Behning, 1940: fig. 17n]; 3) rami of uropod III with group of lateral spines (Fig. 10*k*) vs. rami of uropod III without lateral spines [Behning, 1940: fig. 17n].

The species can be most easily separated from *Diasynurella kiwi* Marin et Palatov sp.n., by the following features: urosomites II–III completely fused (Fig. 11*c*) vs. all urosomites completely free (Fig. 11*a*); 2) uropod III is subequal to telson in length (Fig. 11*c*) vs. uropod III is much longer than telson (Fig. 11*a*); 3) inner plate of maxilla I with two plumose marginal setae (Fig. 8*g*) vs. inner plate of maxilla I with four plumose marginal setae (Fig. 3*g*).

For the differences from *D. cavatica* Palatov et Marin sp.n. and *D. khalabensis* Palatov et Marin sp.n. see below.

DISTRIBUTION AND ECOLOGY. The species is known only from single spring located in the Samur forest, Dagestan (northwestern Hyrcania). It is possible that the species inhabit other nearby springs and groudwaters, however, like other species the genus, it is extremely difficult to detect due to its very small size and habitat in the bottom sediment.

Diasynurella cavatica Palatov et Marin **sp.n.**
Figs 12–15, 20.

MATERIAL EXAMINED. Holotype ♀ (bl. 4.0 mm), ZMMU Mb-1252, Southern slope of the Great Caucasian Ridge, Colchis lowland, Georgia, Samegrelo-Zemosvaneti, Garakha cave, 42°31′47.5″N, 42°10′39.2″E, about 200 m a.s.l., hand net sampling, 3 February 2017, coll. D. Palatov.

ETYMOLOGY. The species is named after its cave-dwelling lifestyle, which is currently unique for the genus.

DESCRIPTION. Female. Body: moderately stout, largest collected ♀ has bl. 4.0 mm. Head with wide rounded and little concave or straight anteroventral lobe (Fig. 20*b*).

Antenna I (Fig. 12*a*) about 55% of body length, about 2.2X longer than antenna II; primary flagellum with twelve segments, with aesthetascs on distal segments; accessory flagellum 2-segmented, distal segment about 2.0–4.4X shorter than basal one (Fig. 12*b*).

Antenna II (Fig. 12*c*): gland clone distinct, distally pointed; peduncle about 2.5X longer than flagellum, with robust setae tightly covering segments III and IV; peduncle of segment IV about 1.1–1.2X longer than segment V; flagellum 7-segmented.

Mandible (Fig. 13*d*–*g*): left mandible (Fig. 8*c, d*) incisor 5-dentate, *lacinia mobilis* 5-dentate, with three robust plumose accessory setae; molar process with a single seta. Right mandible (Fig. 8*e*, *f*) incisor 4-dentate, *lacinia mobilis* toothed, triturative, lobes with numerous protuberances; underlying with row of three robust plumose setae; molar process similar to left mandible. Palp 3-segmented, segment II with six–seven setae; segment III about 3.1–3.2X longer than wide, with seven–eight separate D-setae, single B-seta and four separate E-setae (Fig. 13*e, g*).

Labrum (upper lip) (Fig. 13*a*): oval, apical margin with numerous small fine setae.

Labium (lower lip) (Fig. 13*b*): inner lobes feebly developed.

Lateralia (Fig. 13*c*) with eight strong pectinate setae.

Maxilla I (Fig. 13*h*): inner plate with two plumose marginal setae, outer plate with seven apical comb-spines; palp 2-segmented, distal segment pubescent, about 3.0X of basal segment, apical margin of distal segment with seven simple setae.

Maxilla II (Fig. 13*i*): inner and outer plates covered in pubescent setae, subequal in length; outer plate weakly narrowing distally, with eleven apical setae; inner plate narrowing explicitly distally, with group of dense short setae on apex, with an oblique row of two short plumose setae.

Maxilliped (Fig. 13*j*): inner plate much shorter than outer plate, with four spines and single simple seta apically, and two–three simple setae laterally; outer plate narrow, with row of 14–16 medial stiff simple setae of different length; palp quadriarticulate, article I with two simple setae on inner margin, article II with row of 16–18 simple setae on inner margin and without setae on outer margin, article III sub-quadrate; dactylus with single seta on outer margin and without setae at inner margin, nail long, slender, with one or two thin setae at hinge.

Gnathopod I (Fig. 12*d, e*): smaller than GnII; coxal plate subtrapezoidal or suboval, slightly narrowing distally, with rounded corners and with five apical and numerous facial setae, width/depth ratio 0.60/1; basis width/length ratio is 0.35/1, with two short setae on anterior margin, two long setae on inner face and four long setae on posterior margin; merus with nine–ten distal setae; carpus is 0.60X of basis and 0.87X of propodus in length, with ten serrated setae in inner margin and eight simple setae in outer margin; propodus 1.70X longer than broad, with four simple setae in anterior margin and nine serrated single setae in posterior margin; distal margin of palm (Fig. 12*e*) distinctly or slightly oblique, with double row of four inner and three outer robust setae; palmar groove (depression) feebly developed, with two inner and three outer robust setae; dactylus with single outer seta.

Gnathopod II (Fig. 12*f, g*): coxal plate subovate, with five apical and numerous facial setae, width/depth ratios is 0.55/1; basis width/length ratio is 0.30/1, with several (three–four) long setae inserted along posterior margin and with four short simple setae in anterior margin; ischium with single short simple seta; merus with three distal setae; carpus is 0.60X of length of basis and 0.82X of propodus, with five anterior simple setae and five groups of plumose posterior setae; propodus 2.4X longer than broad, with four simple anterior setae, five superior medial, four inferior medial and six groups of posterior setae; palm distinctly oblique with double row of five inner and six outer spiniform setae of different size; palm groove (depression) feebly developed, palmar corner (Fig. 12*g*) with three strong palmar spiniform setae, three supporting bifurcate setae on inner surface; dactylus with single seta along anterior margin and few short setae along inner margin.

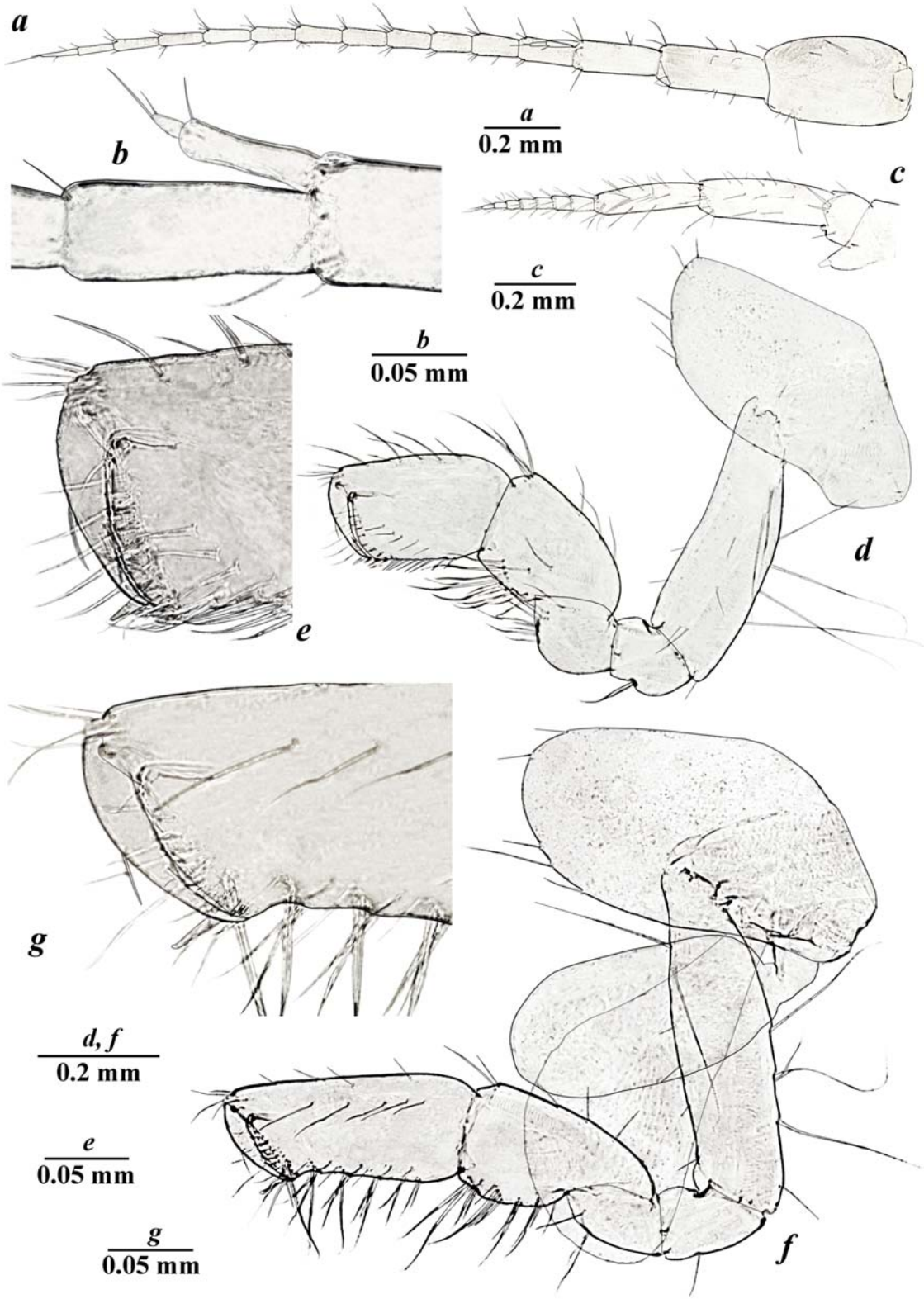

Fig. 12. *Diasynurella cavatica* Palatov et Marin sp.n., Georgia, Samegrelo-Zemosvaneti, Chkhorotsqu district, Garakha Cave: *a* — antenna I; *b* — accessory flagellum of antenna I; *c* — antenna II; *d* — gnathopod I; *e* — distoventral palmar margin of chela of GnI; *f* — gnathopod II; *g* — distoventral palmar margin of chela of GnII.

Рис. 12. *Diasynurella cavatica* Palatov et Marin sp.n., Грузия, Самегрело – Верхняя Сванетия, Чхороцкуский район, пещера Гараха: a — антенна I; *b* — вспомогательный жгутик антенны I; *c* — антенна II; *d* — гнатопода I; *e* — дистовентральный край ладони клешни GnI; *f* — гнатопода II; *g* — дистовентральный край ладони клешни GnII.

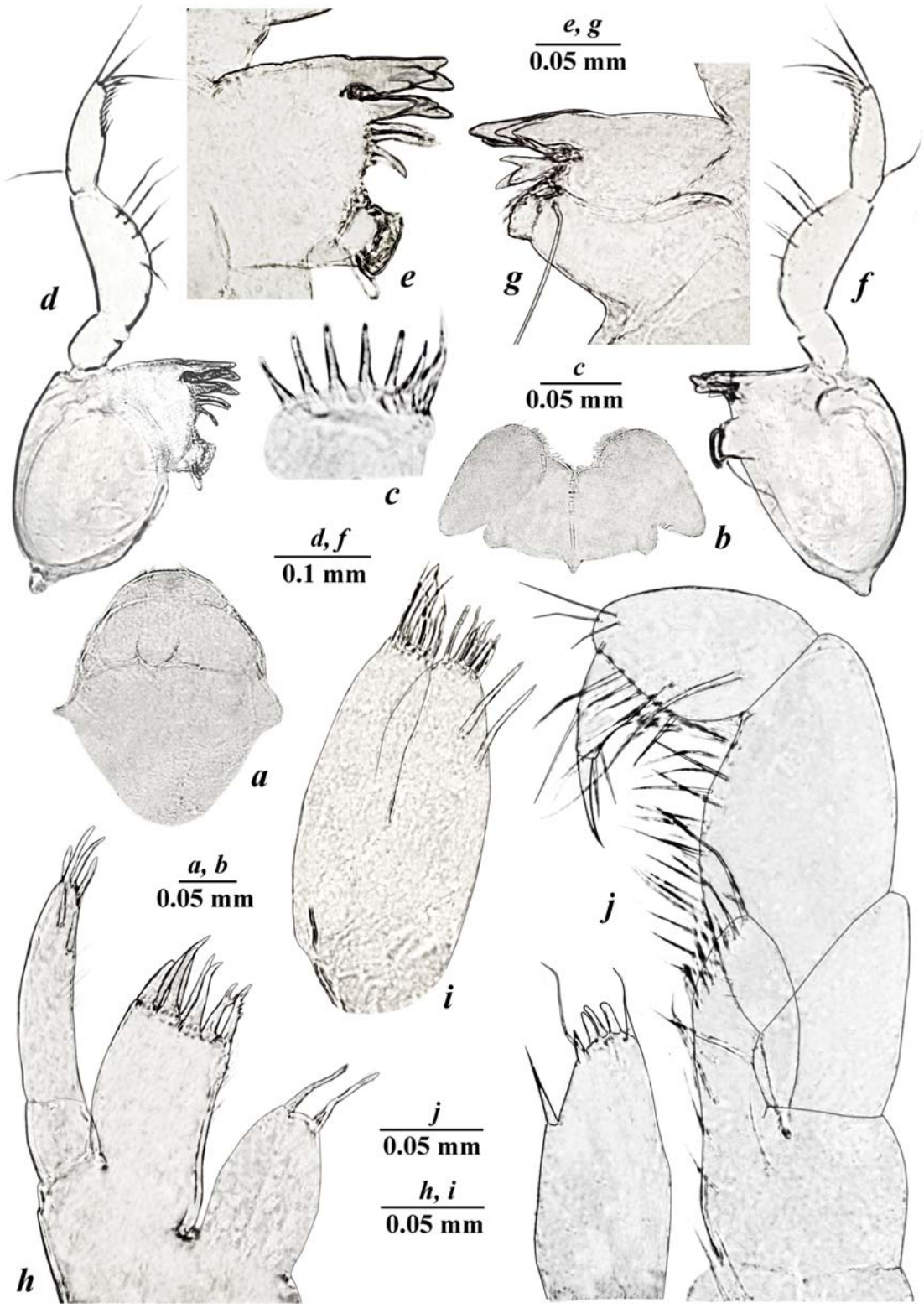

Fig. 13. *Diasynurella cavatica* Palatov et Marin sp.n., Georgia, Samegrelo-Zemosvaneti, Chkhorotsqu district, Garakha Cave: *a* — labrum (upper lip); *b* — labium (lower lip); *c* — lateralia; *d* — left mandible; *e* — same, incisor process and pars incisiva; *f* — right mandible; *g* — same, incisor process and pars incisiva; *h* — maxilla I; *i* — maxilla II; *j* — maxilliped.

Рис. 13. *Diasynurella cavatica* Palatov et Marin sp.n., Грузия, Самегрело – Верхняя Сванетия, Чхороцкуский район, пещера Гараха: *a* — верхняя губа; *b* — нижняя губа; *c* — латералия; *d* — левая мандибула; *e* — то же самое, резцовый отросток и pars incisiva; *f* — правая мандибула; *g* — то же самое, резцовый отросток и pars incisiva; *h* — максилла I; *i* — максилла II; *j* — максиллипеда.

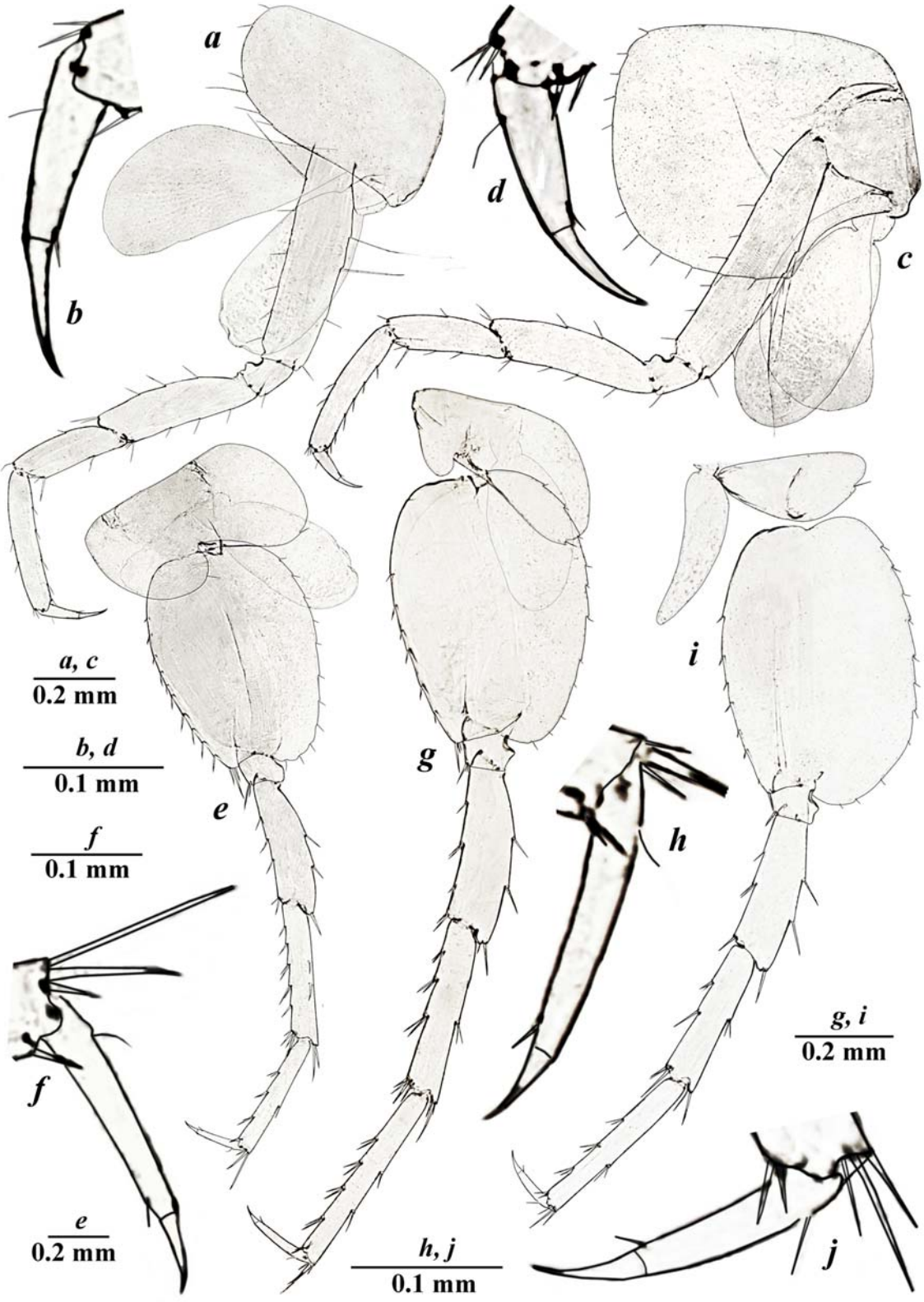

Fig. 14. *Diasynurella cavatica* Palatov et Marin sp.n., Georgia, Samegrelo-Zemosvaneti, Chkhorotsqu district, Garakha Cave: *a* — pereopod III; *b* — dactylus of PIII; *c* — pereopod IV; *d* — dactylus of PIV; *e* — pereopod V; *f* — dactylus of PV; *g* — pereopod VI; *h* — dactylus of PVI; *i* — pereopod VII; *j* — dactylus of PVII.

Рис. 14. *Diasynurella cavatica* Palatov et Marin sp.n., Грузия, Самегрело – Верхняя Сванетия, Чхороцкуский район, пещера Гараха: *a* — переопода III; *b* — дактилус PIII; *c* — переопода IV; *d* — дактилус PIV; *e* — переопода V; *f* — дактилус PV; *g* — переопод VI; *h* — дактилус PVI; *i* — переопода VII; *j* — дактилус PVII.

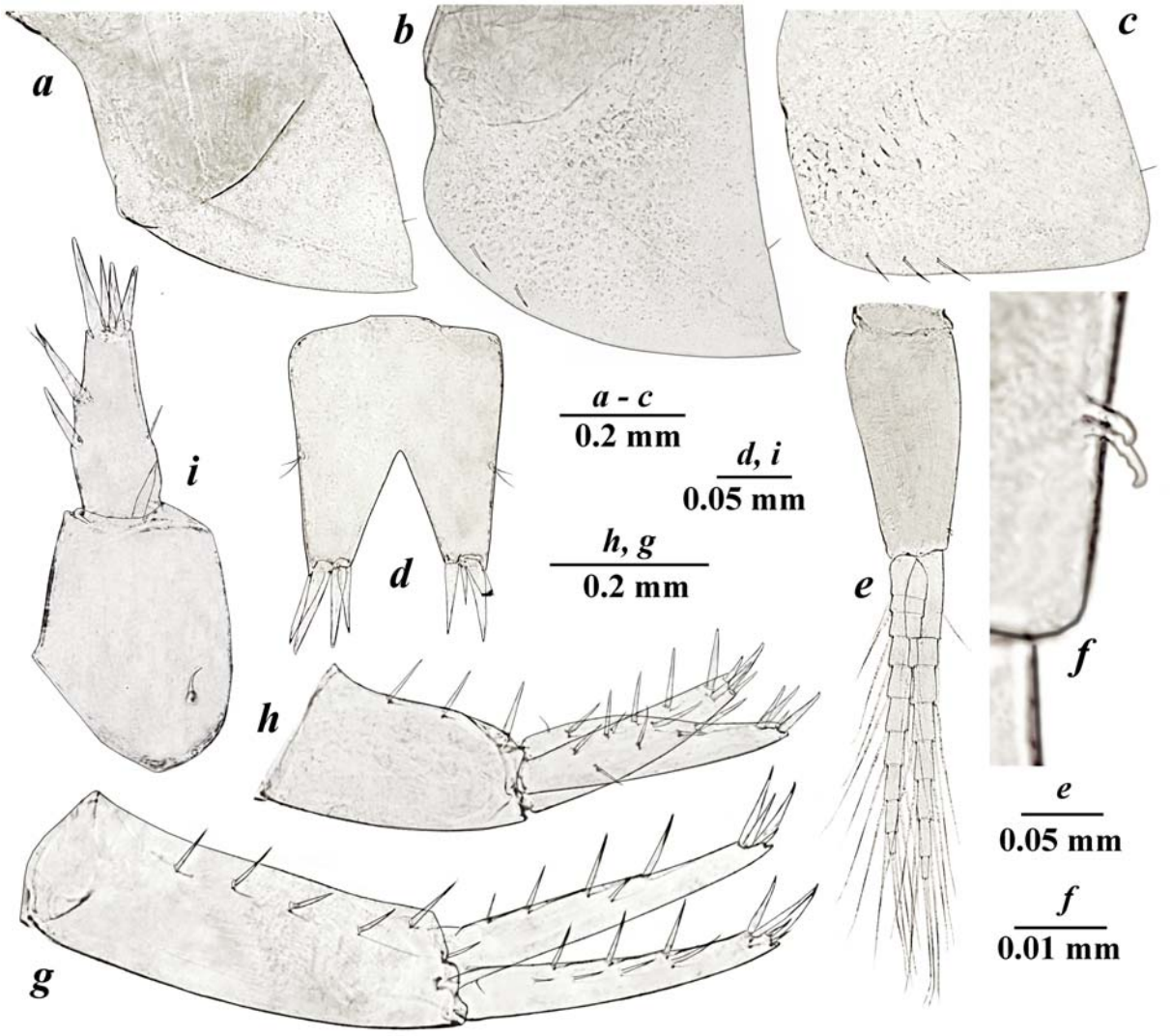

Fig. 15. *Diasynurella cavatica* Palatov et Marin sp.n., Georgia, Samegrelo-Zemosvaneti, Chkhorotsqu district, Garakha Cave: *a* — epimeral plate I; *b* — epimeral plate II; *c* — epimeral plate III; *d* — telson; *e* — pleopod III; *f* — hooks of retinacula of pleopod II; *g* — uropod I; *h* — uropod II; *i* — uropod III.

Рис. 15. *Diasynurella cavatica* Palatov et Marin sp.n., Грузия, Самегрело – Верхняя Сванетия, Чхороцкуский район, пещера Гараха: *a* — эпимеральная пластина I; *b* — эпимеральная пластина II; *c* — эпимеральная пластина III; *d* — тельсон; *e* — плеопода III; *f* — крючки ретинакулы плеоподы II; *g* — уропода I; *h* — уропода II; *i* — уропода III.

Pereopod III (Fig. 14*a*): coxal plate oval or sub-rectangular, with six apical and numerous facial setae, width/depth ratio is 0.6/1; basis about 4.3X as long as wide, with long anterior and posterior simple setae; merus about 0.63X of basis, about 1.40X of carpus and about 1.07X of propodus in length; carpus about 0.77X of propodus in length; dactylus (Fig. 14*b*) about 0.46X of propodus, with single plumose seta on outer margin and an additional spine accompanying with singleseta along ventral margin.

Pereopod IV (Fig. 14*c*): subequal to PIII in length; coxal plate expanded and broadly convex distally, posterior margin with a shallow excavation, distal margin with eleven apical short setae and numerous facial setae, width/depth ratio is 0.86/1; basis about 4.8X as long as wide, with long anterior and posterior simple setae; merus about 0.66X of basis, about 1.50X of carpus and about 1.22X of propodus in length; carpus about 0.81X of propodus in length; dactylus (Fig. 14*d*) about 0.42X of propodus, with single plumose seta on outer margin and an additional spine accompanying with single seta along ventral margin.

Pereopods V, VI, VII with length ratio 1/1.20/1.08.

Pereopod V (Fig. 14*e*): coxal plate large, bilobate, with distinct anterior and posterior lobes; posterior and anterior lobes with single margin simple seta each, with numerous facial setae; basis about 1.38X as long as wide, with numerous facial setae, posterior margin slightly convex, armed with 11 shallow serrations, with distinct distal corner, anterior margin with ten split-tipped robust and four distal setae; merus about 0.65X of basis, 1.05X of carpus and 1.14X of propodus in length; dactylus (Fig. 14*f*) approximately 0.48X of propodus, with single plumose seta on outer margin and an additional spine accompanying with single seta along ventral margin.

Pereopod VI (Fig. 14*g*): coxal plate bilobate, with distinct posterior and vestigial anterior lobes; anterior lobe

without setae, posterior lobe with single margin seta, each with numerous facial setae; basis about 1.38X as long as wide, with numerous facial setae, posterior margin convex, armed with 11 shallow serrations, anterior margin with six split-tipped robust and three distal setae; merus about 0.69X of basis, subequal of carpus and 0.90X of propodus in length; dactylus (Fig. 14*h*) approximately 0.40X of propodus, with single plumose seta on outer margin and an additional spine accompanying with single seta along ventral margin.

Pereopod VII (Fig. 14*i*): coxal plate small, semi-lunar, with single posterior seta; basis about 1.10X as long as wide, with numerous facial setae, posterior margin convex, armed with 11 serrated setae, with distal corner; anterior margin with six split-tipped robust and three distal setae; merus about 0.56X of basis, about 1.08X of carpus and about 0.90X of propodus in length; dactylus (Fig. 14*j*) approximately 0.40X of propodus in length, with single plumose seta on outer margin and an additional spine accompanying with single seta along ventral margin.

Gills, brood plates (Fig. 14): coxal gills on somites II–VI, somites V–VIII with lanceolate sternal gill on each. Coxal gills of pereopods II–VI ovoid, gills/bases ratios are 0.84/1, 0.78/1, 0.82/1, 0.68/1 and 0.60/1, respectively.

Pleopods (Fig. 15*e*, *f*): pleopods I and II peduncles with two coupling hooks in retinacula (Fig. 10*h*), without lateral setae; outer and inner rami with 8 and 10 segments, respectively; basal segments of outer ramus with single clothes-pin seta. Pleopod III peduncle with two coupling hooks in retinacula, without setae; outer and inner rami with 7 and 8 segments, respectively; basal segment of outer ramus with single clothes-pin seta.

Epimera. Epimeral plate I (Fig. 15*a*) weakly produced distally, pointed, ventral margin without spines, posterior margin oblique, with one seta. Epimeral plate II (Fig. 15*b*) distally produced and sharply pointed, ventral margin armed with two spines, posterior margin slightly oblique, with single seta. Epimeral plate III (Fig. 15*c*) subtrapezoidal, blunted distally, ventral margin armed with three spines, posterior margin slightly oblique, with single seta.

Urosomites fused partially: Urosomite I completely free, urosomites II–III fused, with slightly noticeable suture (Fig. 20*a*).

Uropod I (Fig. 15*g*): peduncle about 3.2X as long as wide, with dorsoexternal row of four thin spines, single subdistal short thin spine and single dorsointernal thin spine; exopodite about 0.9X of endopodite in length; endopodite not paddle-like, with four dorsal, single dorsolateral and five apical thin spines; with three dorsal, four dorsolateral and five apical thin spines.

Uropod II (Fig. 15*h*): peduncle about 1.7X as long as wide, subequal of endopodite in length, with three dorsoexternal long spines; exopodite about 0.88X of endopodite in length, with four dorsal, single dorsolateral and five apical robust spines; endopodite with five dorsal, single dorsolateral and five apical robust spines.

Uropod III (Fig. 15*i*): uniramous, peduncle cone-shaped, about 1.4X as long as wide, without terminal "knob", single simple seta on lateral margin and single spine on apical margin; peduncle about 1.4X of ramus in length; inner margin of ramus with single simple seta, outer margin of ramus armed with two spines, apical margin armed with four spines.

Telson (Fig. 15*d*): slightly narrowing distally, slightly elongated, 0.75X as long as broad, subequal with uropod III in length; apical margin cleft about 0.48X of total length; with four apical spines and two additional submarginal plumose setae on each lobe.

COLORATION. The body and appendages unpigmented, without well-developed pigmented eyes.

GENBANK ACCESSION NUMBERS. OQ534005, OQ534006.

TAXONOMIC REMARKS. The species can be most easily separated from *D. waschuschtii* by the following features: 1) ramus and peduncle of uropod III approximately equal in length (Fig. 15*i*) vs. ramus is significantly smaller than peduncle in length [Behning, 1940, fig. 17n]; 2) rami of uropod III with two separate spines on lateral margins (Fig. 15*i*) vs. rami of uropod III without lateral spines [Behning, 1940, fig. 17n]; 3) epimeral plates II–III with two and three thin spiniform setae on ventral margin, respectively (Fig. 15*b*, *c*) vs. epimeral plates II–III with single thin seta on ventral margin each [Behning, 1940, fig. 18j].

The species can be most easily separated from *Diasynurella kiwi* Marin et Palatov sp.n., by the following features: 1) urosomites II and III completely fused (Fig. 20*a*) vs. all urosomites completely free (Fig. 11*a*); 2) uropod III is subequal to telson in length (Fig. 20*a*) vs. uropod III is much longer than telson (Fig. 11*a*); 3) inner plate of maxilla I with two plumose marginal setae (Fig. 13*g*) vs. inner plate of maxilla I with four plumose marginal setae (Fig. 3*g*).

The species can be most easily separated from *Diasynurella dzhamirzoevi* Palatov et Marin sp.n., by the following features: 1) apical margin cleft of telson is about half of its total length (Fig. 15*d*) vs. apical margin cleft of telson is more than half of its total length (Fig. 10*e*, *f*); 2) palm of propodus of gnathopod II slightly oblique (Fig. 12*g*) vs. palm of propodus of gnathopod II distinctly oblique (Fig. 7*g*); 3) posterior margin of epimeral plate II is slightly oblique, almost straight (Fig. 15*b*) vs. posterior margin of epimeral plate II is significantly oblique (Fig. 10*b*).

For the differences from *D. khalabensis* Palatov et Marin sp.n. see below.

DISTRIBUTION AND ECOLOGY. The species is known only from the subterranean water flow in the Garakha Cave, southwestern Georgia, SW Caucasus [Chertoprud *et al.*, 2020 (as *Synurella* sp.); present study]. This is the only cave-dwelling species in the genus *Diasynurella*.

Diasynurella khalabensis Palatov et Marin **sp.n.**
Figs 16–19, 20*c*–*h*.

MATERIAL EXAMINED. Holotype ♀ (bl. 4.5 mm), ZMMU Mb-1253, Lesser Caucasus, Armenia, Lori region, Khalab Ridge, 40°48′4.11″N, 44°43′35.74″E, about 2400 m a.s.l.., hand net sampling, 29 August 2011, coll. D. Palatov. Paratypes 2♀♀ (bl. 4.0 mm), ZMMU Mb-1254, same locality and data as for holotype.

Additional material: 3♀♀, LEMMI, same locality and data as for holotype.

ETYMOLOGY. The species is named after the Khalab Ridge located in the Lori Province of Armenia, where the species was discovered.

DESCRIPTION. Female. Body: moderately stout; the largest collected ♀ has bl. 4.5 mm.

Antenna I (Fig. 16*a*) about 55% of body length, about 1.9X longer than antenna II; primary flagellum with 11 segments, with aesthetascs on distal segments; accessory flagellum 2-segmented, distal segment about 2.3X shorter than basal one (Fig. 16*b*).

Antenna II (Fig. 16*c*): gland clone distinct, distally pointed; peduncle about 2.1X longer than flagellum, with robust setae tightly covering segments III and IV; peduncle of

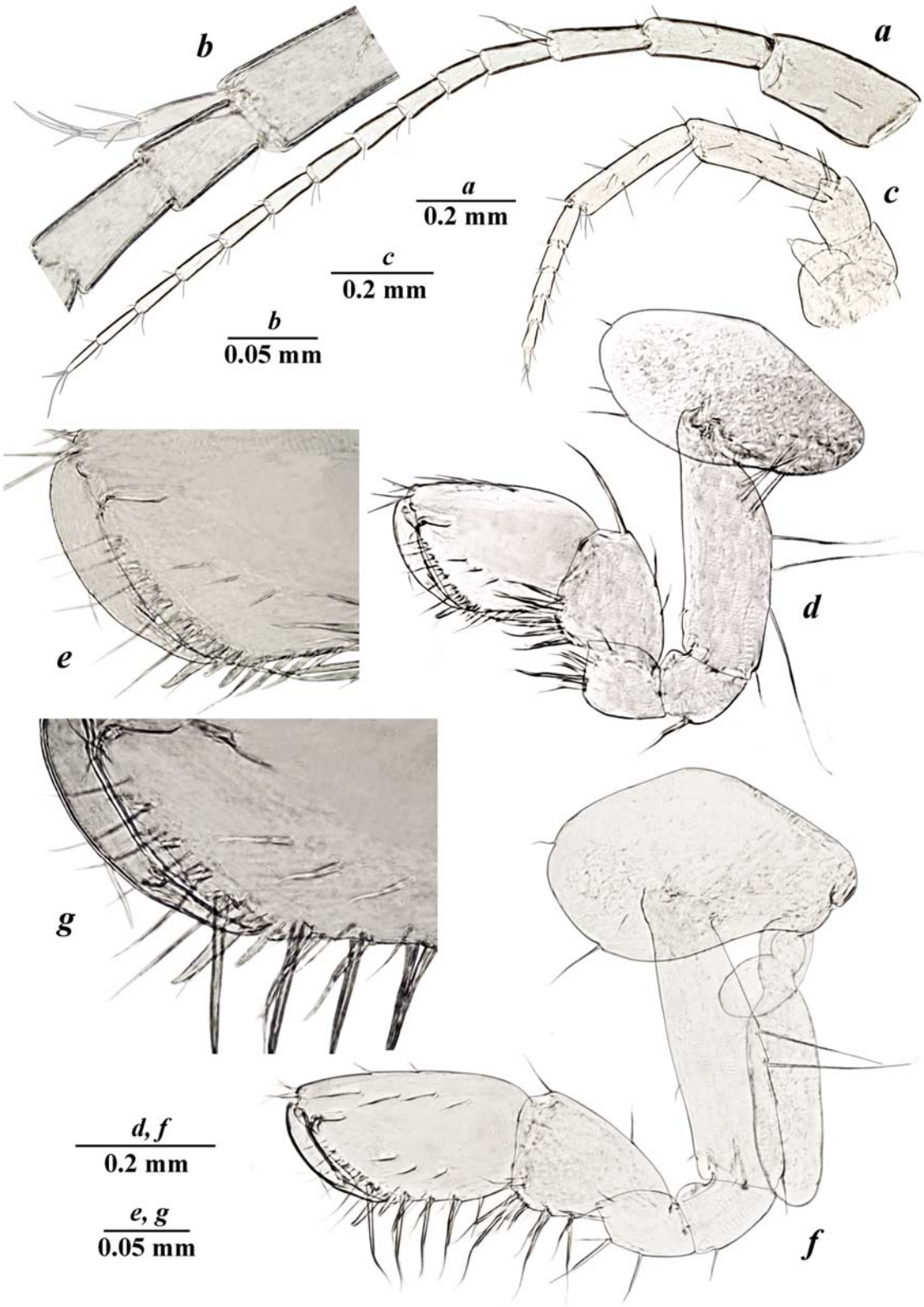

Fig. 16. *Diasynurella khalabensis* Palatov et Marin sp.n., Armenia, Lori region, Khalab Ridge: *a* — antenna I; *b* — accessory flagellum of antenna I; *c* — antenna II; *d* — gnathopod I; *e* — distoventral palmar margin of chela of GnI; *f* — gnathopod II; *g* — distoventral palmar margin of chela of GnII.

Рис. 16. *Diasynurella khalabensis* Palatov et Marin sp.n., Армения, Лорийская область, Халабский хребет: *a* — антенна I; *b* — вспомогательный жгутик антенны I; *c* — антенна II; *d* — гнатопода I; *e* — дистовентральный край ладони клешни GnI; *f* — гнатопода II; *g* — дистовентральный край ладони клешни GnII.

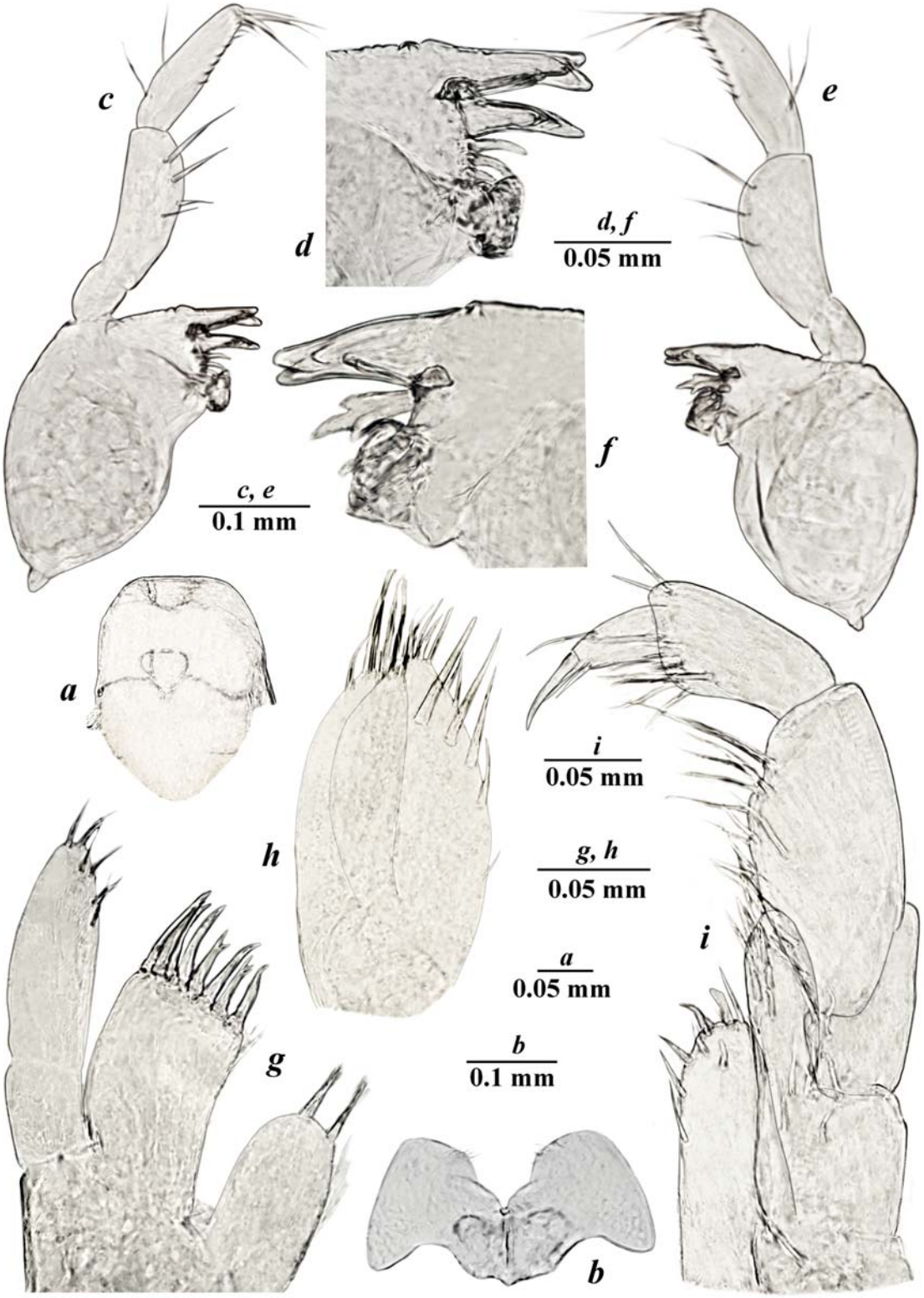

Fig. 17. *Diasynurella khalabensis* Palatov et Marin sp.n., Armenia, Lori region, Khalab Ridge: *a* — labrum (upper lip); *b* — labium (lower lip); *c* — left mandible; *d* — same, incisor process and pars incisiva; *e* — right mandible; *f* — same, incisor process and pars incisiva; *g* — maxilla I; *h* — maxilla II; *i* — maxilliped.

Рис. 17. *Diasynurella khalabensis* Palatov et Marin sp.n., Армения, Лорийская область, Халабский хребет: *a* — верхняя губа; *b* — нижняя губа; *c* — левая мандибула; *d* — то же самое, резцовый отросток и pars incisiva; *e* — правая мандибула; *f* — то же самое, резцовый отросток и pars incisiva; *g* — максилла I; *h* — максила II; *I* — максиллипед.

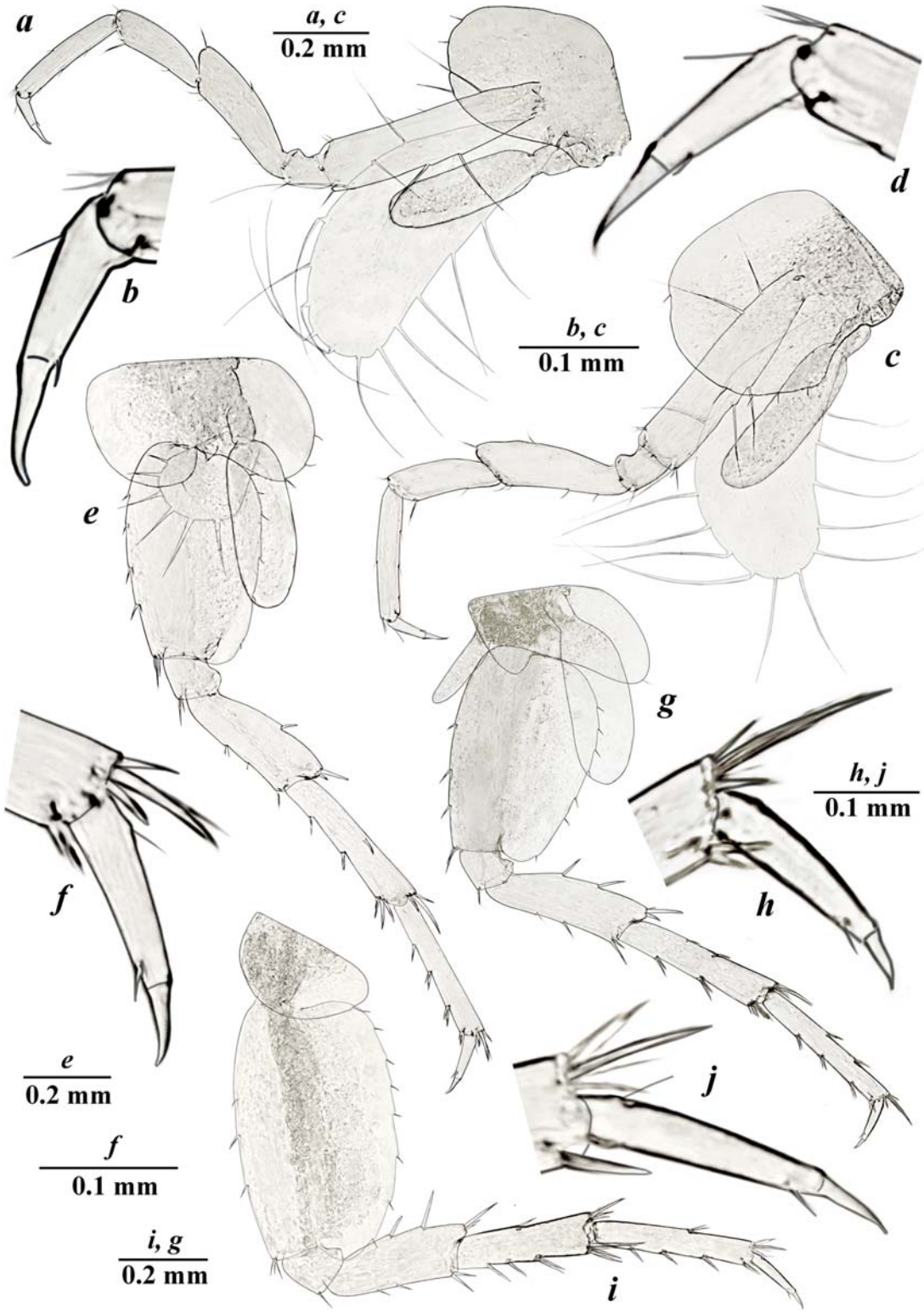

Fig. 18. *Diasynurella khalabensis* Palatov et Marin sp.n., Armenia, Lori region, Khalab Ridge: *a* — pereopod III; *b* — dactylus of PIII; *c* — pereopod IV; *d* — dactylus of PIV; *e* — pereopod V; *f* — dactylus of PV; *g* — pereopod VI; *h* — dactylus of PVI; *i* — pereopod VII; *j* — dactylus of PVII.

Рис. 18. *Diasynurella khalabensis* Palatov et Marin sp.n., Армения, Лорийская область, Халабский хребет: *a* — переопода III; *b* — дактилус PIII; *c* — переопода IV; *d* — дактилус PIV; *e* — переоподаV; *f* — дактилус PV; *g* — переопода VI; *h* — дактилус PVI; *i* — переопод VII; *j* — дактилус PVII.

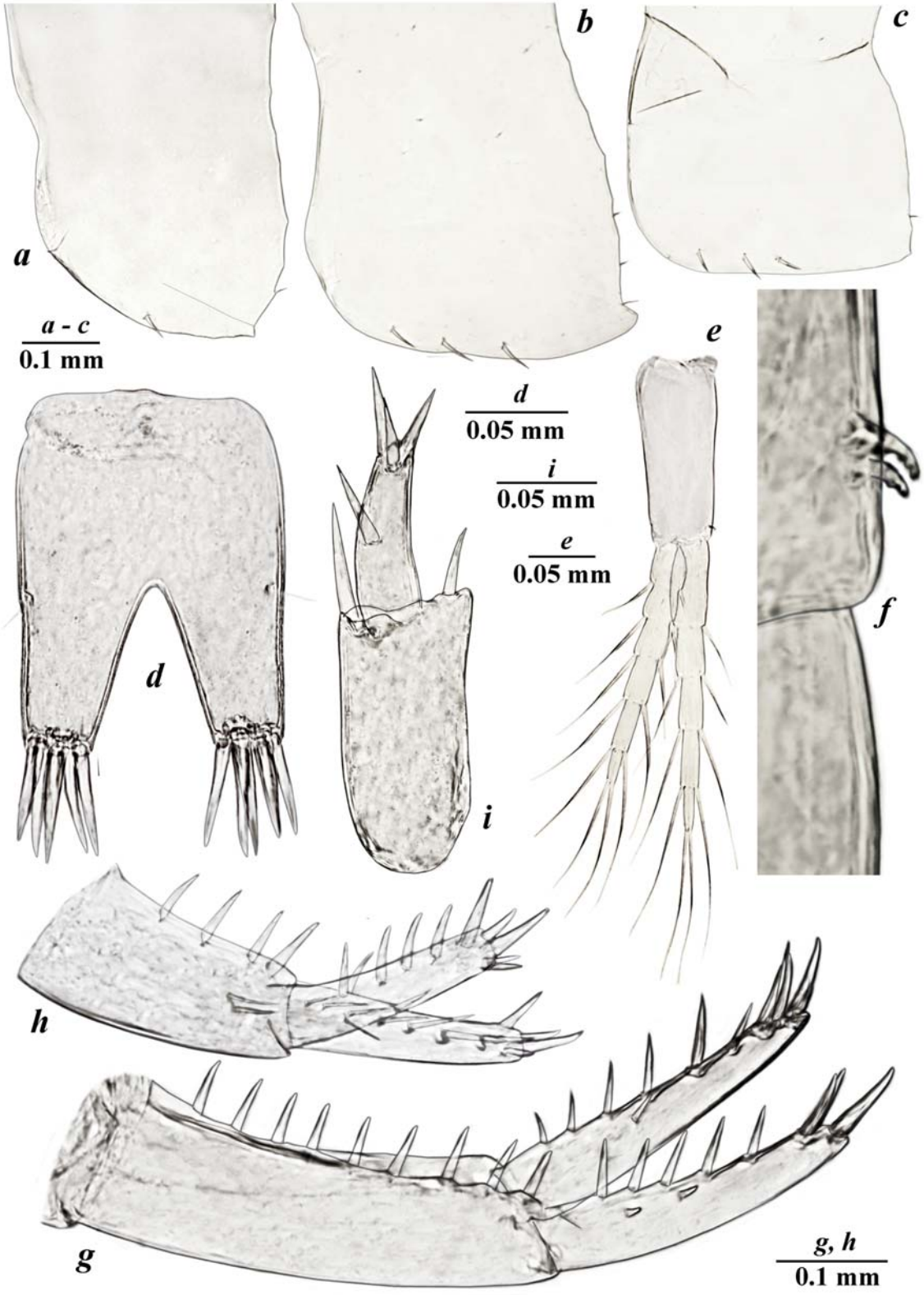

Fig. 19. *Diasynurella khalabensis* Palatov et Marin sp.n., Armenia, Lori region, Khalab Ridge: *a* — epimeral plate I; *b* — epimeral plate II; *c* — epimeral plate III; *d* — telson; *e* — pleopod I; *f* — hooks of retinacula of pleopod II; *g* — uropod I; *h* — uropod II; *i* — uropod III.

Рис. 19. *Diasynurella khalabensis* Palatov et Marin sp.n., Армения, Лорийская область, Халабский хребет: *a* — эпимеральная пластинка I; *b* — эпимеральная пластинка II; *c* — эпимеральная пластинка III; *d* — тельсон; *e* — плеоподаI; *f* — крючки ретинакулы плеоподы II; *g* — уропода I; *h* — уропода II; *i* — уропода III.

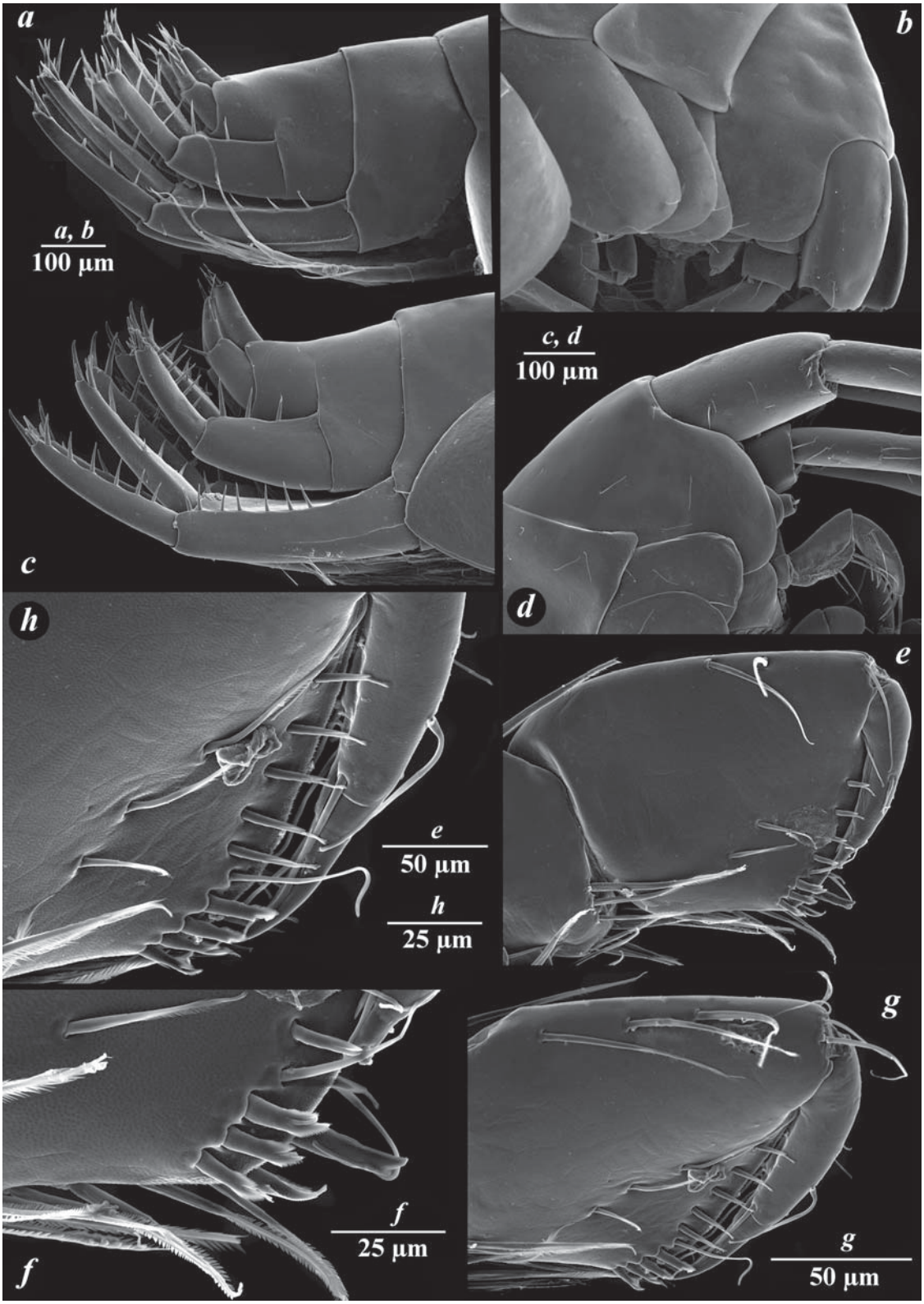

Fig. 20. *Diasynurella cavatica* Palatov et Marin sp.n. (*a, b*) and *D. khalabensis* Palatov et Marin sp.n. (*c–h*): *a*, *c* — urosomal segments, lateral view; *b*, *d* — head; *e* — chela of gnathopod I; *f* — distoventral margin of chela of gnathopod I; *g* — chela of gnathopod II; *h* — distoventral margin of chela of gnathopod II.

Рис. 20. *Diasynurella cavatica* Palatov et Marin sp.n. (*a, b*) и *D. khalabensis* Palatov et Marin sp.n. (*c–h*): *a*, *c* — уросомальные сегменты, вид сбоку; *b*, *d* — голова; *e* — клешня гнатоподы I; *f* — дистовентральный край клешни GnI; *g* — клешня гнатоподы II; *h* — дистовентральный край клешни GnII.

segment four about 1.1X longer than segment 5; flagellum 6-segmented.

Mandible (Fig. 17*c–f*): left mandible (Fig. 17*c*, *d*) incisor 5-dentate, *lacinia mobilis* 5-dentate, with three robust plumose accessory setae; molar process with single seta. Right mandible (Fig. 17*e, f*) incisor 5-dentate, *lacinia mobilis* toothed, triturative, lobes with numerous protuberances; underlying with a row of two robust plumose setae; molar process similar to left mandible. Palp 3-segmented, segment II with four–five setae; segment III about 3.2–3.3X longer than wide, with seven–eight separate D-setae, two B-seta and four separate E-setae (Fig. 17*e, g*).

Labrum (upper lip) (Fig. 17*a*): oval, apical margin with numerous small fine setae.

Labium (lower lip) (Fig. 17*b*): inner lobes feebly developed.

Lateralia with eight strong pectinate setae.

Maxilla I (Fig. 17*g*): inner plate with two plumose marginal setae, outer plate with seven apical comb-spines; palp 2-segmented, distal segment pubescent, about 3.0X of basal segment, apical margin of distal segment with seven simple setae.

Maxilla II (Fig. 17*h*): inner and outer plates covered in pubescent setae, subequal in length; outer plate weakly narrowing distally, with seven apical setae; inner plate narrowing explicitly distally, with group of dense short setae on apex, with an oblique row of four short plumose setae.

Maxilliped (Fig. 17*i*): inner plate much shorter than outer plate, with two–three spines and single simple seta apically, and three–five simple setae laterally; outer plate narrow, with row of 14–16 medial stiff simple setae of different length; palp quadriarticulate, article I with two simple setae on inner margin, article II with row of 14–16 simple setae on inner margin and without setae on outer margin, article III sub-quadrate; dactylus with single seta on outer margin and without setae at inner margin, nail long, slender, with two thin setae at hinge.

Gnathopod I (Fig. 16*d, e*): smaller than GnII; coxal plate subtrapezoidal or suboval, slightly narrowing distally, with rounded corners and with four apical and numerous facial setae, width/depth ratio 0.61/1; basis width/length ratio is 0.35/1, with single short seta on anterior margin, three long setae on inner face and four long setae on posterior margin; merus with eight distal setae; carpus is 0.57X of basis and 0.76X of propodus in length, with eight serrated setae in inner margin and four simple setae in outer margin; propodus 1.50X longer than broad, with three simple setae in anterior margin and five serrated single setae in posterior margin; distal margin of palm (Fig. 16*e*) distinctly or slightly oblique, with double row of four inner and three outer robust setae; palmar groove (depression) feebly developed, with two inner and two outer robust setae; dactylus with single outer seta.

Gnathopod II (Fig. 16*f, g*): coxal plate subovate, with three apical and numerous facial setae, width/depth ratios is 0.64/1; basis width/length ratio is 0.30/1, with several (two–three) long setae inserted along posterior margin and with two short simple setae in anterior margin; ischium with short simple seta; merus with five distal setae; carpus is 0.57X of length of basis and 0.74X of propodus, with anterior simple seta and three groups of plumose posterior setae; propodus 1.8X longer than broad, with one–two simple anterior setae, three superior medial, three inferior medial and four groups of posterior setae; palm distinctly oblique with double row of four inner and five outer spiniform setae of different size; palm groove (depression) feebly developed, palmar corner (Fig. 16*g*) with two strong palmar spiniform setae, two supporting bifurcate setae on inner surface; dactylus with single seta along anterior margin and few short setae along inner margin.

Pereopod III (Fig. 18*a*): coxal plate oval or sub-rectangular, with three apical and numerous facial setae, width/depth ratio is 0.8/1; basis about 4.4X as long as wide, with long anterior and long posterior simple setae; merus about 0.60X of basis, about 1.33X of carpus and about 1.13X of propodus in length; carpus about 0.85X of propodus in length; dactylus (Fig. 18*b*) about 0.48X of propodus, with single plumose seta on outer margin and single additional spine accompanying with single seta along ventral margin.

Pereopod IV (Fig. 18*c*): subequal to PIII in length; coxal plate expanded and broadly convex distally, posterior margin with shallow excavation, distal margin with five apical short setae and numerous facial setae, width/depth ratio is 0.88/1; basis about 4.2X as long as wide, with long anterior and long posterior simple setae; merus about 0.63X of basis, about 1.33X of carpus and about 1.05X of propodus in length; carpus about 0.79X of propodus in length; dactylus (Fig. 18*d*) about 0.45X of propodus, with single plumose seta on outer margin and an additional spine accompanying with single seta along ventral margin.

Pereopods V, VI, VII with length ratio 1/1.23/1.08.

Pereopod V (Fig. 18*e*): coxal plate large, bilobate, with distinct anterior and posterior lobes; posterior lobes with three margin simple setae and anterior lobes with single margin simple seta, with numerous facial setae; basis about 1.54X as long as wide, with numerous facial setae, posterior margin slightly convex, armed with six shallow serrations, with distinct distal corner, anterior margin with four split-tipped robust and four distal setae; merus about 0.71X of basis, 0.90X of carpus and subequal of propodus in length; dactylus (Fig. 18*f*) approximately 0.46X of propodus, with single plumose seta on outer margin and an additional spine accompanying with single seta along ventral margin.

Pereopod VI (Fig. 18*g*): coxal plate bilobate, with distinct posterior and vestigial anterior lobes; anterior lobe without setae, posterior lobe with single margin seta, each with numerous facial setae; basis about 1.54X as long as wide, with numerous facial setae, posterior margin convex, armed with six shallow serrations, anterior margin with three split-tipped robust and three distal setae; merus about 0.69X of basis, 0.90X of carpus and 0.93X of propodus in length; dactylus (Fig. 18*h*) approximately 0.36X of propodus, with single plumose seta on outer margin and single additional spine accompanying with single seta along ventral margin.

Pereopod VII (Fig. 18*i*): coxal plate small, semi-lunar, with single posterior seta; basis about 1.63X as long as wide, with numerous facial setae, posterior margin convex, armed with eight serrated setae in distal corner; anterior margin with three split-tipped robust and three distal setae; merus about 0.56X of basis, subequal of carpus and about 0.88X of propodus in length; dactylus (Fig. 18*j*) approximately 0.48X of propodus in length, with single plumose seta on outer margin and single additional spine accompanying with single seta along ventral margin.

Gills, brood plates (Fig. 18): coxal gills on somites II–VI, somites V–VIII with lanceolate sternal gill on each. Coxal gills of pereopods II–VI elongated, narrow, gills/bases ratios are 0.72/1, 0.69/1, 0.78/1, 0.80/1 and 0.78/1, respectively.

Pleopods (Fig. 19*e*, *f*): pleopods I peduncle with two coupling hooks in retinacula (Fig. 19*h*), without lateral set-

ae; outer and inner rami with five and six segments, respectively; basal segments of outer ramus with single clothes-pin seta. Pleopod II peduncle with two coupling hooks in retinacula, without setae; outer and inner rami with five segments, respectively; basal segment of outer ramus with single clothes-pin seta. Pleopod III peduncle with two coupling hooks in retinacula, without setae; outer and inner rami with four and five segments, respectively; basal segment of outer ramus with single clothes-pin seta.

Epimera. Epimeral plate I (Fig. 19*a*) subovate, pointed distally, ventral margin with one spine, posterior margin convex, with one site. Epimeral plate II (Fig. 19*b*) weakly produced distally, bluntly pointed distally, ventral margin armed with three spines, posterior margin slightly oblique, with three setae. Epimeral plate III (Fig. 19*c*) subtrapezoidal, blunted distally, ventral margin armed with three spines, posterior margin slightly oblique, with single seta.

Urosomites fused partially: Urosomite I completely free, urosomites II–III fused, with distinct suture (Fig. 20*c*).

Uropod I (Fig. 19*g*): peduncle about 3.6X as long as wide, with dorsoexternal row of nine spines and single subdistal short spine; exopodite about 0.9X of endopodite in length; endopodite not paddle-like, with six dorsal, single dorsolateral and five apical thin spines; with five dorsal, two dorsolateral and five apical thin spines.

Uropod II (Fig. 19*h*): peduncle about 2.0X as long as wide, subequal of endopodite in length, with four dorsoexternal long spines; exopodite about 0.90X of endopodite in length, with four dorsal, single dorsolateral and five apical robust spines; endopodite with six dorsal, single dorsolateral and five apical robust spines.

Uropod III (Fig. 19*i*): uniramous, peduncle cylindrical-shaped, about 2.1X as long as wide, without terminal «knob», two spines on apical margin; peduncle about 1.4X of ramus in length; inner margin of ramus without setae, outer margin of ramus armed with single spine, apical margin armed with three spines.

Telson (Fig. 19*d*): subrectangular, elongated, 0.72X as long as broad, slightly longer than uropod III; apical margin cleft about 0.50X of total length; with five apical spines and two additional submarginal plumose setae on each lobe.

COLORATION. The body and appendages unpigmented, without well-developed pigmented eyes.

GENBANK ACCESSION NUMBERS. LK028567, LK028568.

TAXONOMIC REMARKS. The species can be most easily separated from *D. waschuschtii* by the following features: 1) rami of uropod III with single spiniform spine on lateral margins (Fig. 19*i*) vs. rami of uropod III without lateral spines [Behning, 1940, fig. 17n]; 2) propodus of gnathopod II is relatively short, suboval in shape (Fig. 16*f*) vs. propodus of gnathopod II is elongated, subrectangular shape [Behning, 1940, fig. 17c]; 3) epimeral plates II–III with three thin spiniform setae on ventral margin, each (Fig. 19*b*, *c*) vs. epimeral plates II–III with single thin seta on ventral margin, each [Behning, 1940, fig. 18j].

The species can be most easily separated from *Diasynurella kiwi* Marin et Palatov sp.n., by the following features: 1) urosomites II–III completely fused (Fig. 20*c*) vs. all urosomites completely free (Fig. 11*a*); 2) uropod III is subequal to telson in length (Fig. 20*c*) vs. uropod III is much longer than telson (Fig. 11*a*); 3) inner plate of maxilla I with two plumose marginal setae (Fig. 17*g*) vs. inner plate of maxilla I with four plumose marginal setae (Fig. 3g).

The species can be most easily separated from *Diasynurella dzhamirzoevi* Palatov et Marin sp.n., by the following features: 1) apical margin cleft of telson is about half of its total length (Fig. 19*d*) vs. apical margin cleft of telson is more than half of its total length (Fig. 10*e*, *f*); 2) propodus of gnathopod II is relatively short, suboval in shape (Fig. 16*f*) vs. propodus of gnathopod II is elongated, subrectangular shape (Fig. 7*f*); 3) epimeral plate I with distinct spiniform seta on ventral margin (Fig. 19*a*) vs. epimeral plate I without setae on ventral margin (Fig. 10*a*).

The species can be most easily separated from *Diasynurella cavatica* Palatov et Marin sp.n., by the following features: 1) propodus of gnathopod II is relatively short, suboval in shape (Fig. 16*f*) vs. propodus of gnathopod II is elongated, subrectangular shape (Fig. 12*f*); 2) epimeral plate I with distinct spiniform seta on ventral margin (Fig. 19*a*) vs. epimeral plate I without setae on ventral margin (Fig. 15*a*); 3) outer and inner rami of pleopods I–III heavily shortened and consist of five and six, five and five, and four and five segments, respectively (Fig. 19*e*) vs. and inner rami of pleopods I–III of normal length and consist of eight and ten, eight and ten, and seven and eight, respectively (Fig. 15*e*).

DISTRIBUTION AND ECOLOGY. The species is known only from few nearby weakly flowing springs of alpine zone of the Khalab Ridge in Lori, Armenia (the Lesser Caucasus). It is possible that the species can live in other nearby springs and groundwaters, however, like other species, it is extremely difficult to find due to its very small size and habitat in bottom sediment.

THE DIFFERENTIAL KEY TO THE KNOWN SPECIES OF THE GENUS *DIASYNURELLA* BEHNING, 1940

1. All segments of urosome are free; uropod III is much longer than telson .... *Diasynurella kiwi* Marin et Palatov sp.n.
– Urosomite I completely free, urosomites II–III fused; uropod III is subequal to telson in length or shorter 2
2. Chela of gnathopod II is relatively short, about as long as wide, oval in shape .... *Diasynurella khalabensis* Palatov et Marin sp.n.
– Chela of gnathopod II is clearly elongated, longer than wide, rectangular in shape 3
3. Ramus of uropod III without lateral spines .... *Diasynurella wachuschtii* Behning, 1940
– Ramus of uropod III with several lateral spines 4
4. Cleft of apical margin of telson clearly longer than half its length .... *Diasynurella dzhamirzoevi* Palatov et Marin sp.n.
– Cleft of apical margin of telson shorter or equal to half of its length .... *Diasynurella cavatica* Palatov et Marin sp.n.

Phylogenetic part

The molecular genetic analysis (Fig. 21) clearly confirmed the monophyly (Bayesian–PP=1.00; ML–BS=95%) of the genus *Diasynurella*, which is well separated from other lineages (genera) of the family Crangonyctidae; the clade is a sister to the genus *Pontonyx* Palatov et Marin, 2021 [Marin, Palatov, 2021*a*, 2022*a*, *b*], separating for 0.35±0.024 substitutions per 100 nucleotides (35%) by COI mtDNA gene marker, which can be estimated as 45–7 Mya, with the average about 14 Mya (min. (0.77% Mya^{-1}) and max. (5.16% Mya^{-1}) after Guy-Haim *et al.* [2018]; the average — 2.5% Mya^{-1} for COI mtDNA gene marker after Lefébure *et al.* [2006] and Copilaº-Ciocianu, Petrusek

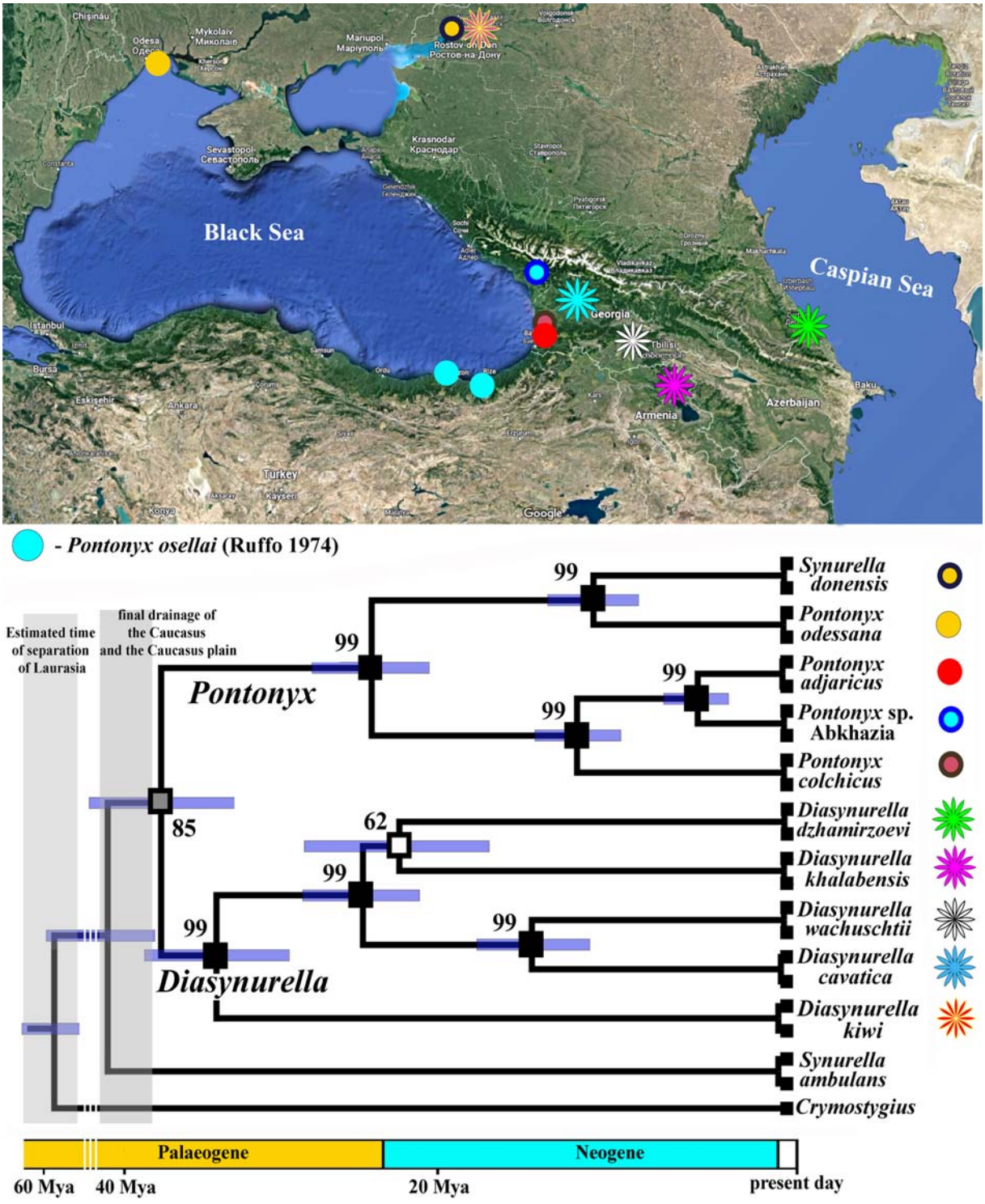

Fig. 21. The map of distribution and the time-calibrated phylogenetic reconstruction of the studied species of the related genera *Diasynurella* Behning, 1940 and *Pontonyx* Palatov et Marin, 2021 based on COI mtDNA gene marker. Posterior probabilities of the nodes are reported. Blue horizontal bars show the 95% HPD (the highest posterior density) of node ages on an arbitrary time scale.

Рис. 21. Карта распространения и откалиброванная по времени филогенетическая реконструкция изученных видов родственных родов *Diasynurella* Behning, 1940 и *Pontonyx* Palatov et Marin, 2021 на основе маркера гена COI мтДНК. Данные апостериорной вероятности узлов приведены на картинке. Синие горизонтальные полосы показывают 95% HPD (наибольшую плотность) расчетного возраста узлов в произвольном масштабе времени.

Table 1. Comparison of pairwise genetic (COI mtDNA) distances (*p*-distances±SE) (substitutions per 100 nucleotides) between the studied species of the genus *Diasynurella*.
Таблица 1. Сравнение попарных генетических (COImtDNA) дистанций (*p*-distances±SE) (замен на 100 нуклеотидов) между изучаемыми видами рода *Diasynurella*.

Diasynurella waschuschtii		*D. cavatica*	*D. khalabensis*	*D. dzhamirzoevi*
D. cavatica sp.n. (Garakha Cave)	0.177±0.021			
D. khalabensis sp.n. (Armenia)	0.224±0.024	0.258±0.022		
D. dzhamirzoevi sp.n. (Dagestan)	0.244±0.024	0.231±0.025	0.230±0.024	
D. kiwi sp.n. (Rostov-on-Don)	0.309±0.033	0.317±0.031	0.302±0.029	0.309±0.030

[2015]). At the same time, according to the published phylogenetic reconstruction [Copilaş-Ciocianu *et al.*, 2019], the split between these genera occurred at about 40 Mya, while both genera separated from other crangonyctid amphipods about 70–100 Mya, what is related to the estimated time of Laurasia disruption.

The interspecific genetic divergence based on COI mtDNA gene marker between the discovered species of the genus *Diasynurella* exceed 0.177±0.021 substitutions per 100 nucleotides (about 18%), up to 0,317±0,031 substitutions per 100 nucleotides (about 31%), the largest split between *Diasynurella cavatica* Palatov et Marin sp.n. and *D. kiwi* Marin et Palatov sp.n. (Table 1), showing a long-time isolation of all species. *D. kiwi* Marin et Palatov sp.n. is the most genetically/geographically divergent species within the genus, which is also considered as basal for the genus (Table 1; Fig. 1).

The estimated divergence time based on COI mtDNA gene marker between the species within the genus *Diasynurella* vary from 41 Mya (maximal) (*Diasynurella cavatica* Palatov et Marin sp.n. vs. *D. kiwi* Marin et Palatov sp.n.) to 3.4 Mya (minimal) (*D. cavatica* Palatov et Marin sp.n. vs. *D. waschuschtii*) (min. as 0.77% Mya^{-1}; and max. as 5.16% Mya^{-1} after Guy-Haim *et al.* [2018]), and 18 Mya to 10 Mya, respectively, according to Copilaş-Ciocianu *et al.* [2019] (about 1.773% Mya^{-1} for COI mtDNA gene marker).

Discussion

Morphological features may also indicate the close relationships of *Diasynurella* and *Pontonyx*, since both genera have a similar structure of gnathopods and fused urosomites II and III. At the same time, all urosomites are completely fused in all known species of the genus *Pontonyx* [Marin, Palatov, 2021a; Palatov, Marin, 2021b], while urosomite I is always free in all species of the genus *Diasynurella* (see above). The only exception with all free urosomal segments is the most basal species in the genus *Diasynurella*, *D. kiwi* Marin et Palatov sp.n., which apparently separated a very long time ago, about 35 Mya (see above). Thus, we believe that the free urosomal segments is certainly a plesiomorphic (ancestral) feature for both genera. The fusion of the urosomal segments is probably a consequence of the refusal to use flexible urosome and pleopods for swimming. Also, all *Diasynurella* are very small in total body size (2–3 mm) similarly to some species of the genus *Palearcticarellus*, namely *P. pusillus* (Martynov, 1930) and *P. mikhaili* (Sidorov, Holsinger et Takhteev, 2010), living in the highlands of Kuray mountain steppe in the Altai mountains [Palatov, Marin, 2020]. It is likely that similar adaptations could occur in similar environmental conditions.

Currently, the distribution range of the genus *Diasynurella* includes mountainous areas of the Caucasus with altitudes above 200 m a.s.l. (*D. waschuschtii*, *D. cavatica* Palatov et Marin sp.n. and *D. khalabensis* Palatov et Marin sp.n. occurring on the altitude about 2400 m a.s.l.), Ciscaucasian Plain (*D. kiwi* Marin et Palatov sp.n.) and northwestern Hyrcania (*D. dzhamirzoevi* Palatov et Marin sp.n.). It is unambiguous that the Caucasian/Ciscaucasian endemic genus *Pontonyx* is a sister taxon for *Diasynurella*, which is supported both by morphological and genetic analysis. Both genera live in the coastal areas of the Black/Caspian Sea and the modern Caucasus/Lesser Caucasus, and their known ranges intersect in the area of the norther Azov Sea Lowland, in the current locality of Rostov-on-Don City (Fig. 21), so historical interpretations of their origin should be exclusively associated with these areas, probably, with the transgressions and the Paratethys history. Probably in the past, in Paratethys times [Popov *et al.*, 2004, 2006], these closely related genera followed different specialization pathways: representatives of the genus *Pontonyx*, being large and semi-stygobiotic amphipods, inhabited surface waters and some coastal springs beyond the Paratethys sea line, while *Diasynurella*, being stygobiotic microcrustaceans, could penetrate into deep groundwater and remain in areas from which Paratethys had already retreated.

The question of the origin of the genus *Diasynurella*, like *Pontonyx*, still remains unresolved, but it is obvious that this genus is very ancient. The estimated time of divergence vary from 100 Mya [Copilaş-Ciocianu *et al.*, 2019] to 40 Mya or less (present study) (Fig. 21). In addition, its relationship with other crangonyctid genera remains unclear and according to different reconstructions, it is phylogenetically close to the "*Synurella*" Clade or the "*Stygobromus*" Clade of the family Crangonyctidae [Copilaş-Ciocianu *et al.*, 2019; Palatov, Marin, 2021b; Marin, Palatov, 2021a, 2022a]. Nevertheless, the final phylogenetic conclusions need to be made based on multi-locus phylogeny of all related genera from this group, which will be presented in further studies.

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References

Avise J.C. 1994. Molecular markers, natural history and evolution. NewYork: Chapmanand Hall. 511 pp. http://dx.doi.org/10.1007/978-1-4615-2381-9

Behning A.L. 1940. [Some Crustaceans from the Environs of Bakuriani, Georgian SSR] // Trudy Biologicheskikh Stantsii Narkomprosa Gruzinskoi SSR. Vol.1. P.11–58 [in Russian].

Bouckaert R., Vaughan T.G., Barido-Sottani J., Duchęne S., Fourment M., Gavryushkina A., Heled J., Jones G., Kühnert D., De Maio N., Matschiner M., Mendes F.K., Müller N.F., Ogilvie H.A., du Plessis L., Popinga A., Rambaut A., Rasmussen D., Siveroni I., Suchard M.A., Wu Ch., Xie D., Zhang C., Stadler T., Drummond A.J. 2019. BEAST 2.5: An advanced software platform for Bayesian evolutionary analysis // PLoS Computational Biology. Vol.15. No.4. Art.e1006650. https://doi.org/10.1371/journal.pcbi.1006650

Bouckaert R., Heled J., Kühnert D., Vaughan T., Wu Ch., Xie D., Suchard M.A., Rambaut A., Drummond A.J. 2014. Beast 2: a software platform for Bayesian evolutionary analysis // PLoS Computational Biology. Vol.10. No.4. Art.e1003537. https://doi.org/10.1371/journal.pcbi.1003537

Bousfield E.L., Holsinger J.R. 1989. A new crangonyctid amphipod crustacean from hypogean fresh waters of Oregon // Canadian Journal of Zoology. Vol.67. P.963–968.

Cannizzaro A.G., Daniels J.D., Berg D.J. 2021. Phylogenetic analyses of a new freshwater amphipod reveal polyphyly within the Holarctic family Crangonyctidae, with revision of the genus *Synurella* // Zoological Journal of the Linnean Society. zlab092. https://doi.org/10.1093/zoolinnean/zlab092

Chertoprud E.S., Borisov R.R., Palatov D.M., Marinskiy V.V., Krylenko S.V., Kovacheva N.P., Pichkhaia I. 2020. Aquatic macroinvertebrate fauna of caves of Samegrelo-Zemo Svaneti and Imereti, Western Georgia, Caucasus: troglobiotic and epigean species complexes // Russian Journal of Zoology. Vol.99. No.3. P.275–289. https://doi.org/10.31857/S0044513420030058

Copilaş-Ciocianu D., Petrusek A. 2015. The southwestern Carpathians as an ancient centre of diversity of freshwater gammarid amphipods: Insights from the *Gammarus fossarum* species complex // Molecular Ecology. Vol.24. No.15. P.3980–3992. https://doi.org/10.1111/mec.13286

Copilaş-Ciocianu D., Sidorov D.A., Gontcharov A. 2019. Adrift across tectonic plates: molecular phylogenetics supports the ancient Laurasian origin of old limnic crangonyctid amphipods // Organisms Diversity & Evolution. Vol.19. P.191–207. https://doi.org/10.1007/s13127-019-00401-7

Derzhavin A.N. 1945. [Subterranean Amphipods of Transcaucasia] // Izvestiya Akademii Nauk Azerbaidzhanskoi SSR. No.8. P.27–43 [in Russian].

Folmer O., Black M., Hoeh W., Lutz R., Vrijenhoek R. 1994. DNA primers for amplification of mitochondrial cytochrome c oxidase subunit 1 from diverse metazoan // Molecular Marine Biology and Biotechnology.Vol.3. No.5. P.294–299.

Guindon S., Dufayard J.F., Lefort V., Anisimova M., Hordijk W., Gascuel O. 2010. New algorithms and methods to Estimate Maximum-Likelihood Phylogenies: Assessing the Performance of PhyML 3.0 // Systematic Biology. Vol.59. No.3. P.307–321. https://doi.org/10.1093/sysbio/syq010

Guy-Haim T., Simon-Blecher N., Frumkin A., Naaman I., Achituv Y. 2018. Multiple transgressions and slow evolution shape the phylogeographic pattern of the blind cave-dwelling shrimp *Typhlocaris* // PeerJ.Vol.6. Art.e5268. https://doi.org/10.7717/peerj.5268

Horton T., Lowry J., De Broyer C., Bellan-Santini D., Coleman C.O., Corbari L., Costello M.J., Daneliya M., Dauvin, J.-C., Fišer C., Gasca R., Grabowski M., Guerra-García J.M., Hendrycks E., Hughes L., Jaume D., Jazdzewski K., Kim Y.-H., King R., Krapp-Schickel T., LeCroy S., Lörz A.-N., Mamos T., Senna A.R., Serejo C., Sket B., Souza-Filho J.F., Tandberg A.H., Thomas J.D., Thurston M., Vader W., Väinölä R., Vonk R., White K., Zeidler W. 2021. World Amphipoda Database. *Synurella* Wrześniowski, 1877. Accessed through: World Register of Marine Species at: https://www.marinespecies.org/aphia.php?p=taxdetailsetid=489372 on 2022-02-27

Karaman G.S. 1974. 58. Contribution to the knowledge of the Amphipoda. Genus *Synurella* Wrzes. in Yugoslavia with remarks on its all World known species, their synonymy, bibliography and distribution (fam. Gammaridae) // Poljoprivreda i Sumarstvo, Titograd. Vol.20. No.2–3. P.83–133.

Kimura M. 1980. A simple method for estimating evolutionary rates of base substitutions through comparative studies of nucleotide sequences // Journal of Molecular Evolution. Vol.16. No.2. P.111–120. https://doi.org/10.1007/BF01731581

Kumar S., Stecher G., Tamura K. 2016. MEGA7: molecular evolutionary genetics analysis version 7.0 for bigger datasets // Molecular Biology and Evolution. Vol.33. No.7. P.1870–1874. https://doi.org/10.1093/molbev/msw054

Lefébure T., Douady C.J., Gouy M., Trontelj P., Briolay J., Gibert J. 2006. Phylogeography of a subterranean amphipod reveals cryptic diversity and dynamic evolution in extreme environments // Molecular Ecology.Vol.15. P.1797–1806. http://doi.org/10.1111/j.1365-294X.2006.02888.x

Marin I.N., Palatov D.M. 2021a. *Volgonyx* gen.n. and *Pontonyx* gen.n., two new genera of the family Crangonyctidae (Crustacea: Amphipoda) from the southeastern Europe // Arthropoda Selecta. Vol.30. No.1. P.43–61. http://doi.org/10.15298/arthsel.30.1.05

Marin I.N., Palatov D.M. 2021b. The hidden diversity of the genus *Lyurella* Derzhavin, 1939 (Crustacea: Amphipoda: Crangonyctidae): four new species from the subterranean habitats of the northwestern Caucasus, Russia // Zootaxa. Vol.5006. No.1. P.127–168. https://doi.org/10.11646/zootaxa.5006.1.17

Marin I.N., Palatov D.M. 2022a. *Uralocrangonyx* gen.n. (Amphipoda: Crangonyctidae) from the Southern Ural, Russia // Arthropoda Selecta. Vol.31. No.2. P.183–195. https://doi.org/10.15298/arthsel.31.2.07

Marin I.N., Palatov D.M. 2022b. Lifestyle switching and refugee availability are the main factors in the evolution and distribution of the genus *Synurella* Wrześniowski, 1877 (Amphipoda: Crangonyctidae) // Arthropoda Selecta. Vol.31. No.4. P.393–448. https://doi.org/10.15298/arthsel.31.4.04

Marin I.N., Palatov D.M. (in press). Diversity of the crangonyctid genus *Pontonyx* Palatov et Marin, 2021 (Amphipoda: Crangonyctidae) in the coastal habitats around the Black and Azov Seas, with the description of a new species from the southwestern Caucasus // Arthropoda Selecta. Vol.32.

Marin I.N., Palatov D.M. (in press). Insights on the existence of ancient glacial refugee in the Northern Black/Azov Sea Lowland, with the description of the first stygobiotic microcrustacean species of the genus *Niphargus* Schiödte, 1849 from the mouth of the Don River // Diversity.

McInerney C.E., Maurice L., Robertson A.L., Knight L.R.F.D., Arnscheidt J., Venditti C., Dooley J.S.G., Mathers T., Matthijs S., Eriksson K., Proudlove G.S., Hänfling B. 2014. The ancient Britons: groundwater fauna survived extreme climate change over tens of millions of years across NW Europe // Molecular Ecology. Vol.23. P.1153–1166. https://doi.org/10.1111/mec.12664

Palatov D.M., Marin I.N. 2020. A new genus of the family Crangonyctidae (Crustacea, Amphipoda) from the Palaearctic, with descriptions of two new species from the foothills of the Altai Mountains // Zoologicheskiy Zhurnal. Vol.99. No.10. P.1160–1186. https://doi.org/10.31857/S004451342010013X

Palatov D.M., Marin I.N. 2021. When males and females belong to different genera: an interesting case of *Synurella/Pontonyx* (Crustacea: Amphipoda: Crangonyctidae) co-occurrence // Arthropoda Selecta. Vol.30. No.4. P.443–472. https://doi.org/10.15298/arthsel.30.4.03

Popov S.V., Rogl F., Rozanov A.Y., Steininger F.F., Shcherba I.G., Kovac M. 2004. Lithological-paleogeographic maps of Paratethys // Courier Forschungsinstitut Senckenberg. Vol.250. P.1–46.

Popov S.V., Shcherba I.G., Ilyina L.B., Nevesskaya L.A., Paramonova N.P., Khondkarian S.O., Magyar I. 2006. Late Miocene to Pliocene palaeogeography of the Paratethys and its relation to the Mediterranean // Palaeogeography, Palaeoclimatology, Palaeoecology. Vol.238. P.91–106. https://doi.org/10. 1016/j.palaeo.2006.03.020.

Sidorov D.A., Holsinger J.R. 2007. *Amurocrangonyx*, a new genus of subterranean amphipod (Crangonyctidae) from the Russian Far East, with a redescription of the poorly known *Crangonyx arsenjevi* and comments on biogeographic relationships // Journal of Crustacean Biology. Vol.27. No.4. P.660–669. https://doi.org/10.1651/s-2817r.1

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