Dursogammarus dromaderus gen. et sp. nov., a new Ponto-Caspian gammarid (Amphipoda: Gammaridae) from the coastal pebble habitats of the foothills of the Caucasus

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A new gammarid Dursogammarus dromaderus gen. et sp. nov. (Amphipoda: Gammaridae) is described from coastal Black Sea habitats of the southwestern foothills of the Russian Caucasus, being an obligate dweller of coastal pebbles. The new species morphologically resembles representatives of Echinogammarus Stebbing, 1899 and Dikerogammarus Stebbing, 1899, and somewhat Gmelina G. O. Sars, 1894, but can be easily separated by a unique combination of morphological features not characteristic for the latter genera. The most remarkable features are the presence of a dorsal knob (tubercle) on urosomal segment I as well as the long and wide outer ramus (exopod) of uropod III with mostly reduced distal article.

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Keywords: Crustacea; biodiversity; rivers; coastal communities; Black Sea.

Introduction

The aquatic invertebrate fauna of the Ponto-Caspian basin, which includes the basins of the Black, Azov, Caspian and Aral Seas, is one of the most diverse in the Palaearctic, second only to Lake Baikal (Cristescu et al., 2003; Väinölä et al., 2008; Dumont, 2000; Copilaş-Ciocianu et al., 2022). Amphipods are apparently one of the richest and most successful groups among all endemic Ponto-Caspian organisms, showing significant adaptive radiation. A total of 82 valid extant species, belonging to 34 genera and 5 families, are known in the Ponto-Caspian region (Copilaş-Ciocianu & Sidorov, 2022). At the same time, the diversity of the Ponto-Caspian amphipods has not yet been fully studied, especially in the Black Sea basin, despite considerable attention to this group in the context of the study of invasive species currently widespread in the fresh waters of Europe (e.g., Müller & Eggers, 2006; Messiaen et al., 2010; Arbachiauskas et al., 2013). Many species were also described along the “edges” of the Ponto-Caspian basin, for example, from the Black Sea coastal areas of Russia (Greze, 1985; Grintsov, 2009; Marin & Palatov, 2021) and Turkey (Özbek & Ustaoglu, 2007; Özbek & Özkan, 2011). The emergence of new molecular genetic methods allowed rethinking some taxonomic solutions and provoked a wave of revisions and descriptions of Ponto-Caspian gammarids (e.g., Morhun et al., 2022; Copilaş-Ciocianu et al., 2022).

In the course of studying the freshwater and coastal fauna of the Russian Black Sea coast and the foothills of the southwestern Caucasus, we studied the crustacean diversity in the mountainous rivers flowing into the sea, including all possible biotopes, adjacent
springs, river pebbles, the coastal part near the sea and others (Marin et al., in press). In the lowest part of the Durso River, under a thick layer of coastal pebbles, we found a new exotic amphipod species clearly different from the species living in the same area, as well as all known Ponto-Caspian amphipods. It is described here.

**Material and Methods**

Amphipods were collected with a hand net at the mouth and the lower part of the Durso river (44°40'N, 37°33'E), Durso, Novorossiysk area of Krasnodar Krai, southwestern Caucasus, Russia. In the estuarine part, to collect animals, it was necessary to excavate a thick layer of large coastal pebbles. Alive large animals were relaxed in a solution of a clove oil, then photographed with a Canon G16 digital camera. All crustaceans were fixed in 90% solution of ethanol. Morphological photographs were made with a digital camera attached to a light microscope Olympus ZX10 and Olympus CX21. Scanning Electron Microscopy (SEM) images were made using a Vega3 Tescan microscope in the Yu. A. Orlov Paleontological Museum of the Paleontological Institute of the Russian Academy of Sciences, Moscow. Body length (bl., mm), the dorsal length from the distal margin of the head to the posterior margin of telson, without uropod III and both antennas, was used as a standard measurement.

**Abbreviations**

Mx – maxilla; Gn – gnathopod; P – pereopod; Pp – pereopods; Cp – coxal plate; Pl – pleopod; Ep – epimeral plate; Us – urosomal segment; U – uropod.

LEMMI – The author’s personal collection at the A. N. Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences (Moscow, Russia).

**Results**

**Order Amphipoda Latreille 1816, Family Gammaridae Leach, 1814**

**Dursogammarus gen. nov.**

*Diagnosis.* Relatively large-sized species (up to 13 mm), females slightly larger than males (13 vs. 11.5 mm). Body slim and elongated, unpigmented, smooth. Pleon with free smooth urosomites, with well-defined remarkable conical protrusion (knob) on dorsal surface of urosomal segment I. Head with blunt lateral lobes. Eye elongated reniform, well pigmented. Antenna I with small aesthetascs and 3-segmented accessory flagellum. Antenna II shorter than AI, with smooth, non-setose articles. Lower lip (labium) with mostly reduced inner lobes. Maxilla II with inner plate armed with only 2 large stiff-like setae medially. Gnathopod I slightly smaller than GnII, with teardrop-shaped propodus (palm). Gnathopod II with pyriform propodus (palm), with oblique distoventral part of palmar margin. Pleopods with 2 elongated hooks and 2 thick bristles in retinacules. Pereopod VII with basis (article 2) lacking ventral lobe. Uropod III with outer ramus broad, about 5–6 times as long as wide, with mostly reduced distal article furnished with numerous long simple distal setae. Telson almost entirely cleft, with suboval lobes furnished with long slender setae.

*Differential diagnosis.* According to the keys of Ponto-Caspian gammarids (Karaman & Barnard, 1979; Copilaş-Ciocianu & Sidorov, 2022), the newly discovered gammarid cannot be referred to any of the described genera. The new genus is morphologically most similar to the genus *Echinogammarus* Stebbing, 1899 sensu lato sharing the characters that the AII much is smaller than AII and basis of PVII without ventral lobe. The new genus is also characterized by mostly reduced inner lobes of lower lip (labium); short distal article of outer ramus of UIII; and the presence of a distinct knob on UsI
strongly referring the genus to *Dikerogammarus* Stebbing, 1899. At the same time, the specific shape of both gnathopods, retinacules of pleopods with 2 elongated hooks and 2 thick bristles, fully split telson with suboval lobes, and UIII with large and strongly extended outer ramus (exopod) are characteristic for *Echinogammarus* and *Dikerogammarus*, and also present in the new genus.

The new genus can be clearly separated from the genus *Echinogammarus* sensu stricto by having an smooth and slim body, AI with short, 3-segmented accessory flagellum; short but not densely setose AII, with calceoli on flagellum; mostly reduced inner lobes of lower lip (labium); inner plate of MxII with only 2 large stiff-like setae medially; the presence of a distinct knob on UsI but the absence of any other armature of urosomal segments; very short (mostly reduced) distal article of outer ramus of UIII; and the absence of strong spines (only simple setae) on the telson.

The new genus can be separated from the genus *Dikerogammarus* by slim elongated body, short, 3–segmented accessory flagellum of AI; short and non-setose AII; basis of PVII without ventral lobe; and the absence of strong distal spines on the lobes of the telson.

The new genus also resembles *Gmelina* G. O. Sars, 1894, but it can be easily separated by different shape of upper (labrum) and lower lips (labium); palp with fused segments and trapezoidal inner lobe of MxI; different shape of GnI–II without distoventral notch; basis of PVII without ventral lobe; and entirely cleft telson without distal spines.

**Etymology.** The new genus is named after its discovery in the Durso River (Caucasus), meaning “Gammarus from Durso”.

*Dursogammarus dromaderus* sp. nov. (Figures 1–7)

**Material.** Holotype, 1♂ (bl. 7.5 mm), ZMMU Mb-1225. – Russian Federation, southwestern Caucasus, Krasnodar Krai, Novorossiysk area, mouth of Durso river (44°40'42.1"N, 37°33'41.9"E), in the stream under a thick layer of coastal pebbles, with hand net, leg. D. M. Palatov & I. N. Marin, 20.vii.2021. Deposited in the collection of Zoological Museum of Moscow State University, Moscow, Russia (ZMMU). – Paratype, 1♀ (bl. 10 mm), ZMMU Mb-1226; same locality and data as for holotype (ZMMU). – Additional material: 1♀, 1♂ (dissected), LEMMI PG-123, same locality.
and data as for holotype; 5♂, LEMMI PG-124, same locality, leg. D. M. Palatov & I. N. Marin, 20.vi.2022.

**Description.** Body slim and elongated, up to 13 mm long (Figure 1). Head (Figure S3a) with anterolateral lobe blunt, with slightly concave distal margin; eye elongate reniform, well-pigmented (Figure 1). Metasoma unarmed, with some short setules near dorsal articulation of segments. Urosomites I–III smooth (Figure 4); urosomite I with well-marked dorsal protrusion (knob) covered with thin simple setae; urosomites II–III smooth, with few simple setae, without spines or any armature. Antenna I about twice
longer and slender than antenna II, extending half of body length (Figure 1), with robust peduncular segments (Figure 2a), articles ratio is 1.0:0.91:0.30; primary flagellum consisting of about 25–26 segments, with small aesthetascs; accessory flagellum 3-segmented (Figure 2b). Antenna II (Figures 2c; Figure S3b) with strong, forward pointing gland cone; peduncle segments 2–5 relatively stout, with ratio 1.0:1.6:3.33.1; with short distal setae; primary flagellum consisting of 13–14 segments, with calceoli on articles I–X (Figure S3b, c). Upper lip (labrum) (Figure S1a) with rounded ventral margin, covered with minute setae. Mandible asymmetrical; left mandible (Figure S1g, h):
incisor with 5 teeth, lacinia mobilis with 4 teeth; with a row of 6 serrated setae between lacinia and molar, few spatulate setae and one long seta at base of molar; proximal article of palp without setae; article 2 with 26 setae; distal article with group of 3 A-setae 20–21 D-setae and 4 E-setae (Figure S1c); right mandible (Figure S1e, f): incisor process with 4 teeth, lacinia mobilis bifurcate, toothed, with a row of 5 serrated setae between lacinia and molar process. Lower lip (labium) (Figure S1ab) covered with thin setae, with mostly reduced inner lobes. Maxilla I (Figure S1g, h) with trapezoidal inner lobe, armed with 5–6 plumose setae; outer lobe with 9 distal spines with two- or multiple dentitions (Figure S1i); palp asymmetrical, with a convex outer, and slightly concave inner margins: right palp wide, with 3 strong, heavy distal spines and with 2 lateral setae (Figure S1g); left palp narrow, with 5 weaker, slenderer, distal spines and with 3 lateral setae. Maxilla II (Figure S1j) inner plate with 2 large stiff-like setae medially and numerous medium plumose setae apically; outer plate with numerous plumose setae apically. Maxilliped (Figure S1k): inner and outer plates with numerous strong stout spines and densely setose apically; palp with 4 articles, covered with numerous simple setae, terminal article hooked. Gnathopod I (Figures 2d; S3d) with groups of long plumose and simple setae on ischial, meral, carpal and propodal segments; CpI distally widened, with small simple setae on anterior margin and 2 setae on upper margin; basis sub-linear, about 3 times as long as wide, with long anterior and posterior setae; ischium about as long as wide, slightly shorter than merus; merus about 1.5 times longer than wide, with long setae on posterior margin; carpus short, triangular, about as long as wide, tapered in small distolateral lobe, with a cluster of long setae on posterior margin; propodus (palm) pyriform, about 2 times as long as wide, with oblique distoventral part of palmar margin; crenulated in its proximal (angular) part, with 3 palmar angle spines and 2–3 mid-palmar spines (Figures 2e; S3e); dactylus reaching about 55% length of propodus, posterior margin arc-shaped, with 1 long medial seta. Gnathopod II (Figures 2f; S3f) with groups of long plumose and simple setae on ischial, meral, carpal and propodal segments; CpII distally tapering, concave, with simple facial setae on anterior margin; basis sub-linear, about 4 times as long as wide, with strong anterior and long posterior setae; ischium about as long as wide, equal to merus; merus about 1.3 times as long as wide, with several long setae on posterior margin; carpus short, triangular, with a cluster of long setae on posterior margin, tapered in small distolateral lobe; propodus (palm) pyriform, about 1.5 times as long as wide, with oblique distoventral part of palmar margin; crenulated in its proximal (angular) part, with 3 palmar angle spines, 2–3 mid-palmar spines (Figures 2g; S3g, h); dactylus reaching about 40% length of propodus, posterior margin arc-shaped, with 1 long medial seta. Pereopod III (Figure S2a) with segments covered with numerous anterior and posterior long setae and spiniform setae; CpIII slightly concave, tapering distally, with numerous simple setae on anterior margin; basis sub-linear, about 4 times as long as wide; ischium as long as wide; merus about 3.5 times as long as wide; carpus about 4 times as long as wide, with posterior margin bearing tufts of long simple setae, especially distally; propodus about 5 times as long as wide, with smooth anterior margin, several long sub-distal setae and tufts of setae along posterior margin; dactylus stout, curved, with 1 long stout seta at hinge of unguis (Figure S2b). Pereopod IV (Figure S2c) with segments covered with numerous anterior and posterior long spines and spiniform setae; CpIV almost rectangular, with concave distal margin, armed with numerous simple setae on anterior margin; basis sub-linear, about 4.5 times as long as wide, with several tuft of long setae along posterior margin; ischium as long as wide; merus about 3 times as long as wide; carpus about 4 times as long as wide, with smooth anterior margin and several tuft of medium setae along posterior margin; propodus about 4 times as long as wide, with smooth anterior
Figure 4. *Dursogammarus dromaderus* gen. et sp. nov., ♂, urosomal segments, lateral view, and dorsal knob of urosomal segment I (enlarged).

margin; dactylus stout, curved, with 1 stout seta at hinge of unguis. *Pereopod V* (Figure S2d) slightly shorter than PpVI–VII; CpV bilobate, with 1 seta on anterior lobe and 1 spine on posterior lobe; basis narrow, about 2.5 times as long as wide, with numerous facial setae and slightly overhanging posterodistal corner, with relatively short spines on anterior and setae on posterior margins; ischium subquadrate, about as long as wide; merus about 2 times as long as wide; carpus about 4 times as long as wide; carpal and
meral segments with strong spines and spiniform setae along anterior and posterior margins; propodus about 6 times as long as wide, with smooth anterior margin, with several long sub-distal anterior setae and several strong spines fringed with tufts of simple setae along posterior margin; dactylus stout, curved, with 1 stout seta at hinge of unguis (Figure S2e). Pereopod VI (Figure S2f) almost similar in shape; CpVI bilobate, with several simple setae on anterior lobe and 1 spine on posterior lobe; basis narrow, about 3 times as long as wide, with numerous facial setae and slightly overhanging posterodistal corner, with relatively short spines on anterior and short spiniform setae on posterior margins; ischium subquadrate, about as long as wide; merus about 2 times as long as wide; carpus about 4–4.5 times as long as wide; propodus about 6 times as long as wide, tapering distally; carpal, meral and propodal segments with strong spines and spiniform setae along anterior and posterior margins; dactylus stout, curved, with 1 stout seta at hinge of unguis. Pereopod VII (Figure S2g) almost similar in shape to PVI; CpVII semilunar, with several simple setae on posterior and anterior margins; basis narrow, about 3.5 times as long as wide, close to linear, without posterior lobe, with relatively short spines on anterior and short spiniform setae on posterior margins; ischium subquadrate, about as long as wide; merus about 2 times as long as wide; carpus about 4–4.5 times as long as wide; propodus about 6 times as long as wide, tapering distally; carpal, meral and propodal segments with strong spines and spiniform setae along anterior and posterior margins; dactylus stout, curved, with 1 stout seta at hinge of unguis. Coxal gills balloon-shaped, present on GnII and PpIII–VI. Oostegites rather wide, close to suboval. Epimeral plate I (Figure 3a) almost ventrally rounded, with 8 setae on posterior margin, with rounded posterior corner. Epimeral plate II (Figure 3b) ventrally slightly rounded, with 3 long submarginal spines on anterior margin, posterior margin with 10–12 setae, with produced posterior corner. Epimeral plate III (Figure 3c) almost straight, with 7 long submarginal stiff-like setae and about 10 setae on posterior margin, with sharply produced posterior and pointed corner. Pleopods I–III (Figure 3h) similar in shape; both rami almost subequal, with plumose setae (Figure 5f), basal segment with 2 coupling slender hooks and 2 long stout setae in retinacules (Figure 5g). Uropod I (Figure 3h) with peduncle armed with proximoventral spine, with 4 basoventral spine and 1 subdistal spine; outer ramus shorter than inner ramus; outer ramus (exopodite) with 1 dorsal, 1 mesial and 4 distal spines; inner ramus (endopodite) with 2 dorsal and 4 distal spines. Uropod II (Figure 3i) smaller than uropod I; peduncle with 2 basoventral spine and 2 subdistal spines; outer ramus (exopodite) shorter than inner ramus (endopodite); outer ramus with 1 dorsal, 1 mesial spine and 5 distal spines; inner ramus with 2 dorsal and 5 distal spines. Uropod III (Figure 3j) with peduncle about 1.5 times longer than wide, with a cluster of subdistal spines; inner ramus (endopod) reduced, scale-like, about 7–8 times shorter than outer ramus (exopod), with several apical setae; outer ramus 2-segmented, proximal segment armed with about 10 groups of spines and/or short setae along outer margin and inner margins, distal part fringed with simple strong setae, distal segment mostly reduced (Figures 5k; 6i). Telson (Figure 3d) almost entirely cleft; lobes suboval, slightly elongated, about twice as long as wide, each lobe with 6–7 marginal and subapical slender setae, without terminal or lateral strong spines.

Sexual dimorphism. Females are slightly larger than males, with stouter body and longer antenna II (Figure 1).

Colouration. Body, appendages and internal organs are translucent whitish; eyes light pink (Figure 1).
Body size. The largest collected ♀ has tbl. 13.0 mm; the largest collected ♂ has tbl. 11.5 mm.

Etymology. The species is named after the similarity in the presence of a dorsal uroso-mal knob (tubercles) with the Dromedary, or one-humped Arabian camel (*Camelus dromedarius* Linnaeus, 1758). In Russian pronunciation as “dromader”.

Distribution and ecology. The species is presently known as an endemic of the small mountainous Durso River, Novorossiysk area of Krasnodar Krai, southwestern Caucasus, Russia. All individuals were collected in the lowest part of the river (no pronounced estuarine part present), under a thick layer of coastal pebbles, about 1–2 meters from the Black Sea shore. Probably, most of the year it is a purely freshwater habitat, but we assume that this species may be tolerant to salinity, since this part is still flooded with seawater during storms. Numerous individuals of *Echinogammarus* sp. (Crustacea: Gammaridae), probably also representing a new species, we also collected together with the new species, under the pebbles. Other species found in the same river but upstream in the wider part are gammarid amphipods *Gammarus* cf. *komareki* Schäferna, 1923, *Trichogammarus trichiaitus* (Martynov, 1932), and *Pontogammarus robustoides* G. O. Sars, 1894 (Amphipoda: Gammaridae); mayflies *Baetis* cf. *rhodani* (Pictet, 1843) and *Electrogena* sp. (Insecta: Ephemeroptera); caddisfly *Hydropsyche acuta* Martynov, 1909 (Insecta: Trichoptera).

Supplementary Material

Supplementary Material is given as a Supplementary Annex, which is available via the “Supplementary” tab on the article’s online page.

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Disclosure Statement

No potential conflict of interest was reported by the authors.

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