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Redescription of three species of Apseudidae (Tanaidacea) from the Kurile-Kamchatka Trench with general remarks on tanaidacean diversity in oceanic trenches

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Redescriptions of three species of Apseudidae are given based on samples collected from the Kurile-Kamchatka Trench during the Kurambio deep-sea expedition: Fageapseudes bicornis, F. vitjazi *and* Leviapseudes zenkevitchi. *The identification key for species of* Fageapseudes *is given. Tanaidacean fauna from the main world trenches is discussed.*

Keywords: KuramBio, deep-sea, *Fageapseudes*, *Leviapseudes*

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INTRODUCTION

Tanaidacea are known from a wide spectrum of marine habitats e.g. river estuaries, coral reefs, cold seeps or hydrothermal vents (as was summarized by Larsen, 2005) and in a wide range of depth, from shelf to hadal zone (Błażewicz-Paszkowycz *et al.*, 2012). Tanaidaceans are also described as a poorly taxonomically recognized group of Peracarida with about 1250 known species and according to the most recent estimates the total number of tanaidacean species may be an order of magnitude higher (Błażewicz-Paszkowycz *et al.*, 2012). Taking this into account it may be surprising that species known from oceanic trenches comprise about 8% of all known Tanaidacea (Anderson, 2013). Although as was shown by Błażewicz-Paszkowycz *et al.* (2014) even for the most frequently studied trenches, the state of knowledge of their tanaidacean fauna is unsatisfactory. First records of Tanaidacea from trenches date to the 1950s, when Wolf (1956a, b) described a series of four neotanaid and one apseudid species collected during Galathea cruises from Kermadec Trench. Later, studies on hadal tanaidaceans were dominated by Russian scientists, who examined materials taken during RV 'Vitjaz' expeditions to, for example, Bougainville Trench (Kudinova-Pasternak, 1965), Kurile-Kamchatka Trench (Kudinova-Pasternak, 1970), Kermadec Trench (Kudinova-Pasternak, 1972), Aleutian Trench (Kudinova-Pasternak, 1973) or Izu-Bonin Trench (Kudinova-Pasternak, 1977). Single records of hadal tanaidaceans were then made by Lang (1968) from Sunda Trench, Menzies *et al.* (1973) from Kermadec Trench, Messing (1977) from Puerto-Rico Trench and finally by Gamô (1984) from Philippine Trench. Significant studies in the field of deep-water Tanaidacea were recently conducted by Bamber (2007), Bird (2007a, b), Błażewicz-Paszkowycz (2007), Larsen (2007) and McLelland (2007). Those studies resulted in 21 new species of tanaidaceans and were summarized in a monograph dedicated to Kurile-Kamchatka and Japan Trenches fauna (Larsen & Shimomura, 2007).

The project KuramBio (Kurile Kamchatka Biodiversity Study) is the continuation of German-Russian studies in the North-west Pacific (after SoJaBio) and is dedicated to examining biodiversity and community patterns of the fauna from the Kurile Kamchatka Trench and adjacent abyssal plain. Quantitative samples taken along the Kurile Kamchatka Trench have resulted so far in 48 tanaidacean species (Błażewicz-Paszkowycz *et al.*, 2014). Preliminary studies on qualitative samples revealed three additional species representing suborder Apseudomorpha: *Fageapseudes bicornis* (Kudinova-Pasternak, 1973), *Fageapseudes vitjazi* (Kudinova-Pasternak, 1970) and *Leviapseudes zenkevitchi* (Kudinova-Pasternak, 1966). So far, the morphology of those species is poorly described and the type collections are believed to no longer be in existence. The taxonomic part of this paper presents redescriptions of them based on neotypes designated herein. Knowledge on Tanaidacea fauna from oceanic trenches is summarized.

MATERIALS AND METHODS

Material was collected from July to September 2012 on board RV 'Sonne' using Agassiz trawl – AGT (19 stations) from depths ranging between 4869 and 5427 m, and epibenthic sledge – EBS (21 station) from depths ranging between 4830 and 5780 m. Sampling was conducted along Kurile Kamchatka Trench between Hokkaido and Matua islands. Collected samples were immediately transferred into pre-cooled 96% ethanol and kept at least for 48 h in −20°C for DNA. Material from second deployment per station was fixed in formaline (4%).

Specimens were dissected using chemically sharpened tungsten needles. Appendages were then mounted in

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glycerine. Drawings were prepared using a microscope combined with a camera lucida and redrawn on a digital tablet as proposed by Coleman (2003). The morphological terminology follows that proposed by Błażewicz-Paszkowycz & Bamber (2007). The body length to width ratio was calculated using measurements from tip of the rostrum to end of pleotelson and of the widest part of cephalothorax. The redescriptions are based only on the KuramBio collection, as the type material was not available for the study. The neotypes of redescribed species were designated in accordance with Article 75.3 of the Code of Zoological Nomenclature (International Commission on Zoological Nomenclature, 1999). The examined material is deposited in the Zoological Museum, Hamburg. In this study tanaidacean systematics keeps the division into three suborders: Apseudomorpha, Neotanaidomorpha and Tanaidomorpha, unlike that proposed by Kakui *et al.* (2011), where neotanaids were demoted to superfamily level within Tanaidomorpha.

SYSTEMATICS

Suborder APSEUDOMORPHA Sieg, 1980
Superfamily APSEUDOIDEA Leach, 1813
Family APSEUDIDAE Leach, 1813
Subfamily LEVIAPSEUDINAE Sieg, 1983
Genus *Fageapseudes* Băcescu & Guţu, 1971
Fageapseudes bicornis (Kudinova-Pasternak, 1973)
(Figures 1–3)

Apseudes bicornis Kudinova-Pasternak, 1973, pp. 143–146; *Fageapseudes bicornis* Băcescu, 1978, p. 200; *Collosella bicornis* Jóźwiak & Błażewicz-Paszkowycz, 2007, pp. 8, 14.

MATERIAL EXAMINED

Neotype female (drawn in Figure 1), 12 mm long, (So 223, Station 1–10; coordinates: 43°58.26′–43°58.33′N 157°19.68′–157°17.98′E, EBS; water depth: 5417–5423 m) (cat. no. ZMH K-44336) 30 July 2012.

Additional material: one specimen (dissected on slides) (So 223, Station 6–11; coordinates: 42°29.58′–42°28.47′N 154°0.04′–153°59.67′E, EBS-S; water depth: 5290–5305 m) (cat. no. ZMH K-44337) 15 August 2012; one specimen (So 223, Station 6–11; coordinates: 42°29.58′–42°28.47′N 154°0.04′–153°59.67′E, EBS-S; water depth: 5290–5305 m) 15 August 2012; one specimen (So 223, Station 2–10; coordinates: 46°13.54′–46°14.99′N 155°33.58′–155°32.64′E, EBS-S; water depth: 4857–4867 m) 3 Aug 2012; two specimens (So 223, Station 2–9; coordinates: 46°13.60′–46°14.93′N 155°33.42′–155°32.57′E, EBS; water depth: 4860–4866 m) 2 August 2012; one specimen (So 223, Station 3–9; coordinates: 47°13.83′–47°14.87′N 154°41.88′–154°43.18′E, EBS-S; water depth: 4988–4998 m) 5 August 2012; two specimens (So 223, Station 5–9; coordinates: 43°35.50′–43°34.30′N 153°57.89′–153°58.18′E, EBS-S; water depth: 5376–5378 m) 11 August 2012; one specimen (So 223, Station 6–12; coordinates: 42°29.47′–42°28.20′N 153°59.93′–153°59.73′E, EBS-S; water depth: 5290–5307 m) 15 August 2012.

DIAGNOSIS

Pleonites without lateral apophyses and ventral bulbus, mandibles body with crenulated outer margin, article-2 of mandibular palp about 10 times as long as wide, labial palp with one spine, cheliped basis without ventral spine, cheliped propodus with three dorsal subdistal long setae, and dactylus of pereopod-4 simple.

DESCRIPTION

Female. Body (Figure 1A, B) elongated, 12 times as long as wide. Carapace without rostrum, distinctly wider in distal part; eyelobes well developed, acute and fused to carapace, visual elements absent. Pereon of six free pereonites; pereonite-1 smooth laterally, remaining pereonites with well developed lateral apophyses and hyposphenium, pereonites length-width ratio 0.6, 1.6, 2.1, 2.6, 2.3 and 2.3 respectively. Pleon of five free pleonites; pleonites trapezoidal, without lateral apophyses, subequal in length.

Antennule (Figure 2A) peduncle article-1 10 times as long as wide, with four simple setae on inner margin and one simple and seven penicillate setae on outer margin; article-2 about half as long as article-1, with one simple seta on inner

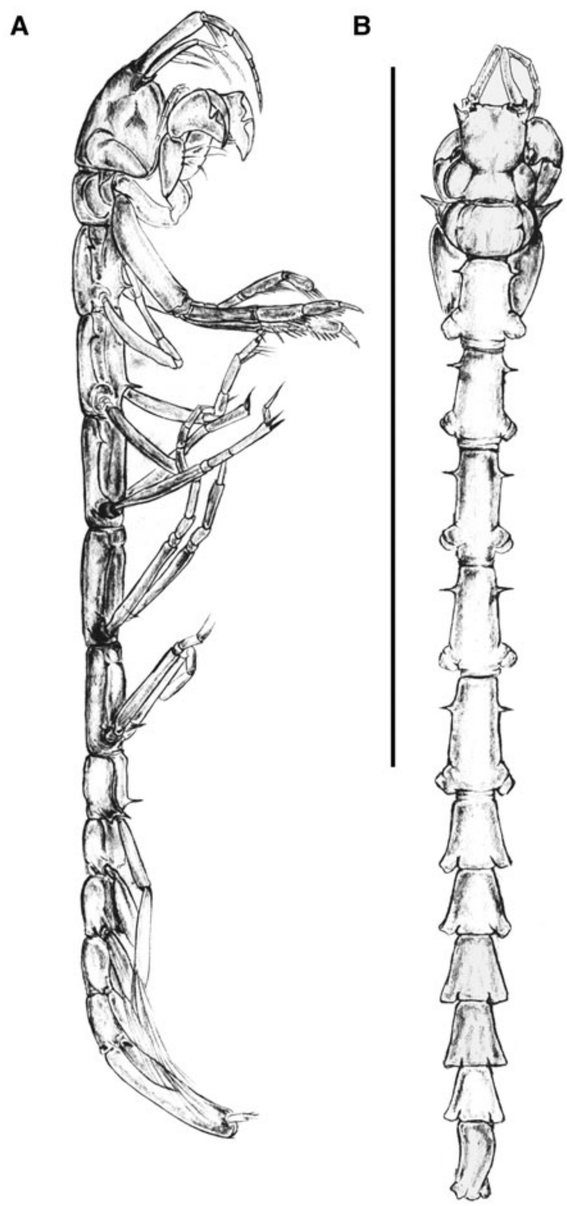

Fig. 1. *Fageapseudes bicornis* (Kudinova-Pasternak, 1973), neotype female: (A) lateral view; (B) dorsal view. Scale bar: 5 mm.

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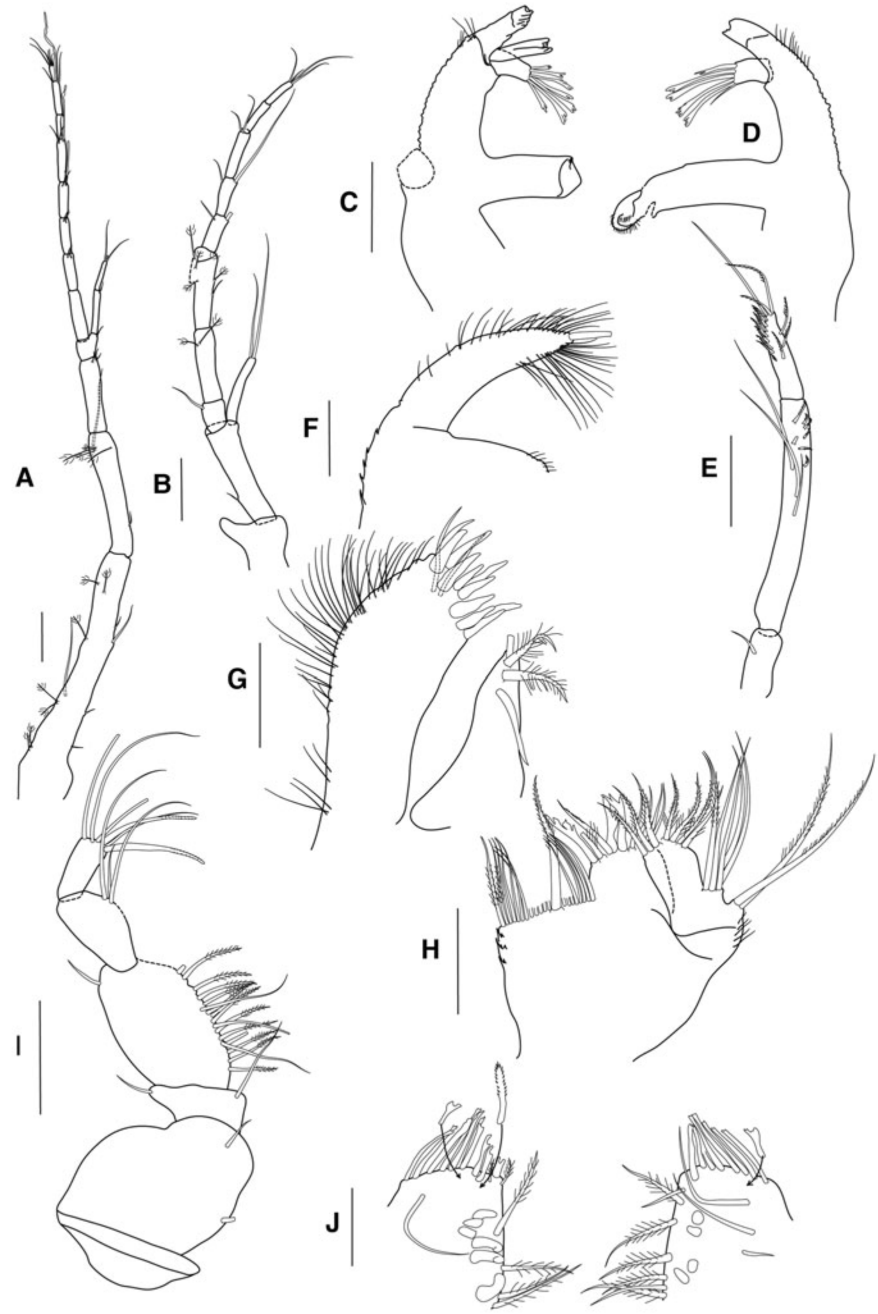

Fig. 2. *Fageapseudes bicornis* (Kudinova-Pasternak, 1973), female: (A) antennule; (B) antenna; (C) left mandible; (D) right mandible; (E) mandibular palp; (F) labium; (G) maxillule; (H) maxilla; (I) maxilliped; (J) maxillipedal endites. Scale bars: A–F and H–J, 0.2 mm; G, 0.1 mm.

margin and one simple and four penicillate setae subdistally; article-3 0.6 times as long as article-2, with three minute setae distally; article-4 with single distal seta. Outer flagellum with eight segments, with usually pair of simple distal setae; segments 4, 5 and 7 with aesthetasc; last segment with six simple setae of varying length. Inner flagellum with two unequal segments; segment-1 with one simple seta and segment-2 with three setae distally.

Antenna (Figure 2B) peduncle article-1 with distal inner projection; article-2 4.4 times as long as wide, with one inner seta; squama elongated, with two simple setae distally; article-3 about 0.3 times as long as article-2, with one simple seta on inner margin; article-4 2.7 times as long as article-3, with two subdistal penicillate setae; article-5 subequal to article-4, with six penicillate setae distally and subdistally. Flagellum of five segments, that bears usually pair of distal setae; segment-2 seta reaches end of last article; segment-5 with four distal setae of varying length.

Mouthparts. Left mandible (Figure 2C) body slightly crenulated on outer margin and with few simple setae distally; incisor well calcified, with five small denticles; lacinia mobilis with five denticles; setiferous lobe with seven multifurcated setae; molar wide and strongly calcified. Right mandible (Figure 2D) incisor bifurcated; setiferous lobe with one simple and five multifurcated setae; molar with numerous minute setae. Palp (Figure 2E) of three articles; article-1 with one simple seta on inner margin; article-2 about 10 times as long as wide, with three long simple and seven

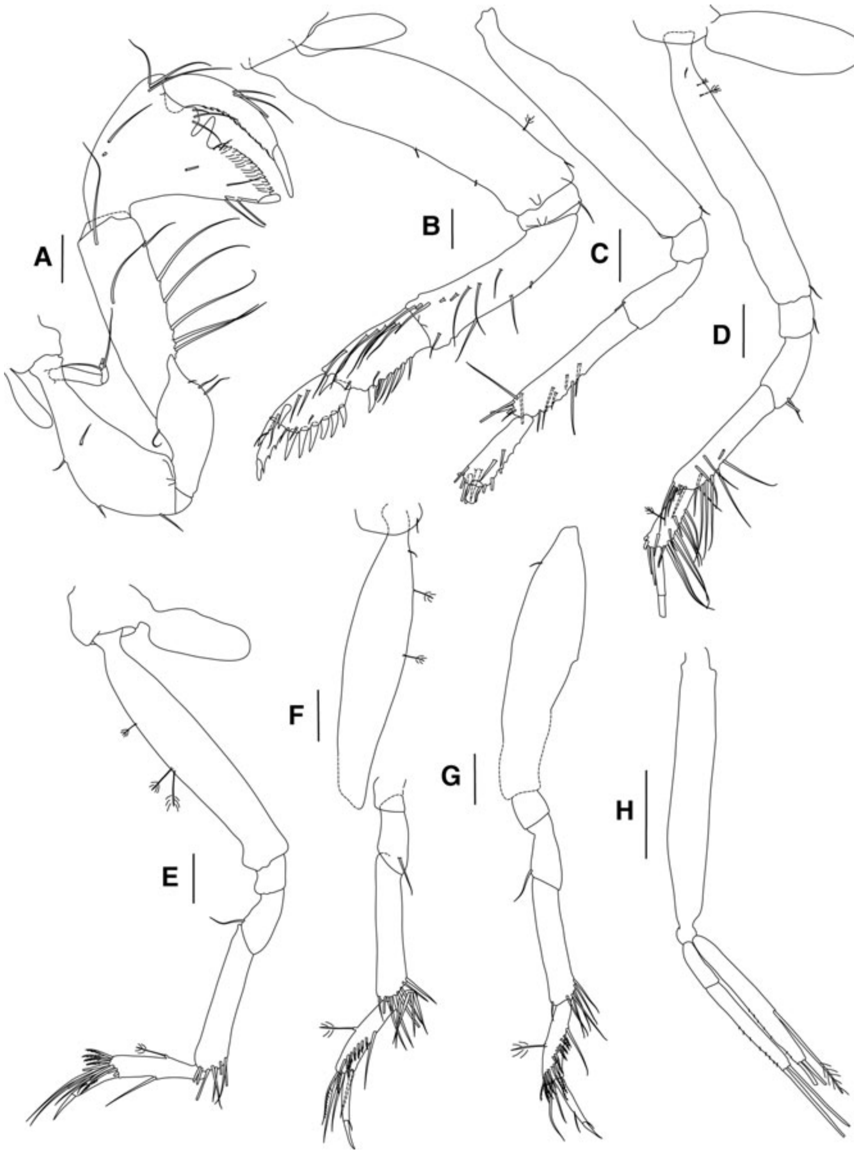

Fig. 3. *Fageapseudes bicornis* (Kudinova-Pasternak, 1973), female: (A) cheliped; (B) pereopod-1; (C) pereopod-2; (D) pereopod-3; (E) pereopod-4; (F) pereopod-5; (G) pereopod-6; (H) pleopod. Scale bars: 0.2 mm.

serrated setae on inner margin; article-3 with two rows of serrated setae and one simple seta on inner margin. Labium (Figure 2F) with small denticles on outer margin and setation on inner margin; palp narrow covered with setae, distally with one spine. Maxillule (Figure 2G) inner endite with four distal spines, at least two of them plumose; outer endite with pair of simple setae subdistally and 11 spines distally, outer margin with numerous simple setae. Maxilla (Figure 2H) outer lobe of moveable endite with two plumose setae subdistally and one plumose and four simple setae distally; inner lobe of moveable endite with seven plumose setae; outer lobe of fixed endite with four simple, two (one broken) plumose and three multifurcated setae; inner lobe of fixed endite with row of at least 20 setae and one thick plumose seta. Maxilliped (Figure 2I) basis with two inner setae; palp article-1 with one inner and one outer seta; article-2 with one outer distal seta and with inner row of at least 17 simple and plumose setae; article-3 with three simple setae on inner margin; last article with six distal setae, two of them slightly serrated. Endites (Figure 2J) inner margin with four to six coupling hooks and four to six plumose setae; distal margin with bi- and multifurcated setae, caudoinner seta slim leaflike.

Cheliped (Figure 3A) basis with four short setae ventrally and tubercle distally; exopod of three articles, last article with three distal setae (one broken); merus with one dorsal and three ventral short simple setae; carpus about twice as long as merus, with two long dorsal and six long ventral setae; propodus 1.1 times as long as wide, with five setae on dorsal margin and three setae near dactylus insertion; fixed finger as long as propodus, with four ventral setae, cutting edge with strong tooth and row of serrated denticles; dactylus subequal to fixed finger, with three dorsal setae and denticles on cutting edge.

Pereopod-1 (Figure 3B) basis four times as long as wide, with one penicillate seta on ventral and dorsal margins, ventrodistally with single simple seta, subdistally with tubercle; ischium with one simple seta and tubercle; merus about half as long as basis, with two rows of simple setae: one dorsally and one ventrally; carpus 0.6 times as long as merus, with row of simple setae and single spine on dorsal and ventral margins; propodus 0.7 times as long as carpus, with three simple setae and two spines dorsally and three simple setae and six spines ventrally; dactylus with three ventral denticles, dactylus and unguis 0.9 times as long as propodus, dactylus longer than unguis.

Pereopod-2 (Figure 3C) basis 5.7 times as long as wide, with one ventrodistal seta; ischium apparently naked; merus 0.3 times as long as basis, with one dorsodistal simple seta; carpus half as long as basis, with row of ventral setae and six simple setae dorsodistally; propodus 0.6 times as long as carpus, with apparently one serrated and eight simple setae ventrally (some of them broken off) and one spine and five setae dorsally; dactylus broken.

Pereopod-3 (Figure 3D) similar to pereopod-2, but basis with three penicillate setae ventrally, ischium with seta, merus with two subdistal ventral setae, propodus with dorsal penicillate seta.

Pereopod-4 (Figure 3E) basis about six times as long as wide, with three penicillate setae dorsally; ischium naked; merus 0.2 times as long as basis, with one dorsodistal seta; carpus 2.3 times as long as merus, with eight setae distally; propodus 0.6 times as long as carpus, with one long seta ventrally, one penicillate seta dorsally and nine simple and four serrated setae distally; dactylus with single dorsal seta, dactylus and unguis shorter than some of propodus distal setae.

Pereopod-5 (Figure 3F) similar to pereopod-4, but carpus with 13 setae distally in two rows, propodus with row of serrated setae ventrally and only four distal setae, dactylus with distal short seta, dactylus and unguis longer than propodus setae.

Pereopod-6 (Figure 3G) similar to pereopod-5, but basis without penicillate setae, carpus with less setae and dactylus with dorsal seta.

Pleopod (Figure 3H) basis elongated, 7.4 times as long as wide; exopod uniarticled, with plumose seta at the midlength and two setae distally; endopod of two articles, article-1 0.4 times as long as article-2, naked; article-2 with two setae distally.

Uropods broken.

REMARKS

From six currently known *Fageapseudes* species, *F. bicornis* closely resembles *F. suprema* (Jóźwiak & Błażewicz-Paszkowycz, 2007) by having only one spine on labial palp, by lacking lateral apophyses on pleonites and by lacking spine ventrally on cheliped basis and denticles on pereopod-4 dactylus. Those similarities may in fact suggest that both species are members of a new genus as was already proposed for *F. suprema* by Jóźwiak and Błażewicz-Paszkowycz (2007); although *F. bicornis* can be distinguished from *F. suprema* by having mandibles body with crenulated outer margin, article-2 of mandibular palp about 10 times as long as wide and three long setae dorsally on cheliped propodus (near dactylus insertion). *Fageapseudes suprema* has a smooth outer margin of mandibles body, article-2 of mandibular palp five times as long as wide and only two minute setae on the top of cheliped propodus.

There are slight differences between the description of *F. bicornis* from the current study and that presented by Kudinova-Pasternak (1973):

- length/width ratio of article-3 of maxillipedal palp: it is 1.0 in Kudinova-Pasternak (1973) and 0.6 in this study;
- length/width ratio of pereopod-1 carpus: two times as long as wide in oryginal description and 1.2 times in present study;
- number of dorsal spines on pereopod-1 propodus: one in Kudinova-Pasternak (1973) and two in this study.

DISTRIBUTION

This species was known so far from two stations from the Gulf of Alaska (incorrectly assigned to Sea of Okhotsk by Anderson, 2013) in a depth range from 3350 to 3620 m (Kudinova-Pasternak, 1973). In our studies *F. bicornis* was recorded in a series of stations west of Kurile Islands in a depth range from 4860 to 5423 m.

Fageapseudes vitjazi (Kudinova-Pasternak, 1970)
(Figures 4–7)

Apseudes vitjazi Kudinova-Pasternak, 1970, pp. 342–344, 379; *Fageapseudes vitjazi* Jóźwiak, 2014, p. 24.

MATERIAL EXAMINED

Neotype female (drawn in Figure 4 and partly dissected – one slide), 21.5 mm long (So 223, Station 9–11; coordinates: 40°34.70′–40°34.45′N 151°0.14′–151°0.15′E, AGT; water depth: 5407–5408 m) (cat. no. ZMH K-44338) 24 August 2012.

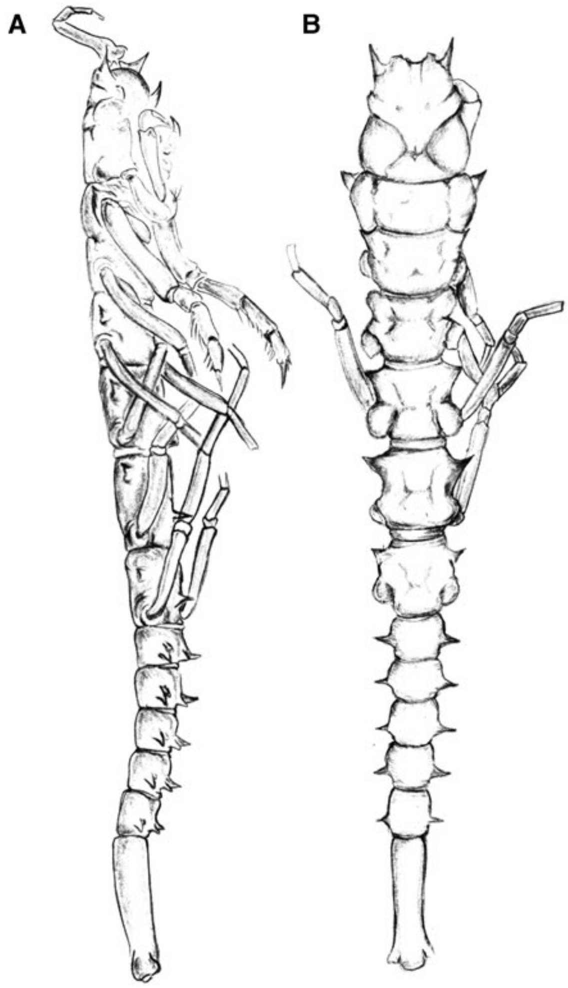

Fig. 4. *Fageapseudes vitjazi* (Kudinova-Pasternak, 1970), neotype female: (A) lateral view; (B) dorsal view. Scale bar: 5 mm.

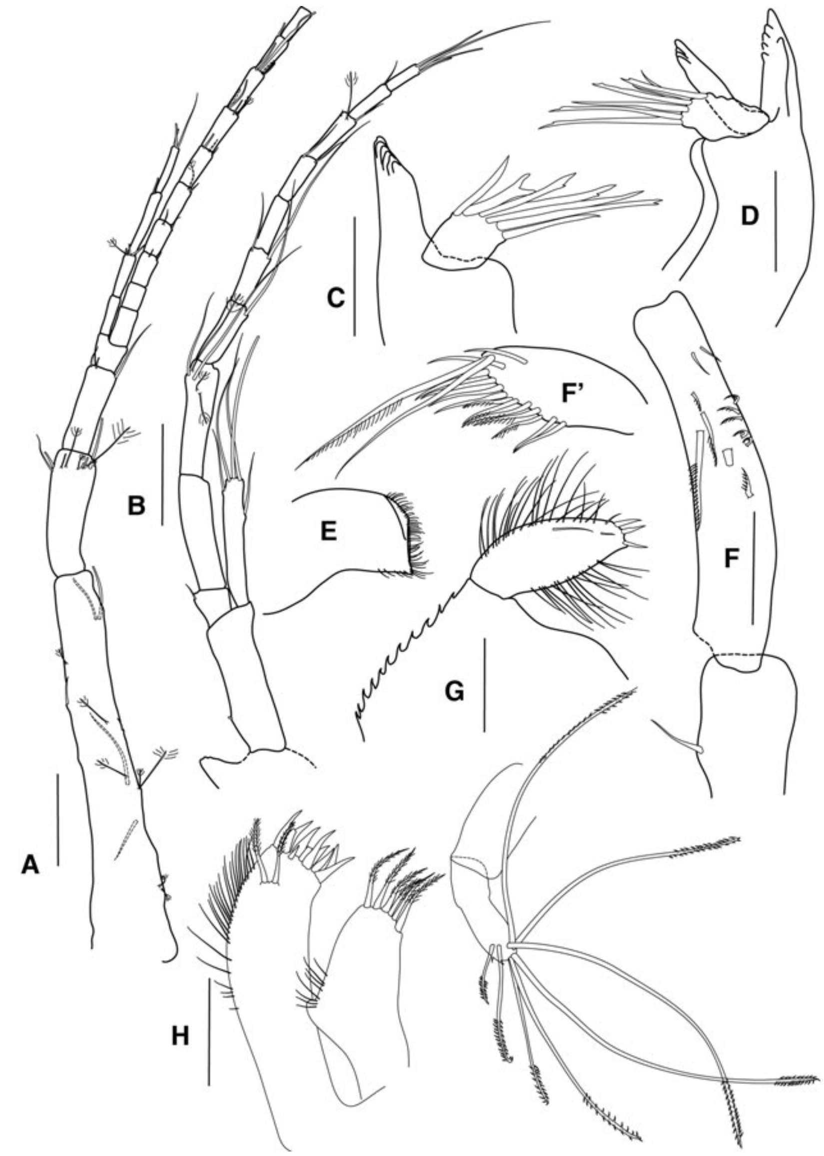

Fig. 5. *Fageapseudes vitjazi* (Kudinova-Pasternak, 1970), female: (A) antennule; (B) antenna; (C) right mandible; (D) left mandible; (E) molar process; (F) mandibular palp articles 1 and 2; (F') mandibular palp article-3; (G) labium; (H) maxillule. Scale bars: A–B, 0.2 mm; C–H, 0.1 mm.

Additional material: one specimen dissected on slides (So 223, Station 3–5; coordinates: 47°14.30′N 154°42.23′E, GKG; water depth: 4984 m) (cat. no. ZMH K-443394) 5 August 2012; one specimen (So 223, Station 9–12; coordinates: 40°35.40′–40°34.27′N 150°59.84′–150°59.00′E, EBS; water depth: 5389–5400 m) 24 August 2012; two specimens (So 223, Station 5–9; coordinates: 43°35.50′–43°34.30′N 153°57.89′–153°58.18′E, EBS; water depth: 5376–5378 m) 11 August 2012; one specimen (So 223, Station 3–4; coordinates: 47°14.32′–47°14.32′N 154°42.26′–154°42.26′E, GKG; water depth: 4982 m) 4 August 2012; one damaged specimen (So 223, Station 2–9; coordinates: 46°13.60′–46°14.93′N 155°33.42′–155°32.57′E, EBS; water depth: 4860–4866 m) 2 August 2012; one specimen (So 223, Station 2–10; coordinates: 46°13.54′–46°14.99′N 155°33.58′–155°32.64′E, EBS; water depth: 4857–4867 m) 3 August 2012.

DIAGNOSIS

Pereonites with short lateral apophyses, pleonites with well developed lateral apophyses and ventral bulbus, mandibles body with smooth outer margin, second article of mandibular palp five times as long as wide, labial palp with three spines, cheliped basis with ventral spine, pereopod-1 coxa apophysis short, and dactylus of all pereopods with ventral denticles.

DESCRIPTION

Female. Body (Figure 4A, B) 8.2 times as long as wide. Carapace 14% of total body length, without rostrum but with well developed acute eyelobes, no track of visual elements. Pereon of six free pereonites; pereonites length-width ratio: 0.4, 0.7, 0.9, 1.0, 1.1 and 1.0 respectively; pereonites from 2 to 6 with lateral apophyses. Pleon 38% of total body length, with five free pleonites; pleonites squareshaped, subequal in size, with lateral acute apophyses accompanied by ventral bulbus; pleotelson as long as last three pleonites.

Antennule (Figure 5A) peduncle article-1 8.5 times as long as wide, with one penicillate and one simple setae on inner margin and four simple and seven penicillate setae on outer margin; article-2 0.3 times as long as article-1, with five simple and four penicillate setae subdistally; article-3 0.7

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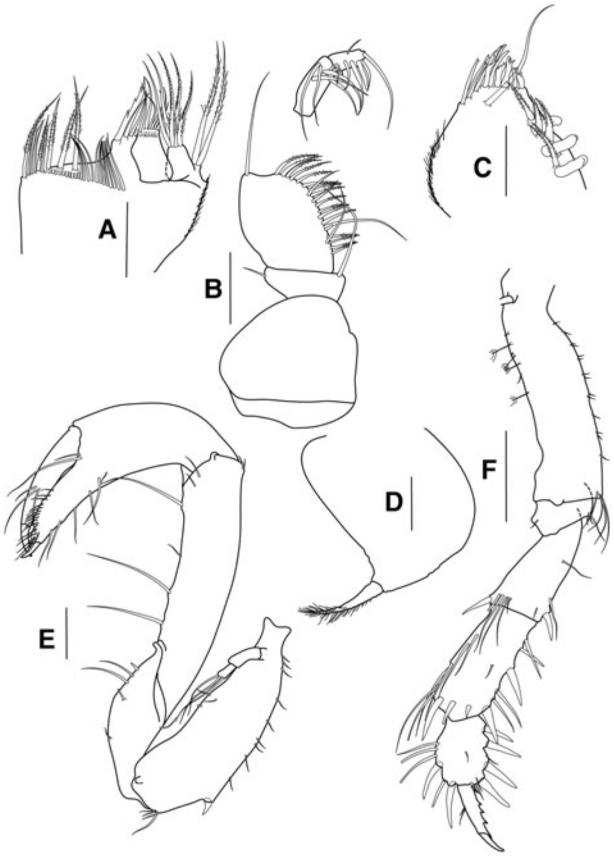

Fig. 6. *Fageapseudes vitjazi* (Kudinova-Pasternak, 1970), female: (A) maxilla; (B) maxilliped; (C) maxillipedal endite; (D) epignath; (E) cheliped; (F) pereopod-1. Scale bars: A–E, 0.2 mm; F, 0.5 mm.

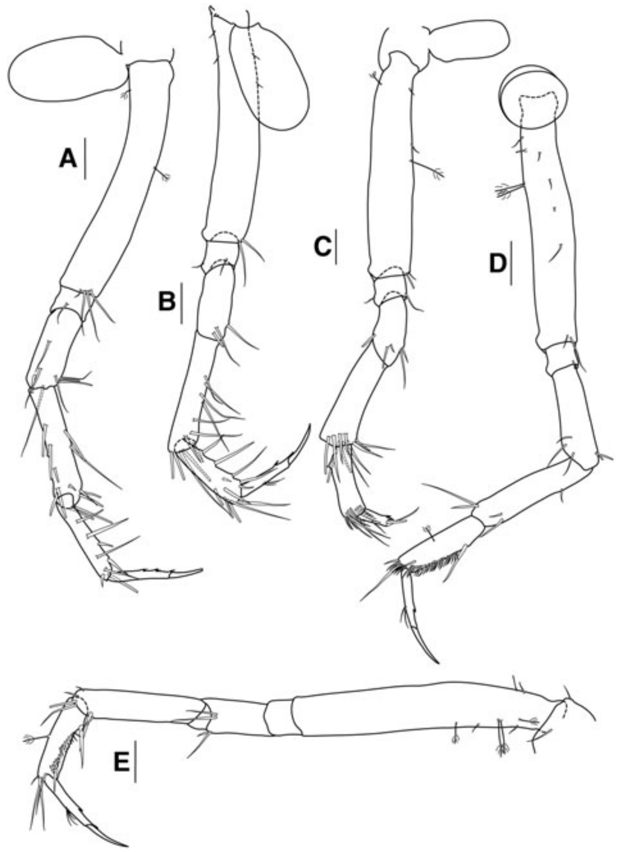

Fig. 7. *Fageapseudes vitjazi* (Kudinova-Pasternak, 1970), female: (A) pereopod-2; (B) pereopod-3; (C) pereopod-4; (D) pereopod-5; (E) pereopod-6. Scale bars: 0.2 mm.

times as long as article-2, with three setae distally; article-4 naked. Outer flagellum with at least 10 segments, segment-8 with aesthetasc. Inner flagellum of four segments; segment-2 with two simple and two penicillate setae, segment-3 with one penicillate seta and segment-4 with three simple setae distally.

Antenna (Figure 5B) peduncle article-1 with distaloinner projection; article-2 with one inner seta; squama elongated, with one seta subdistally and four simple setae distally; article-3 with one simple seta on distaloinner margin; article-4 as long as article-5, naked; article-5 with three penicillate and two simple setae distally. Flagellum of seven segments; segments 1 and 2 with elongated simple seta; last segment with four distal setae.

Mouthparts. Right mandible (Figure 5C) incisor with six denticles distally; setiferous lobe with three simple and four bifurcated setae. Left mandible (Figure 5D) incisor with six denticles distally; lacinia mobilis with four denticles; setiferous lobe with three simple and four bifurcated setae; molar process (Figure 5E) with numerous minute setae. Palp (Figure 5F, F') of three articles; article-1 with single inner seta; article-2 five times as long as wide, with 10 serrated and two simple setae on inner margin; article-3 with nine simple and six serrated setae. Labium (Figure 5G) outer margin serrated; palp covered with numerous simple setae, terminally with three spines. Maxillule (Figure 5H) inner endite with six plumose spines distally and some setae on outer margin; outer endite with two plumose setae subdistally, 11 spines distally and numerous setae on outer margin. Palp of two articles, second article with eight setae with rows of hooks in distal part. Maxilla (Figure 6A) outer lobe of moveable endite with two plumose setae subdistally, two simple and three plumose setae distally; inner lobe of moveable endite with six simple setae; outer lobe of fixed endite with three simple and one serrated setae; inner lobe of fixed endite with row of 27 simple setae and five plumose setae. Maxilliped (Figure 6B) basis naked; palp article-1 with short seta on outer margin and elongated simple seta on inner margin; article-2 with 18 serrated and three simple setae on inner margin and one long seta on distal outer margin; article-3 with seven setae subdistally; last article with one simple seta on outer margin and five simple setae on inner margin. Endite (Figure 6C) outer margin with minute setae; inner margin with three coupling hooks and four plumose spines; distal margin with one simple, five multifurcated and six bifurcated setae; caudoinner seta simple. Epignath (Figure 6D) massive; distal seta half as long as lobe, with fine setation.

Cheliped (Figure 6E) basis 3.2 times as long as wide, with three short setae dorsally, row of short setae and spine ventrally and tuft of four setae ventrodistally, distally with tubercle; merus half as long as basis, with one dorsal seta and four setae and one spine ventrally; carpus 4.3 times as long as wide, with four (three long and one short) setae ventrally, pair of seta ventrodistally and dorsodistally; propodus 2.3 times as long as wide, with two unequal setae near dactylus insertion; fixed finger with six setae ventrally and row of fine setae on cutting edge; dactylus as long as fixed finger, with three middorsal setae.

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Pereopod-1 (Figure 6F) basis 4.3 times as long as wide, with seven penicillate setae dorsally, row of paired short setae ventrally and tuft of four setae ventrodistally; ischium with one dorsal seta and three ventral setae; merus 0.4 times as long as wide, with one seta ventrally, two setae and spine ventrodistally and five setae and spine dorsodistally; carpus 1.3 times as long as merus, with six setae and one spine dorsally, two spines distally and four setae and two spines ventrally; propodus half as long as carpus, with four setae and two spines dorsally and one serrated and three simple setae and four spines ventrally; dactylus with two setae dorsally and four denticles ventrally, dactylus and unguis slightly shorter than propodus.

Pereopod-2 (Figure 7A) basis 6.3 times as long as wide, with penicillate seta on dorsal and ventral margin, ventrodistally with four simple setae; ischium with seta; merus 0.3 times as long as basis, with three setae dorsally, one seta distally and four setae ventrally; carpus half as long as basis, with five setae ventrally, five setae dorsally, two setae distally and short spine subdistally; propodus 0.8 times as long as carpus, with one spine and three setae ventrally, two setae and two spines distally; dactylus half as long as carpus, with three ventral denticles accompanied by short setae.

Pereopod-3 (Figure 7B) basis 5.7 times as long as wide, with pair of minute setae on lateral margins and two simple setae ventrodistally; ischium with one dorsal and one ventral setae; merus 0.3 times as long as basis, with three setae ventrodistally; carpus 1.5 times as long as merus, with six setae ventrally, two spines ventrodistally and four setae dorsodistally; propodus slightly longer than merus, with four setae and one spine ventrally, five setae dorsally and two spines subdistally; dactylus with two dorsal setae and two ventral denticles, dactylus and unguis 0.9 times as long as propodus.

Pereopod-4 (Figure 7C) basis 3.7 times as long as wide, with one penicillate seta dorsally, one penicillate and two minute setae ventrally and two setae ventrodistally; ischium with one dorsal and one ventral setae; merus 0.3 times as long as basis, with four setae ventrodistally and single seta dorsodistally; carpus about half as long as basis, with total of 11 setae in two rows distally; propodus 0.7 times as long as carpus, with penicillate seta dorsally and 11 simple setae distally and subdistally; dactylus with two ventral denticles; unguis broken.

Pereopod-5 (Figure 7D) basis six times as long as wide, with one simple and three penicillate setae dorsally, four setae ventrally and two setae ventrodistally; ischium with simple seta; merus 0.4 times as long as basis, with three setae dorsodistally and two setae ventrodistally; carpus 1.2 times as long as merus, with one seta ventrally, two setae ventrodistally and two setae dorsodistally; propodus about as long as merus, with penicillate seta dorsally, strong seta ventrally and distally and row of short spines ventrally and distally; dactylus with two dorsal setae and one ventral denticle, with unguis subequal merus.

Pereopod-6 (Figure 7E) similar to pereopod-5, but merus with four distal setae, carpus with six distal setae, propodus with three long dorsodistal setae and dactylus with three dorsal setae.

Pleopods absent.

Uropods broken.

REMARKS

This species was primarily classified as genus *Apseudes* (Kudinova-Pasternak, 1970) but was recently moved to *Fageapseudes* on the basis of lack of rostrum and shape of pereonites 1 and 6 and pleon (Jóźwiak, 2014). *Fageapseudes vitjazi* differs from both *F. suprema* and *F. bicornis* by having well developed lateral apophyses on pleonites, labial palp with three spines, ventral denticles on dactylus of all pereopods and cheliped basis with ventral spine. It can be distinguished from *F. brachyomos* Bamber, 2007 by well developed, acute lateral apophyses on pleonites and from *F. retusifrons* (Richardson, 1912) by relatively short apophyses on pereonites and pereopod-1 coxa. Taking into account the shape of pleonites (including presence of ventral bulbus), armament of cheliped and pereopods 2–6, *F. vitjazi* resembles *F. pluma* Drumm & Bamber, 2013; however, both species can be distinguished by the slenderness of their second mandibular palp, carpus and propodus of pereopod-1 (see Jóźwiak, 2014) and by the shape of caudoinner seta of maxillipedal endite.

The main difference between descriptions of *F. vitjazi* from this paper and Kudinova-Pasternak (1970) is the number of ventral spines on pereopod-1 propodus, since this study showed four in comparison to the five spines stated in the original description.

DISTRIBUTION

Fagapseudes vitjazi was recorded east off Kurile Islands in depths between 4857 and 5408 m (Kudinova-Pasternak, 1970, 1973; KuramBio collection).

KEY FOR IDENTIFICATION *FAGEAPSEUDES* SPECIES

1. Pleonites with distinct lateral apophyses 2
   – Pleonites without lateral apophyses 4
2. Pleonites with ventral bulbous processes 3
   – Pleonites without ventral bulbous processes . . . . *F. retusifrons*
3. Cheliped exopod with two setae terminally . . . . . *F. pluma*
   – Cheliped exopod with three setae terminally . . . . *F. vitjazi*
4. Labial palp with three terminal spines. . . . *F. brachyomos*
   – Labial palp with one terminal spine 5
5. Mandibles body with crenulated outer margin, palp article-2 ten times as long as wide. . . . . *F. bicornis*
   – Mandibles body with smooth outer margin, palp article-2 five times as long as wide . . . . . . *F. suprema*

Genus *Leviapseudes* Sieg, 1983
Leviapseudes zenkevitchi (Kudinova-Pasternak, 1966)
(Figures 8–10)

Apseudes sp. Belyaev, 1966, p. 87; *Apseudes zenkevitchi* Kudinova-Pasternak, 1966, pp. 518–521; *Leiopus zenkevitchi* Lang, 1968, p. 25; *Leviapseudes zenkevitchi* Sieg, 1983, p. 176.

MATERIAL EXAMINED

Neotype juvenile male (drawn in Figure 8), 12.2 mm long (So 223, Station 7–9; coordinates: 43°2.87′N–43°1.50′N 152°59.45′E–152°58.35′E, EBS; water depth: 5121–5126 m) (cat. no. ZMH K-44340) 17 August 2012.

Additional material: one manca dissected on slides (So 223, Station 6–11; coordinates: 42°29.58′N–42°28.47′N 154°0.04′E– 153°59.67′E, EBS; water depth: 5290–5305 m) (cat. no. ZMH K-44341) 15 August 2012.

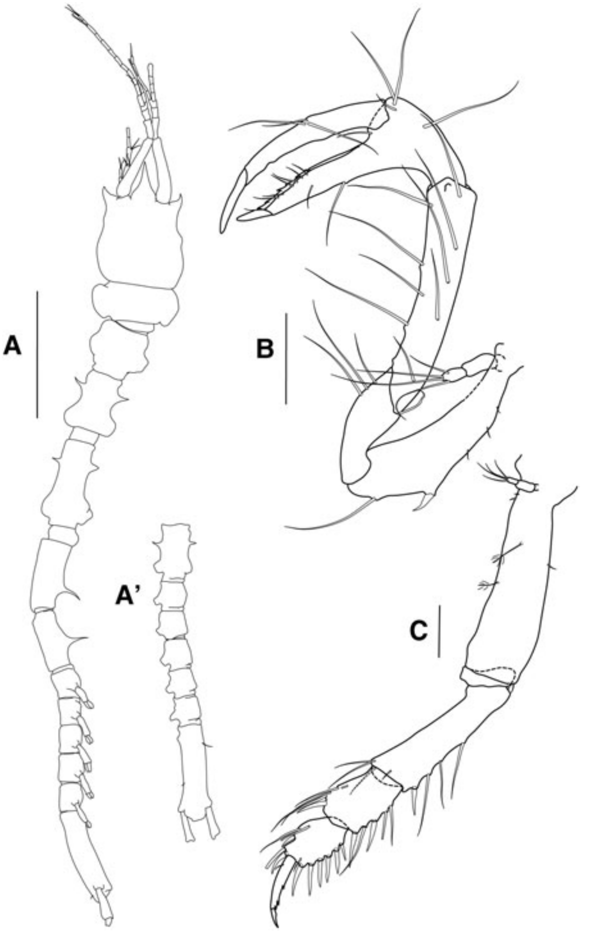

Fig. 8. *Leviapseudes zenkevitchi* (Kudinova-Pasternak, 1966), neotype juvenile male: (A) body; (A') pleon dorsal view; manca: (B) cheliped; (C) pereopod-1. Scale bars: A, A', 1 mm; B–C, 0.2 mm.

DIAGNOSIS

Pleonites without lateral apophyses, antenna squama slim, with reduced setation, cheliped basis with ventral spine, cheliped carpus elongated (6.4 times as long as wide), and pereopod-1 propodus shorter than carpus.

DESCRIPTION

Juvenile male. Body (Figure 8A, A') elongated, nine times as long as wide. Carapace 17% of total body length, with well developed rostrum and acute eyelobes that lack visual elements; well developed apophyses additionally in front of branchial chambers. Pereon of six free pereonites, length-width ratio 0.4, 0.8, 1.7, 2.9, 2.8 and 2.1 respectively; pereonites 3–6 with lateral apophyses. Pleon 31% of total body length, of five free pleonites, pleonites trapezoidal without lateral apophyses, subequal in size; pleotelson longer than last three pleonites.

Antennule (Figure 9A) peduncle article-1 6.6 times as long as wide, with two penicillate setae on inner margin and one simple and six penicillate setae on outer margin; article-2 0.3 times as long as article-1, with one simple and six penicillate setae subdistally; article-3 0.6 times as long as article-2, with four minute setae distally; article-4 naked. Outer flagellum with 11 segments, segment-9 with two setae and aesthetasc; last segment with one penicillate and four simple setae. Inner flagellum of three segments; segment-1 with one minute seta, segment-2 with one penicillate seta and segment-3 with one penicillate and three simple setae distally.

Antenna (Figure 9B) peduncle article-1with distaloinner projection; article-2 2.4 times as long as article-3, naked; squama elongated, with two unequal simple setae distally; article-3 with one simple inner seta; article-4 2.6 times as long as article-3, with two penicillate setae distally; article-5 1.4 times as long as article-4, with four penicillate setae distally and subdistally. Flagellum of three segments; segment-1 with simple seta reaching end of antenna; segment-2 with two simple setae; last segment with four distal setae.

Mouthparts. Right mandible (Figure 9C) incisor with five distal denticles; setiferous lobe with five bi- or trifurcated setae; palp (Figure 9C') of three articles; article-1 with single inner seta; article-2 4.2 times as long as wide, with three serrated setae in distal inner part; article-3 with distal inner row of nine serrated setae increasing in length towards the end of article. Maxillule (Figure 9D) inner endite with simple setae on inner and outer margins, distally with one serrated and two simple spines; outer endite with three setae ventrally, three subdistally and nine distal spines; palp (Figure 9D') of two articles, article-2 with two simple setae and five setae terminated with row of small hooks. Maxilla (Figure 9E) outer lobe of moveable endite with two plumose setae subdistally and five plumose setae distally; inner lobe of moveable endite with seven plumose setae; outer lobe of fixed endite with one simple, two plumose, four multifurcated and three bifurcated setae; inner lobe of fixed endite with row of 25 setae and three thick plumose setae. Maxilliped (Figure 9F, F') basis naked; palp article-1 with one short outer seta and one inner seta reaching end of last article; article-2 with two long simple outerodistal setae and five simple and nine serrated setae on inner margin; article-3 with four simple setae on inner margin; last article with five simple setae. Endite (Figure 9G) on inner margin only one coupling hook left; subdistally with three bi- and five multifurcate setae; distally with one simple seta, two bifurcate setae with pointed tip and four multifurcate setae (one seta broken); caudoinner seta leaf shaped.

Cheliped (Figure 8B) basis slim, 4.2 times as long as wide, ventrally with three minute setae in proximal part, one spine at midlength and one long seta in distal part; exopod of three articles, last article with four setae distally; merus half as long as basis, with three ventral setae; carpus 6.4 times as long as wide, with two rows of four setae: ventral and dorsal; propodus 1.5 times as long as wide, with one short and three long setae dorsally and single seta ventrally near dactylus insertion; fixed finger with two ventral setae, cutting edge with few simple setae and denticles; dactylus slightly longer than fixed finger, with three middorsal setae.

Pereopod-1 (Figure 8C) basis 4.3 times as long as wide, with two minute and two penicillate setae dorsally and two minute setae ventrally; ischium with simple seta; merus four times as long as wide, with one spine and three setae ventrally, two simple setae distally and two dorsodistally; carpus half as long as merus, with four setae and one spine dorsally and three setae and two spines ventrally; propodus 0.7 times as long as carpus, with three setae and two spines dorsally and one seta and six spines ventrally; dactylus with dorsal seta and three ventral denticles, dactylus and unguis as long as carpus.

Pereopod-2 (Figure 10A) basis 8.5 times as long as wide, with two penicillate setae dorsally, two minute ventrally and one seta ventrodistally; ischium with single seta; merus

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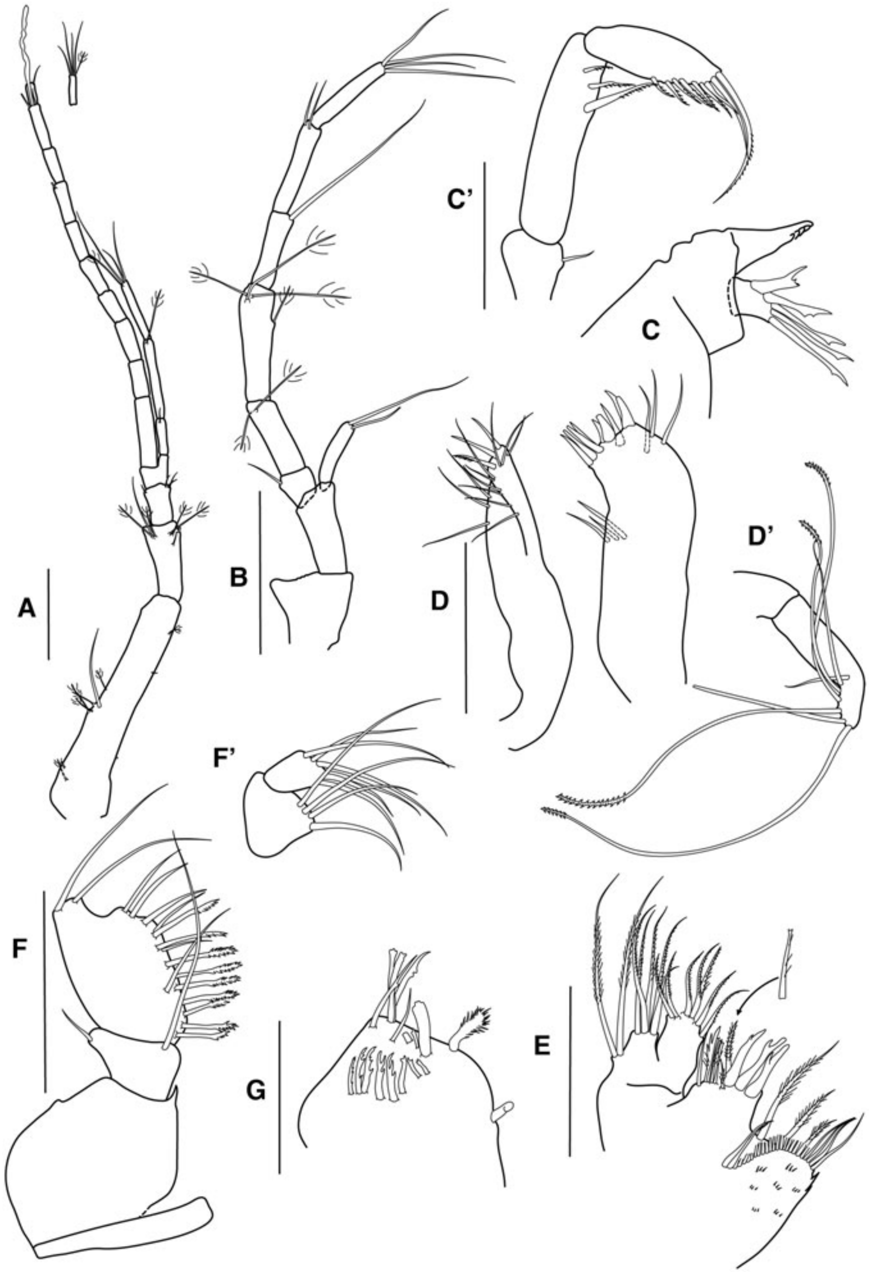

Fig. 9. *Leviapseudes zenkevitchi* (Kudinova-Pasternak, 1966), manca: (A) antennule; (B) antenna; (C) right mandible; (C') mandibular palp; (D) maxillule; (D') maxillular palp; (E) maxilla; (F) maxilliped; (F') articles 3 and 4 of maxillipedal palp; (G) maxillipedal endite. Scale bars: 0.2 mm.

about 0.4 times as long as basis, with three setae ventrally and one seta dorsally; carpus half as long as basis, with four setae dorsally, one short seta distally and five setae ventrally; propodus 0.8 times as long as carpus, with five setae dorsally, two spines distally and six setae and two spines ventrally; dactylus with one dorsal seta and one seta ventrally at unguis insertion, dactylus and unguis as long as carpus.

Pereopod-3 (Figure 10B) basis 8.8 times as long as wide, with two penicillate setae ventrally and one simple seta ventrodistally; ischium with single seta; merus 0.3 times as long as basis, with short seta dorsodistally and one long seta ventrodistally; carpus 1.5 times as long as merus, with three setae ventrally, one distally and two dorsodistally; propodus 0.8 times as long as carpus, with four setae dorsally, six setae ventrally and two distal spines; dactylus as long as merus, with one dorsal and one ventral setae, dactylus and unguis half as long as basis.

Pereopod-4 (Figure 10C, C') basis 9.6 times as long as wide, with two penicillate setae dorsally and simple seta ventrodistally; ischium with one seta; merus with one seta dorsodistally and two setae ventrodistally; carpus 1.8 times as long as merus, with one seta at midlength ventrally and eight setae distally; propodus 0.8 times as long as carpus, with one penicillate seta dorsally and 14 setae dorsodistally; dactylus short, with dorsal seta and ventrodistal apophysis, unguis trifurcated (Figure 10C').

Pereopod-5 (Figure 10D) basis almost nine times as long as wide, with three penicillate setae dorsally, one penicillate seta

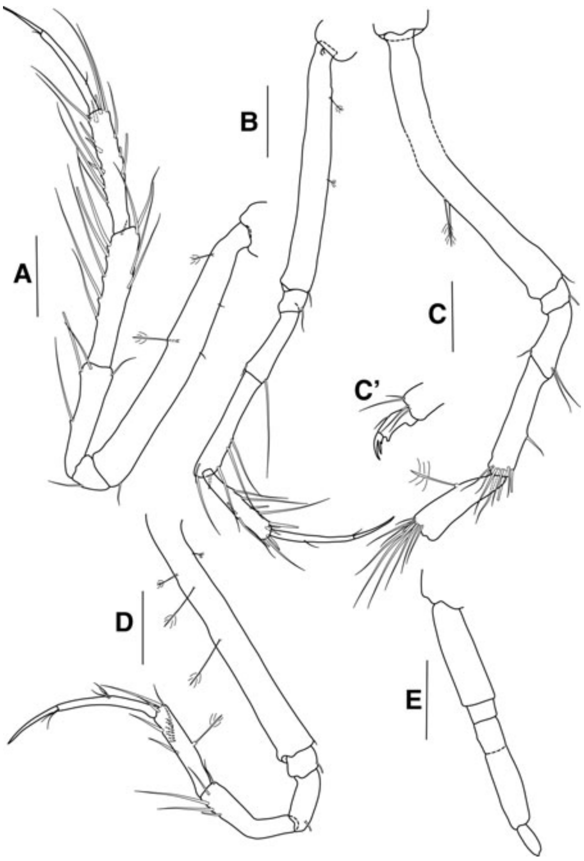

Fig. 10. *Leviapseudes zenkevitchi* (Kudinova-Pasternak, 1966), manca: (A) pereopod-2; (B) pereopod-3; (C) pereopod-4; (C') dactylus and unguis of pereopod-4; (D) pereopod-5; (E) pereopod-6. Scale bars: 0.2 mm.

ventrally and one simple seta ventrodistally; ischium with single seta; merus with one ventral seta; carpus twice as long as merus, with five setae in distal part; propodus as long as carpus, with one penicillate seta dorsally, three simple setae dorsodistally, two strong setae ventrally and ventral row of short spines; dactylus as long as propodus, with three dorsal and two ventral setae, together with unguis longer than half of basis.

Pereopod-6 (Figure 10E) rudimental and without setation.

REMARKS

The main characters differentiating *L. zenkevitchi* from remaining species of the genus are:

- lack of lateral apophyses on pleonites. Apophyses are present in *L. abberans* (Lang, 1968), *L. bipartitus* Larsen, 2005, *L. demerarae* Băcescu, 1984, *L. galatheae* (Wolff, 1956), *L. gracillimus* (Hansen, 1913), *L. hanseni* (Lang, 1968), *L. longispina* Băcescu, 1983, *L. macaronesia* Larsen, 2012, *L. pleonudus* Błażewicz-Paszkowycz & Larsen, 2004, *L. preamazonica* Băcescu, 1984, *L. tenuimanus* Błażewicz-Paszkowycz & Larsen, 2004 and *L. wolffi* (Lang, 1968).
- ventral spine on cheliped basis. In *L. conspicuus* (Lang, 1968), *L. demerarae, L. drachi* Băcescu, 1984, *L. gracilis* (Norman & Stebbing, 1886), *L. gracillimus, L. segonzaci gasconicus* Băcescu, 1984, *L. segonzaci segonzaci* Băcescu, 1981, cheliped is smooth.
- pereopod-4 dactylus-unguis comb-like. Smooth dactylus-unguis is present in *L. aberrans*, *L. angelikae* Jóźwiak & Błażewicz-Paszkowycz, 2007, *L. gracillimus*, *L. leptodactylus* (Beddard, 1886), *L. macaronesia*, *L. preamazonica*, *L. shiinoi* (Lang, 1968), *L. tenuimanus*.
- pereopod-1 basis ventrodistally only with simple setae. In *L. angelikae, L. bipartitus, L. conspicuus, L. macaronesia* and *L. pleonudus* ventrodistal corner of pereopod-1 basis has a simple spine, while in *L. gracilis, L. leptodactylus, L. longispina, L. shiinoi* and *L. wolffi* it is terminated with well developed acute process.

Moreover *L. zenkevitchi* differs from *L. caecus* (Willemoes-Suhm, 1875) by having reduced, slim squama with only two setae (in latter species at least nine setae). From *L. weberi* (Nierstrasz, 1913) it differs by elongated carpus of cheliped (6.4 times as long as wide in *L. zenkevitchi* and 3.2 times as long as wide in *L. weberi*). *Leviapseudes zenkevitchi* can be distinguished from *L. zenkevitchioides* by having propodus of pereopod-1 shorter than carpus (in latter species it is distinctly longer).

The specimens of *L. zenkevitchi* described herein differ slightly from the original description of this species (Kudinova-Pasternak, 1966), as its pereonites from 4 to 6 and cheliped dactylus are narrower. This variability can be explained by the fact that the type specimen was a mature female and our redescription is based on mancas.

DISTRIBUTION

Leviapseudes zenkevitchi is a widely distributed species including Kurile Islands, Kermadec, the Caribbean Sea and Grenada, with the original type locality in the North-east Pacific – 40°19.7′N 175°45.3′E, in depths from 1067 to 6065 m (Kudinova-Pasternak, 1966; Kudinova-Pasternak & Pasternak 1978; KuramBio collection).

DISCUSSION

General remarks on Tanaidacea fauna of oceanic trenches

Up to now, there are 105 Tanaidacea species known from 17 oceanic trenches (Table 1); 94 of them are officially described. The best examined trench with regard to tanaidacean fauna is the Kurile-Kamchatka Trench with 45 recorded species. Next in order are Aleutian and Japan Trenches with 26 and 25 species respectively. The Izu-Bonin Trench has 11 recorded species while Kermadec Trench 10 species. Single Tanaidacea species were found also in: South Shetlands Trench (six species), Bougainville Trench (five species), Puerto Rico Trench (four species), Peru-Chile and Philippine Trenches (each with three species), Romanche and Cayman Trenches (two species each), and finally Banda, Mariana, New Hebrides, Palau and Sunda Trenches (with only one species).

Oceanic trenches fauna is dominated by tanaidomorphs as they were recorded in 13 from 17 considered trenches, with typically deep-water families such as Akanthophoreidae (noted in eight trenches) and Agathotanaidae (in five trenches), and families with suggested deep-water origin such as Colletteidae Larsen & Wilson, 2002 (five trenches), Typhlotanaidae Sieg, 1984 or Pseudotanaidae Sieg, 1973

Table 1. List of tanaidacean species recorded for oceanic trenches. Doubtful records are marked with asterisks.

Localization	Family	Species	Record
Aleutian Trench (NW Pacific)	Apseudidae	*Carpoapseudes serratispinosus* Lang, 1968	Kudinova-Pasternak (1973)
		Fageapseudes vitjazi (Kudinova-Pasternak, 1970)	Kudinova-Pasternak (1973)
		Fageapseudes bicornis (Kudinova-Pasternak, 1973)	Kudinova-Pasternak (1973)
		Leviapseudes zenkevitchi (Kudinova-Pasternak, 1966)	Kudinova-Pasternak (1973)
	Neotanaidae	*Neotanais americanus* Beddard, 1886 (=*N. serratispinosus*)*	Kudinova-Pasternak (1973)
		Neotanais triangulocephalus Kudinova-Pasternak, 1973	Kudinova-Pasternak (1973)
		Neotanais barfoedi Wolff, 1956	Kudinova-Pasternak (1973)
	Agathotanaidae	*Agathotanais splendidus* Kudinova-Pasternak, 1970	Kudinova-Pasternak (1973)
		Paragathotanais zevinae (Kudinova-Pasternak, 1970)	Kudinova-Pasternak (1973)
		Paranarthrura insignis Hansen, 1913*	Kudinova-Pasternak (1973)
		Paranarthrura vitjazi Kudinova-Pasternak, 1970	Kudinova-Pasternak (1973)
	Akanthophoreidae	*Akanthophoreus gracilis* (Krøyer, 1842)*	Kudinova-Pasternak (1973)
		Chauliopleona armata (Hansen, 1913)*	Kudinova-Pasternak (1973)
		Parakanthophoreus longiremis (Lilljeborg, 1864)*	Kudinova-Pasternak (1973)
		Tumidochelia dentifera (Sars, 1899)*	Kudinova-Pasternak (1973)
	Colletteidae	*Collettea cylindrata* (Sars, 1882)*	Kudinova-Pasternak (1973)
		Collettea larviformis (Kudinova-Pasternak, 1973)	Kudinova-Pasternak (1973)
	Cryptocopidae	*Cryptocopoides arcticus* (Hansen, 1887)*	Kudinova-Pasternak (1973)
	Leptognathiidae	*Leptognathia zenkevitchi* Kudinova-Pasternak, 1970	Kudinova-Pasternak (1973)
		Leptognathia zezinae Kudinova-Pasternak, 1973	Kudinova-Pasternak (1973)
	Pseudotanaidae	*Pseudotanais inflatus* Kudinova-Pasternak, 1973	Kudinova-Pasternak (1973)
		Pseudotanais vitjazi Kudinova-Pasternak, 1966	Kudinova-Pasternak (1973)
	Tanaellidae	*Tanaella forcifera* (Lang, 1968)	Kudinova-Pasternak (1973)
	Typhlotanaidae	*Peraeospinosus magnificus* (Kudinova-Pasternak, 1970)	Kudinova-Pasternak (1973)
		Torquella grandis (Hansen, 1913)*	Kudinova-Pasternak (1973)
		Typhlotanais compactus Kudinova-Pasternak, 1966	Kudinova-Pasternak (1973)
Banda Trench (SW Pacific)	Pseudotanaidae	*Pseudotanais nordenskioldi* Sieg, 1977*	Kudinova-Pasternak (1977)
Bougainville Trench (W Pacific)	Neotanaidae	*Neotanais americanus* Beddard, 1886 (=*N. serratispinosus*)	Kudinova-Pasternak (1965)
	Akanthophoreidae	*Chauliopleona armata* (Hansen, 1913)	Kudinova-Pasternak (1965); Menzies *et al.* (1973)
	Leptognathiidae	*Leptognathia elegans* Kudinova-Pasternak, 1965	Kudinova-Pasternak (1965)
	Incertae sedis	*Leptognathia birsteini* Kudinova-Pasternak, 1965	Kudinova-Pasternak (1965)
		Paranarthrurella caudata (Kudinova-Pasternak, 1965)	Kudinova-Pasternak (1965)
Cayman Trench (W Atlantic)	Apseudidae	*Eliomosa sibogae* (Nierstrasz, 1913)	Kudinova- Pasternak & Pasternak (1978)
	Agathotanaidae	*Paranarthrura insignis* Hansen, 1913*	Kudinova- Pasternak & Pasternak (1978)
Izu-Bonin Trench (NW Pacific)	Neotanaidae	*Neotanais americanus* Beddard, 1886*	Kudinova-Pasternak (1977)
	Akanthophoreidae	*Parakanthophoreus longiremis* (Lilljeborg, 1864)*	Kudinova-Pasternak (1977)
	Colletteidae	*Collettea minima* (Hansen, 1913)*	Kudinova-Pasternak (1977)
	Cryptocopidae	*Cryptocopoides arcticus* (Hansen, 1887)*	Kudinova-Pasternak (1977)
	Pseudotanaidae	*Pseudotanais nordenskioldi* Sieg, 1977*	Kudinova-Pasternak (1977)
		Pseudotanais affinis Hansen, 1887*	Kudinova-Pasternak (1977)
	Tanaellidae	*Arthrura longicephala* (Kudinova-Pasternak, 1977)	Kudinova-Pasternak (1977)
	Typhlotanaidae	*Peraeospinosus rectus* (Kudinova-Pasternak, 1966)	Kudinova-Pasternak (1977)

Continued

Table 1. Continued

Localization	Family	Species	Record
		Torquella elegans (Kudinova-Pasternak, 1977)	Kudinova-Pasternak (1977)
	Incertae sedis	*Leptognathia microcephala* Kudinova-Pasternak, 1977	Kudinova-Pasternak (1977)
		Robustochelia robusta (Kudinova-Pasternak, 1970)	Kudinova-Pasternak (1977)
Japan Trench (NW Pacific)	Apseudidae	*Carpoapseudes varindex* Bamber, 2007	Bamber (2007)
		Fageapseudes brachyomos Bamber, 2007	Bamber (2007)
	Neotanaidae	*Neotanais kuroshio* Bamber, 2007	Bamber (2007)
		Neotanais oyashio Bamber, 2007	Bamber (2007)
		Neotanais wolffi Kudinova-Pasternak, 1966	Kudinova-Pasternak (1966)
		Neotanais sp. indet.	Bamber (2007)
	Akanthophoreidae	*Akanthophoreus gracilis* (Krøyer, 1842)	Kudinova-Pasternak (1976)
		Akanthophoreus undulatus Bird, 2007	Bird (2007a)
		Akanthophoreus sp. KK#1	Bird (2007a)
		Akanthophoreus sp. KK#3	Bird (2007a)
		Akanthophoreus sp. KK#5	Bird (2007a)
		Parakanthophoreus crassicaudus (Bird, 2007)	Bird(2007a)
		Parakanthophoreus imputatus (Bird, 2007)	Bird (2007a)
		Parakanthophoreus longiremis (Lilljeborg, 1864)	Kudinova-Pasternak (1976)
	Agathotanaidae	*Agathotanais hadalis* Larsen, 2007	Larsen (2007)
		Paragathotanais abyssorum Larsen, 2007	Larsen (2007)
		Paranarthrura vitjazi Kudinova-Pasternak, 1970	Larsen (2007)
	Anarthruridae	*Siphonolabrum tenebrosus* Bird, 2007	Bird (2007b)
	Colletteidae	*Leptognathiopsis langi* (Kudinova-Pasternak, 1970)	Bird (2007b)
	Heterotanoididae	*Heterotanoides ornatus* Kudinova-Pasternak, 1976	Kudinova-Pasternak (1976)
	Leptognathiidae	*Leptognathia aneristus* Bird, 2007	Bird (2007b)
		Leptognathia rotundicauda Kudinova-Pasternak, 1970	Bird (2007b)
	Typhlotanaidae	*Larsenotanais kamchatikus* Błażewicz-Paszkowycz, 2007	Błażewicz-Paszkowycz (2007)
		Torquella angularis (Kudinova-Pasternak, 1966)	Błażewicz-Paszkowycz (2007)
		Typhlotanais compactus Kudinova-Pasternak, 1966	Błażewicz-Paszkowycz (2007)
Kermadec Trench (SW Pacific)	Apseudidae	*Carpoapseudes oculicornutus* Lang, 1968	Kudinova-Pasternak (1972)
		Leviapseudes aberrans (Lang, 1968)	Kudinova-Pasternak (1972)
		Leviapseudes galatheae (Wolff, 1956)	Kudinova-Pasternak (1972); Wolff (1956a)
	Neotanaidae	*Herpotanais kirkegaardi* Wolff, 1956	Kudinova-Pasternak (1972); Wolff (1956a)
		Neotanais americanus Beddard, 1886 (=*N. serratispinosus*)	Kudinova-Pasternak (1972); Wolff (1956b)
		Neotanais barfoedi Wolff, 1956	Kudinova-Pasternak (1972); Wolff (1956a)
		Neotanais hadalis Wolff, 1956	Wolff (1956a)
		Neotanais robustus Wolff, 1956	Kudinova-Pasternak (1972); Wolff (1956b)
	Akanthophoreidae	*Parakanthophoreus longiremis* (Lilljeborg, 1864)	Kudinova-Pasternak (1972)
	Incertae sedis	*Exspina typica* Lang, 1968	Kudinova-Pasternak (1972)
Kurile-Kamchatka Trench (NW Pacific)	Apseudidae	*Fageapseudes bicornis* (Kudinova-Pasternak, 1973)	Present study
		Fageapseudes vitjazi (Kudinova-Pasternak, 1970)	Kudinova-Pasternak (1970); present study
		Leviapseudes zenkevitchi (Kudinova-Pasternak, 1966)	Present study
	Neotanaidae	*Neotanais americanus* Beddard, 1886 (=*N. serratispinosus*)*	Kudinova-Pasternak (1970)
		Neotanais tuberculatus Kudinova-Pasternak, 1970	Kudinova-Pasternak (1970, 1976)

Continued

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Table 1. Continued

Localization	Family	Species	Record
	Agathotanaidae	*Agathotanais ingolfi* Hansen, 1913*	Kudinova-Pasternak (1970)
		Agathotanais splendidus Kudinova-Pasternak, 1970	Kudinova-Pasternak (1970)
		Paragathotanais zevinae (Kudinova-Pasternak, 1970)	Kudinova-Pasternak (1970)
		Paranarthrura vitjazi Kudinova-Pasternak, 1970	Kudinova-Pasternak (1970)
	Akanthophoreidae	*Akanthophoreus gracilis* (Krøyer, 1842)*	Kudinova-Pasternak (1970)
		Akanthophoreus sp. KK#5	Bird (2007a)
		Chauliopleona armata (Hansen, 1913)*	Kudinova-Pasternak (1970)
		Chauliopleona spp	Bird (2007a)
		Tumidochelia dentifera (Sars, 1899)*	Kudinova-Pasternak (1970)
	Anarthruridae	*Anarthruropsis langi* Kudinova-Pasternak, 1976	Kudinova-Pasternak (1976)
	Colletteidae	*Collettea cylindrata* (Sars, 1882)*	Kudinova-Pasternak (1970)
		Leptognathiopsis langi (Kudinova-Pasternak, 1970)	Kudinova-Pasternak (1970); Bird (2007b)
	Cryptocopidae	*Cryptocope* sp.	Kudinova-Pasternak (1970)
		Cryptocopoides arcticus (Hansen, 1887)*	Kudinova-Pasternak (1970)
		Cryptocopoides pacificus McLelland, 2007	McLelland (2007)
	Leptognathiidae	*Leptognathia aneristus* Bird, 2007	Bird (2007b)
		Leptognathia breviremis (Lilljeborg, 1864)*	Kudinova-Pasternak (1970)
		Leptognathia greveae Kudinova-Pasternak, 1976	Kudinova-Pasternak (1976)
		Leptognathia parelegans Kudinova-Pasternak, 1970	Kudinova-Pasternak (1970)
		Leptognathia tuberculata Hansen, 1913*	Kudinova-Pasternak (1970)
		Leptognathia rotundicauda Kudinova-Pasternak, 1970	Kudinova-Pasternak (1970)
		Leptognathia zenkevitchi Kudinova-Pasternak, 1970	Kudinova-Pasternak (1970)
		Leptognathia sp.	Kudinova-Pasternak (1970)
	Pseudotanaidae	*Pseudotanais nipponicus* McLelland, 2007	McLelland (2007)
		Pseudotanais vitjazi Kudinova-Pasternak, 1966	Kudinova-Pasternak (1970)
		Pseudotanais sp.	Kudinova-Pasternak (1970)
	Tanaidae	*Protanais birsteini* (Kudinova-Pasternak, 1970)	Kudinova-Pasternak (1970)
		Tanaidae gen. sp.	Kudinova-Pasternak (1970
	Typhlotanaidae	*Meromonakantha setosa* (Kudinova-Pasternak, 1966)	Kudinova-Pasternak (1970)
		Peraeospinosus magnificus (Kudinova-Pasternak, 1970)	Kudinova-Pasternak (1970)
		Peraeospinosus rectus (Kudinova-Pasternak, 1966b)	Kudinova-Pasternak (1970)
		Torquella grandis (Hansen, 1913)*	Kudinova-Pasternak (1970)
		Typhlamia mucronata (Hansen, 1913)*	Kudinova-Pasternak (1970)
		Typhlotanais compactus Kudinova-Pasternak, 1966	Kudinova-Pasternak (1970)
		Typhlotanais kussakini Kudinova-Pasternak, 1970	Kudinova-Pasternak (1970)
		Typhlotanais longicephala Kudinova-Pasternak, 1970	Kudinova-Pasternak (1970)
	Incertae sedis	*Exspina typica* Lang, 1968	Kudinova-Pasternak (1970)
		Leptognathia birsteini Kudinova-Pasternak, 1965	Kudinova-Pasternak (1970)
		Leptognathia microcephala Kudinova-Pasternak, 1977	Bird (2007b)
		Leptognathia vinogradovae Kudinova-Pasternak, 1970	Kudinova-Pasternak (1970)
		Leptognathioides sp.KK#1	Bird (2007b)
Mariana Trench (W Pacific)	Neotanaidae	*Neotanais insignis* Kudinova-Pasternak, 1977	Kudinova-Pasternak (1977)
New Hebrides Trench (E Pacific)	Neotanaidae	*Neotanais* sp.	Kudinova-Pasternak (1966)
Palau Trench (W Pacific)	Leptognathiidae	*Leptognathia parabranchiata* Kudinova-Pasternak, 1977	Kudinova-Pasternak (1977)
Peru-Chile Trench (E Pacific)	Apseudidae	*Carpoapseudes bacescui* Guțu, 1975	Guțu (1975)
		Carpoapseudes menziesi Guțu, 1975	Guțu (1975)
	Neotanaidae	*Neotanais vemae* Gardiner, 1975	Gardiner (1975)

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Table 1. Continued

Localization	Family	Species	Record
Philippine Trench (W Pacific)	Gigantapseudidae	*Gigantapseudes adactylus* Kudinova-Pasternak, 1978	Kudinova-Pasternak (1978)
		Gigantapseudes maximus Gamô, 1984	Gamô (1984)
	Akanthophoreidae	*Parakanthophoreus longiremis* (Lilljeborg, 1864)*	Kudinova-Pasternak (1977)
Puerto Rico Trench (W Atlantic)	Neotanaidae	*Neotanais hadalis* Wolff, 1956	Kudinova-Pasternak & Pasternak (1978)
		Neotanais persephone Messing, 1977	Messing (1977)
		Neotanais tuberculatus Kudinova-Pasternak, 1970	Kudinova-Pasternak & Pasternak (1978)
	Incertae sedis	*Paranarthrurella dissimilis* (Lang, 1972)	Kudinova-Pasternak & Pasternak (1978)
Romanche Trench (C Atlantic)	Agathotanaidae	*Paranarthrura kurchatovi* Kudinova-Pasternak, 1975	Kudinova-Pasternak (1975a)
	Incertae sedis	*Leptognathia angustocephala* Kudinova-Pasternak, 1975	Kudinova-Pasternak (1975a)
South Sandwich Trench (W Southern Ocean)	Neotanaidae	*Neotanais kurchatovi* Kudinova-Pasternak, 1975	Kudinova-Pasternak (1975b)
	Akanthophoreidae	*Akanthophoreus gracilis* (Krøyer, 1842)	Kudinova-Pasternak (1975b)
		Chauliopleona armata (Hansen, 1913)	Kudinova-Pasternak (1975b)
	Colletteidae	*Collettea antarctica* (Vanhöffen, 1914)	Kudinova-Pasternak (1975b)
	Tanaellidae	*Tanaella paraforcifera* (Lang, 1968)	Kudinova-Pasternak (1975b)
	Incertae sedis	*Robustochelia robusta* (Kudinova-Pasternak, 1970)	Kudinova-Pasternak (1975b)
Sunda Trench (E Indian Ocean)	Neotanaidae	*Neotanais pfaffioides* Lang, 1968	Lang (1968)

(noted from four trenches). So far the only record of the typically shallow-water genus – *Heterotanoides* Sieg, 1977 (representing clearly the shallow-water family Heterotanoididae Bird, 2012) in the Japan Trench at depth 7370 m (Kudinova-Pasternak, 1976) seems to be doubtful. Additionally, according to Kudinova-Pasternak (1976) *Heterotanoides ornatus* has well developed, functional eyes, thus the most reasonable explanation of its presence in the deep sea is contamination of sample (as was proposed by Bird, 2012).

Representing exclusively deep-sea forms, Neotanaidomorpha are the second most common group of Tanaidacea in trenches. Members of genus *Neotanais* Beddard, 1886 were recorded from 12 trenches, while genus *Herpotanais* Wolff, 1956 is known only from Kermadec Trench.

Members of suborder Apseudomorpha are scarcely represented in trench communities and they are restricted only to members of two taxa, described by Błażewicz-Paszkowycz *et al.* (2012) as exclusively deep water – subfamily Leviapseudinae and family Gigantapseudidae Kudinova-Pasternak, 1978. Leviapseudinae were recorded only in: Aleutian Trench with *Carpoapseudes serratispinosus* Lang, 1968, *Fageapseudes vitjazi* (Kudinova-Pasternak, 1970), *Leviapseudes zenkevitchi* (Kudinova-Pasternak, 1966) and *Fageapseudes bicornis* (Kudinova-Pasternak, 1973); Japan Trench with *Carpoapseudes varindex* Bamber, 2007 and *Fageapseudes brachyomos* Bamber, 2007; Kermadec Trench with *Carpoapseudes oculicornutus* Lang, 1968, *Leviapseudes aberrans* (Lang, 1968) and *Leviapseudes galatheae* (Wolff, 1956); Kurile-Kamchatka Trench with *F. bicornis* (Kudinova-Pasternak, 1973), *Fageapseudes vitjazi* (Kudinova-Pasternak, 1970) and *Leviapseudes zenkevitchi* (Kudinova-Pasternak, 1966) and Peru-Chile Trench with *Carpoapseudes bacescui* Guţu, 1975 and *Carpoapseudes menziesi* Guţu, 1975. Monogeneric Gigantapseudidae is known so far only from the Philippine Trench with: *Gigantapseudes adactylus* Kudinova-Pasternak, 1978 and *Gigantapseudes maximus* Gamô, 1984.

Distribution of Tanaidacea recorded from trenches

From 105 tanaidacean species recorded from oceanic trenches, 28 are known from more than one trench (Table 2): 21 species were recorded from two trenches and three species from three trenches. *Akanthophoreus gracilis* (Krøyer, 1842) and *Chauliopleona armata* (Hansen, 1913) were found in four trenches while the most widespread, *Neotanais americanus* and *Parakanthophoreus longiremis*, were recorded in five trenches. The highest similarity regarding the composition of Tanaidacea fauna is presented between four West Pacific trenches, for example Aleutian and Kurile-Kamchatka Trenches share 14 species, Japan and Kurile-Kamchatka Trenches share six species, Aleutian and Japanese Trenches and Izu-bonin and Kurile-Kamchatka Trenches have four species in common, while Aleutian and Izu-Bonin Trenches share three species. This similarity can be explained by the fact that all of these trenches are within one basin and moreover three of them lie in a single line with the northernmost Aleutian Trench, Kurile-Kamchatka Trench in the middle and Izu-Bonin Trench in the south. In this trench system, the Japan Trench is the second southern junction of Kurile-Kamchatka Trench. Strong affinities between those areas are derived also indirectly by the fact that they are the best studied trenches regarding tanaidacean fauna. Single species are also shared between other Western Pacific trenches, for example:

- *Parkanthophoreus longiremis* was recorded for Philippine, Aleutian, Izu-Bonin and Japan Trenches but also for Kermadec Trench.
- Bouganville Trench shares *Chauliopleona armata* with Aleutian and Kurile-Kamchatka Trenches.
- *Pseudotanais nordenskioldi* is common to Banda and Izu-Bonin Trenches.

Table 2. List of tanaidacea species common for the trenches.

Species	Aleutian Trench	Banda Trench	Bougainville Trench	Cayman Trench	Izu-Bonin Trench	Japan Trench	Kermadec Trench	Kurile-Kamchatka Trench	Philippine Trench	Puerto Rico Trench	South Sandwich Trench
Fageapseudes vitjazi	+							+			
Neotanais americanus	+		+		+		+	+			
Neotanais barfoedi	+						+				
Neotanais hadalis							+			+	
Neotanais tuberculatus								+		+	
Agathotanais splendidus	+							+			
Paragathotanais zevinae	+							+			
Paranarthrura insignis	+			+							
Paranarthrura vitjazi	+					+		+			
Akanthophoreus gracilis	+					+		+			+
Parakanthophoreus longiremis	+				+	+	+		+		
Akanthophoreus sp. KK#5						+		+			
Chauliopleona armata	+		+					+			+
Collettea cylindrata	+							+			
Leptognathiopsis langi						+		+			
Tumidochelia dentifera	+							+			
Cryptocopoides arcticus	+				+			+			
Leptognathia rotundicauda						+		+			
Leptognathia zenkevitchi	+							+			
Pseudotanais nordenskioldi		+			+						
Peraeospinosus magnificus	+							+			
Peraeospinosus rectus					+			+			
Torquella grandis	+							+			
Typhlotanais compactus	+					+		+			
Exspina typica							+	+			
Leptognathia birsteini			+					+			
Leptognathia microcephala					+			+			
Robustochelia robusta					+						+

It is noteworthy that a series of 29 tanaidacean species were recorded primarily outside trenches and sometimes even from different basins (Table 1, species marked with asterisks). The best examples of this phenomenon are studies of Kudinova-Pasternak, who recorded in Aleutian Trench (Kudinova-Pasternak, 1973): *Paranarthrura insignis* Hansen, 1913, *Akanthophoreus gracilis* (Krøyer, 1842) or *Torquella grandis* (Hansen, 1913) – tanaidaceans with the type locality limited to the North Atlantic (Hansen, 1913; Krøyer, 1842). There is a similar situation with some records from Izu-Bonin Trench, where Kudinova-Pasternak (1977) found *Parakanthophoreus longiremis* (Lilljeborg, 1864) or *Collettea minima* (Hansen, 1913), first species described from littoral of Western Sweden (Lilljeborg, 1864), second from Davis Strait (Hansen, 1913); or with records from Kurile-Kamchatka Trench (Kudinova-Pasternak, 1970) of, for example, *Leptognathia breviremis* (Lilljeborg, 1864) with type cords on Swedish and Norwegian fjords (Lilljeborg, 1864) or *Typhlamia mucronata* (Hansen, 1913) with type locality south-east off Iceland (Hansen, 1913). It cannot be excluded that the species mentioned above are in fact widely distributed, as species common for the Pacific and Atlantic Oceans were previously reported for various deep-sea groups (Vinogradova, 1969). According to Vinogradova (1969) the fauna of the North Pacific is even more closely related to North Atlantic fauna than to South Pacific fauna. At least two possible corridors can be mentioned in explanation of affinities between faunas of Pacific and Atlantic Oceans:

- First, Trans-Arctic that took place in the Pliocene when exchange was possible through Bering Strait. This connectivity was studied using molecular methods on various groups of benthic invertebrates such as sea urchins (Palumbi & Kessing, 1991) or bivalves (Nikula *et al*., 2007).
- Second, exchange by the Panama Seaway, that was intensively studied on, for example, bryozoans (Dick *et al*., 2003), gastropods (Duda & Kohn, 2005) or decapods (Knowlton & Weigt, 1998).

Tanaidacea (as with most of the peracarids) are known to have limited dispersal abilities mainly by having non-planktonic larvae and by their almost sedentary lifestyle (Błażewicz-Paszkowycz *et al*., 2012). Therefore, the general and the most trustworthy explanation of very wide distribution of deep-sea Tanaidacea is taxonomic misidentification (Larsen, 2005). Trench records of numerous tanaidacean species were already questioned by several studies, for example Bird (2007a, b), Larsen (2007) or McLelland (2007). Bird (2007a) suggested that records of *A. gracilis* from Japan and Kurile-Kamchatka Trenches (Kudinova-Pasternak, 1970, 1976) may be in fact *A. undulatus* Bird, 2007 and *Akanthophoreus* sp.KK#1, while *C. armata* from Aleutian (Kudinova-Pasternak, 1973) and Kurile-Kamchatka Trenches (Kudinova-Pasternak, 1970) can be records of two putative new species found by Bird (2007a) in the Kurile-Kamchatka collection. It was also Bird (2007b), who doubted the presence of North Atlantic *Collettea cylindrata* (Sars, 1882) in Kurile-Kamchatka Trench (Kudinova-Pasternak, 1970) and suggested that this record may refer to Aleutian species – *C. larviformis* (Kudinova-Pasternak, 1973). *Agathotanais ingolfi* was described from the Davis Strait and often recorded in Atlantic waters, for example Hebrides Slope, Rockall Trough, North Feni Ridge, Porcupine Seabight, Celtic Slope, Bay of Biscay, off Iceland or off Faroes. Unexpectedly Kudinova-Pasternak (1970) found it also on two stations in Kurile-Kamchatka Trench. Later Larsen (2007) has pointed out morphological similarities between *A. ingolfi* sensu Kudinova-Pasternak (1970) and newly described *A. hadalis* Larsen, 2007, and suggested that these species may be the same. Finally, McLelland (2007) stated that it is less probable that *Cryptocopoides arcticus*, which is widely distributed in the North Atlantic and Arctic area, was found in Kurile-Kamchatka Trench (Kudinova-Pasternak, 1970). As an explanation of this phenomenon Mclelland (2007) suggested that this finding is in fact *C. pacificus* McLelland, 2007.

At present, none of the doubtful records of Tanaidacea from trenches (Table 2) have been satisfactorily explained as the literature data are still scarce and the access to the old tanaidacean material from trenches is limited or impossible (Błażewicz-Paszkowycz personal communication). Moreover, as pointed out by Larsen (2005), in cases of cryptic species we cannot rely only on morphological methods. To solve the problem further studies on Tanaidacean fauna from trenches are needed with emphasis on molecular methods.

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REFERENCES

Anderson G. (2013) Tanaidacea taxa and literature. Available at http://peracarida.usm.edu/.

Băcescu M. (1978) Contribution to the knowledge of Monokonophora (Crustacea: Tanaidacea) from the NW of the Indian Ocean. *Memoriile Sectiunii Stiintifice* 4, 197–220.

Bamber R.N. (2007) Suborders Apseudomorpha Sieg, 1980 and Neotanaidomorpha Sieg, 1980. In Larsen K. and Shimomura M. (eds) *Tanaidacea (Crustacea: Peracarida) from Japan III. The Deep Trenches: The Kurile-Kamchatka Trench and Japan Trench. Zootaxa* 1599, 13–40.

Belyaev G.M. (1966) *Hadal bottom fauna of the world oceans*. Moscow: Izatel'stvo "Nauka".

Bird G.J. (2007a) Family incertae cedis. In Larsen K. and Shimomura M. (eds) *Tanaidacea (Crustacea: Peracarida) From Japan III. The Deep Trenches: The Kurile-Kamchatka Trench and Japan Trench. Zootaxa* 1599, 121–149.

Bird G.J. (2007b). Families Anarthruridae Lang, 1971, Colletteidae Larsen & Wilson, 2002, and Leptognathiidae Sieg, 1976. In Larsen K. and Shimomura M. (eds) *Tanaidacea (Crustacea: Peracarida) from Japan III. The Deep Trenches: The Kurile-Kamchatka Trench and Japan Trench. Zootaxa* 1599, 61–85.

Bird G.J. (2012) A new leptochelioid family, Heterotanoididae (Crustacea: Peracarida: Tanaidacea), and a new species of *Heterotanoides* from New Zealand. *Zootaxa* 3481, 1–26.

Błażewicz-Paszkowycz M. (2007) Family Nototanaidae Sieg, 1976 and Typhlotanaidae Sieg, 1984. In Larsen K. and Shimomura M. (eds) *Tanaidacea (Crustacea: Peracarida) from Japan III. The Deep Trenches: The Kurile-Kamchatka Trench and Japan Trench. Zootaxa* 1599, 101–120.

Błażewicz-Paszkowycz M. and Bamber R.N. (2007) New apseudomorph tanaidaceans (Crustacea: Peracarida: Tanaidacea) from eastern Australia: Apseudidae, Whiteleggiidae, Metapseudidae and Pagurapseudidae. *Memoirs of Museum Victoria* 64, 107–148.

Błażewicz-Paszkowycz M., Bamber R. and Anderson G. (2012) Diversity of Tanaidacea (Crustacea: Peracarida) in the world's oceans – how far have we come? *PLoS ONE* 7, e33068. doi: 10.1371/journal.pone.0033068.

Błażewicz-Paszkowycz M., Pabis K. and Jóźwiak P. (2014) Tanaidacean fauna of the Kurile-Kamchatka Trench – abundance, diversity and rare species. *Deep-Sea Research Part II*. doi: 10.1016/j.dsr2.2014.08.021.

Coleman C.O. (2003) "Digital inking": how to make perfect line drawings on computers. *Organisms Diversity and Evolution* 14, 1–14.

Dick M.H., Herrera-Cubilla A. and Jackson J.B. (2003) Molecular phylogeny and phylogeography of free-living Bryozoa (Cupuladriidae) from both sides of the Isthmus of Panama. *Molecular Phylogenetics and Evolution* 27, 355–371.

Duda T.F. and Kohn A.J. (2005) Species-level phylogeography and evolutionary history of the hyperdiverse marine gastropod genus *Conus*. *Molecular Phylogenetics and Evolution* 34, 257–272.

Gamô S. (1984) A new remarkably giant tanaid, *Gigantapseudes maximus* sp. nov. (Crustacea) from the abyssal depths far off southeast of Mindanao, the Philippines. *Science Reports of the Yokohama National University, Section II Biology and Geology* 31, 1–12.

Gardiner L.F. (1975) The systematics, postmarsupial development, and ecology of the deep-sea family Neotanaidae (Crustacea: Tanaidacea). *Smithsonian Contributions to Zoology* 170, 1–265.

Guţu M. (1975) *Carpoapseudes bacescui* n. sp. and *C. menziesi* n. sp. (Crustacea – Tanaidacea) from the Peru-Chile Trench. *Revue Roumaine de Biologie* 20, 93–100.

Hansen H.J. (1913) Crustacea, Malacostraca. II. IV. The Order Tanaidacea. *The Danish Ingolf Expedition* 3, 1–145.

International Commission on Zoological Nomenclature (1999) *International code of zoological nomenclature*, 4th edn. London: The International Trust for Zoological Nomenclature.

Jóźwiak P. (2014) *Zoidbergus*, a new genus of Apseudidae (Tanaidacea) with remarks on *Apseudes siegi* and *Apseudes vitjazi*. *Polish Polar Research* 35, 389–414. doi: 10.2478/popore–2014–0020.

Jóźwiak P. and Błażewicz-Paszkowycz M. (2007) Apseudomorpha (Malacostraca: Tanaidacea) of the ANDEEP III Antarctic Expedition. *Zootaxa* 1610, 1–25.

Kakui K., Katoh T., Hiruta S.F., Kobayashi N. and Kajihara H. (2011) Molecular systematics of Tanaidacea (Crustacea: Peracarida) based on 18S sequence data, with an amendment of suborder/superfamily-level classification. *Zoological Science* 28, 749–757.

Knowlton N. and Weigt L.A. (1998) New dates and new rates for divergence across the Isthmus of Panama. *Proceedings of the Royal Society B* 265, 2257–2263.

Krøyer H. (1842) Nye Arter af Slaegten *Tanais*. *Naturhistorisk Tidsskrift* 4, 167–188.

Kudinova-Pasternak R.K. (1965) Deep-sea Tanaidacea from the Bougainville Trench of the Pacific. *Crustaceana* 8, 75–91.

Kudinova-Pasternak R.K. (1966) Tanaidacea (Crustacea) of the Pacific ultra-abyssals. *Zoologicheskii Zhurnal* 45, 518–535.

Kudinova-Pasternak R.K. (1970) Tanaidacea of the Kurile-Kamchatka Trench. *Trudy Instituta Okeanologii* 86, 341–381.

Kudinova-Pasternak R.K. (1972) Notes about the Tanaidacean fauna (Crustacea Malacostraca) of the Kermadec Trench. *Complex Research of the Nature of the Ocean* (*Moscow*) 3, 257–258.

Kudinova-Pasternak R.K. (1973) Tanaidacea (Crustacea, Malacostraca) collected on the *R/V* "Vitjas" in regions of the Aleutian Trench and Alaska. *Trudy Instituta Okeanologii* 91, 141–168.

Kudinova-Pasternak R.K. (1975a) Tanaidacea (Malacostraca) of the deep-sea trench Romansh and Guinea Hollow. *Zoologicheskii Zhurnal* 54, 682–687.

Kudinova-Pasternak R.K. (1975b) Tanaidacea (Crustacea, Malacostraca) from the Atlantic sector of Antarctic and Subantartic. *Trudy Instituta Okeanologii* 103, 194–229.

Kudinova-Pasternak R.K. (1976) Additional notes on the fauna of Tanaidacea (Crustacea, Malacostraca) of the deep water trenches. *Trudy Instituta Okeanologii* 99, 115–125.

Kudinova-Pasternak R.K. (1977) Tanaidacea (Crustacea, Malacostraca) from the deep-sea trenches of the western part of the Pacific. *Trudy Instituta Okeanologii* 108, 115–135.

Kudinova-Pasternak R.K. (1978) Gigantapseudidae fam. n. (Crustacea, Tanaidacea) and composition of the suborder Monokonophora. *Zoologicheskii Zhurnal* 57, 1150–1161.

Kudinova-Pasternak R.K. and Pasternak F.A. (1978) Deep-sea Tanaidacea (Crustacea, Malacostraca) collected in the Caribbean Sea and Puerto-Rico Trench during the 16-th cruise of *R/V* "Akademic Kurchatov" and the resemblance between fauna of deep-sea Tanaidacea of the Caribbean region and the Pacific. *Trudy Instituta Okeanologii* 113, 178–197.

Lang K. (1968) Deep-Sea Tanaidacea. In Wolff T. (ed.) *Galathea report*, Vol. 9. Copenhagen: Danish Science Press, pp. 23–210.

Larsen K. (2005) *Deep-sea Tanaidacea (Peracarida) from the Gulf of Mexico*. Leiden: Brill.

Larsen K. (2007) Family Agathotanaidae Lang, 1971a. In Larsen K. and Shimomura M. (eds) *Tanaidacea (Crustacea: Peracarida) from Japan III. The Deep Trenches: The Kurile-Kamchatka Trench and Japan Trench. Zootaxa* 1599, 41–60.

Larsen K. and Shimomura M. (2007) *Tanaidacea (Crustacea: Peracarida) from Japan III. The deep trenches: the Kurile-Kamchatka Trench and Japan Trench*. Auckland: Magnolia Press.

Lilljeborg W. (1864) Bidrag til kännedomen om de inom Sverige och Norrige förekommande Crustaceer af Isopodernas underordning och

Tanaidernas familj. Inbjudningsskrift till Åhörande av de Offentliga Föreläsningar. *Uppsala universitets Årsskrift* 1865, 1–31.

McLelland J.A. (2007) Family Pseudotanaidae Sieg, 1976. In Larsen K. and Shimomura M. (eds) *Tanaidacea (Crustacea: Peracarida) from Japan III. The Deep Trenches: The Kurile-Kamchatka Trench and Japan Trench. Zootaxa* 1599, 87–99.

Menzies R.J., George R.Y. and Rowe G.T. (1973) *Abyssal environment and ecology of the world oceans*. London: J. Wiley and Sons.

Messing C.G. (1977) Biological results of the University of Miami deep-sea expeditions. *Neotanais persephone*, a new species of hadal Tanaidacean (Crustacea: Peracarida). *Bulletin of Marine Science* 17, 511–519.

Nikula R., Strelkov P. and Väinölä R. (2007) Diversity and trans-arctic invasion history of mitochondrial lineages in the North Atlantic *Macoma baltica* complex (Bivalvia: Tellinidae). *Evolution* 4, 928–941.

Palumbi S.R. and Kessing B.D. (1991) Population biology of the Trans-Arctic exchange: MtDNA sequence similarity between Pacific and Atlantic sea urchins. *Evolution* 45, 1790–1805.

Sieg J. (1983) Tanaidacea. Part 6. In Gruner H.E. and Holthuis L.B. (eds) *Crustaceorum catalogus*. Hague: W. Junk, pp. 1–552.

Vinogradova N.G. (1969) Vertical distribution of deep-sea benthic fauna. In Zenkevitch L.A. (ed.) *The Pacific Ocean. The biology of the Pacific Ocean. Part II. The deep-sea bottom fauna. Pleuston. Akademija Nauk SSSR*. Moscow: Institut Okeanologii, pp. 144–174.

Wolff T. (1956a) Crustacea Tanaidacea from depths exceeding 6000 meters. In Bruun A., Greve S., Spärck R. and Wolff T. (eds) *Galathea report: scientific results of the Danish deep-sea expedition round the world 1950–52*. Copenhagen: Danish Science Press, pp. 187–241.

and

Wolff T. (1956b) Six new abyssal species of *Neotanais* (Crust. Tanaidacea). *Dansk Naturhistorisk Forening. Videnskabelige Meddelelser* 118, 41–52.

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