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New fossil amphipod, *Palaeogammarus polonicus* sp. nov. from the Baltic amber

KRZYSZTOF JAŻDŻEWSKI [1] & RÓŻA KULICKA [2]

[1] *Department of Invertebrate Zoology, University of Łódź*
12/16 Banacha St., PL-90-237 Łódź, Poland. E-mail: kryjaz@biol.uni.lodz.pl
[2] deceased; last address: *Museum of the Earth, Polish Academy of Sciences*
20/26 Na Skarpie Al., PL-00-488 Warszawa, Poland

ABSTRACT:

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A new species of the amphipod crustacean, *Palaeogammarus polonicus* sp. nov., is established upon one specimen embedded in a piece of Eocene Baltic amber. The new species is compared with four formerly described amphipods from Baltic amber, all belonging to the genus *Palaeogammarus* ZADDACH, 1864 (Crangonyctidae).

Key words: Crustacea, Amphipoda, *Palaeogammarus polonicus*, Eocene, Systematics.

INTRODUCTION

The fossil record of amphipod crustaceans is rather scarce. According to HURLEY (1973), KARAMAN (1984), BOUSFIELD & POINAR (1994, 1995) and COLEMAN & MYERS (2001) 11 genera and 20 species of fossil amphipods have been hitherto described, some of them coming from the Baltic amber. The oldest ever recorded amphipod specimen from upper Eocene amber of the eastern Baltic coast of Sambia Peninsula, Russia, was described as *Palaeogammarus sambiensis* ZADDACH, 1864. This specimen was lost (BACHOFEN-ECHT 1949) but it was well illustrated by ZADDACH (1864).

LUCKS (1928) described *Palaeogammarus balticus* LUCKS, 1928, but the origin of amber piece remained unknown; in that piece there were two specimens, of which one was destroyed.

JUST (1974) described the specimen identified as *Palaeogammarus danicus* JUST, 1974, preserved in a piece of amber washed up on the coast of Jutland, Denmark.

Quite recently COLEMAN & MYERS (2001) described *Palaeogammarus* sp., again from a piece of Baltic amber (late Eocene) from the Gulf of Gdańsk.

The genus *Palaeogammarus* ZADDACH, 1864, was included in the family Crangonyctidae by JUST (1974) and this view was subsequently supported by HOLSINGER (1977).

Finally, JAŻDŻEWSKI & KULICKA (2000 b) informed briefly on the discovery of several poorly preserved amphipods in a weathered piece of amber from the collection of Paleontological Institute of Russian Academy of Sciences in Moscow, suggesting that they might also represent the family Crangonyctidae.

MATERIAL

The studied amphipod specimen comes from the Baltic region and was kindly offered in 1997 by Mr. A. RYBICKI to the collection of the Museum of Earth, Polish Academy of Sciences in Warsaw (abbreviated MZ; Cat.

No MZ 22 999). This amphipod is included in a small piece of transparent, light yellow amber of the dimensions of 1.3 × 0.7 × 0.4 cm. In this same piece of amber there is also a fragment of a dipteran insect of the family Dolichopodidae (Brachycera). In some places a thin, milky layer of decay gases make the study of the animal somewhat difficult.

It is possible that the amphipod was captured alive in the resin, because rings present in the amber could be interpreted as signs of movements.

The crustacean is in a typical "amphipod position", i.e. body bent ventrally that makes difficult to measure its length. The curve of its bending is similar to the circle of the diameter of 3.2 mm; possible total length is estimated at about 6.5 mm.

DESCRIPTION OF THE SPECIMEN

Palaeogammarus polonicus sp. nov.
(Text-figs 1-2, Pls 1-2)

2000a. *Palaeogammarus* sp.; K. JAŻDŻEWSKI & R. KULICKA, p. 24, Fig. 2.

Body dorsally smooth, without keel or teeth. Head cuboidal, slightly deeper than long, somewhat shorter than two first pereonites combined. Lateral head lobe poorly developed, upper sinus shallow. No traces of eyes. Antenna 1 (A1) nearly 3 mm in length, i.e. more or less half the body length. Primary flagellum consists of 17 joints, their length increasing distally; joints armed distally with short setules. Accessory flagellum 2-jointed. Antenna 2 (A2) half the length of A1; five visible A2 flagellum joints allow to suppose that their total number could be 6-7.

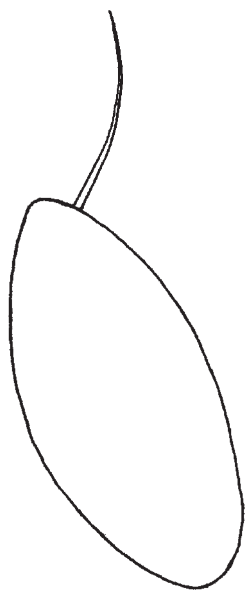

Fig. 1. *Palaeogammarus poloniucs* sp. nov.; body outline from the dorsal side with anteriorly projecting A1; × 16

In the left side view, between the flagella of left A1 and A2 a somewhat obscure setose structure is visible; most probably it represents a gnathopod; what is seen does suggest that distal part of carpus is armed with several stout setae, the propus is strong and bears at least several long setae.

Coxal plates 1-4 (Cx1-4) deep, slightly deeper than their pereonites; Cx1-3 partially hidden by the consecutive plates; large Cx4 is deeply excavated posteriorly, with a pronounced posterior lobe. Distally Cx4 is more than twice as wide as at its base. Lower margin of Cx1-4 armed with short setae. Coxa 5 (Cx5) comparatively large, incised ventrally. This incision divides the plate into antero-ventral rounded lobe and a postero-distal, also rounded one. The difference in the shape of Cx5 between the left- and right-side view evidently comes from the somewhat different position of these plates.

Only distal joints of pereopods 3 and 4 (P3 and P4) are visible; propus is distinctly longer than carpus, dactylus slightly curved, 1/3 of the length of propus. Carpus and propus each with robust distal seta shorter than dactylus.

Pereopod 5 (P5) well visible on both sides, P6 and P7 only partly. P6 is the longest appendage. P5-P7 bases are wide, broadly rounded; width of their distal parts 2.5 times as wide as ischium width. P5-P7 basis produced in a postero-distal rounded lobe. Hind margins of basis of P5 to P7 with several shallow serrations with short setules. Remaining articles of P5-P7 slender; in P5 carpus and propus combined are equal to the half of the whole pereopod length, in P6 - even longer. Merus, carpus and propus of P5 to P7 with prominent robust (spiny) setae of the length more or less equal to the width of these articles. Distal setae of each article still longer, forming a kind of spur. Distal setae of propus in P5-P7 very long, as long as dactylus or even longer; these long setae are accompanied by at least one shorter seta.

Hind margin of the third pleonal segment with some setae (two are visible in the right-side view). Epimera completely hidden. First urosomite on its hind margin armed with a regular row of at least 8 short setae (5 are visible from the left side, four from the right side) bordering the segment; similar row on second urosomite is less visible; probably smaller number of setae in the same position.

Uropods 1 and 2 (U1 and U2) with protopodites somewhat longer than rami, that are subequal in U1 and (probably) in U2; protopodites with medial and apical prominent spiny seta, exopodites with two medial setae (apical not visible).

Uropod 3 (U3) broken on both sides or non-discernible, if present.

Telson (Text-fig. 2), despite special attempts when polishing the piece of amber – hardly visible, because the crack perpendicular to the telson plane crosses telson exactly in the middle, obscuring the identification of its morphology. The better visible half of telson is laterally armed with three stout, slightly curved setae; at least one such seta is inserted at the tip of this telson half. The telson might be deeply or even fully cleft but the crack situated just in the possible incision of telson does not allow the unequivocal decision.

DISCUSSION

The comparison of the morphology of the presently described amphipod with all hitherto published figures and descriptions of *Palaeogammarus* ZADDACH, 1864 (*P. sambiensis, P. balticus, P. danicus*) and especially the shape of coxal plates 1-4 and of the P5-P7 basis, the length of A1 and A2, the presence of 2-3 jointed accessory flagellum and the length of P5-P7 and proportions between their joints, inclines the present authors to assign the specimen also to this genus.

A very important similarity of the studied specimen to the specimens described by ZADDACH (1864) and LUCKS (1928) is the armature of the hind margin of the first and second urosomites which are bordered with a regular row of short setae. They are drawn in the figures by ZADDACH (1864) on two first urosomites, whereas, although these setae are not illustrated in the LUCKS' (1928) drawings, this author writes in text (LUCKS 1928, p. 9) that fourth to sixth segment (of pleon, i.e. first to third urosomite) is beset on its dorsal hind margin with groups of very small spines: [Das vierte bis sechste Segment ist am Hinterrande auf dem Rücken mit Gruppen sehr kleiner Dornen besetzt].

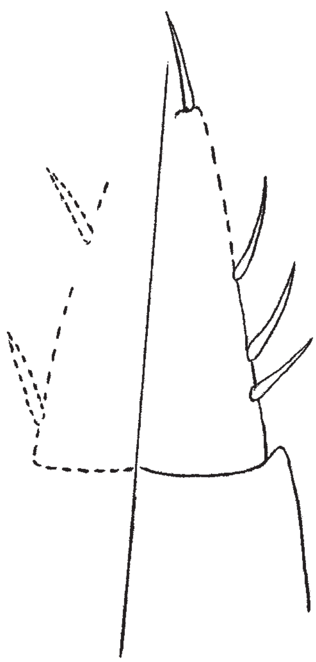

Fig. 2. *Palaeogammarus poloniucs* sp. nov.; telson; stright line indicates the crack plane obscuring the full telson morphology; dotted line indicates poorly visible structures; × 150

Main differences between the presently described specimen and *P. sambiensis* ZADDACH, 1864, are in the shape of head lateral lobe (but the position of two specimens could be also much different), the shape of Cx5 that is ventrally slightly excavated in the specimen of ZADDACH and rounded and incised in our individual and in the proportions of dactylus and distal robust seta of propus in P5-P7. In the studied specimen this distal seta is at least as long as the moderately long, slightly curved dactylus or even surpassing its length, whereas in ZADDACH's individual dactyli of P5 and P6 (P7 is broken) are very long and straight and distal setae of propus are 3-4 times shorter than the dactylus. Propus and carpus of P5 and P6 in ZADDACH's specimen were armed with higher number of short setules than in our specimen where these setae were less numerous but longer, usually of the length equal to the joint's width.

The specimen described by LUCKS (1928) is not sufficiently illustrated, although the amphipod drawn *in toto* shows a splendid state of preservation. Antennae of LUCKS' individual are slightly longer than in the studied specimen but size and shape of head, coxal plates and of P5-P7 are very similar. In LUCKS' specimen proportions of dactylus and distal seta of propus in P5-P7 are similar as in ZADDACH's individual.

The specimen of LUCKS (1928) was the only one where maxilliped palp and the end of gnathopod 2 (G2) were visible. Their general shape could fit to the shape variability of these appendages in extant Crangonyctidae (but also Gammaridae). Carpus of maxilliped palp in *P. balticus* LUCKS, 1928, is rather long and densely setose on its inner margin whereas propus is stout, trapezoidal, distally expanded. Curiously enough this appendage is rarely illustrated in hitherto described crangonyctids.

In the specimen of LUCKS telson was also visible but, unfortunately, was not drawn; according to this author (LUCKS 1928, p. 9) telson was apparently fully cleft [...anscheinend bis zum Grunde gespaltene Telson].

Amphipod described by JUST (1974) as *Palaeogammarus danicus* JUST, 1974, in its general view looks very much alike to the studied specimen. Body shape and proportions of antennae, coxal plates and pereopods are rather similar; even the number of articles in flagellum of A1 is the same (17) and 2-jointed accessory flagellum is shared by both compared specimens. The specimen of JUST has somewhat deeper coxal plates than our specimen has, but this difference can be due to different amphipod orientation in the amber piece; bases of P5-P7 in JUST's specimen are somewhat narrower than in our amphipod whereas the proportions between remaining articles are similar. In JUST's figure hind margins of P5-P7 basis are devoid of setae or serration, however in text this author (JUST 1974, p. 95) suggests that due to difficulties in observation "some kind of minute serration or crenulation may be present". Distal setae of P5 propus were very short in this specimen.

JUST (1974, p. 94) stated that "no spines or setae can be seen dorsally on the urosome", however, since he has not explicitely mentioned hind urosomites' margin, he could have meant only the dorsal surface armament and not the hind margin itself.

Palaeogammarus sp. recently described by COLEMAN & MYERS (2001) is very similar to our specimen. Slight differences noted are in distal expansion of merus in hind peropods and in the length of 2-nd peduncular article of A1 subequal to the 1-st article.

The placing of *Palaeogammarus* in the family Crangonyctidae by JUST (1974) seems to be justified; his view is shared by such authorities as HOLSINGER (1977) and BOUSFIELD (1982). In general morphology *Palaeogammarus* resembles recent Holarctic *Crangonyx*, although LUCKS (1928) described the telson of *P. balticus* as apparently cleft to the base, that never happens in recent Crangonyctidae; their telson is rarely cleft more than half the length, most often is emarginate with deeper or shallower *U*-shaped or *V*-shaped notch, or even entire (SCHELLENBERG 1942; HOLSINGER 1974, 1976, 1978).

The present authors challenge the suggestion of ZADDACH (1864) that *Palaeogammarus* might have inhabited shallow marine littoral or even wet sandy beach. General habitus of *Palaeogammarus* and the morphology of its pereopods and uropods are different from those of the Talitroidea, the typical amphipod inhabitants of wet land (beaches, rocky shores, etc.). Most probably, like many extant epigean crangonyctids (*Crangonyx, Synurella*), *Palaeogammarus* lived in very shallow freshwaters, in secluded habitats like e.g. leaf litter and such a near-surface mode of life could offer the possibility of inclusion in the fresh resin of trees growing at the water body, although the idea of LARSSON (1978) that amphipods would intentionally jump out on the roots of trees producing resin seems improbable. It is herein suggested that in sub-tropical climate of Eocene, small, shallow water bodies could quickly dry out at water margin. Amphipods could be then captured in micro-pools at the water-line and half-dry, still in good shape, covered with resin drops falling from the trees growing nearby.

The possiblity of dwelling in such freshwater habitat can be supported also by the presence in the same amber piece of a fragment of larval stage of a dolichopodid dipteran; larvae of these insects live in wet soil very often at the water line of freshwater basins. Freshly dead amphipods (gammarids) can be, for instance, found just at the water line, sometimes on wet sand, during mass upstream spring and early summer migrations along the stream littoral (GOEDMAKERS & PINKSTER 1981; and own observations of K.J.).

Freshwater habitat of *Palaeogammarus* is well proved by the trichopteran and dipteran remnants in the same piece of amber studied by COLEMAN & MYERS (2001).

According to HOLSINGER (1994), recent Crangonyctidae are a Holarctic group of about 150 species (North America, Eurasia). Some 75% of taxa live in subterranean waters, the remaining are epigean, living in small and shallow water bodies like springs, streams, ponds, swamps, etc. HOLSINGER (1994, p. 138) is of the opinion that: "Holarctic crangonyctids were probably already established on Laurasia prior to separation of North America and Eurasia in the late Mesozoic". According to KARAMAN (1974), the number of extant European species of Crangonyctidae is restricted to four species of *Crangonyx* and 11 species of *Synurella*. Of these only several species are epigean, while most of them live in groundwaters.

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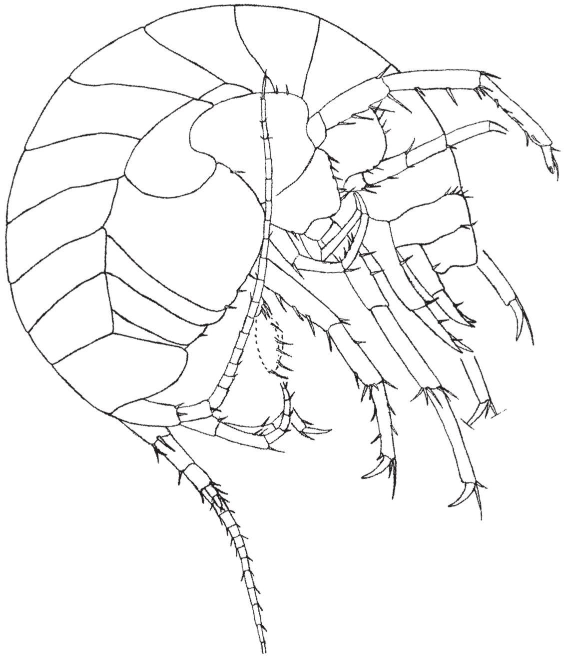
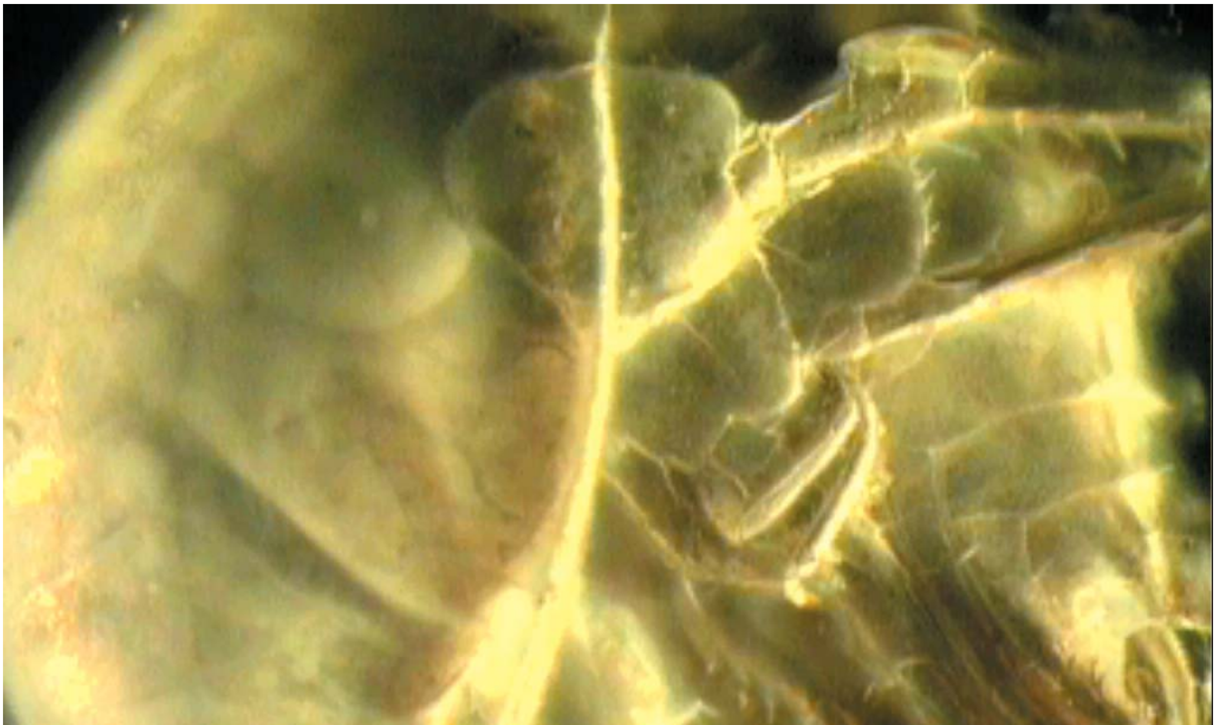
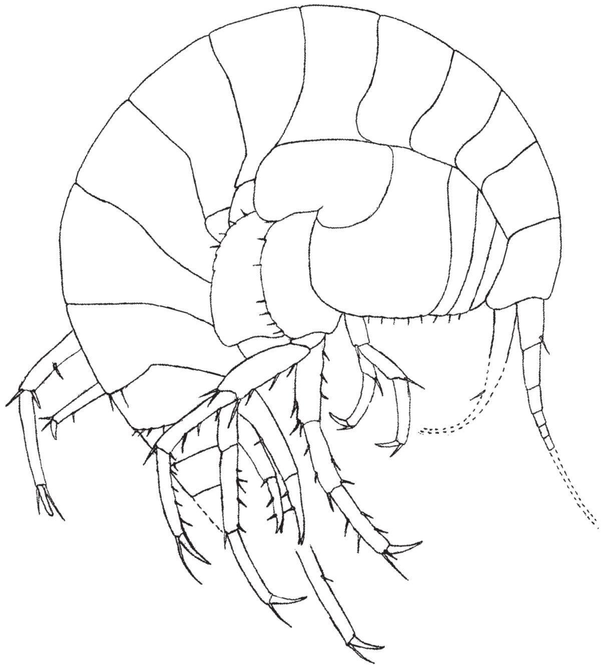




Palaeogammarus poloniucs sp. nov.; left side; × 50; Photo by J. MARCZAK



Palaeogammarus poloniucs sp. nov.; right side; × 50; Photo by F. ROOZENDAEL