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Parastenocaris andreji n. sp. (Crustacea; Copepoda) – the first record of the genus in Slovenia (SE Europe)

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Abstract

Parastenocaris andreji n. sp. was found in ground water in a northwestern part of Slovenia (southern part of Central Europe). Two adult females of the new species were filtered out of 20 000 l of water during examination of an aquifer for water supply. The bore well was 10 m deep. The aquifer is fed by rainwater and probably only occasionally from a nearby alpine river Sava. The new species differs markedly from other known species of the genus by shape and armature of furcal rami, very long and slim maxillae and some characters on endopodites P2–P5. The closest related species are probably *Parastenocaris nolli* Kiefer, 1938 with subspecies *P. nolli alpina* Kiefer, 1960, *P. gertrudae* Kiefer, 1968 and *P. austriaca* Kiefer, 1976.

Introduction

The genus *Parastenocaris* is a widely distributed genus in Europe (Kiefer, 1978). More than 50 species have been described in Europe (Petkovski, 1959; Rouch, 1988, 1992; Janetzky et al., 1996; Karanovic & Bobic, 1998). Members of the genus are restricted to ground water along rivers (interstitial water), to aquifers in alluvial plains and also common in small basins on the walls filled with dripping water in caves (Petkovski, 1959; Karanovic & Bobic, 1998). The elongated body shape, reduced and simplified appendages and absence of eyes clearly indicate their connection with such habitats. From more than 50 known species of the genus *Parastenocaris* in Europe, less than one tenth of them are found in the Alps (Kiefer, 1978; Janetzky et al., 1996).

In Slovenia, which is in the southern part of Central Europe, species of the genus *Parastenocaris* have not previously been found. In nearby countries (Italy; Austria, Dinaric region and Macedonia), the genus is quite common, with several new species described from there (Kiefer, 1933, 1938, 1968; Chappuis, 1935; Petkovski, 1959). Subterranean habitats in Slovenia, except those in caves and dug wells, have been relatively poorly investigated. Only a few systematic surveys, which included also microcrustacean fauna, were done in ground water near Ljubljana and thermal springs in NE Slovenia (Sket, 1981a, b). An intensive sampling of water from dug wells (depth from 2 m to >25 m) in alluvial plains all over Slovenia resulted in Cyclopoida (genera *Diacyclops* and *Acanthocyclops*) but no Harpacticoida (Brancelj, unpubl.).

During the last year, several samplings of interstitial fauna from bore wells were made during a survey of aquifers for water supply. Bore wells were drilled to different depths (from 5 m to over 50 m) in alluvial gravel plains and along rivers. In several samples we obtained some specimens of Cyclopoida as well as Harpacticoida. Harpacticoida were represented mainly by genera *Bryocamptus* and *Attheyella*, including species common to both epigean and subterranean habitats (Brancelj, unpubl.). In this paper, a new species from genus *Parastenocaris* is described in detail.

Materials and methods

Water from a bore well (capacity of about 5.5 l s^{-1})

was filtered for 1 h through a net with mesh size of 40 μm. In total, about 20 000 l of water were filtered. The hole was 10 m deep and the water table was at 5 m. Below 5 m, there was gravel (diameter 4–10 cm) with some traces of fine sand (>0.1 mm). Above 5 m, there was a layer of mixed sand and gravel. Water temperature was about 3.5 °C, pH 7.91 and it was very hard −9.4 Nt° (as Ca) with 67.3 mg Ca l^{-1}. Conductivity: 476 μS cm^{-1}, conc. of total N: 2.38 mg $l^{-1}$and of total P: 0.019 mg l^{-1}.

The bore well was in the middle of the small settlement Javornik (part of Jesenice; NW Slovenia) at an elevation of about 560 m. The main source is percolating water from hills north of the drill and only a small part originates from the river Sava. In the sample, there was no debris, no other taxa or chitinous remains thereof. This supports the hypothesis that the pumped water has very little or no connection with water from the river.

Specimens were transferred from 4% formaldehyde solution to 70% alcohol for a few days. Before dissection animals were put into a mixture of glycerol and 70% alcohol (ratio 1:1) and within 1 h replaced by pure glycerol. Dissection was made at 100× magnification (Olympus SZH2 stereomicroscope). Examination of all appendages and postabdomen was done under a magnification of 1000×. All drawings were made at the same magnification (1000×) with a drawing attachment tube on the Olympus microscope (BHS40).

Descriptive part

Material examined

Two adult females from the bore well in Javornik (Jesenice; NW Slovenia); collected 27 July 1999. Holotype: one completely dissected female (length: 423 μm), mounted in glycerol and sealed with nail polish. Paratype: one partly dissected female (length: 420 μm); mounted in glycerol and sealed with nail polish.

No males were found.

Material deposition

Holotype and paratype are deposited in the British Museum (Natural History) (each on two separate slides). Access no.: holotype 2000.2252, paratype 2000.2253.

Female

Body length 420–423 μm; elongated, cylindrical, colourless. Naupliar eye absent. Hind margins of all abdominal segments smooth, both ventral and dorsal (Figure 1a, b). No hairs on ventral or lateral side of abdominal somites. Anal segment with four groups of 5–7 spines on ventral side (Figure 1b). Anal operculum big, semicircular, with smooth margins, and not reaching distal end of anal segment (Figure 1a).

Furca sub-parallel; caudal ramus about 3.2 times as long as wide, slightly tapering to the posterior end (Figure 1a, b). Inner margin completely smooth. Outer margin with two setae close to the posterior end of the ramus (Figure 1a). Posterior end of ramus ventrally with two small spines. Seta on dorsal side at about two-thirds from the base of ramus; as long as caudal ramus and close to the inner margin. Outer terminal seta short, on small tuberculum, displaced sub-terminally. Inner terminal seta as long as width of the ramus, very conspicuous. Middle terminal seta as long as abdomen (225–230 μm).

Antennule /A1/ (Figure 1c) is seven segmented, with elongated 2nd segment (about 4 times as long as wide). Aesthete on the 4th segment reaching the end of antenna, with pointed tip. Aesthete on the 7th segment small, cylindrical.

Antenna /A2/ (Figure 1d) is two segmented, with elongated proximal segment (about 5 times as long as wide). Exopodite one-segmented with one fine seta.

Mandible (Figure 1f) is short and robust, with strong teeth on gnathobase. Mandibular palp 1-segmented, with two long, sub-equal setae.

Paragnaths (Figure 1h) are two segmented. Proximal one (= basipodite) with two short spines on tubercules on inner side. Distal one long, beak-like with two long setae externally (= exopodite). Inner one (= endopodite) two-lobed, with three setae. Innermost one with strong spine.

Maxillule (Figure 1g) with four strong and robust spines on gnathobasic endite and additional seta, originating from the middle of the dorsal side of the segment. Basis with two lobes; inner one with one seta and outer one with three setae.

Maxilla (Figure 1e) is three segmented, with middle segment extremely elongated (about 10 times as long as wide; length of about 50 μm. Distal segment slightly shorter than previous one, with about 7 strong spines at the tip.

Rostrum (Figure 1i) small rounded. Frontal side with two groups of 5 fine spines.

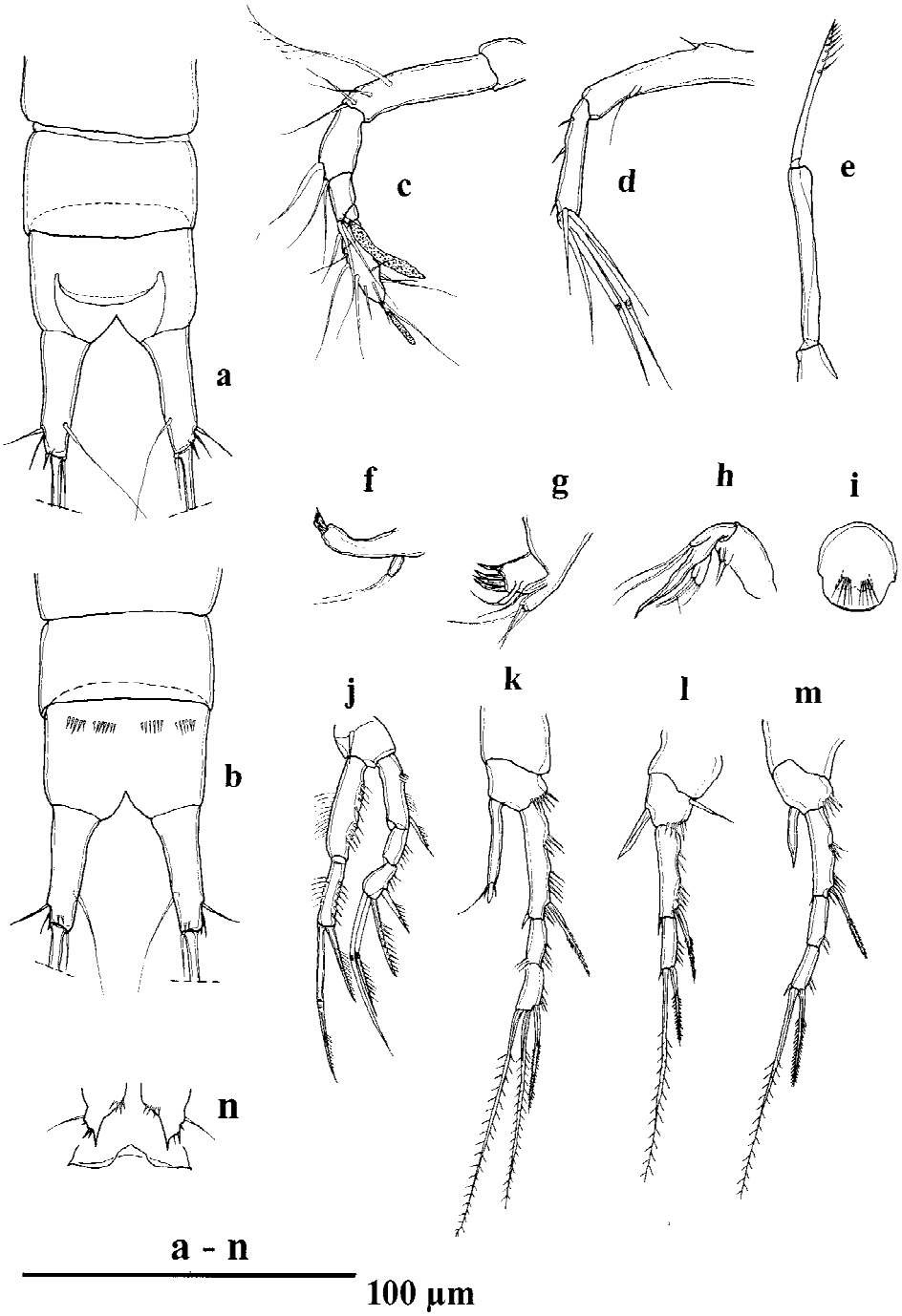

Figure 1. Parastenocaris andreji sp. n.; ground water in Javornik; Jesenice, Slovenia. a – abdomen dorsally; b – abdomen ventrally; c – antennule; d – antenna; e: maxilla; f – mandible; g – maxillule; h – paragnaths; i – rostrum (frontal view); j – P1; k – P2; l – P3; m – P4; n – P5 & P6.

P1 (Figure 1j) with 3-segmented exopodite and 2-segmented endopodite. Endopodite slightly longer than exopodite. Inner side of endopodite with long and fine hairs, outer margin with strong spines. Exopodite with 3 terminal spines, endopodite with two terminal spines, outer one about half as long as inner one. Basipodite with strong spine at the base.

P2 (Figure 1k) with 3-segmented exopodite and 1-segmented endopodite; endopodite slightly shorter than proximal segment of exopodite. Proximal segment of endopodite elongated, with one strong spine, middle segment without such a spine, terminal segment with one spine and two long setae (about twice as long as spine). Endopodite with three short spines and one long, fine seta. Middle short spine strong and slightly curved. Basipodite with no spine or seta on outer margin.

P3 (Figure 1l) with 2-segmented exopodite and 1-segmented endopodite. Proximal segment of exopodite distally with one long spine, terminal segment with one spine of similar size to those on proximal segment and one long seta (about three times as long as spine). Endopodite with no ornamentation; tip spiniform. Basipodite with long spine on outer margin.

P4 (Figure 1m) with 3-segmented exopodite and 1-segmented endopodite. Proximal segment of exopodite distally with one long spine, second segment without spine. Terminal segment similar to that in P3. Endopodite similar to that in P3. Basipodite with no spine on outer margin.

P5 (Figure 1n) sub-triangular, with sharply pointed tip. Outer margin with three spines distally and one long seta proximally. Inner side with 4–5 small spinules.

P6 (Figure 1n) reduced to small plate with pointed tip.

Variability

Due to the small number of specimens examined, we cannot find any variability.

Etymology

Specific name *andreji* is taken from my son Andrej who had his 5th birthday when I received samples with specimens described above.

Discussion

Distribution

The species is known from type locality only. Due to the very specific condition of sampling, it would be difficult to obtain more material from this location.

Ecology

Lack of pigment and eyes indicate stygobytic environment, whilst elongated and slim body shape indicates interstitial habitats. Ornamentation (including spinulation and setation) is reduced as a result of small interstitial space and probably also of lack of food. The most obvious characteristic are the elongated proximal segments of A1, A2 and particularly maxillae. In maxillae, the second segment is extremely elongated, while the distal one is armed with several strong spines. In one female, both parts of the maxillae were open to an angle of 180° and stretched out on both sides for one body width. This produces, together with elongated A1 and A2, what is probably a very effective basket and increasing the chances of finding and catching prey. Elongated appendages help to detect a potential prey earlier which, at the same time, has less chance to escape. Enlarged appendages (i.e. maxillae) equipped with strong spines suggest a lack or rarity of appropriate prey. In an environment where prey is rare, predators must be able to fix and win bigger and more powerful prey. Elongated mouthparts with strong spines create better chance of success. Strong teeth on mandibles and strong spines on maxillae get no doubt on the predator nature of this species. All the characteristics mentioned suggest that the aquifer examined for water supply is the original habitat of this species.

Affinities

Absence of males makes it difficult to establish a clear relationship between the new species and other taxa within *Parastenocaris* genus. According to Lang (1948), species from the genus are put in several groups according to the armature of basipodites of P4 in males.

Females of the new species have a relatively simple (reduced?) armature of Fu, which resembles *Parastenocaris nolli* Kiefer, 1938 and particularly subspecies *P. nolli alpina* Kiefer, 1960. A similar armature of Fu as well as P1–P4 can bee seen in *P. gertrudae* Kiefer, 1968 and *P. austriaca* Kiefer, 1976. All the

species mentioned are geographically relatively close and this could support some phylletic connections. But extremely elongated segments of mouthparts, A1 and A2 make the new species distinct from other taxa. We may suppose that such characters reflect an environment extremely poor in food and they are genetically fixed and not expressed only on the level of eco-phenotype.

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