

***Paracamptus gasparoi* n. sp. (Copepoda: Harpacticoida) from cave waters in Slovenia**

*Paracamptus gasparoi* n. sp. (Copepoda: Harpacticoida) iz jamskih voda Slovenije

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**Abstract.** *Paracamptus gasparoi* n. sp., the second species of the genus *Paracamptus* found in Europe, was collected in a Slovenian cave where it inhabits small puddles of percolating water as well as a hypogean fast running stream. The female of the new species is characterized by the presence of long caudal rami with dorsal surface densely spinulose and with reduced setation. The new species is closely related to *Paracamptus schmeili* (Mrázek, 1893) which is considered a species complex in urgent need of revision.

**Key words:** Copepoda, Harpacticoida, *Paracamptus gasparoi* n. sp., cave waters, Slovenia

**Izvleček.** *Paracamptus gasparoi* n. sp., druga evropska vrsta tega rodu, je bila najdena v jami Viršnici, blizu Grosuplja na Dolenjskem. Naseljuje lužice prenikle vode in hitro tekoč podzemeljski potok. Za samico nove vrste sta značilni dolgi veji furke, ki imata hrbtno površino gosto trnasto, a z reduciranimi ščetinicami. Nova vrsta je tesno sorodna s *Paracamptus schmeili* (Mrázek, 1893), ki je verjetno agregat vrst, potreben revizije.

**Ključne besede:** Copepoda, Harpacticoida, *Paracamptus gasparoi* n. sp., jamske vode, Slovenija

## Introduction

Recent stygobiological investigations in North-Italian and Slovenian caves yielded several new or rare species of copepods (STOCH 1995, SKET & BRANCELJ 1992), most of them not yet described. During a biospeleological survey in the Viršnica cave (Radensko Polje, Slovenia), some specimens of the genus *Paracamptus* Chappuis, 1929, were collected. They turned out to belong to a new species, *P. gasparoi* n. sp., which is described herein.

Up to now, all the European populations of the genus *Paracamptus* were attributed to the polytypic species *P. schmeili* (Mrázek, 1893) (see LANG 1948, DUSSART & DEFAYE 1990, JANETZKY et al. 1996), reported from mosses, lakes, springs, and caves. For this reason, it is noteworthy to give herein the description of the second European species of the genus;

moreover, its discovery raises several doubts about the taxonomic status of other populations of the "rassenkreis" *P. schmeili*, which is in urgent need of revision.

## Material and methods

The specimens were collected from two main cave habitats:

- vadose zone: small puddles of percolating water were sampled using a small rubber hand pump and a hand plankton net; the samples were poured into vials and fixed with formaldehyde (5%)
- epiphreatic zone: the water of the hypogean brook was filtered using a plankton net stirring the substratum upstream; the samples were fixed as above.

Copepods were extracted from detritus under a stereomicroscope (50 X) and stored in 70% ethanol with 10% glycerine added. Selected specimens were dissected in glycerine, and permanently mounted on slides in Faure's medium. A Zeiss Axioskop microscope fitted with a drawing tube was used to study the details at 1000X using an oil immersion lens. The terminology related to the external morphology follows HUYS & BOXSHALL (1991).

## Taxonomic account

Family Canthocamptidae Sars, 1906

Subfamily Canthocamptinae Sars, 1906 emend. Chappuis, 1929

Genus *Paracamptus* Chappuis, 1929

*Paracamptus gasparoi* n. sp. (Figs. 1-3)

Material examined - Cave named "Viršnica" (Slovenian cadastre number 571), V. Račna (Grosuplje), Radensko Polje, Slovenia; 24 August 1995, leg. F. Gasparo and F. Stoch. Small pools of percolating water: water temperature = 11.3°C, pH = 8.9, conductivity = 290  $\mu$ S/cm; 1♀. Hypogean brook: water temperature = 12.8°C, pH = 8.2, conductivity = 440  $\mu$ S/cm; 5 ♂♂, 3 ♀♀.

Type series - Holotype ♀, allotype ♂, from the brook, completely dissected and mounted on slide in Faure's medium; paratypes 4 ♂♂, 3 ♀♀ (in 70% ethanol). Holotype and allotype deposited in the collections of the University of Ljubljana; paratypes in the collections of British Museum (Natural History).

Etymology - The new species is dedicated to my friend Dr. F. Gasparo (Trieste), accomplished biospeleologist, for his help in the field work and his contribution to the knowledge of the cave fauna of Italy and Slovenia.

Diagnosis: small *Paracamptus* with body somites covered by transverse rows of microsetules; caudal rami of female more than 4 times longer than wide, with dorsal surface densely covered by stout spinules and inner terminal seta very short or reduced to a small hump; antennule aesthetasc on segment 4 elongated, longer than 4 distal segments; P1-P4 of female with 3-segmented exopods and 2 segmented endopod; P1-P4 setation and male characters as in *Paracamptus schmeili*.

Female - Length of the holotype, excluding caudal setae, 540  $\mu$ m. Hyaline fringes of dorsal posterior margins of somites coarsely crenulated (Fig. 1a); urosomites with transverse rows of microsetules on both dorsal and ventral sides (Fig. 1e, f). Nucal organ small, as in Fig. 1b. Genital segment and genital field as in Fig. 1f, with hyaline fringe of caudal margin ventrally crenulated, without spinules. Two urosomites posterior to genital segment (Fig. 1f) with caudal margin armed with a ventral row of spinules, accompanied by an additional

ventral row, continuous in urosomite 3, medially interrupted in urosomite 2. Anal somite with 2 rows of short spinules (Fig. 1f) near posteroventral margin above each caudal ramus, 2 smaller lateral rows of spinules and a long medial spinule. Ventral side of anal somite densely covered by hairs, dorsal side with a transverse row of hairs; the surface of both dorsal and ventral sides also coarsely punctate. Anal operculum slightly convex, with small microspinules; an additional row of microspinules is present anterior to operculum.

Caudal rami more than 4 times longer than wide (Fig. 1g, h), slightly conical, as long as the last two urosomites. Inner and outer margins with 1 row of long hairs, inner row continuing basally with an oblique dorsal row. Inner margin with a pronounced recess. Dorsal surface densely covered with stout spinules. Anterolateral and posterolateral setae shorter than ramus width. Outer terminal seta and terminal accessory seta short, of equal length. Inner terminal seta very short or reduced to a stout hump. Dorsal seta longer than ramus width, inserted on a small protuberance.

Antennula (Fig. 1c) 8-segmented; segment 4 with 1 aesthetasc longer than 4 distal segments; segment 8 bearing 1 distal aesthetasc. Antenna as in Fig. 1d, with exopod 2-segmented; exopod segment 1 bearing 1 seta, segment 2 armed with 1 seta and 1 stout spine.

Labrum and paragnaths as in Fig. 2 a, b. Mandible as in Fig. 2c; coxa without proximal spinules, gnathobase with 6 teeth; mandibular palp 1-segmented bearing 1 short and 2 longer terminal setae. Maxillule (Fig. 2d) with praecoxa unarmed; arthrite with 7 distal spines; coxa with 1 claw; basis with 1 distal claw and 4 setae. Maxillary syncoxa (Fig. 2e) with 2 endites each bearing 2 stout distal setae; allobasis bearing 1 endite transformed in a claw; endopod bearing 2 setae. Maxilliped (Fig. 2f) prehensile; basis with a double row of spinules along inner margin, and tiny spinules along outer margin; endopodal claw with microspinules.

Swimming legs, exopods 3-segmented; setal formula of exopods: P1 0.0.022; P2 0.1.122; P3 0.1.122; P4 0.1.022. Couplers of P2-P4 with 2 transverse rows of setules. P1 (Fig. 2g): basipod with 1 inner and 1 outer stout spine; endopod 2-segmented, with segment 2 elongated, bearing 2 distal setae. P2 (Fig. 2h): basipod with 1 outer stout spine; endopod 2-segmented, slightly longer than exopod segment 1; endopod segment 1 short, segment 2 elongated, with 1 terminal pinnate spine longer than endopod, and 1 short and curved inner subdistal spinule. P3: endopod (Fig. 2i) 2-segmented; segment 2 bearing 1 spiniform seta longer than endopod. P4 (Fig. 2j): endopod 2-segmented, segment 2 bearing 1 spiniform seta longer than endopod. P5 (Fig. 2k): baseoendopod with 5 pinnate spines; exopod armed with 4 strong spiniform setae accompanied by a medial tiny seta.

Male - Length of allotype, excluding caudal setae, 430  $\mu\text{m}$ . Hyaline fringes of posterior margins of somites crenulated; urosomites with transverse rows of setules (Fig. 3a), and each with 1 row of spinules on ventral margin, accompanied by an additional medioventral row of shorter spinules. Anal somite with surface punctate, and two rows of microsetules anterior to anal operculum (Fig. 3b).

Caudal ramus short (Fig. 3b), about 1.5 times as long as wide, conical; inner margin with a row of setules; dorsal surface with an oblique basal row and a distal transverse row of microsetules. Anterolateral and posterolateral setae as long as ramus width; outer terminal seta longer than ramus, terminal accessory seta slightly shorter; inner terminal seta well developed; dorsal seta slightly longer than ramus.

Antennula (Fig. 3c) geniculate, 8-segmented; segment 4 with 1 aesthetasc longer than 4 distal segments. Antenna and mouthparts as in female; rostrum as in Fig. 3d.

Swimming legs, exopods P1-P3 and setal formula as in female. P1 endopod as in female. P2 endopod (Fig. 3e) 2-segmented, slightly shorter than exopod; segment 2 elongated, bearing 2 terminal spiniform setae of different length. P3 (Fig. 3f): endopod 3-segmented, segment 1 unarmed; segment 2 with spiniform process not reaching tip of longer terminal seta of

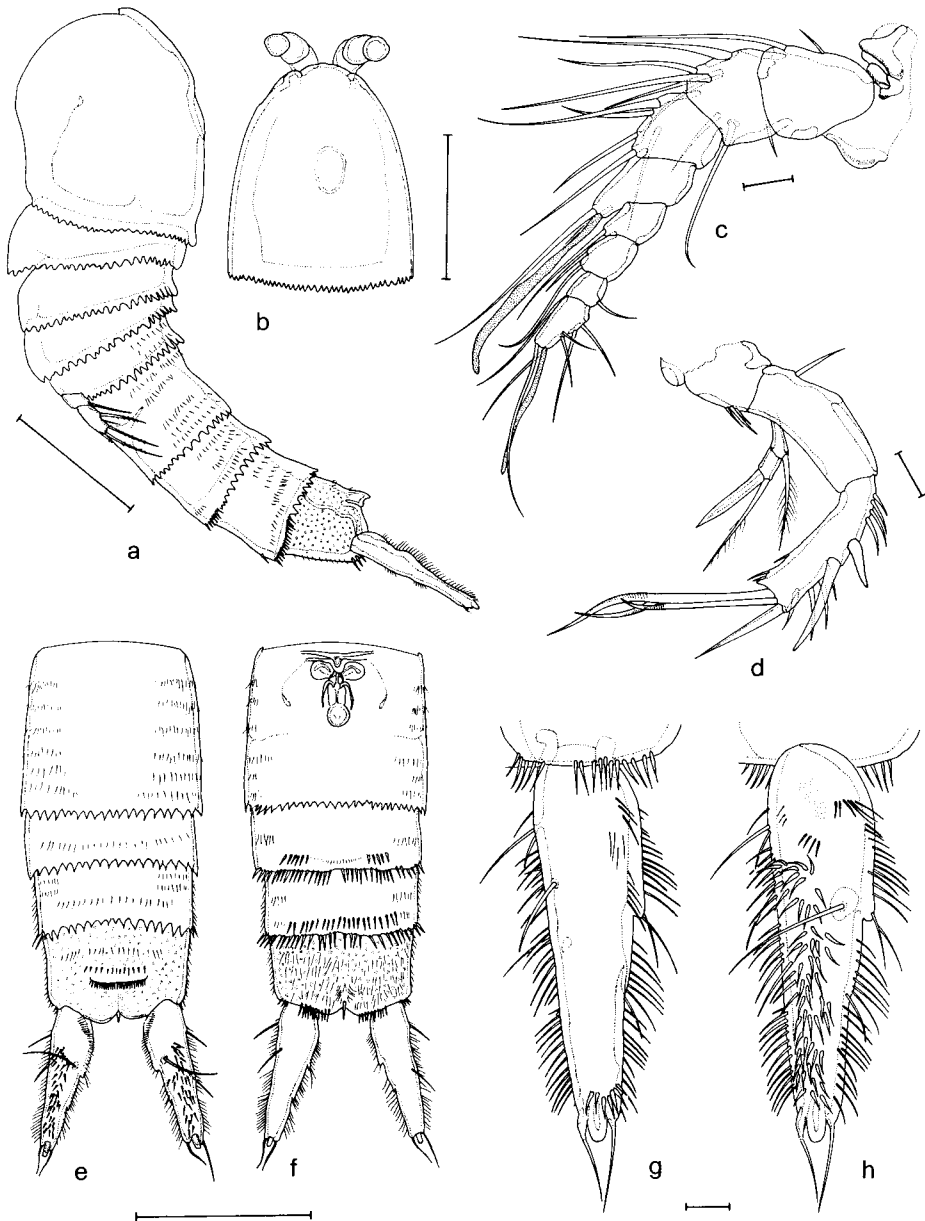


Fig. 1. *Paracampton gasparoi* n. sp., holotype ♀. a) habitus (lateral view); b) head and nuchal organ (dorsal view); c) antennule; d) antenna; e) abdomen and caudal rami (dorsal view); f) abdomen and caudal rami (ventral view); g) left caudal ramus (ventral view); h) left caudal ramus (dorsal view). Scale bars: 100 µm (a,b,e,f); 10 µm (c,d,g,h).

Sl. 1. *Paracampton gasparoi* n. sp., holotip ♀. a) habitus od strani; b) glava in nukalni organ, hrbtno; c) antenula; d) antena; e) zadek in furkalni veji, hrbtno; f) zadek in furkalni veji, ventralno; g) leva furkalna veja, ventralno; h) leva furkalna veja, dorzalno. Merila: 100 µm (a, b, e, f) ali 10 µm (c, d, g, h).

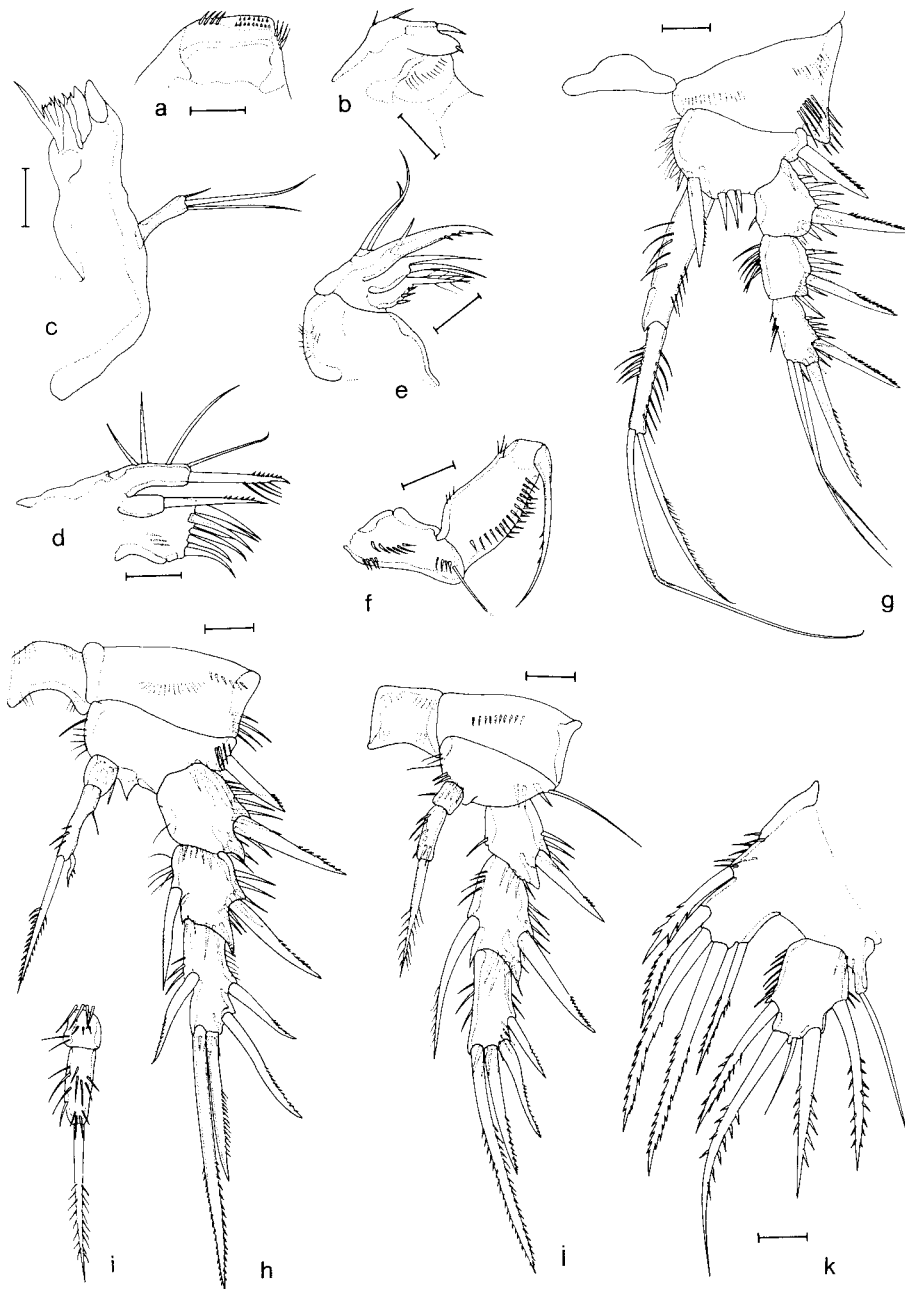


Fig. 2. *Paracamptus gasparoi* n. sp., holotype ♀. a) labrum; b) paragnath; c) mandible; d) maxillule; e) maxilla; f) maxilliped; g) P1; h) P2; i) P3 endopod; j) P4; k) P5. Scale bars, 10 µm.

Sl. 2. *Paracamptus gasparoi* n. sp., holotip ♀. a) labrum; b) paragnat; c) mandibula; d) maksilula; e) maksila; f) maksiliped; g) P1; h) P2; i) endopodit P3; j) P4; k) P5. Merila: 10 µm.

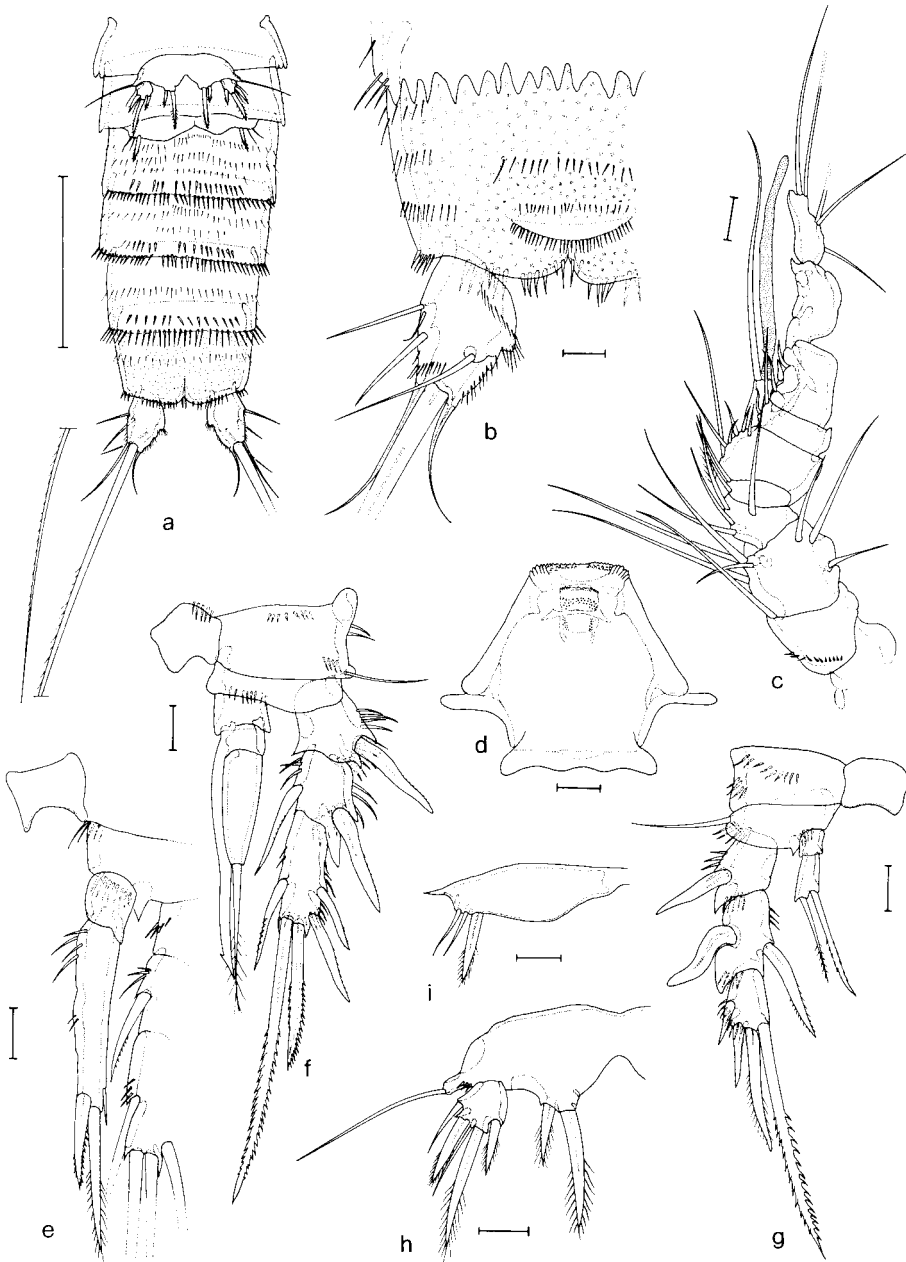


Fig. 3. *Paracampton gasparoi* n. sp., allotype  $\sigma$ . a) rear thoracic somite, abdomen and furcal rami (ventral view); b) anal somite and furcal ramus (dorsal view); c) antennule; d) labrum; e) P2 endopod; f) P3; g) P4; h) P5; i) P6. Scale bars, 10  $\mu$ m (b-i), 100  $\mu$ m (a).

Sl. 3. *Paracampton gasparoi* n. sp., alotip  $\sigma$ . a) zadnji somit oprsja, zadek in furkalni veji, ventralno; b) analni somit in furkalna veja, dorzalno; c) antenula; d) labrum; e) P2, endopodit; f) P3; g) P4; h) P5; i) P6. Merila: 100  $\mu$ m (a), 10  $\mu$ m (b-i).

segment 3; segment 3 bearing only 1 terminal seta, shorter than endopod. P4 (Fig. 3g): exopod with outer spines of segments 2-3 stout and curved, as usual in the genus; endopod segment 2 short, bearing 2 setae. P5 (Fig. 3h): baseoendopod with 2 spines, the inner one double than outer one. P5 exopod armed with 5 setae, 3 of them being stout and spiniform. P6 (Fig. 3i) bearing 1 stout spine and 2 shorter setae.

Remarks - No variation of the morphological characters described above was observed in the specimens examined. *Paracamptus gasparoi* n. sp. can be easily distinguished from the unique European congeneric species, *Paracamptus schmeili* (Mrázek, 1893) and its subspecies (see GURNEY 1932, Lang 1948, ŠTĚRBA 1954, DUSSART & DEFAYE 1990) by the shape and unusual ornamentation of furcal rami of the female, while the morphological characters of the male are quite similar in both species. The highly elongated, apomorphic caudal rami and the elongation of antennule aesthetascs suggest that the new species could be eustygophilous or stygobiont.

The examination of several samples of the type-species *Paracamptus schmeili* from Germany, Italy, and Slovenia, showed variation in the length of furcal rami and caudal setae of females, as well as in the setal formula of the endopods of swimming legs and the ornamentation of urosomites in both sexes. Nevertheless, a careful examination of the available material, as well as a critical review of the literature, indicate that some of the differences observed between the females of the populations of this polymorphic species are taxonomically significant in many other harpacticoid genera, first of all *Bryocamptus* and *Maraenobiotus*. The range of different habitats exploited by this species, as well as its presence in some highly isolated karstic areas suggest to me the possibility that *P. schmeili* is a complex of closely related species. A redescription of the type species and of some other new *Paracamptus* from Slovenia is in progress and will be reported in another paper (STOCH in prep.).

Distribution and habitat - The new species was found only in the Viršnica cave, in samples from the inner stretch of the hypogean brook and in percolating water. *P. gasparoi* n.sp. was accompanied by some other stygophilous or stygobiont harpacticoids - *Attheyella crassa* (Sars, 1863), *Bryocamptus tatrensis* Minkiewicz, 1916, *Elaphoidella jeanneli* (Chappuis, 1928) and *Moraria poppei* (Mrázek, 1893), as well as by cyclopoids, isopods, amphipods, oligochaetes and gastropods including some rare or new taxa.

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