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A NEW CYCLOPOID COPEPOD FROM HYPORHEIC SUBTERRANEAN WATERS OF YUGOSLAVIA: *ACANTHOCYCLOPS* (*ACANTHOCYCLOPS*) *PETKOVSKII* N. SP.
(CRUSTACEA: COPEPODA)

RIASSUNTO

UN NUOVO CICLOPOIDE DI ACQUE SOTTERRANEE IPORREICHE DELLA YUGOSLAVIA: « *ACANTHOCYCLOPS* (*ACANTHOCYCLOPS*) *PETKOVSKII* » N.SP. (CRUSTACEA: COPEPODA). - Viene descritto *Acanthocyclops* (*Acanthocyclops*) *petkovskii* n.sp. di acque sotterranee iporreiche di Yugoslavia. La nuova specie, per le piccole dimensioni, l'accorciamento dei rami furcali ed il numero di articoli dell'antennula, come pure per la sua peculiare ecologia, rientra in un gruppo ben caratterizzato di *Acanthocyclops* cui afferiscono le specie *A. kieferi* (Chappuis) di acque sotterranee di Romania, Yugoslavia e Germania, *A. hispanicus* Kiefer, di acque cavernicole di Spagna e *A. reductus* (Chappuis), di acque interstiziali dell'Europa orientale. *A. (A.) petkovskii* n. sp. risulta, in particolare, molto affine ad *A. kieferi* da cui si differenzia essenzialmente per il diverso rapporto tra le setole furcali interna ed esterna, e per la diversa armatura dell'ultimo articolo dell'endopodite del quarto paio di arti.

Subterranean waters in larger area near Zagreb, Yugoslavia, viz. hyporheic biotopes of the streams of Medvednica (Mountain of Zagreb, 1035 m a.s.l.) were investigated, with different methods by M. Mestrov since 1955 (MESTROV, 1960a,b). Later on, these researches, accomplished in the region of the lowest hill-sides, were carried on by the second Author of the present paper (LATTINGER-PENKO, 1970a,b, 1972), and then extended along the streams up to their springs.

Interesting stygofauna has been found so far, with several new species. Among these, there was also identified one specimen of a new cyclopoid copepod species, which the first Author describes herein as *Acanthocyclops* (*Acanthocyclops*) *petkovskii* n. sp.

Remarks on the ecology of the type-locality, as well as a list with the main biological parameters at the new species finding-place are reported ; some information is also given about the biocoenoses in which the new species lives.

Acanthocyclops (Acanthocyclops) petkovskii n. sp. (Figs. 1-6)

Material : 1 ♀ (holotype) ; locality : south-west slopes of the mountain Medvednica, upper reaches of the stream Dolje, upstream of the village Podsusedsko Dolje, vicinity of Zagreb ; 240 m a.s.l. ; alluvion in the stream bed, depth 40 cm (locality n. D) ; coll. R. Lattinger ; 11.1.1976. Type, completely dissected and mounted on cover lips in Faure's medium, deposited at the Zoological Institute of the University of L'Aquila (Italy) (First Author's collections).

Description : The present description is based on a single specimen, but the morphological features of this *Acanthocyclops* are remarkable, and they may quite assure its specific identity.

Body length : 0,80 mm, excluding antennae, antennulae and furcal setae. Cephalotorax about as long as large. Genital segment slightly longer than wide, and enlarged anteriorly ; genital field as in Fig. 2. Abdominal segments with a posterior denticulate chitinous lamella, the last one with a row of small spinules at the base of each furcal ramus. Anal operculum slightly convex and quite naked.

Antennula 11-segmented, aesthete on the 8th segment very short, reaching about the 1/2 of the 9th segment. Antenna 4-segmented, with numerous setae of different length, some plumose.

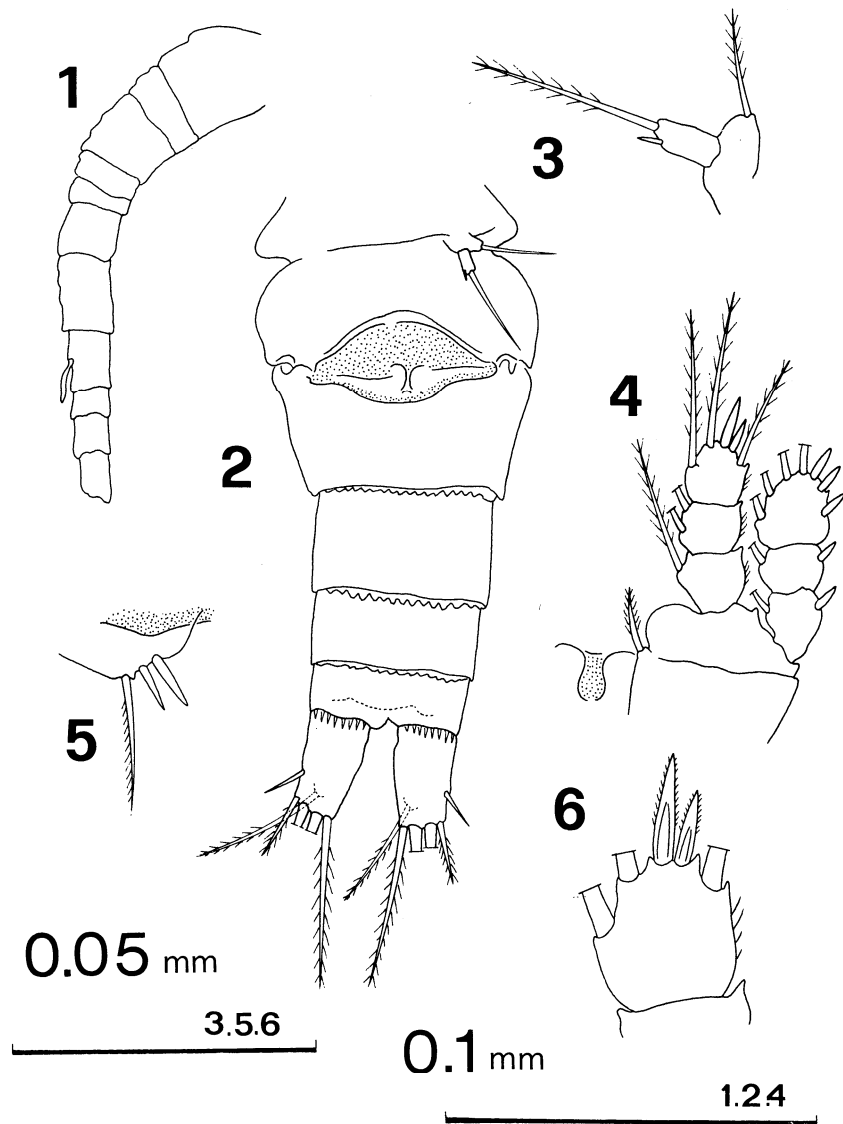
Mouthparts without particular characteristics.

Legs 1-4, exopod and endopod 3-segmented. Spine formula of the exopods 3 : 2.3.3.3.

Setal formula for legs 1-4 as follows :

	P ₁	P ₂	P ₃	P ₄
segm. 1	1/1	1/1	1/1	1/1
segm. 2	1/1	1/1	1/1	1/1
segm. 3	4/3	4/4	4/4	4/2

Precoxal plate of leg 4 without prominent tubercles, spinules or hairlike elements ; endopod, segment 3 of leg 4 slightly larger than long,



Figs. 1-6 — *Acanthocyclops* (*Acanthocyclops*) *petkovskii* n.sp. 1. Antennula; 2. Abdomen and furcal rami, ventral view; 3. Leg. 5; 4. Leg 4; 5. Leg 6; 6. Distal segment of the leg 4 endopod.

and armed with two apical, short spines, the inner the longest, quite shorter than the segment.

Leg 5 composed of 2 segments, the basal very large and armed with an outer seta, the apical with the typical short, subapical spine and the long apical plumose seta.

Leg 6 composed of two spiniform elements and one long seta. Furcal rami subparallel, well divaricated and twice longer than large. Apical inner seta very long, 2.55 times longer than the outer one, and quite longer than furcal ramus; dorsal seta moderately long, and slightly longer than furcal ramus; medial distal setae of different length, the inner 1.75 times longer the outer one.

Etymology: Name after Prof. T. K. Petkovski in recognition of his contributions to the knowledge of the genus *Acanthocyclops*.

Taxonomic remarks: *Acanthocyclops* (*Acanthocyclops*) *petkovskii* n. sp., due to the shortness of the furcal rami, the number of segments of the antennula, as well as to the ecology, belongs to the group of stygobiont species of the genus *Acanthocyclops*, which includes the following other species: *A. kieferi* (Chappuis) from subterranean waters of Roumania, Yugoslavia and Germany; *A. hispanicus* Kiefer from cave waters of Spain and *A. reductus* (Chappuis) from underground biotopes of east Europe*.

Among these species *A. petkovskii* n. sp. is close to *A. kieferi* by the length of the furcal rami, the armature of legs 1-4 and by the morphology of the «receptaculum seminis». From the above species, as well as from all the others of the genus *Acanthocyclops*, *A. petkovskii* n. sp. is easily distinguishable by the relative length of the inner and the outer furcal setae and by the shortness of the inner spine on the apical segment of the endopod of leg 4.

Ecology: The upper reach of the stream, along which *A. (A.) petkovskii* n. sp. was found, crosses a narrow walley covered by forest. The inclination of the stream bed is 113.3‰. The biggest flow is about 1 m³/sec. The spring and the part of the stream course are in an area of mesozoic dolomites and limestone (middle and upper triassic periods). The finding place is several meters long, narrow alluvion of coarse sandy clay within the stream bed, 300 m downstream from the spring (and quarry, too). The pits were dug 20 to 50 cm off the water edge.

(*) Recently KIEFER (1982) described a new species of the same phyletic group from groundwater of north Italy, viz. *Acanthocyclops (A.) sambugaræ* but PETKOVSKI (1984) synonymized the above species with *A. (A.) hispanicus*.

TABELLA I
Ecological parameters at *Acanthocyclops (Acanthocyclops) petkovskii* n.sp. finding place

Date	Air temp. °C	Sample	Water temp. °C	O ₂ mg/l	% satur.	CO ₂ mg/l	Alkalinity mval/l	pH	Loss by ignition mg/kg	<i>Escherichia coli</i> ind/ml	Heterotrophes ind/ml	Filtrated water/depth of pit 1 cm	Hyporheic fauna
11.I.1976	17,8	Hyporheic water	6									5/40	See text
29.III.1976	8,5	Stream water	7,6	11,4	98,45	12,09	5	14	5,5				
		Hyporheic water	6	2,4	19,90	12,29	5,58	16,22				8/80	0
5.VII.1976	24,5	Stream water	14,5	10,7	108,4	9,78	6,6	18,48	7,8	90	300		
		Hyporheic water	13,5	1,4	13,86	10,09	9,2	25,76	7,6	820	200	7/50	0
		Sandy clay at 50 cm depth											
									12.208				
21.IX.1976	16	Stream water	11,2	12,4	116,76	3,9	5,92	16,57	7,8				
		Hyporheic water	11,7	1,8	17,14	13,42	16,50	46,16	7,3			4/60	0
20.I.1977	0,5	Stream water	7,4	14,8	127,15		5,2	14,56	8,4	226			Lumbriculidae, 3
		Hyporheic water	6,2	10,2	85	9,75	5,55	15,51	6,5	206		5/50	Tubifex tubifex, 18
		Sandy clay at 50 cm depth								3.366			Haplotaenidae, 1 Enchytraeidae, 4
11.V.1977	17,8	Stream water	13,5	11,3	111,99	4,59	5,18	14,50	7,2	136	0		
		Hyporheic water	10,1	3,1	28,44	13,77	7,13	19,96	7,4	126	0	5/50	0
		Sandy clay at 50 cm depth											
4.X.1977	18	Stream water	10,5	11,60	107,41	8,34	5,36	15,01	8,2	264	100		0
		Hyporheic water	10,2	4,7	43,24	33,51	7,09	19,86	8,0	324	350	1/90	
15.III.1978	10,5	Stream water	9,2	10,8	96,95								Nematodes, 2
		Hyporheic water					No water (wet)					0/80	Oligochaeta, 3 Ostracoda, 1 Collembola, 2

In the finding time of *A. (A.) petkovskii* n. sp. the alluvion was only wet till the depth of 40 cm ; at this depth there was a slight inflow of water in the pit, in direction from the bank to the stream.

In the same locality, the new species lives in association with the cyclopoid copepods *Diacyclops languidoides hypnicola* (Gurney) (stygo-biont species) and *Diacyclops languidus disjunctus* (Thallwitz) (stygo-phil species), and with the following other animals :

- Oligochaeta : Lumbriculidae gen. sp.
- Tubificidae (*Psammoryctes* sp.)
- Rotatoria : gen. sp.
- Nematoda : gen. sp.
- Copepoda Harpacticoida : *Attheyella crassa* (Sars),
Elaphoidella elaphoides Chappuis,
Nitocrella psammophila Chapuis, 44
- Ostracoda : gen. sp.
- Amphipoda : *Niphargus* sp.
- Insecta Dolichopodidae : gen. sp.,

From the same alluvion the samples were taken 7 more times, and physico-chemical analyses of stream and underground water were performed (Tab. I).

The pits were dug till 90 cm of depth. Sometimes there was no water and sometimes there was a poor inflow from the bank, from the stream or from both sides at the same time. Only twice the fauna was collected, but this very scarce fauna, originated from the stream benthos.

Nearly always very small quantity of oxygen, higher hardness of water and greater amount of CO₂ prove that this alluvion is typical interstitial underground biotope of hyporheic type, which is also shown by variable direction of water inflow, similarity of temperature of stream and underground waters, their synchronous fluctuation as much as by the presence of the stream fauna within the substrate of the finding place ; the stygo-biont component of the animal settlement in it depends evidently on the inflow of underground water from the neighbouring hill, where likely exists a hypotelminorheic biotope with its stock of veritable underground animals.

SUMMARY

Acanthocyclops (Acanthocyclops) petkovskii n. sp., a stygo-biont cyclopoid copepod from hyporheic waters of the Dolje stream (Medvednica mountains,

Yugoslavia) is described. The new species belongs to the group of stygobiont forms of the genus *Acanthocyclops*, being very close to *A. kieferi*.

Detailed information is also given about the ecology and the affinities of the new species.

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