Thalerius konradi gen. nov., sp. nov., a new tardigrade from the periglacial area of the Ötztal Alps, Austria (Tardigrada)

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ABSTRACT Contrib. Nat. Hist. 12: 391–402.

A new semiterrestrial genus and species of Tardigrada, *Thalerius konradi* gen. nov., sp. nov. (Hypsibiidae), from the glacier foreland in the Langtal Valley of the Ötztal Alps are described. The new tardigrade differs from other hypsibiids mainly by the presence of a peculiar incision at the base of the external claws and two unique plates at the cuticular bars on the first to third pair of legs.

Keywords: Tardigrada, taxonomy, *Thalerius konradi,* new genus, new species, glacier foreland, the Alps, Austria.

Introduction

Although diverse groups of invertebrates, particularly arthropods, have been reported during studies of succession in the alpine glacier foreland (e.g. Janetschek 1949, Kaufmann 2001, Kaufmann & al. 2002), little is known about the micrometazoans in such habitats. This is particularly valid for tardigrades.

During studies on the biology of the tardigrade *Hypsibius klebelsbergi* Mihelčič, 1959, a spectacular endemic species reported exclusively from the glacier surfaces in the Alps (e.g. Steinböck 1957, Kraus 1971, Dastych & al. 2003), numerous bryophyte samples were collected on the glacier foreland in several valleys of the Ötztal Alps. In two of the samples a tardigrade belonging to a new genus and a new species was discovered and the present paper describes these two taxa.

Material and Methods

The two samples of moss with tardigrades for this study came from a periglacial area in the Langtal Valley in the Ötztal Alps near Obergurgl (Nordtirol, Austrian Central Alps). The exact data for the locality are given in the description of the new species. The tardigrades were extracted by the method described by Dastych (1985). The terms "fore-" and "hind claw" describe structures on the fourth pair of legs. The morphometric indices employed in the paper are explained in Dastych (2004a, b), Dastych (2006). All photos taken are of the holotype.

Abbreviations used are:

DIC	differential interference contrast
ECI	external claws' index
HBI	hind claw base index
HSBI	hind claw secondary branch index
LM	light microscope
LRU	light-refracting unit
MBI	claws' main branch index
PHC	phase contrast
PT	whole buccal tube indices (comp. Pilato 1981; = WTI indices: Dastych (2006)
SSA	buccal tube anterior unit (distance between stylet sheats and stylet support insertion)
WTI	whole buccal tube indices (= pt indices)
WT SSA	stylet supports 'anterior' index (= "pt ss")
ZMH	Zoologisches Museum Hamburg

Description of new taxa

Family Hypsibiidae

Thalerius gen. nov.

Diagnosis: Semiterrestrial, medium sized hypsibiids. Claw system of *Hypsibius*-type.

The bases of external claws expanded posteriorly, each with a roundish, deep incision, the sides of the incision with a well formed tooth. Main branches of external claws thin and markedly long. At the base of each internal claw

Figs. 1–2. The type locality of *Thalerius konradi* gen. nov., sp. nov.: The periglacial zone at the glacier Langtaler Ferner, the Ötztal Alps; general (1) and detailed (2) view.

on legs I to III a distinct cuticular bar. Each bar with two unique, small and half-rounded plates close to each other. Buccopharyngeal apparatus similar to that of species of the *Isohypsibius prosostomus*-group. Mouth tube without strengthening bar. Pharynx with three macroplacoids and one microplacoid.

Type species: *Thalerius konradi* sp. nov. by monotypy.

Included taxa: A single species, *Thalerius konradi* sp. nov.

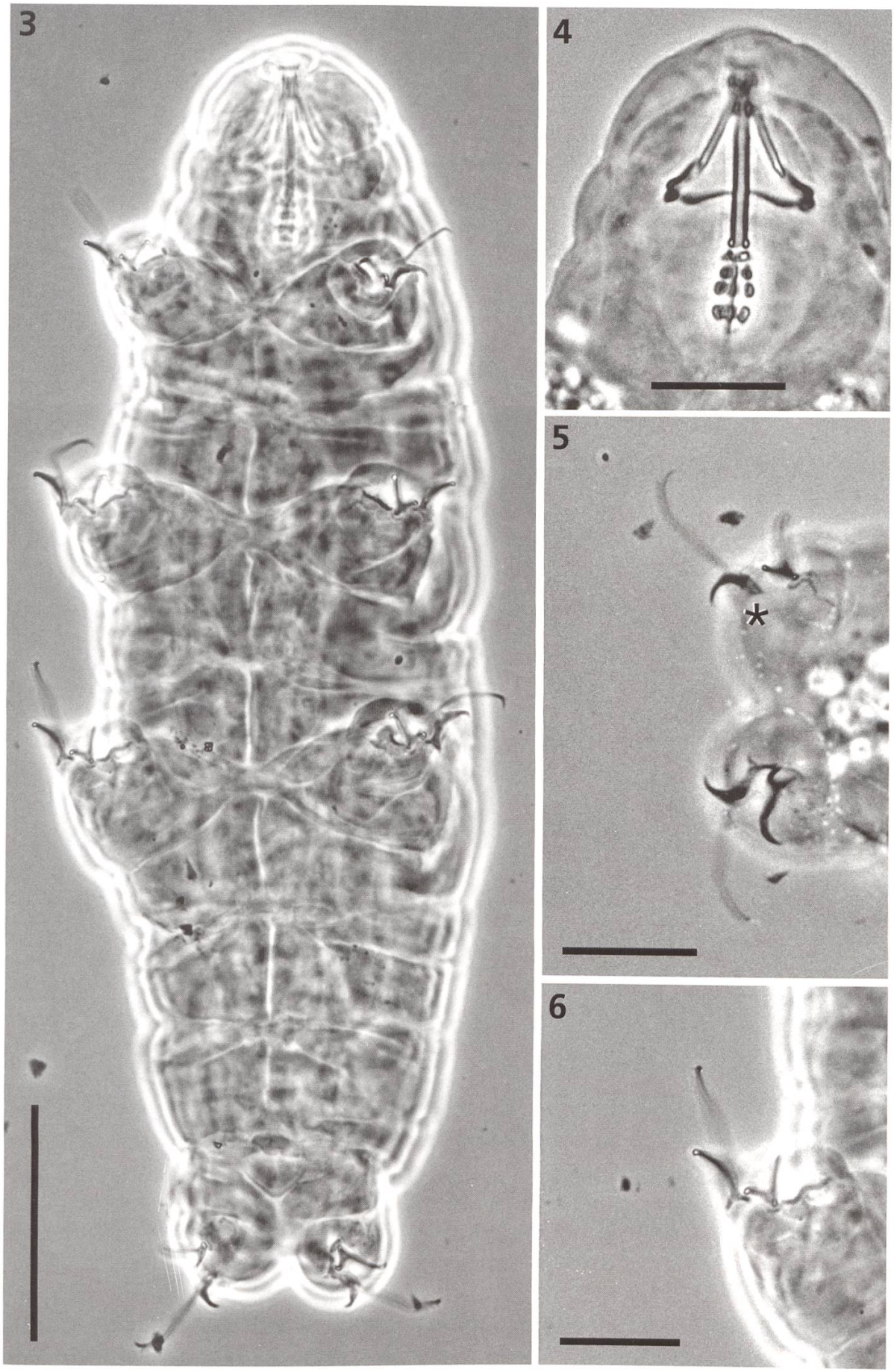
Etymology: In honour of the deceased colleague and arachnologist, Prof. Dr. Konrad Thaler (formerly at the Institut für Zoologie & Limnologie, Universität Innsbruck).

Remarks: The hypsibioidal claw system and the morphology of the buccopharyngeal apparatus place the new tardigrade clearly within the Hypsibiidae. The new genus can be distinguished from all other eutardigrade genera by the presence of peculiarly incised and oriented bases of all external claws and the presence of unique small plates at each cuticular bar on legs I to III.

The claw system of *Thalerius* gen. nov. resembles most closely that of *Ramajendas* Pilato & Binda, 1990, a taxon reported from the (Sub-) Antarctic region. However, although the external claws in *Ramajendas* are quite similar to those of the new genus (see Pilato & Binda 1990) as far as the long flexible and thin main branch and the similar shape of the remaining part of the claw are concerned, they differ in having distinct lunules (particularly large on legs IV) and no incision at the claw base. The structures are differently formed in *Thalerius* gen. nov. Furthermore, *Ramajendas* has no plates at the cuticular bars on legs I–III and no external incision between the base and secondary branch of external claws as in the new genus. Further, the internal claws in *Ramajendas* are of the *Isohypsibius*-type (Pilato & Binda, l. c.), those in *Thalerius* gen. nov. resemble more the *Hypsibius*-type.

Although the shape of both mouth tube anterior apophyses in the new genus is still not known (see description), available information on general morphology of the buccopharyngeal apparatus suggests its close relationship to that of the *Isohypsibius*-type.

The phylogenetic position of *Thalerius* gen. nov. within the Hypsibiidae is not clear and at present can only be a subject of speculation. Although the claws in the new genus are more of the "*Hypsibius*-type", when considering their morphology and the available definition on that claw system (e.g. Thulin 1928, Marcus 1929, and their interpretations), little is known about existing convergences resulting from the claws' evolution, particularly the external ones. As a result it is difficult in some cases to include the considered claw system into the existing pre-defined "claw types" on which the recent systematics are based (e.g. see remarks in Dastych & al. 2003). Thus, despite the "*Hypsibius*-like" form of the claws in the new genus (and partly those of



Figs. 3–6. ***Thalerius konradi*** **gen. nov., sp. nov., holotype. – 3: habitus, ventral view; – 4: buccal apparatus; – 5: claws IV; – 6: claws III (Scale bars: Fig. 3: 50 µm, others 20 µm. All PHC. Other explanations in text).**

Ramajendas), one cannot exclude that both genera are related more closely to the *Isohypsibius* than the *Hypsibius* clade, as separate phylogenetic lineages exist within the supposedly polyphyletic family Hypsibiidae (see Kiehl & al., 2007). A molecular study of these two genera might help to better understand their placement within the phylogenetic system.

Distribution: Known only from the type locality in the Langtal Valley of the Ötztal Alps, Austria.

Description of the species

Thalerius konradi sp. nov.

Holotype (Figs. 3–22): sex unknown, 276 µm long, mounted on slide in Faure's medium together with two specimens of *Diphascon recamieri* Richters, 1911. The microslide (No. T770) is deposited in the Zoologisches Museum Hamburg (ZMH Acc. No. A27/06).

Type locality (Figs. 1–2). Austria, Ötztal Alps, Langtal Valley, in close proximity to a recent lateral moraine of the glacier Langtaler Ferner (11° 00' 24" E and 46° 48' 15" N). About 100 m from the glacier edge; exposition N, ca. 2500 m a.s.l. Vegetation periglacial, pioneer. Small cushions of unidentified moss (see notes on biology) at or between stones on silicate, sandy and rich mica mineral soil. Coll. H. Dastych, 6 September 2004.

Paratype: All locality data as above. A juvenile, sex unknown. The individual, not longer than 150 µm, was partly disfigured during preparation. Mounted in Faure's medium together with three specimens of *D. recamieri*, the latter in *simplex*-stage. The slide is in the collection of the Museum d'Histoire Naturelle (Arthropodology & Entomology), Geneva, Switzerland (No. T769; ZMH Acc. No. A28/06).

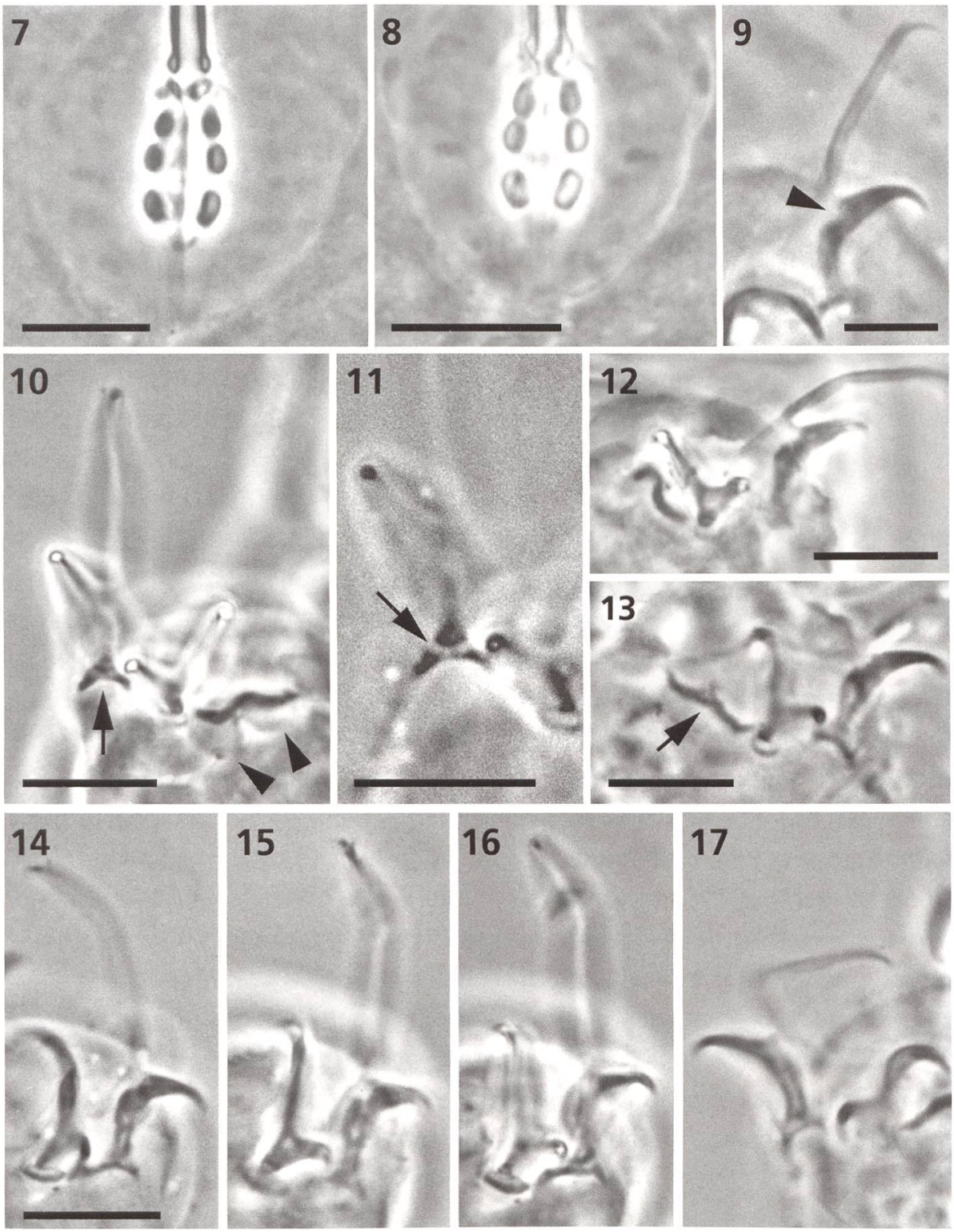
Etymology: The specific name, like the generic one, is a homage to the late colleague, Prof. Konrad Thaler.

Diagnosis: as for genus.

Description

The body between 150 and 276 µm long, whitish, with relatively small posterior eyes. Intestine green. Cuticle with tiny wrinkles, particularly in the rear of the body, but appearing mostly smooth in LM.

Buccopharyngeal apparatus medium sized, resembling that found in the *Isohypsibius prosostomus*-species complex. Neither lobes nor papulae could



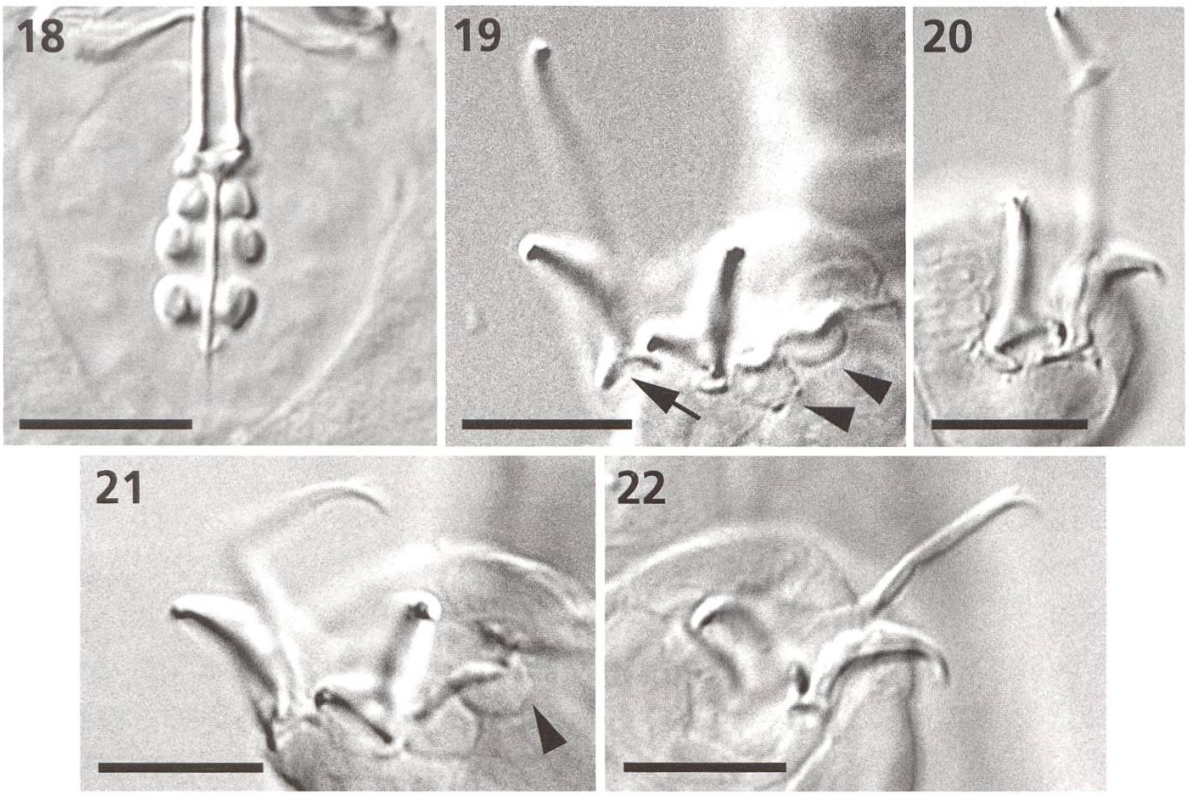
Figs. 7–17. *Thalerius konradi* gen. nov., sp. nov., holotype. – 7, 8: pharynx, dorso- and ventro-median focus, respectively; – 9: claws I; – 10: claws III; – 11: details of the base of external claw III; – 12: claws III; – 13: claws II; – 14–16: claws IV; – 17: claws II (Scale bars: all 10 µm. All PHC. Other explanations in text).

be discerned around the mouth opening in LM, nor teeth or granules in the mouth cavity. As both animals are not laterally positioned, the shape and the type of anterior mouth tube apophyses could not be precisely defined. However, some details of the dorsal and ventral apophyses indicate they are of similar shape and flat, suggesting a type different from that of *Hypsibius*.

Mouth tube relatively wide and with distinct posterior apophyses (Fig. 4). Pharyngeal apophyses well formed, relatively large and placed close to the first macroplacoid (Figs. 4, 7, 8). Pharynx ovoid, with three grain-like macroplacoids and a small microplacoid. The first macroplacoid slightly longer than the second, both situated very close to each other. Consequently, they could even be interpreted as a single, long and sideward strongly incised placoid (Figs. 7, 8, 18). The third macroplacoid is the longest and well separated from the second one.

Claw system of *Hypsibius*-type. Claws are slender, legs I to III have distinct bars at the internal claws. Main branches of external claws markedly long, thin and flexible, but without distinct light-refracting unit (LRU) at the base of the branch (Figs. 3, 5, 9, 14–17). The branches with relatively thin accessory spines. The secondary branch of the external claw and the claw's base quite long, forming an arch-like structure together, i.e. of *Hypsibius*-type (Figs. 9, 12, 14, 17). At the fusion border between these claw units, externally a distinct incision (Figs. 9 arrowhead, 12, 14). The bases of the external claws without lunules, posteriorly markedly expanded and with roundish, more or less U-shaped incision, which is smooth, relatively deep and terminated with a distinct tooth (spine) on both sides of the base (Figs. 5, 6, 10 arrow, 11, 14, 19 arrow, 20). Thus, the posterior parts of the bases of the external claws are somewhat fork-like or similar to an upturned 'Y'. The claws' bases posteriorly with a more or less discernible narrow stripe which refracts light differently from the rest (Fig. 11, arrow). (In the holotype one base [claw IV] is aberrantly shortened and without incision [broken off?]: Fig. 5, asterisk). The internal claws have relatively long main branches, particularly on legs IV (Figs. 14, 15), secondary spines and distinct roundish, smooth lunulae. The lunulae are markedly larger on legs IV (comp. Figs. 13 and 16). On legs I to III a distinct cuticular bar occurs obliquely to each internal claw base (Fig. 13, arrow). The bars are more or less sinuous, often similar to a wide 'W' or narrow 'S' (Figs. 10 and 12, respectively). Each bar has on its whole length posteriorly aligned two small, thin and half-rounded plates (Figs. 10, 19, 21 arrowheads). These unique plates are placed close to each other.

The eggs are unknown.



Figs. 18–22. *Thalerius konradi* gen. nov., sp. nov., holotype. – 18: pharynx; – 19: claws III; – 20: claws IV; – 21: claws II; – 22: claws I (Scale bars: all 10 µm. All DIC. Other explanations in text).

Morphometric data

Measurements are in µm, all indices in %. For abbreviations and definitions see material and methods and Dastych (2006). The first measurement concerns the holotype, the second the paratype. Not measured (unfavourably positioned) structures in the paratype are marked with "/ -".

A) Measurements (µm)
Body length ca. 150 / 276
Buccal apparatus length 48 / 42.6
Pharynx size 23.6 x 22.8 / 18.2 x 17.5
Mouth tube length 25.2 / 22.5
SSA length (tube above stylet supports) 16.2 / 15.3
Mouth tube width (external) 2.4 / 1.9
Mouth tube width (internal) 1.5 / 1.4
Macroplacoid row length 9.5 / 8.1
Macroplacoid 1 length 2.4 / 2.3
Macroplacoid 2 length 2.1 / 1.8
Macroplacoid 3 length 3.0 / 2.7

Microplacoid length 1.0 / 0.9
External claw 1 length 18.9 / 17.2
External claw 1 base height 7.2 / -
External claw 1 main branch length 11.4 / -
Internal claw 1 main branch length 6.1 / -
Hind claw length 23.6 / -
Hind claw base height 9.24 / 7.2
Hind claw main branch length 21.6 / -
Hind claw secondary branch length 6.0 / -
Fore claw length 10.3 / 9.0
Fore claw base height 4.5 / 3.6
Fore claw main branch length 7.7 / 6.3

The width of the base of hind (= external) claw IV in the holotype equals 4.8 µm, the external claw's base on leg I is 3.2 µm wide. Two lateral teeth at the base of claw IV are ca. 1.8 µm long. The lunulae on fore claw are 4.5 µm wide, those on claws II 2.3 µm. The bar on leg II is 8.6 µm long, the two aligned roundish plates are 4 µm wide and 2.5 µm high each.

B) Indices
1) WTI (the whole tube length indices) (= "pt indices"):
WT SSA (stylet supports) 64.3 / 68.0
WT mouth tube width (ext.) 9.5 / 8.4
WT mouth tube width (int.) 6.0 / 6.2
WT macroplacoid row length 37.7 / 36.0
WT macroplacoid 1 length 9.5 / 10.2
WT macroplacoid 2 length 8.3 / 8.0
WT macroplacoid 3 length 11.9 / 12.0
WT microplacoid length 4.0 / 4.0
WT claw 1 (ext.) length 75.0 / 76.4
WT claw 1 (ext.) base height 28.6 / -
WT claw 1 (ext.) main branch length 45.2 / -
WT claw 1 (int.) main branch length 24.2 / -
WT hind claw length 93.7 / -
WT hind claw base height 36.7 / 32.0
WT hind claw main branch length 85.7 / -
WT hind claw secondary branch length 23.8 / -
WT fore claw length 40.9 / 40.0
WT fore claw base height 17.9 / 16.0
WT fore claw main branch length 30.6 / 28.0

C) Other indices
External claws index (ECI) 80.0 / -
Claw main branch index (MBI) 52.8 / -
Hind claw base index (HBI) 42.8 / -
Hind claw secondary branch index (HSBI) 64.9 / -

Notes on biology: The only available information on the biology of the new species comes from the data on its type locality (Figs. 1, 2) situated in the vicinity of a retreating glacier. The moss samples collected one year later (2005) from the same place as the type locality, where initially (2004) the type specimens have been sampled, represent *Pohlia filium* (Schimp.) Maart. (Bryaceae). This moss species is characteristic for wet sands, particularly in the river alluviums of high mountains (Doz. Dr. G. Gärtner, in litt.). Accordingly, it indicates a hydrophilous character of the new tardigrade and, considering the green intestine content of the two examined individuals, its plant (algae?) feeding behaviour.

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