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Redescription of the glacier tardigrade *Hypsibius janetscheki* Ramazzotti, 1968 (Tardigrada) from the Nepal Himalayas

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(With 23 Figures)

Abstract

A redescription of the cryobiontic tardigrade, *Hypsibius janetscheki* Ramazzotti, 1968, based on type material, is presented. The species is known from one locality on the Nare Glacier at Mt Ama Dablam in the Himalayas [NE Nepal, the Chomolungma (= Mt Everest) region]. There, within the glacier's ablation zone, the animals inhabit cryoconite holes. A comparison with a very similar glacier tardigrade from the Alps, *H. klebelsbergi* Mihelčič, 1959, supports the thesis that the taxa are separate ones.

K e y w o r d s: Tardigrada, taxonomy, redescription, *Hypsibius janetscheki*, glacier, cryoconite holes, the Himalayas, Nepal

Introduction

Tardigrades (or water-bears) are among the few invertebrates able to dwell permanently on glaciers. There the animals inhabit cryoconite holes (Kryokonitlöcher, Mittagslöcher) in the ablation zone, *i.e.*, aquatic microcaverns on the glacier's snowless surface. Hitherto two tardigrade species have been described exclusively from such a habitat, *i.e.*, *Hypsibius klebelsbergi* Mihelčič, 1959 and *H. janetscheki* Ramazzotti, 1968. The former taxon has been reported from several Austrian glaciers, the latter so far only from one glacier in the Himalayas. While there are several other tardigrades occasionally reported from cryoconite holes, these are known to dwell permanently in other habitats outside glaciers (for review see Dastych *et al.* 2003). Due to the striking resemblance between *H. klebelsbergi* and *H. janetscheki*, there are doubts that the two are separate taxa (Ramazzotti 1972, Kraus 1972, Ramazzotti & Maucci 1983, Dastych 1993, Thaler 1999, Dastych *et al.* 2003). Little is known about the morphology and biology of these enigmatic ice dwellers. This particularly concerns *H. janetscheki*. Some aspects of the confused taxonomic history of these species and notes on their status are presented in the chapter "Discussion", while more details on the latter taxon can be found in Dastych *et al.* (2003).

Recently I was able to examine the type series of *H. janetscheki*, through the kindness of Prof. R. Bertolani (Modena). In the present paper I provide a redescription of the species. A comprehensive morphological revision of *H. janetscheki* will be possible only after a study of new material from the Himalayas.

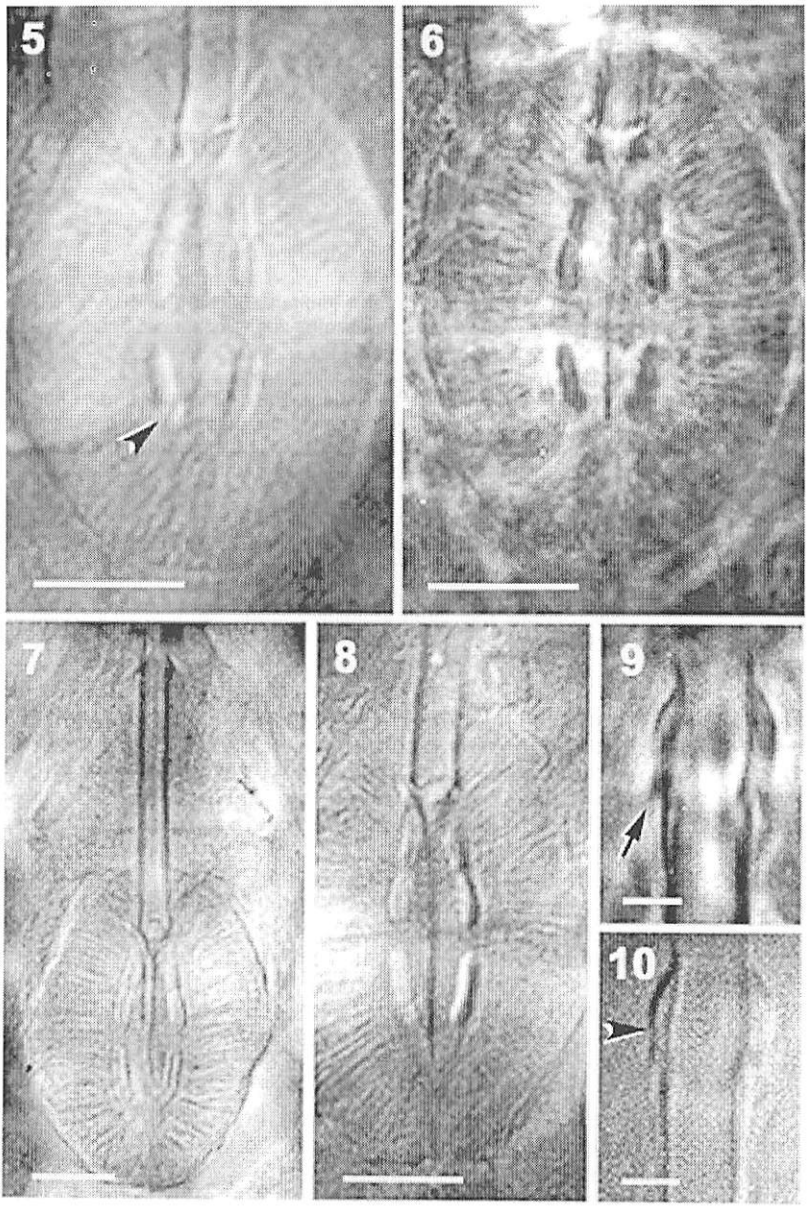
Material and methods

The material for the redescription comes from the Austrian zoological expedition to the Nepal Himalayas of 1961 (for details see Janetschek 1990). Then, two samples with glacier tardigrades were collected from the Nare Glacier (= Amai Dablang Glacier, *auct.*: 5620 m a.s.l.). However, one has been lost in Innsbruck (sample code "57": *l.c.*, p. 20, 24); the other sample (code "82": *l.c.*, p. 24) originated from the same glacier "at the valley head of Mingbo, a snowless surface of the glacier, 5600 ± m, mixed sample of cryoconite, pipetted mud from various cryoconite holes, 4.6.1961. ... *Hypsibius (H.) janetscheki* nov. spec., 41 Exp., *Hypsibius* (*H.*) *convergens* (Urbanovitz [*sic*], 1925) 186 Ex., cosmopolitan..." (*l.c.*, p. 48, 49: from German). The latter sample was the base for the description of *H. janetscheki*.

For the present paper I examined 19 specimens of *H. janetscheki*, *i.e.*, 13 syntypes and six topotypes, mounted on five microslides. The animals are embedded both in polyvinyl-lactophenol (four slides) and Faure's medium. The original description by Ramazzotti (1968) was based on 41 individuals, but the author provided neither number of designated type specimens (or mounted microslides) nor named their deposition. Thus, the whereabouts of the remaining 22 type specimens is unknown. The known specimens and the embedding medium have partly deteriorated (*e.g.*, Figs 1, 2), so this and the extreme dark pigmentation of individuals markedly or totally hinder the examination of internal, and often external structures. The buccal apparatus is visible only in six specimens (all mounted in Faure's medium: slide "Tipo 180"), while the anterior apophyses of the mouth tube can be seen in lateral view only in two individuals.

Three microslides with syntypes of *H. janetscheki* and two slides with topotypes contain also other, distinctly lesser pigmented tardigrade with markedly longer claws. Ramazzotti (1968: p. 2) identified the sympatric taxon as *Hypsibius convergens* (Urbanowicz, 1925). The key morphological structures of the latter taxon are much better discernible on microslide preparations than those of *H. janetscheki*. Curiously, no microslide label bears the name "*H. convergens*" and both slides ("Tipo 178", "Tipo 180") with the syntypes (and the sympatric taxon) are only labelled as "*H. janetscheki*". Moreover, two slides containing topotypes of *H. janetscheki* and individuals of the other taxon have no species identification whatsoever. As a result, the inscriptions on labels, including numerals indicating the number of mounted specimens, misleadingly suggest the presence of only *H. janetscheki* in that material and exaggerate the real number of its individuals. Nevertheless, one label (of the slide: "Tipo 178") has an additional inscription, *i.e.*, "Tipi 2". This remark specifies the number of (two) dark pigmented type specimens of *H. janetscheki* among eight light pigmented individuals of another species and, consequently, indicates which species Ramazzotti considered as *H. janetscheki* among these two sympatric taxa which have been mounted together.

"Stylet support attachments" characterize the distance between the upper (dorsal) edge of the stylet sheaths and the anterior edge of stylet support. The diameter of the buccal tube is taken just above the level of insertion of stylet supports. "External claw IV" means the most posteriorly located claw on leg IV



Figs 5-10. *Hypsibius janetscheki* Ramazzotti: **5**, **6**, **8** - pharynx; **7** - buccopharyngeal apparatus; **9**, **10** - anterior apophyses, lateral view [Explanations in text. All Faure's medium. Figs 6, 9: *PHC*, others: *DIC*. Figs 5, 6 - lectotype, others: paralectotypes. Scale bars: 10 µm (Figs 5-8) and 3 µm (Figs 9, 10)].

janetscheki / Ramazzotti" and "Pozzetto / glaciale Hima= /laya m 5600 Ghiac / ciaio Amar Dablam / (Polyv.)"; and (C) seven syntypes labelled: "Tipo 180 / 14 *Hyps.* (*H.*) / *janetscheki* / Ramazzotti" and " Pozzetti / glaciali m 5600 / Himalaya / 4.VI.61 / Faure".

One specimen has here been designated as l e c t o t y p e (248 µm long, sex unknown: Fig. 1, microslide labelled "Tipo 180"). The remaining six individuals of this species on the slide and those on the slides "Tipo 178" (two) and "Tipo 179" (four specimens) have been designated as p a r a l e c t o t y p e s.

O t h e r m a t e r i a l e x a m i n e d (six topotypes on two slides): (D) one specimen on microslide labelled: "XI-22 / 8 *H.* (*H.*) / Ramazzotti / (Poliv.)" and "Pozzetti glaciali Himalaya / Ghiacciaio Amar / Dablam 5600 m"; and lastly (E) five individuals labelled: "XI-27 / 17 *H.* (*H.*) /Ramazzotti" and "Pozzetto glaciale m 5600 / Himalaya (Poliv.)".

T y p e l o c a l i t y: NE Nepal, Saragmatha National Park, Khumbu Himal, sediment from cryoconite holes of various size, within an area of *c.* 20 m² on the Nare Glacier in the Mingbo Valley, 5570 m a.s.l.; 4 Juni 1961, collected by H. Janetschek (altitude data from Janetschek 1990: p. 21, 48, 49 and Ramazzotti 1968).

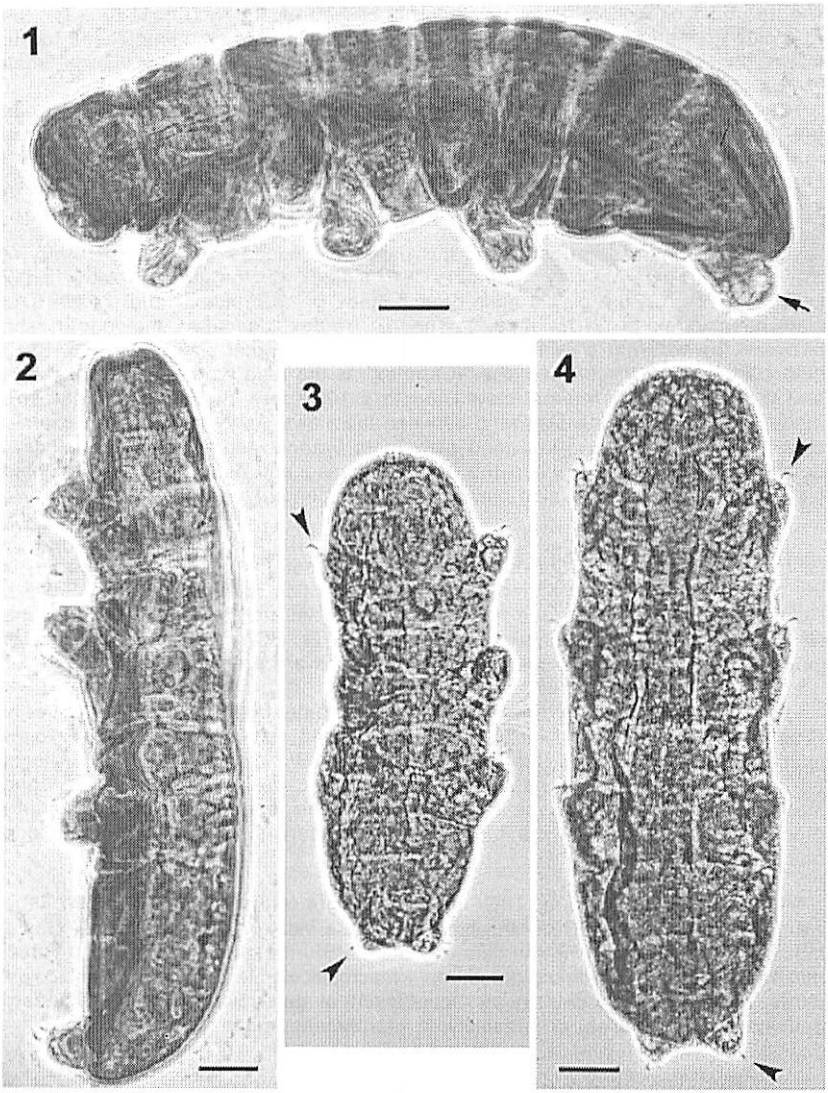
Note: The incorrectly spelled name "Amar Dablam" on the microslide labels refers to the impressive summit at the Nare Glacier, *i.e.*, the Mt Ama Dablam (= Amai Dablang, *auct.*, 6856 m a.s.l.) in the region of Chomolungma (= Mt Everest).

D e p o s i t o r y: The material has been deposited in the Ramazzotti's Collection lodged at the Museo Civico di Storia Naturale, Verona.

D i a g n o s i s o f s p e c i e s: Small to median sized, highly pigmented dark-brown hypsibiids with large eyes. Cuticle smooth. The mouth tube anterior apophyses resembling the "sharp hook"-type. Pharynx with two macroplacoids, no microplacoid. Claws small, intermediate between *Isohypsibius*- and *Hypsibius*-type, but closer to the latter type. External claw on leg I-III larger than the external (= hind) claw IV. Accessory spines wide.

D e s c r i p t i o n o f s p e c i e s: Body length 190-406 µm (240-400 µm: Ramazzotti 1968), cuticle smooth. Colour in life not available, the slide mounted animals are intensely dark-brown (Figs 1-4), with large, brownish-black eye-dots. The dark pigmentation of the body is produced by tiny blackish-brown granules found in the epidermal cells. Sex not recognizable in microslide preparations, the reproduction strategy unknown. Presumably confined to glacier environment.

Bucco-pharyngeal apparatus well formed (Figs 1, 7). Mouth cone retracted in all specimens, peribuccal region not visible. Mouth cavity median sized, its details and those of the mouth area opening not visible. Mouth tube relatively short, slightly curved, moderately wide and with almost symmetrical anterior apophyses (Figs 9, 10). Both apophyses terminated caudally by a tiny, somewhat spine-like process directed backwards (Fig. 9, arrow). The apophyses are flattened when observed in lateral view, their external edge slightly concave in its median-caudal part



Figs 1-4. *Hypsibius janetscheki* Ramazzotti: animal in lateral (**1**, **2**), ventral (**3**) and dorsal (**4**) view (Explanations in text. All *PHC*. Fig. 1 - lectotype, Figs 2, 3 - paralectotypes, Fig. 4 - topotype. Scale bars = 25 µm).

Type material: A total of 16 syntypes on three microscope slides. (**A**) Three syntypes on a slide, its labels read: "Tipo 178 / 10 *H.* (*H.*) / *janetscheki* / Ramazzotti (Polyvi)" and "Pozzetto / glaciale m 5600 / Himalaya, Ghiac / ciaio Amar Dablam / Tipi 2"; (**B**) six syntypes on a slide labelled "Tipo 179 / 6 *H.* (*H.*) /

(*i.e.* the hind one), homologous to external claws I-III. "Internal claw IV" (*i.e.*, the fore claw) denotes the most anteriorly located claw on leg IV, homologous to the internal claws I-III. A slash (*/*) shows the separation of lines on each microslide label.

Several morphometric indices have been here employed: "*PT* index" describes the ratio between the length of the buccal tube and that of other structures taken into consideration (Pilato 1981), the macroplacoids' index ("*MPLI* index") characterizes the size ratio between the second and first macroplacoids (= *mpl*2 x 100 / *mpl*1: see Dastych *et al.* 2003).

Four other indices, introduced in this paper, are based on the morphometry of claws: (1) the external claws' index (= "*ECI* index"), (2) the internal claws' index (= "*ICI* index"), (3) the claws' main branch index (= "*MBI* index") and (4) the hind claw base index (= "*HCBI* index"). The "*ECI* index" describes the length ratio between the external claw I and the hind claw (= external claw I length x 100 / hind claw length), the second, the "*ICI* index", is the ratio between internal claw I and the fore claw (= internal claw I length x 100 / fore claw length). The "*MBI* index", characterizes the size ratio between the claws' main branches (= external claw I branch length x 100 / hind claw main branch length), the "*HCBI* index" defines the size ratio between the hind claw base and its main branch (= hind claw base height x 100 / hind claw main branch length).

The coefficient of variability (*V*) is defined as standard deviation divided by (arithmetic) mean (*i.e.*, $SD / \bar{x}$). The coefficient of determination (r^2, *r* squared) is the square of the Pearson's product-moment correlation coefficient, *r* (*e.g.*, Sokal & Rohlf 1981), involving here the mouth tube length and that of considered structure (*PT* indices) or the variables characterizing *MPL*-, *ECI*-, *ICI*-, *MBI*-, and *HCBI* indices defined above. All coefficients and indices are presented in %.

The comparative data on *H. klebelsbergi* come from new Alpine material (Dastych *et al.* 2003) and include still unpublished values of some of the claw indices of this species (*i.e.*, the *ECI*-, *MBI*-, and *HCBI* index: see p. 190). It should be born in mind that *H. janetscheki* is represented by limited, deteriorated and intensely dark pigmented type material. Hence, the features' visibility is usually problematic and this restricts the number of observations, measurements and quality of microphotographs.

Abbreviations used are: *DIC*- differential interference contrast, *ECI* - the external claws' index, *HCBI* - the hind claw base index , *ICI* - the internal claws' index, *n* - sample size, *ND* - no data available, *MBI* - the claws' main branch index, *min-max* - minimum-maximum range, *mpl* - macroplacoid, *MPLI* - the macroplacoids' index, *PHC* - phase contrast, r^2 - coefficient of determination, *SD* - standard deviation, *V* - coefficient of variability, $\bar{x}$ - (arithmetic) mean.

Complementary description

Hypsibius janetscheki Ramazzotti, 1968 (Figs 1-23)

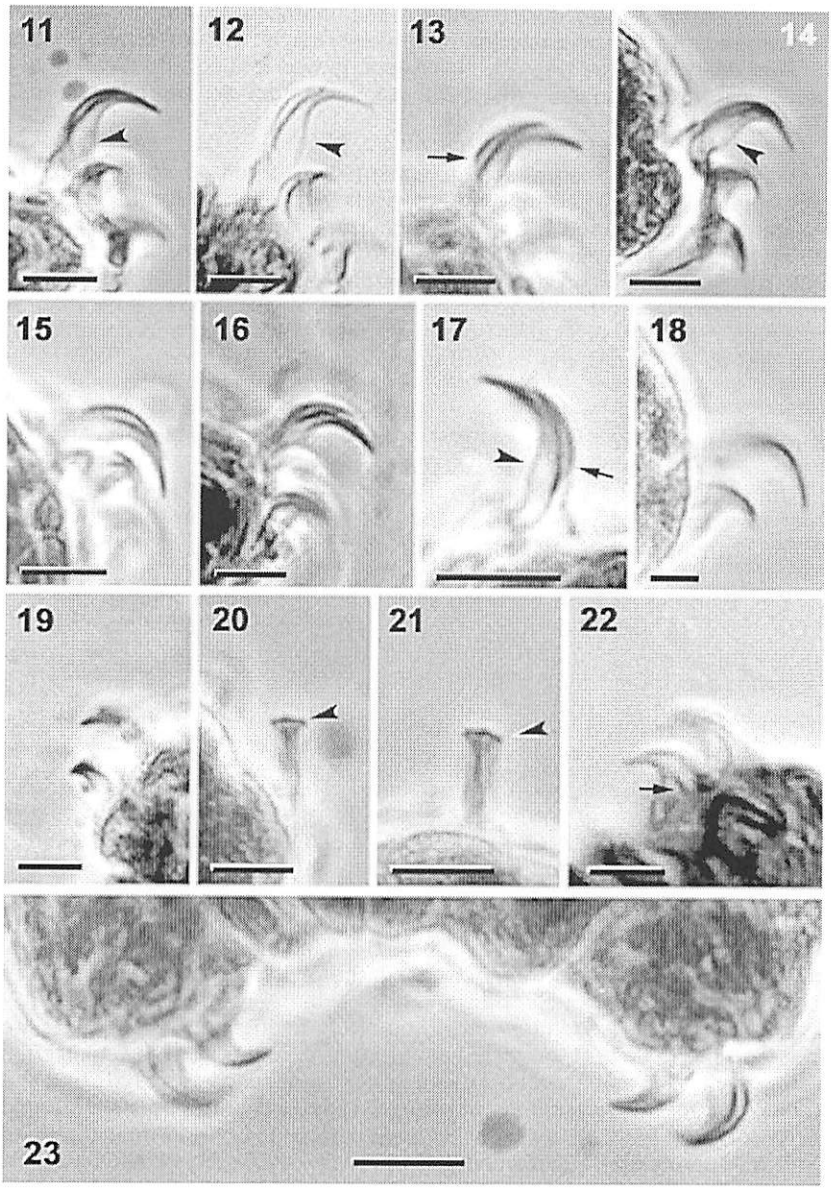
Hypsibius (*Hypsibius*) *janetscheki*: Ramazzotti 1968 (p. 1-3, Figs 1a-c: spec. nov.:), Ramazzotti 1972, Kraus 1972
Hypsibius (*H.*) *janetscheki* nov. spec.: Janetschek 1990
Hypsibius (*N.*) [*sic*] *janetscheki* nov. spec. Ramazzotti 1968: Janetschek 1990
Hypsibius janetschecki [*sic*]: Grøngaard et al. 1999
Hypsibius janetscheki: Kraus 1972, Ramazzotti & Maucci 1983, Dastych 1993, McInnes 1994, Sømme 1996, Dastych *et al.* 2003

(Fig. 10, arrowhead), and bearing a resemblance to the barbs of an arrowhead. Terminal posterior apophyses of the mouth tube absent. Stylets relatively large (Fig. 7), their supports well formed and located in a relatively anterior position (the *PT* index values, *PT ss,* are between 67-70 %).

Pharynx relatively large, sub-spherical (41 x 30 and 40 x 27 µm in two specimens 336 and 288 µm long, respectively), with small roundish pharyngeal apophyses and two macroplacoids (Figs 5, 7). No microplacoids. Pharyngeal apophyses distinctly separated from the first macroplacoid (Fig. 6). Macroplacoids rod-shaped, moderately long and broad, the second macroplacoid 60-70 % of the length of the first one. Both macroplacoids markedly separated from each other (Figs 6, 8) and constricted, the first in its middle, the second posteriorly (Fig. 5, arrowhead).

Legs relatively small, claws small and stumpy, similar in shape and length to those of *H. klebelsbergi* (comp. Dastych *et al.* 2003). Dorsal side of the hind legs mostly distinctly convex in slide preparations, resembling a small hump (Fig.1, arrow). The claws of shape between *Isohypsibius*- and *Hypsibius*-type, though more resembling the latter type. Main branches short, accessory spines wide (Figs 20, 21), peculiarly shaped. Lunules absent, no cuticular bars between the claws and their bases. External claw on each leg slightly larger than the internal one, the latter being of 66.0-89.0 % (n = 4) of the length of the external claw (on leg I) or even larger (89.0-92.6 %, respectively: n = 3) on leg IV. The size of external claws (and their main branches) diminishes slightly towards the body posterior, so that the external claws on the first pair of leg are distinctly larger than those (hind claws) on the fourth legs (Fig 3, 4, arrowheads). The main branch of the hind claw is 62.5-90.0 % (*n* = 6) of the length of the external branch on leg I. The fore claw (IV), as judged from only four measurements, is mostly of the same length as the internal one on leg I or, as in one case, is slightly smaller. One specimen has partly reduced, deformed claws on legs IV (Fig. 19).

The claws' external main branches on legs I-III moderately long, those on legs IV distinctly shorter. All branches relatively wide. The internal (lower) lateral edge of the branch, about the middle of its length, distinctly convex in most specimens, particularly on external claws (Figs 11, 12, 17, arrowheads). The secondary branches are median sized and wide at the base. In the middle of the claw base a transverse bar-like thickening (Fig. 22, arrow). The upper (anterior) edge of the secondary branch and the lateral side of the claw's base of external claw form a slightly obtuse angle (Fig. 22). Accessory spines of *klebelsbergi*-type, *i.e.*, strongly flattened and wide (Figs 20, 21, arrowhead). The base of accessory spines relatively short, *i.e.*, not located over the whole arc of the main branch, but in its posterior part being abruptly terminated, thus forming a distinct swelling on the claws' branch (Figs 13, 17: arrows).



Figs 11-23. *Hypsibius janetscheki* Ramazzotti: claws of leg I (**13**, **16**, **17**, **18**); claws of leg II (**14**); claws of leg III (**11**, **12**, **15**); claws of leg IV (**19-23**) [Explanations in text. Figs 12, 22: *DIC*; others: *PHC*. Figs 16, 19: paralectotypes; others: topotypes. Scale bars = 5 µm].

Morphometric data

Measurements are in µm, indices in %. For abbreviations see "Material and methods". The morphometrics of the lectotype (248 µm long, on microslide "Tipo 180") is separated from other data by a dot (•). The size of the pharynx of the lectotype is 38.7 x 28.8 µm, its buccal apparatus is 67.5 µm long. For the presentation of measurements and indices the following convention has been used:

$\bar{x} \pm SD$ (*min-max*) [*n*] * *V* / r^2

Individuals

A) Measurements (µm)

Body length	287.00 ± 61.25 (179.0-406.0) [19] * 21.34 • 248
Buccal tube length	32.03 ± 5.09 (23.4-37.4) [6] * 15.89 • 33.3
Stylet supports attachments	22.45 ± 4.23 (15.8-27.0) [6] * 18.86 • 23.4
Buccal tube width (external)	3.62 ± 0.95 (2.3-4.5) [4] * 26.40 • 4.5
Buccal tube width (internal)	2.75 ± 0.74 (1.8-3.6) [4] * 27.9 • 3.6
Macroplacoid row length	16.12 ± 4.76 (8.1-20.3) [5] * 29.5 • 17.1
Macroplacoid 1 length	8.18 ± 2.35 (4.5-10.8) [5] * 28.71 • 7.2
Macroplacoid 2 length	5.40 ± 1.68 (2.7-7.2) [5] * 31.18 • 5.4
Claw external 1 length	9.03 ± 1.24 (6.8.-10.4) [11] * 13.80 • 9.5
Claw internal 1 length	7.51 ± 0.68 (6.3-8.1) [6] * 9.08 • 6.3
Claw ext.1 main branch length	6.74 ± 1.13 (5.0-8.6) [10] * 16.78 • 7.2
Hind claw (= ext. 4th) length	7.60 ± 1.16 (5.4-9.9) [11] * 15.30 • 6.8
Hind claw main branch length	5.40 ± 0.94 (4.5-7.2) [12] * 17.41 • 5.4
Hind claw base length	3.95 ± 0.70 (3.6-5.0) [4] * 17.72 • 3.6
Fore claw (= int. 4th) length	7.02 ± 0.81 (6.3-8.1) [4] * 11.59 • 6.3

B) Indices

PT stylet supports	68.63 ± 1.35 (67.4-70.3) [5] * 1.98 / 89.5 • 70.3
PT buccal tube width (ext.)	11.68 ± 1.64 (9.8-13.5) [4] * 14.10 / 58.6 • 13.5
PT buccal tube width (int.)	8.25 ± 2.23 (5.4-10.8) [4] * 27.0 / 58.6 • 10.8
PT macroplacoid row length	50.48 ± 7,95 (36.6-56.3) [5] * 15.75 / 91.3 • 51.4
PT macroplacoid 1 length	25.52 ± 4.39 (19.2-29.3) [5] * 17.23 / 81.8 • 23.1
PT macroplacoid 2 length	16.74 ± 3.15 (11.5-19.3) [5] * 18.87 / 90.8 • 16.2
PT claw I (ext.) length	29.26 ± 4.52 (27.8-31.3) [5] * 4.52 / 93.7 • 28.5
PT claw I (ext.) main branch length	(21.4) [2] • 21.6
PT claw I (int.) length	(23.7, 25.0) [3] • 18.9
PT hind claw length	23.98 ± 4.20 (19.3-28.1) [4] * 17.54 / 13.4 • 21.6
PT hind claw main branch length	18.92 ± 2.41 (16.2-21.9) [5] * 12.77 / 51.3 • 16.2
PT hind claw base height	(15.4) [2] • 10.8
PT fore claw (4) length	(25.0) [2] • 18.9

macroplacoid (*MPLI*) index	65.16 ± 3.99 (60.0-70.1) [5] * 6.14 / 98.0 • 70.1
external claws index (*ECI*)	132.60 ± 16.50 (107.9-142.9) [4] * 12.45 / *ND* • 139.0
internal claws index (*ICI*)	104.60 ± 9.25 (100.0-118.5) [4] * 8.84 / *ND* • 100.0
claw main branch index (*MBI*)	140.00 ± 13.09 (124.4-160.0) [7] * 9.35 / *ND* • 142.9
hind claw base index (*HCBI*)	66.70 ± 7.51 (66.7-80.0) [4] * 10.26 / *ND* • 66.7

Eggs: not known.

Differential diagnosis

The highly pigmented, dark-brown and/or blackish (?) body, the large eyes, the shape of the claws and that of the anterior mouth tube apophyses, the relatively small claws on legs IV, the wide accessory spines and the peculiar (glacier) habitat separate *H. janetscheki* (and *H. klebelsbergi*) well from all known tardigrades.

The differences between *H. janetscheki* and *H. klebelsbergi*, two very similar taxa, based on qualitative and mensural characters, are as follows. Although the values of several of the bucco-pharyngeal morphometrics overlap in both species (see p. 189 and Dastych *et al.* 2003: 86), the length of macroplacoids, macroplacoid rows and the macroplacoid length ratio (*MPLI* index) differ well between these taxa. In *H. janetscheki* both macroplacoids are on average (and in their *min-max* length range) longer than those for *H. klebelsbergi*. The second macroplacoid in the former taxon is shorter, *i.e.*, the *MPL* index values are 65.1 as against 78.2 %, respectively (see *l.c.*). Although the range of *min-max* values for the attachment of stylet supports also overlap, the supports are on average more anteriorly located in *H. janetscheki* compared to *H. klebelsbergi* [*PT ss* index ($\bar{x}$) = 68.6 vs 64.6 % (n = 5 and 55), respectively].

More distinct differences between the two taxa are found in the morphology and morphometry of their claws. Claws in *H. janetscheki* are generally more stumpy than those in *H. klebelsbergi*; the internal lateral edge of the main branches is more convex in its middle in the former species than that in *H. klebelsbergi*. In the latter species the edge (wall) has either a distinctly smaller convexity or is straight. *H. janetscheki* has relatively smaller accessory spines than *H. klebelsbergi*. The posterior swelling of the accessory spines on the main branch arch appears not to be so distinctly marked (*i.e.*, abruptly terminated) in *H. janetscheki* as that in *H. klebelsbergi* (however, only limited observations in the former species are available). In *H. janetscheki* the size of external claws diminishes posteriorly, *i.e.* they are the largest on legs I and the smallest on leg IV, while in *H. klebelsbergi* the size of external claws increases slightly from leg I to IV. Hence, the hind claw in the latter species is larger than the corresponding one on leg I (extremely rarely they are of same size or on leg I it is slightly larger). These opposite trends are confirmed by larger values of the claw indices *ECI* and *MBI* in *H. janetscheki* and smaller in *H. klebelsbergi* (132.6 vs 89.7 %; n = 4 and 11, respectively). On the other hand, the values of the hind claw base index (*HCBI*) indicate the presence of shorter external main branch on hind claw in *H. janetscheki,* compared to that in *H. klebelsbergi* (66.7 vs. 62.7; n = 4 and 11, respectively).

So far not published values of the claws' indices in *H. klebelsbergi* are as follows:

ECI index	89.70 ± 10.21 (71.4-104.8) [11] * 11.39 / 61.7
MBI index	90.75 ± 5.61 (81.1-100.0) [10] * 6.18 / 22.4
HCBI index	62.65 ± 10.20 (50.0-84.2) [11] * 11.80 / 33.5

Discussion

Ramazzotti (1968) listed three key characters to separate *H. janetscheki* from the very similar *H. klebelsbergi*: the presence of eyes, the lack of a hump on legs IV and the broader body of the first species. The author (*l.c.*) based the separation of the taxa only on the original description of *H. klebelsbergi* without consulting the type material. However, that description (Mihelčič 1959) contains serious flaws. Soon after publication by Ramazzotti (*l.c.*) Mihelčič re-examined the type series of his *H. klebelsbergi* and found also the eyes, though only in a quarter of all specimens, half of the individuals without a hump on legs IV and some animals broader than originally described. He noted these omissions in a letter to Ramazzotti (of 22.2.1971) who published Mihelčič's remarks in his tardigrade monographs (Ramazzotti 1972, Ramazzotti & Maucci 1983).

The corrections provided by Mihelčič (Ramazzotti 1972) made the originally described differences between the taxa (Ramazzotti 1968) largely obsolete. Thus, Ramazzotti (1972) and Ramazzotti & Maucci (1983) did not exclude the synonymous relation between the two species. Nevertheless, the authors suggested to keep the names of both species till the examination of new material became possible. The authors (*l.c.*) proposed to implement the ratio of body proportion (length:width) as a character separating the species. The respective ratio for *H. klebelsbergi* should then be about 5:1, for *H. janetscheki* 3,3-3,1:1. However, these ratios vary and often overlap, depending on the animal's age, its physical condition, the type and amount of mounting medium, etc., so that they cannot be considered as a reliable distinguishing feature. Furthermore, some data provided by Mihelčič and presented by Ramazzotti (1972: 462) are problematic. It concerns one of the cited (*l.c.*) body proportion for *H. klebelsbergi*, namely "5,1:1,5". After calculation, the ratio is equal to 3,4:1, *i.e.*, almost the same as that which characterise *H. janetscheki*.

Kraus (1972) compared his material of *H. klebelsbergi* with type specimens of *H. janetscheki* which consisted of 14 individuals. No notation was made as to how many and which microslides with the latter taxon had been examined. He found no marked differences and suggested the two taxa to be conspecific. Similarly, Dastych (1993) did not find any differences considered to be important when examining type material of both species. However, his observations were based on very limited material, *i.e.*, four deteriorated specimens of the former taxon and two (cited erroneously as three) individuals of *H. janetscheki* (the microslide "Tipo 178").

Recent study of *H. klebelsbergi* (see Dastych *et al.* 2003), which included data from the important but unpublished study by Kraus (1972), markedly enhanced information about the glacier tardigrade and shed more light on the even lesser known, very similar *H. janetscheki*. Comparison of both taxa (see § "Differential diagnosis"), particularly the morphometric differences and distinctly opposite trends in their claws' size development imply, in my opinion, the separation of these (morpho)

species. However, additional studies are clearly needed for a reliable decision on the status of the two taxa and require new material from the Himalayas.

Based on examination of an ample material of *H. klebelsbergi* (see Dastych *et al.* 2003) and after analyse of all available type specimens and the old topotypes of *H. janetscheki*, I think that the hypothesis about the presence of two different life forms in *H. janetscheki*, *i.e.*, a darkly pigmented, dormant form with shorter claws and a light pigmented, active one with longer claws (see Dastych 1993), cannot be be given further support. Two such different morphotypes occur on the microslides containing type-series of the latter taxon, all labelled by Ramazzotti only as "*H. janetscheki*" (see § "Material and methods"). These morphotypes also exist on slides with topotypes of *H. janetscheki*. The present review of all available information on glacier tardigrades (Dastych *et al.* 2003, this paper) indicates that these morphotypes indeed represent two "good" separate species, *i.e.*, *H. janetscheki* and, in my opinion, a yet undescribed taxon. This latter species has been shortly commented on but misidentified by Ramazzotti (1968: 2) as *H. convergens*. This taxon is morphologically similar in some aspects to *H. klebelsbergi* and *H. janetscheki*. The presence in both these species and in all examined individuals of *H. klebelsbergi* of only a typical, *i.e.*, "normally" developed bucco-pharyngeal apparatus, indicates the existence in the examined material of a single "normal", *i.e.*, active form. Hence, the phenomenon of cyclomorphosis, which is known in some other tardigrade species (*e.g.*, Kristensen 1982, Rebecchi & Bertolani 1994), cannot be confirmed within these glacier tardigrades. There, a dormant form (= *pseudosimplex*-state, hibernal form) is characterised, among the others, by several morphologically "aberrant" structures, also within buccal apparatus (*l.c.*).

Zusammenfassung

Die kryobionte, nur aus Kryokonitlöchern des Nare Gletschers im Himalaya (NO-Nepal, Region von Chomolungma: = Mt Everest) bekannte Tardigradenart *Hypsibius janetscheki* Ramazzotti, 1968 wird auf Grund des Typenmaterials und alter Topotypen wiederbeschrieben und mit einer sehr ähnlichen Art von Gletschern der Alpen, *H. klebelsbergi* Mihelčič, 1959, verglichen. Die morphometrischen Daten, besonders die gegenteilige Tendenz in der Entwicklung der Krallengröße, unterstützen die Trennung der beiden Arten. Diese Annahme muß durch die Analyse neuen und umfangreicheren Materials aus dem Himalaya überprüft werden.

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