

# The Clawless Water-Bear Genus *Apodibius* Dastych, 1983 – a New Taxon of the Fauna of Continental America (Tardigrada, Panarthropoda)

Die krallenlose Bärtierchen-Gattung *Apodibius* Dastych, 1983 – ein neues Taxon der Fauna Kontinental-Amerikas (Tardigrada, Panarthropoda)

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**Summary:** A clawless tardigrade of the genus *Apodibius*, a taxon hitherto not recorded from Continental America, is reported from Venezuela and is shortly described. The sole specimen found represents with its three macroplocoids in the pharynx one of the two phyletic lines known within the genus. The complete reduction of claws exemplifies the most extreme state of regressive evolution of the locomotor apparatus typical for *Apodibius* and unknown in any other water-bear.

**Key words:** Tardigrada, *Apodibius* sp., new record, claw reduction, Venezuela

**Zusammenfassung:** Ein krallenloses Bärtierchen der Gattung *Apodibius*, dieses Taxon war bisher aus Kontinentalamerika nicht bekannt, wird von Venezuela gemeldet und kurz beschrieben. Das einzige gefundene Exemplar repräsentiert mit seinen drei Makroplocoiden im Pharynx eine der beiden phyletischen Linien innerhalb der Gattung. Das Exemplar belegt mit der vollständigen Reduktion seiner Krallen das extremste Stadium regressiver Evolution des Bewegungsapparates, die typisch für *Apodibius*-Arten und von keinem anderen Tardigraden bekannt ist.

**Schlüsselwörter:** Tardigrada, *Apodibius* sp., neuer Fund, Reduktion von Krallen, Venezuela

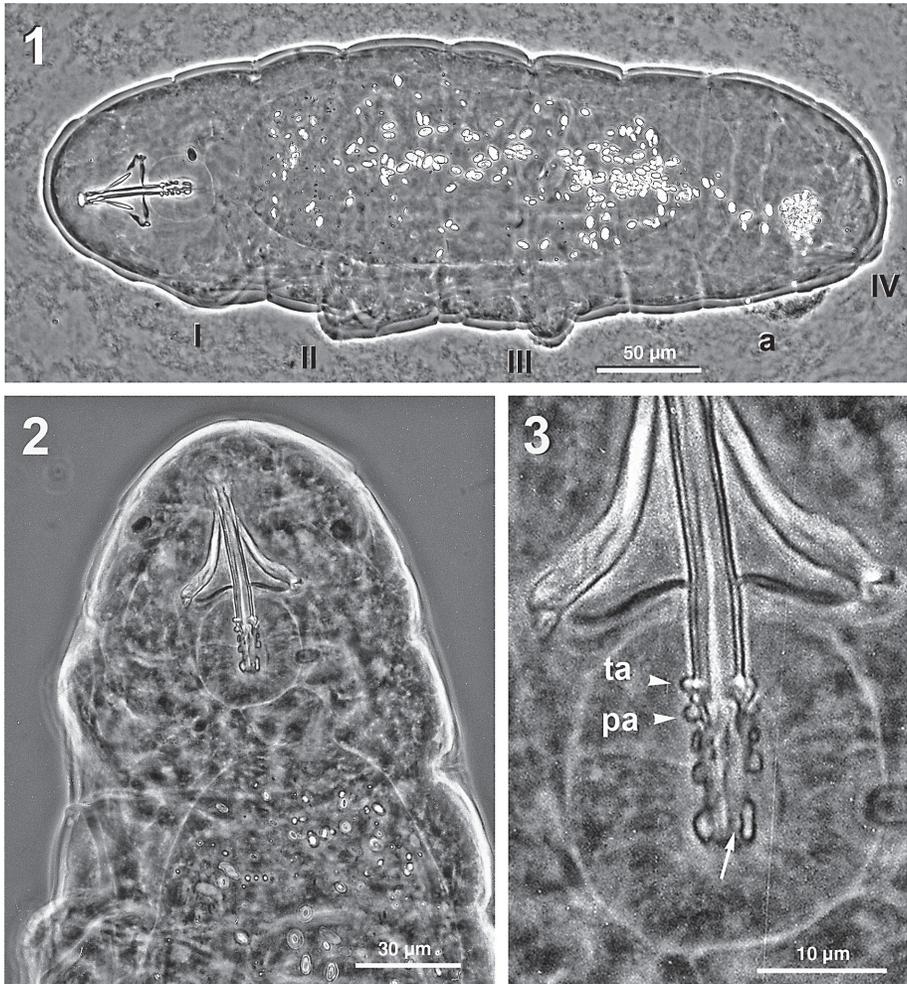
## 1. Introduction

Among all known Tardigrada (or water-bears) only members of the eutardigrade genus *Apodibius* Dastych, 1983 are totally deprived of claws or other cuticular structures on their legs. Despite of rare records, *Apodibius* appears widely spread, as its nominal (three) species have been reported from the Palearctic, Africa and Australia (summarized in DABERT et al. 2014). Until now the only record of the genus from the Western Hemisphere is that from the Galapagos Islands (VAN ROMPU et al. 1996). Hitherto no species of *Apodibius* has been found in Continental America. Recently I examined bryophyte material from Venezuela and found in a moss

sample a specimen representing *Apodibius* sp. Considering the paucity of data on this genus below I describe the animal and provide some additional notes on this interesting taxon.

## 2. Material and methods

A dried moss sample has been processed as in DASTYCH 1985. The single tardigrade I found was mounted in FAURE's medium and deposited in the Zoological Museum Hamburg (Centre for Natural History, University of Hamburg). Accession number: ZMH A11/2017. Microphotographs were taken with ZEISS "Axioskop 2" (Fig. 1) and "Axiomat" (Figs 2, 3).



**Figs 1-3:** *Apodibius* sp. 1 Habitus, dorsal view (I-IV: first to fourth leg, respectively; preparation artefact (a); **2** front of the body, dorsal view; **3** buccopharyngeal apparatus, dorsal view; terminal posterior apophysis of the buccal tube (ta); pharyngeal apophysis (pa); aberrant structure (arrow). (Phase contrast)  
**Abb. 1-3:** *Apodibius* sp. 1 Dorsalansicht (I-IV: erstes bis viertes Bein; Präparationsartefakt (a); **2** Vorderseite des Körpers, dorsal; **3** Buccalapparat, dorsal; hintere terminale Apophyse der Mundröhre (ta); Schlundkopfapophyse (pa); anormale Struktur (Pfeil). (Phasenkontrast)

### 3. Description

Eutardigrada Richters, 1926  
 Isohypsibiidae Sands, McInnes, Marley,  
 Goodall-Copestake, Convey & Linse, 2008

*Apodibius* sp. (Figs 1-3)

The body transparent and light-brownish  
 in the slide preparation, 392.0 µm long.

The body cuticle smooth, relatively thick.  
 Distinct blackish eye-spots. Buccopharyngeal apparatus medium sized, mouth opening slightly ventro-anterior with a ring of tiny oval structures, ca. 1.5 µm in width. Mouth cavity without granules or mucrones. Buccal tube with distinct ventral lamina. Terminal posterior apophyses on the buccal tube well developed (Figs 2,

3: ta); between posterior and pharyngeal apophyses occurs a thin and short (ca. 5  $\mu\text{m}$ ) diagonally directed cuticular bar. Pharynx slightly subspherical, with distinct pharyngeal apophyses (Fig. 3: pa) and three macroplacoids. The macroplacoids and pharyngeal apophyses are partly aberrantly formed (see note “Variability” below). The first and the second macroplacoid small, slightly elongated, distinctly smaller than the third macroplacoid and more closely located to each other than to the third one (Fig. 3). No microplacoid or septulum are present. All legs small and without claws or any other cuticular structures (Figs 1-2). Sex unknown.

**Morphometric data** (in  $\mu\text{m}$ ): Body length 392.0; buccal tube 32.4 long; stylet support attachments on the tube 23.9; buccal tube external width (measured at the level of stylet supports) 3.6, internal one 2.7; pharynx 29.3 x 30.6; terminal posterior apophyses (measurement of each structure on both sides of the pharynx sagittal plane) 1.2/0.9; pharyngeal apophyses 1.4/0.9; macroplacoid I 1.8/1.35; macroplacoid II 1.8/1.8; macroplacoid III 2.7/3.6; macroplacoid row 9.5/10.0. The stylet support index (pt ss: see Pilato 1981) = 73.8 %.

**Variability:** The abnormalities occurring partly in the examined specimen concern only the structures within the animal pharynx, i.e. apophyses and placoids. They vary in their shape, size and also in their slightly asymmetric location on both sides of the pharyngeal sagittal plane (Figs 2, 3). In one of six rows of pharyngeal placoid sets, the macroplacoid I is absent. Moreover, at the rear of the macroplacoid III in two of six sets a tiny aberrant spherical cuticular structure occurred, ca. 1  $\mu\text{m}$  in diameter (Fig. 3, arrow).

**Locality:** Venezuela, Vargas, vicinity of La Guaira, at the tapping of spring of the river Rio Osorio (10° 35' 39.6" N + 66° 55' 52.1" E), 134 m a.s.l. Moss with several non-calciferous small fragments of gravel and soil taken from rock, 10 February 2000, leg. O. HALLAS.

#### 4. Discussion

Considering the formation of the placoids, two phyletic lines can be recognized within the described *Apodibius* species. One group, with only two macroplacoids, is represented by the type species, *A. confusus* Dastych, 1983, and very similar to *A. richardi* Vargha, 1995. Both species are known from the Palearctic (DASTYCH 1983; VARGHA 1995; BISEROV 1999; HOHBERG et al. 2011). The second line with three macroplacoids is represented by *Apodibius nuntius* Binda, 1984, reported from Mozambique (BINDA 1984), Zimbabwe (VAN ROMPU et al. 1995), Australia (MORGAN & NICHOLLS 1986) and Galapagos Islands (VAN ROMPU et al. 1996). In Australia *A. nuntius* was described under the name *A. serventyi* Morgan & Nicholls, 1986 (see synonymy by VAN ROMPU et al. 1995, comp. also MORGAN & NICHOLLS 1986).

The exact species identification of the single specimen of *Apodibius* found in Venezuela was not possible due to partly anomalous formation of its placoids (see note “variability”). Nevertheless, the animal clearly represents the phyletic line within the genus, which is characterized by three macroplacoids. It might even belong to an undescribed species due to the distinctly smaller size of the first and second macroplacoid compared to the third one, the relatively large distance between the second and third macroplacoid, the distinctly larger terminal posterior apophyses of buccal tube, and larger pharyngeal apophyses as compared to images of *A. nuntius* from the literature (see Fig. 1 a, b in BINDA 1984 and Fig. 1 in VAN ROMPU et al. 1995). These differences have been confirmed in recently examined material of the same species from South Africa (DASTYCH, unpublished: Cape Province, Melkboosstrand, 1 Juni 1988, leg. J. MANNING) and Galapagos Islands (specimens by VAN ROMPU et al. 1996). Moreover, the stylet support index (pt ss), considered as

important feature to discriminate eutardigrade species (PILATO 1981), is also different between these animals. In Zimbabwean and Galapagos material the index equals 80.5 % ( $n = 1$ ) and 79.3 % ( $n = 1$ ), respectively, versus 73.8 % in Venezuelan tardigrade.

The complete reduction of claws occurs in all *Apodibius* species described so far. This condition, that may be considered as a case of regressive evolution, i.e. the reduction of traits over time, represents the most extreme reduction of the locomotor apparatus known in tardigrades. However, a trend towards claw reduction has been described in members of some other eutardigrade genera (e.g. *Xerobiotus* Bertolani & Biserov, 1996, *Hexapodibius* Pilato, 1969, *Necopinatum* Pilato, 1971), which seems to be a convergent phenomenon occurring in various distant phyletic lines. Of particular interest is the monospecific genus *Necopinatum*, which is characterized by a complete reduction of claws on II-IV pair of legs, but has cuticular pincer-like structures on legs I. Molecular studies of the above mentioned and related taxa, largely non-existent (but see DABERT et al. 2014), will provide more information concerning the phylogenetic position of these taxa.

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### Literature

- BINDA, M.B. (1984): Noitze sui Tardigradi dell'Africa Meridionale con descrizione di una nuova specie di *Apodibius* (Eutardigrada). *Animalia* 11: 5-15.
- BISEROV, V.I. (1999): Tardigrada of Turkmenistan, with description of three new species. *Zoologischer Anzeiger* 238: 157-167.
- DABERT, M., DASTYCH, H., HOHBERG K., & DABERT, J. (2014): Phylogenetic position of the enigmatic clawless eutardigrade genus *Apodibius* Dastych, 1983 (Tardigrada), based on 18S and 28S rRNA sequence data from its type species *A. confusus*. *Molecular Phylogenetics and Evolution* 70 C: 70-75.
- DASTYCH, H. (1983): *Apodibius confusus* gen. n. sp. n., a new water-bear from Poland (Tardigrada). *Bulletin L'Académie Polonaise des Science* 31: 42-45.
- DASTYCH, H. (1985): West Spitsbergen Tardigrada. *Acta Zoologica Cracoviensia* 28 (3): 169-214
- HOHBERG, K., RUSSELL, D.J., & ELMER, M. (2011): Mass occurrence of algal-feeding tardigrade *Apodibius confusus*, in the young soils of a post-mining site. *Journal of Zoological Systematics and Evolutionary Research* 4: 62-65.
- MORGAN, C.I., & NICHOLLS, C.A. (1986): *Apodibius serventyi* sp. n., a new clawless waterbear (Invertebrata: Tardigrada) from Western Australia. *Journal of the Royal Society of Western Australia* 68: 1-4.
- PILATO, G. (1981): Analisi di nuovi caratteri nello studio degli Eutardigradi. *Animalia* 8: 51-57.
- VAN ROMPU, E.A., DE SMET, W.H., & COOMANS, A. (1995): Some terrestrial tardigrades from Zimbabwe. *Biologisch Jaarboek Dodonaea* 63: 48-55.
- VAN ROMPU, E.A., DE SMET, W.H., & COOMANS, A. (1996): Tardigrada from the Galapagos and Solomon Islands. *Biologisch Jaarboek Dodonaea* 63: 152-160.
- VARGHA, B. (1995): Three new tardigrade species from Hungary. *Acta Zoologica Scientiarum Hungaricae* 41: 301-313.

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