

## Data to the Tardigrada fauna of Albania

BÉLA VARGHA

**ABSTRACT:** Author describes the Tardigrada species detected from 33 moss and 1 lichen samples from Albania. The 59% of the samples contained tardigrades, of which 30 species were detected. Most of the species are xerophilous and eurytopic. The similarity of the Tardigrada species originated from Albanian samples and of the nearby Bulgarian tardigrade fauna is 52%.

### Introduction

The phylum Tardigrada contains more than 1100 described species of cosmopolitan microscopic invertebrates found in diverse habitats within terrestrial, freshwater and marine environments. We have a very incomplete knowledge about the Tardigrada fauna of Albania. The Register of Species of the Fauna of Albania (DHORA 2010) marks only one Tardigrada species (*Macrobiotus ovidii* Bartoš, 1937) without locality and source. There are no incidence data about further limno-terrestrial species. DE ZIO GRIMALDI & GALLO D'ADDABBO (2001) reported from 1 marine species (*Batillipes pennaki* Marcus, 1946) in the intertidal zone of the Albanian coast, near Durrës.

### Materials and methods

Tardigrades described in this work originate from moss and lichen samples collected during collector roads realized under the long-term Balkan research project of the Hungarian Natural History Museum. Dr. Zoltán FEHÉR was kind to make samples available for the tardigrade investigations. 33 moss and 1 lichen species were investigated altogether, of which 19 moss and 1 lichen samples were proved to be positive for tardigrade. The positive samples were collected from the undermentioned locations (Fig. 1).

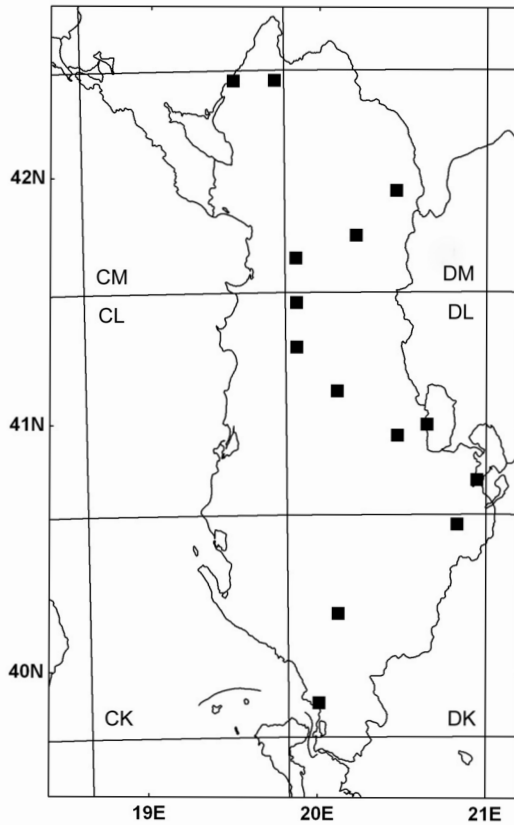
The extraction of tardigrades from air-dry samples occurred after a 24 hour soak in tap water in Petri dish. The detailed description of the method [soaking-washing-filtration-sedimentation and flotation by centrifugation] was published in VARGHA et al. (2002) work. The search and picking of the specimens and eggs occurred by stereo microscope (magnification: 25–50 times). Tardigrade specimens and eggs were mounted on microscopic slides, preserved in polyvinyl – lactophenol, determination of the species by microscope (magnification 400–900 times). Species were determined first of all on the basis of work of DASTYCH (1988) and RAMAZZOTTI & MAUCCI (1983). Microscopic preparations are preserved in the author's collection.

### Sampling sites in Albania (Fehér et al. 2004)

**1992/221/a** Periferi Krujë, Krujë, castle ruins (600 m a.s.l.) [limestone walls] DL09, 13.09.1992. leg.: Fehér, Z., moss from rock

**1992/222** Periferi Krujë, Mali i Krujës, over Krujë (800–1000 m a.s.l.) [limestone rocks] DL09, 13.09.1992. leg.: Fehér, Z., moss from rock

**1992/224** Periferi Tiranë, Tiranë, city park, at the artificial lakelet [lacustrine drift, among leaf-litter] DL07, 14.09.1992. leg.: Fehér, Z., moss



**Fig. 1.** Tardigrade positive sampling sites in Albania by Zoltán Fehér

**1992/224/b** Periferi Korçë, Mali i Moravës, E of Korçë [pine forest plantation] DK89, 17.09.1992. leg.: Fehér, Z., moss

**1992/226** Periferi Korçë, Liqenas, by the shore of Liqeni i Prespes [lacustrine drift, degraded ruderal vegetation] DL91, 18.09.1992. leg.: Fehér, Z., moss

**1993/302/a** Periferi Mat, Ulëz, around the village and by the shore of Liqeni i Ulëzes [secondary shrub vegetation] DM01, 17.07.1993. leg.: Fehér, Z., moss from stone

**1993/303** Periferi Mat, Mali i Dejës, along the road from Qafa e Murrës to Liqeni i Lulevës, DM31 or DM32, 18.07.1993. leg.: Fehér, Z., moss from stone, lichen from tree (This sampling site was mentioned by FEHÉR et al. (2004) as “Shkëmb i Skanderbeut, W of Kurbnesh”, however, this definition was based on a misunderstanding and therefore incorrect. The sample was collected south of the Liqeni i Luleves, but collector is unable to define it more precisely – Fehér, Z. personal communication, 2011.)

**1993/303/a** Periferi Dibrë, SW of Fushë-Lurë, Liqeni i Lulevës [peat-bog, natural pine forest] DM32, 18.07.1993. leg.: Fehér, Z., moss from tree

**1993/305** Periferi Pogradec, Lin, by the shore of Liqeni i Ohrit (710 m a.s.l.) [limestone rocks] DL74, 21.07.1993. leg.: Fehér, Z., moss from stone

**1993/312** Periferi Tiranë, Mali i Dajtit, Linzë, 1 km towards the peak [in an olive grove, under stones] DL07, 27.07.1993. leg.: Fehér, Z., moss from stone

**1993/314** Periferi Sarandë, Sarandë, beach [limestone rocks] DK11, 25.07.1993. leg.: Fehér, Z., moss from stone

**1993/316** Periferi Tepelenë, 7 km S of Tepelenë, Uji i Ftohtë [limestone rocks near the waterfall] DK25, 26.07.1993. leg.: Fehér, Z., moss from stone

**1994/452** Periferi Krujë, Mali i Krujës, over Krujë (800–1000 m) [limestone rocks] DL09, 14.09.1994. leg.: Fehér, Z. & Kónya, P., moss from stone

**2003/022** Periferi Kukës, Bicaj, gorge of the Pr. i Tershanës (500 m) [in/near the brook, limestone rocks] DM54, 25.06.2003. leg.: Eröss, Z., Fehér, Z., Kontschán, J., Murányi, D., moss

**2003/033** Periferi Mat, in the gorge of Lumi i Matit, along the Burrel – Milot main road, 11 km W of the conjunction to Ulëz (100 m) [limestone rocks, in/near the river] DM01, 27.06.2003. leg.: Eröss, Z., Fehér, Z., Kontschán, J., Murányi, D., moss

**2003/046** Periferi Elbasan, Shushicë, Burimi te Byshekut (175 m) [in/near the spring, limestone rocks] DL25, 30.06.2003. leg.: Eröss, Z., Fehér, Z., Kontschán, J., Murányi, D., moss

**2003/057** Periferi Pogradec, Shpellë (4 km SW of Bishnicë), Shkemb i Qytetit (1140 m) [limestone and conglomerate rocks] DL53, 01.07.2003. leg.: Eröss, Z., Fehér, Z., Kontschán, J., Murányi, D., moss

**2003/084** Periferi Malësia, Qafa e Pejës, N of Okol (1700 m) [limestone rocks, subalpine meadow] CM99, 06.07.2003. leg.: Eröss, Z., Fehér, Z., Kontschán, J., Murányi, D., moss

**2003/088** Periferi Malësia, a mountain pass, 2 km N of Raps along the road from Hani i Hotit to Vermosh (760m) [limestone rocks] CM79, 07.07.2003. leg.: Eröss, Z., Fehér, Z., Kontschán, J., Murányi, D., moss

## Results

The 59% of all (34) samples contained tardigrades. Altogether 30 Tardigrada species were detected from the 19 moss and 1 lichen samples. Most of the species are xerophyllous and eurytopic. The most frequent species are: *Macrobotus hufelandi hufelandi* C. A. S. Schultze, 1833 – 9 samples, *Paramacrobotus richtersi* (Murray, 1911) – 7 samples, *Echiniscus granulatus* (Doyère, 1840) – 6 samples. The 43% of the species were found only in 1-1 sample. The most species-rich sampling sites were: 1993/305 (11 species), 1993/303 (10 species) and 1994/452 (9 species). The 35% of the samples contained only the specimens of 1-1 species. The occurrence of more Tardigrada species is expectable by the investigation of further moss, lichen, litter and soil samples from newer, primarily shady, moist areas. The sampling sites of the different Tardigrada species and the occurrence of the Tardigrada species on the different sampling sites is the following.

### Sampling sites of the Tardigrada species

*Echiniscus blumi blumi* Richters, 1903 – 1993/303

*Echiniscus canadensis* Murray, 1910 – 1993/303

*Echiniscus granulatus* (Doyère, 1840) – 1992/222, 1992/224/b, 1992/226, 1993/302/a, 1993/316, 2003/084

*Echiniscus mediantus* Marcus, 1930 – 1993/303

*Echiniscus merokensis merokensis* Richters, 1904 – 1993/302/a, 1993/303/a

*Echiniscus merokensis suecicus* Thulin, 1911 – 1993/302/a

*Echiniscus spinulosus* (Doyère, 1840) – 1993/305

*Echiniscus testudo* (Doyère, 1840)

f. quadrifilis – 1993/305, 1993/316, 2003/088

f. trifilis – 1992/226, 1993/305, 1994/452, 2003/088

*Echiniscus trisetosus* Cuénot, 1932 – 1993/303

*Pseudechiniscus suillus* (Ehrenberg, 1853) – 1993/303, 1993/303/a, 1994/452, 2003/057

*Milnesium tardigradum tardigradum* Doyère, 1840 – 1993/303, 1993/312

*Diphascon (Diphascon) bullatum* Murray, 1905 – 1993/316

*Diphascon (Diphascon) pingue pingue* (Marcus, 1936) – 1993/302/a

*Diphascon (Diphascon) recamieri* Richters, 1911 – 1993/303

*Diphascon (Adropion) prorsirostre* Thulin, 1928 – 2003/057

*Hypsibius convergens* (Urbanowicz, 1925) – 1992/222, 1993/302/a, 1993/305, 1994/452  
*Hypsibius dujardini* (Doyère, 1840) – 1992/224, 1993/312  
*Astatumen trinacriae* (Arcidiacono, 1962) – 1994/452  
*Ramazzottius anomalus* (Ramazzotti, 1962) – 1992/224/b, 1993/303, 1994/452  
*Isohypsibius pappi* (Iharos, 1966) – 1993/302/a  
*Isohypsibius prosostomus prosostomus* Thulin, 1928 – 1992/222  
*Isohypsibius silvicola* (Iharos, 1966) – 1992/226  
*Macrobiotus harmsworthi harmsworthi* Murray, 1907 – 1992/222, 1993/302/a, 1993/305  
*Macrobiotus hufelandi hufelandi* C. A. S. Schultze, 1833 – 1992/222, 1992/226, 1993/302/a, 1993/303/a, 1993/305, 2003/022, 2003/033, 2003/046, 2003/057  
*Macrobiotus islandicus islandicus* Richters, 1904 – 1992/222, 1993/305, 1994/452  
*Macrobiotus macrocalix* Bertolani & Rebecchi, 1993 – 1993/303, 1993/303/a  
*Macrobiotus ovidii* Bartoš, 1937 – 1992/221/a, 1993/305, 1994/452  
*Minibiotus intermedius* (Plate, 1888) – 1993/303/a, 1993/305, 1994/452, 2003/057  
*Paramacrobiotus areolatus* (Murray, 1907) – 1993/303, 1993/305, 1993/314, 1993/316,  
*Paramacrobiotus richtersi* (Murray, 1911) – 1992/224, 1992/224/b, 1992/226, 1993/302/a, 1993/305, 1994/452, 2003/057  
*Richtersius coronifer* (Richters, 1903) – 1993/305

#### Occurrence of the Tardigrada species on the different sampling sites

**1992/221/a:** *Macrobiotus ovidii* – **1992/222:** *Echiniscus granulatus*, *Hypsibius convergens*, *Isohypsibius prosostomus prosostomus*, *Macrobiotus harmsworthi harmsworthi*, *M. hufelandi hufelandi*, *M. islandicus islandicus* – **1992/224:** *Hypsibius dujardini*, *Paramacrobiotus richtersi* – **1992/224/b:** *Echiniscus granulatus*, *Ramazzottius anomalus*, *Paramacrobiotus richtersi* – **1992/226:** *Echiniscus granulatus*, *E. testudo* f. *trifilis*, *Isohypsibius silvicola*, *Macrobiotus hufelandi hufelandi*, *Paramacrobiotus richtersi* – **1993/302/a:** *Echiniscus granulatus*, *E. merokensis merokensis*, *E. merokensis sueticus*, *Diphascion (Diphascion) pingue pingue*, *Hypsibius convergens*, *Isohypsibius pappi*, *Macrobiotus harmsworthi harmsworthi*, *M. hufelandi hufelandi*, *Paramacrobiotus richtersi* – **1993/303 in moss:** *Echiniscus blumi blumi*, *E. canadensis*, *E. mediantus*, *E. trisetosus*, *Pseudechiniscus suillus*, *Milnesium tardigradum tardigradum*, *Macrobiotus macrocalix*, *Paramacrobiotus areolatus*; **in lichen:** *Echiniscus canadensis*, *E. trisetosus*, *Diphascion (Diphascion) recamierei*, *Ramazzottius anomalus*, *Macrobiotus macrocalix* – **1993/303/a:** *Echiniscus merokensis merokensis*, *Pseudechiniscus suillus*, *Macrobiotus hufelandi hufelandi*, *M. macrocalix*, *Minibiotus intermedius* – **1993/305:** *Echiniscus spinulosus*, *E. testudo* f. *quadrifilis*, f. *trifilis*, *Hypsibius convergens*, *Macrobiotus harmsworthi harmsworthi*, *M. hufelandi hufelandi*, *M. islandicus islandicus*, *M. ovidii*, *Minibiotus intermedius*, *Paramacrobiotus areolatus*, *P. richtersi*, *Richtersius coronifer* – **1993/312:** *Milnesium tardigradum tardigradum*, *Hypsibius dujardini* – **1993/314:** *Paramacrobiotus areolatus* – **1993/316:** *Echiniscus granulatus*, *E. testudo* f. *quadrifilis*, *Diphascion (Diphascion) bullatum*, *Paramacrobiotus areolatus* – **1994/452:** *Echiniscus testudo* f. *trifilis*, *Pseudechiniscus suillus*, *Hypsibius convergens*, *Astatumen trinacriae*, *Ramazzottius anomalus*, *Macrobiotus islandicus islandicus*, *M. ovidii*, *Minibiotus intermedius*, *Paramacrobiotus richtersi* – **2003/022:** *Macrobiotus hufelandi hufelandi* – **2003/033:** *Macrobiotus hufelandi hufelandi* – **2003/046:** *Macrobiotus hufelandi hufelandi* – **2003/057:** *Pseudechiniscus suillus*, *Diphascion (Adropion) prorsirostre*, *Macrobiotus hufelandi hufelandi*, *Minibiotus intermedius*, *Paramacrobiotus richtersi* – **2003/084:** *Echiniscus granulatus* – **2003/088:** *Echiniscus testudo* f. *quadrifilis*, f. *trifilis*.

Tardigrada species originated from the Albanian samples show great similarity to the Tardigrada fauna of the nearby Bulgaria. More than the half of the 35 Tardigrada species published from Bulgaria (IHAROS 1961, 1973, 1982, KACZMAREK et al. 2011) and the 30 species detected from Albanian samples are the same (QS% = 52,3).

The taxonomic classification of the Tardigrada species originated from the Albanian samples according to the newest published lists (DEGMA & GUIDETTI 2007, DEGMA et al. 2009–2011, GUIDETTI & BERTOLANI 2005) is the following.

## Tardigrada species from Albania

HETEROTARDIGRADA Marcus, 1927

ECHINISCOIDEA Richters, 1926

Echiniscidae Thulin, 1928

*Echiniscus* C.A.S. Schultze, 1840

*Echiniscus blumi blumi* Richters, 1903

*Echiniscus canadensis* Murray, 1910

*Echiniscus granulatus* (Doyère, 1840)

*Echiniscus mediantus* Marcus, 1930

*Echiniscus merokensis merokensis* Richters, 1904

*Echiniscus merokensis suecicus* Thulin, 1911

*Echiniscus spinulosus* (Doyère, 1840)

*Echiniscus testudo* (Doyère, 1840)

*Echiniscus trisetosus* Cuénot, 1932

*Pseudechiniscus* Thulin, 1911

*Pseudechiniscus suillus* (Ehrenberg, 1853)

EUTARDIGRADA Richters 1926

APOCHELA Schuster, Nelson, Grigarick & Christenberry, 1980

Milnesiidae Ramazzotti, 1962

*Milnesium* Doyère, 1840

*Milnesium tardigradum tardigradum* Doyère, 1840

PARACHELA Schuster, Nelson Grigarick & Christenberry, 1980

Hypsibiodea Pilato, 1969

Hypsibiidae Pilato, 1969

Diphasconinae Dastych, 1992

*Diphascon* (*Diphascon*) Plate, 1888

*Diphascon* (*Diphascon*) *bullatum* Murray, 1905

*Diphascon* (*Diphascon*) *pingue pingue* (Marcus, 1936)

*Diphascon* (*Diphascon*) *recamieri* Richters, 1911

*Diphascon* (*Adropion*) Pilato, 1987

*Diphascon* (*Adropion*) *prorsirostre* Thulin, 1928

Hypsibiinae Pilato, 1969

*Hypsibius* Ehrenberg, 1848

*Hypsibius convergens* (Urbanowicz, 1925)

*Hypsibius dujardini* (Doyère, 1840)

Itaquisconinae Rudescu, 1964

*Astatumen* Pilato, 1997

*Astatumen trinacriae* (Arcidiacono, 1962)

Ramazzottidae Marley, McInnes & Sands, 2011

*Ramazzottius* Binda & Pilato, 1986

*Ramazzottius anomalus* (Ramazzotti, 1962)

Isohypsibiodea Marley, McInnes & Sands, 2011

Isohypsibiidae Marley, McInnes & Sands, 2011

*Isohypsibius* Thulin, 1928

*Isohypsibius pappi* (Iharos, 1966)

*Isohypsibius prosostomus prosostomus* Thulin, 1928

*Isohypsibius silvicola* (Iharos, 1966)

Macrobotoidea Marley, McInnes & Sands, 2011

Macrobotidae Thulin, 1928

*Macrobotus* C. A. S. Schultze, 1834

*Macrobotus harmsworthi harmsworthi* Murray, 1907

*Macrobotus hufelandi hufelandi* C. A. S. Schultze, 1833

*Macrobotus islandicus islandicus* Richters, 1904

*Macrobiotus macrocalix* Bertolani & Rebecchi, 1993  
*Macrobiotus ovidii* Bartoš, 1937  
Minibiotus R. O. Schuster, 1980  
*Minibiotus intermedius* (Plate, 1888)  
Paramacrobiotus Guidetti, Schill, Bertolani, Dandekar & Wolf, 2009  
*Paramacrobiotus areolatus* (Murray, 1907)  
*Paramacrobiotus richtersi* (Murray, 1911)  
Richtersius Pilato & Binda, 1989  
*Richtersius coronifer* (Richters, 1903)

**Acknowledgements:** The author expresses his thanks to Zoltán FEHÉR (Hungarian Natural History Museum, Budapest) for the disposal of the investigation samples, the pass of the description of the sampling sites and the preparation of the map and to his daughter Regina VARGHA (Budapest) for the English translation.

### References

- DASTYCH, H. (1988): The Tardigrada of Poland. – Monografie Fauny Polski Tom XVI. Państwowe Wydawnictwo Naukowe. Warszawa, Krakow, pp. 255+XXXI plates.
- DEGMA, P. & GUIDETTI, R. (2007): Notes to the current checklist of Tardigrada. – *Zootaxa*, 1579: 41–53.
- DEGMA, P., BERTOLANI, R., & GUIDETTI, R. (2009–2011): Actual checklist of Tardigrada species. – *Ver.* 19: 31-05-2011, pp. 36. <http://www.tardigrada.modena.unimo.it/miscellanea/Actual%20checklist%20of%20Tardigrada.pdf>.
- DE ZIO GRIMALDI, S., & GALLO D'ADDABBO, M. (2001): Further Data on the Mediterranean Sea Tardigrade Fauna. – *Zoologischer Anzeiger*, 240: 345–360.
- DHORA, D. (2010): Register of Species of the Fauna of Albania 2010. – *Botimet Camaj-Pipa, Kiras, Kodra, Albania*, pp. 208.
- FEHÉR, Z., ERÖSS, Z., KONTSCHÁN, J. & MURÁNYI, D. (2004): Collecting sites of the zoological expeditions of the Hungarian Natural History Museum to Albania (1992–2003). – *Folia Historico-Naturalia Musei Matraensis*, 28: 67–82.
- GUIDETTI, R. & BERTOLANI, R. (2005): Tardigrade taxonomy: an updated check list of the taxa and a list of characters for their identification. – *Zootaxa*, 845: 1–46.
- IHAROS, G. (1961): Grundlage der Tardigradenfauna Bulgariens. – *Acta Zoologica Academiae Scientiarum Hungaricae*, 7: 111–118.
- IHAROS, G. (1973): Angaben zur geographischen Verbreitung der Tardigraden. – *Opuscula Zoologica*, 12: 73–86.
- IHAROS, G. (1982): Tardigradologische Notizen. I. – *Miscellanea Zoologica Hungarica*, 1: 85–90.
- KACZMAREK, L., GOLDYN, B., PROKOP, Z. M., & MICHALCZYK, L. (2011): New records of Tardigrada from Bulgaria with the description of *Macrobiotus binieki* sp. nov. (Eutardigrada: Macrobiotidae) and a key to the species of the *harmsworthi* group. – *Zootaxa*, 2781: 29–39.
- RAMAZZOTTI, G. & MAUCCI, W. (1983): Il Phylum Tardigrada. III. edizione riveduta e aggiornata. – *Memorie dell' Instituto Italiano di Idrobiologia Dott. Marco de Marchi. Volume 41. Instituto Italiano di Idrobiologia. Verbania, Pallanza*, 1012 pp.
- VARGHA, B., ÖTVÖS, E., & TUBA, Z. (2002): Investigations on ecological effects of heavy metal pollution in Hungary by moss-dwelling water bears (Tardigrada), as bioindicators. – *Annals of Agricultural and Environmental Medicine*, 9: 141–146.

Béla VARGHA  
H-1196 BUDAPEST, Hungary  
Rákóczi utca 119.  
E-mail: adalbertus@hdsnet.hu