

Tardigrada of Xinjiang Uygur Autonomous Region, China

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ABSTRACT

Relatively little is known of the Tardigrada fauna of China, and there are no previous tardigrade records for Xinjiang Uygur Autonomous Region, China's largest administrative division. Moss specimens of the Missouri Botanical Garden Herbarium (St. Louis, U.S.A.) were used as a source of tardigrades from this region. Of the 270 moss specimens sampled, 78 yielded tardigrades. Species found were *Bryodelphax asiaticus*, *Cornechiniscus holmeni*, *Echiniscus blumi*, *Echiniscus canadensis*, *Echiniscus granulatus*, *Echiniscus testudo*, *Echiniscus trisetosus*, *Macrobiotus alekseevi*, *Macrobiotus maucii*, *Milnesium asiaticum*, *Milnesium longiungue*, and *Milnesium tardigradum*. Of the species found, the Heterotardigrada are better represented, which is probably a reflection of the higher altitudes at which the samples were taken and the arid environment of the region; the species found are primarily ones considered to be xerophilic or montane. Seven species new to China are reported.

Key words: China, Xinjiang Region, Tardigrada

1. INTRODUCTION

The Tardigrada fauna of China had limited study prior to the year 2000 (Rahm 1936-37a, 1936-37b, 1937; Bartos 1963; Mathews 1937a, b; Pilato 1974; Beasley & Cleveland 1996; Beasley 1999; Yang 1999). Since that time there have been more papers published on tardigrades of China than during the previous 100 years (Kaczmarek & Beasley 2002; Yang 2002a, 2002b, 2003; Li *et al.* 2004; Kaczmarek *et al.* 2005; Li & Liu 2005; Li & Wang 2005a, b, 2006; Li *et al.* 2005a, b; Wang & Li 2005; Beasley *et al.* 2006). Despite this increase in study, there are still large areas of China that have not been investigated. Xinjiang Uygur Autonomous Region (which has also been called Sinkiang Uygur Autonomous Region), the largest administrative division in China, is about one-sixth of the area of mainland China (Fullard 1968), and has had no reports of Tardigrada. This paper records tardigrade species found in Xinjiang Region, and contains new country records for China.

2. METHODS

Mosses at the Missouri Botanical Garden Moss Herbarium were soaked in water for 24 hours, then the moss was removed. The water was then heated to 80 °C and enough ethyl alcohol was added to result in an 80% concentration. At a later time the samples were examined and microslides of any tardigrades present were prepared using Heinz mounting medium. The slides were ringed with a sealant.

Collection data was obtained from the Missouri Botanical Garden's moss database, MOSs TROPICOS. Figure 1 illustrates the locations of the sampling sites.

Multiple samples were collected at many of the sampling sites. Collection and identification of the mosses were by a variety of bryologists associated with the Missouri Botanical Garden. Moss samples containing Tardigrada were from the following localities:

- Site 1. Hejing Co., south of zero mileage point along Du-ku Highway, Tian Shan Range, 1650-1700 m a.s.l., 43.07°N 84.30°E, 30 July 1995, coll. Zhao Jian-cheng, Si He.
- Site 2. Hejing Co., Gongnaisi Forest Preserve, Tian Shan Range, 1800-2000 m a.s.l., 43.15°N 84.48°E, 30 July 1995, coll. Hu Ren-liang, Zhao Jian-cheng, Si He.
- Site 3. Kuche Co., Kuche Forest Preserve, Tian Shan Range, 2500-2550 m a.s.l., 41.45°N 83.15°E, 31 July 1995, coll. Si He.
- Site 4. Nileke Co., Wulansadik vicinity along Du-ku Highway, Tian Shan Range, 1500-1600 m a.s.l., 44.04°N 84.47°E, 29 July 1995, coll. Zhao Jian-cheng, Si He.
- Site 5. Urumqi Co., Nanshan, Huo-xia Town, Tian Shan Range, 2300-2400 m a.s.l., 43.12.69°N 87.07°E, 24 July 1995, coll. Si He.
- Site 6. Urumqi Co., Shenli (Victory) Summit, Tian Shan Range, 3990-4100 m a.s.l., 43.07°N 84.45°E, 25 July 1995, coll. Si He, Zhao Jian-cheng, Hu Ren-liang.
- Site 7. Urumqi Co., Bai-yang-gou (Poplar Valley), Tian Shan Range, 2060-2250 m a.s.l., 43.25.46°N 87.09.69°E, 23 July 1995, coll. Liu Zhong-ling, Zhao Jian-cheng, Si He.
- Site 8. Wusu Co., Maoliugou vicinity along Du-ku Highway, Tian Shan Range, 1800-1950 m a.s.l.,

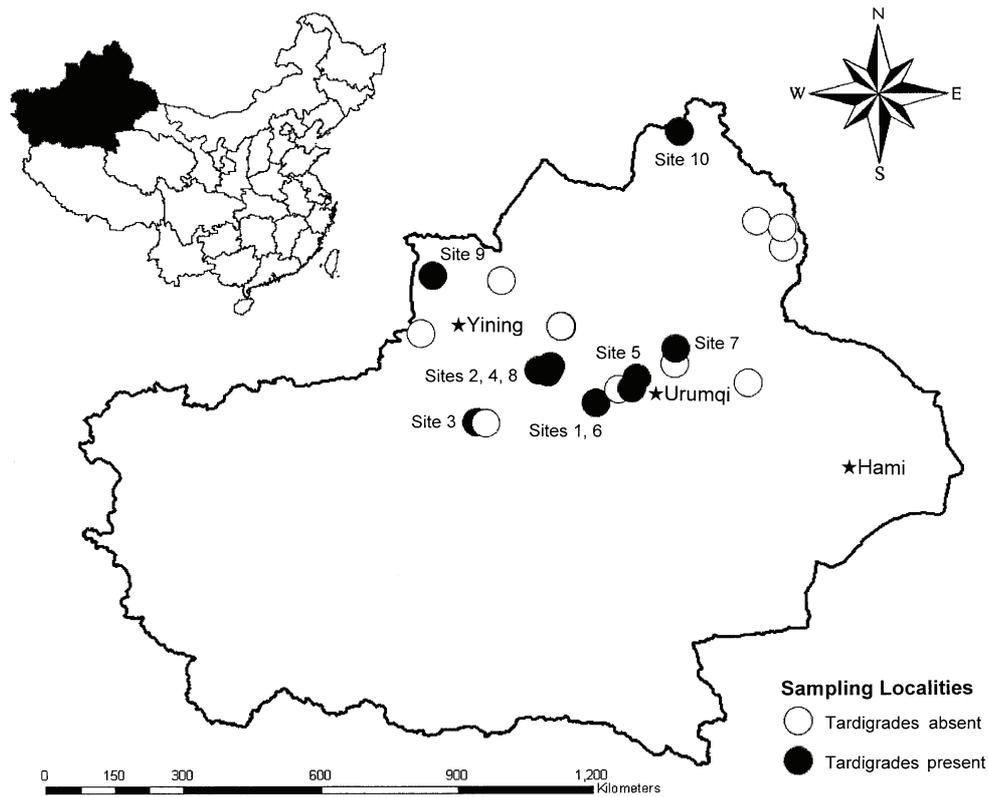


Fig. 1. Map of Xinjiang Region showing locations of sampling sites. Of the 270 moss samples examined, 78 from ten sites contained tardigrades. Insert shows the location of the region within China.

44.04.47°N 84.47.77°E, 28 July 1995, coll. Si He, Zhao Jian-cheng, Liu Zhong-ling.

Site 9. Guo-zi-gou (Fruit Valley), Bore-Yining highway, 1140 m a.s.l., 44.21.00°N 80.59.00°E, 4 August 1993, coll. A. T. Whittemore with B. Tan, R.-L. Hu, J.-C. Zhao, R.-L. Zhu, M. Sulayman.

Site 10. Altai Region, Ha-la-si District, 6 July 1980, coll. Yang Chang-you.

Identification was facilitated by Ramazzotti & Maucci (1983) plus original journal articles. Tumanov's paper (2006) on new species of *Milnesium* was used for identification purposes, and claw measurements of *Milnesium* are according to Tumanov. Measurements were only taken if a structure's orientation was optimal. Body length measurements do not include the hind legs. Buccal tube length, stylet support insertion, and the calculation of the pt ratio followed Pilato (1981). Buccal tube width was measured as the external diameter at the level of the stylet supports. Photomicrographs were taken using phase contrast microscopy.

3. RESULTS

Of the 270 moss specimens examined, 78 yielded tardigrades. Species identified are the following.

3.1. *Bryodelphax asiaticus* (Kaczmarek & Michalczyk 2004)

One specimen was found, with a body length of 152 μm . A transverse band without sculpture is present on the paired plates. Median plates 1 and 2 subdivided transversely, median plate 3 undivided. Terminal plate without incisions, but with grooves in the approximate location of such incisions. Cirrus A 42.1 μm in length. Claws 6.9 μm long, external claws smooth, internal claws with small spur.

This species was found at site 4. Found in the same sample were *Echiniscus testudo* and *E. trisetosus*. *B. asiaticus* was found only in the moss *Pseudoleskella catenulata* (Brid. ex Schrad.) Kindb.

This species was described by Kaczmarek & Michalczyk (2004) from Mongolia, and has not been reported from any other localities. This report represents a new country and region record.

3.2. *Cornechiniscus holmeni* (Petersen 1951)

Eighteen specimens in five samples. Body lengths 233–597 μm (ave. 483). Cuticular ornamentation similar to that of *Echiniscus blumi*, including granulation on the dorsal surfaces of all legs. With characteristically

enlarged appendage A and W-shaped folds on scapular plate. Measurements for a 526 μm specimen are followed in parentheses by the average and range: appendage A 46.5 μm (37.6, 18.8-50.5), C 342.5 μm (264.2, 92.1-387.5), D 280 μm (251.7, 143.6-417.5), Dd 28.9 μm (29.9, 22.3-39.2), Pd (on posterior edge of pseudosegmental plate) 15.4 μm (17.5, 11.4-25.3), and E 33.2 μm (31.2, 10.9-45.1). Claws on legs IV 61.5 μm (48.5, 11.4-65.8); collar on legs IV with one spine, 15.4 μm (14.5, 7.9-18.3).

Dastych (1979) discussed some of the variation of this species, and the Chinese specimens exhibit the same variation in size and shape of the Dd and Pd spines. There is also great variation in the presence of cuticular appendages. Three specimens are missing Pd appendages, one missing Dd, and one missing D. Two specimens are missing one of the D, one specimen missing one of the Pd. Two specimens had one appendage at Cd, and one specimen with two Cd has one of them with a bifurcated tip. Only one tiny upward-pointed spine on an inner claw of legs IV such as was described by Dastych (1979) was observed, and this was only on the one claw of the specimen.

This species was found at sites 6, 7, and 8. The only species found together with *C. holmeni* was *Echiniscus testudo*. *Cornechiniscus holmeni* was found in the mosses *Grimmia tergestina* Tomm. ex B.S.G., *Mnium laevunerve* Cardot, and *Schistidium* sp.

Based on reports so far, this species appears to be holarctic. It has not been previously reported from China, so this report represents a new country and region record.

3.3. *Echiniscus blumi* (Richters 1903)

Four specimens in four samples. Body lengths 152-450 μm (ave. 288). Cuticle with polygonal pattern with a space between the granules. At some focal planes there appears to be a dot within the granules. Measurements for a 450 μm specimen are followed in parentheses by the average and range: appendage A 59.4 μm (50.4, 30.1-64.1), B 123.1 μm (98.9, 82.9-123.1), C 165.8 μm (136.0, 30.1-238.6), Cd 154.5 μm (101.5, 56.9-154.5), D 189.7 μm (147.9, 46.5-226.1). Two specimens had spines at Dd of 4.0 μm , a different specimen had small spines at E of 3.5 μm . Claws on legs IV 26.7 μm (31.9, 26.7-37.1); inner claws of leg IV with spurs; collar on legs IV with 7-10 teeth. One two-clawed individual missing appendages B.

This species was found at sites 5, 6, 7, and 8. Found in the same samples with *E. blumi* were *E. granulatus* and *Macrobotus maucii*. *Echiniscus blumi* was found in the mosses *Abietinella abietina* (Hedw.) M. Fleisch and *Schistidium* sp.

This species has been reported from all continents except Antarctica. It has previously been reported from China (Rahm 1936-37a, 1936-37b, 1937), but this is a new region record.

3.4. *Echiniscus canadensis* (Murray 1910)

Eighty-two specimens in seven samples; one immature specimen with 2 claws per leg. Body lengths 142-355 μm (ave. 273). Cuticular ornamentation similar to that of *E. blumi*; dorsum of all legs granulated. Measurements for a 320 μm specimen are followed in parentheses by the average and range: appendage A 67.8 μm (50.2, 19.8-92.9), Cd 81.6 μm (89.7, 13.4-125.6), and Dd 56.5 μm (29.0, 6.4-56.5). Claws on legs IV 22.3 μm (21.0, 12.4-25.3); all claws of legs IV with spurs, those of the outer claws with smaller straight spurs, the inner curved downward; collar on legs IV with 9-12 teeth.

One specimen was missing the Cd appendages, another the Dd. One specimen had a single short filament present at C, another a short spine at D. Three specimens had very short spines E of 3.5-5 μm .

This species was found at site 2. Found in the same samples with this species were *E. testudo*, *Milnesium longiungue*, and *M. tardigradum*. *Echiniscus canadensis* was found in the mosses *Grimmia laevigata* (Brid.) Brid., *Grimmia ovalis* (Hedw.) Lindb., and *G. tergestina*.

This species has been reported from all continents except Australia and Antarctica. It has previously been reported from China (Li & Wang 2005a), but this represents a new region record.

3.5. *Echiniscus granulatus* (Doyère 1840)

Eight specimens in 3 samples. Body lengths 161-263 μm (ave. 200). Cuticular ornamentation of *E. blumi* type. Measurements for a 204 μm specimen are followed in parentheses by the average and range: appendage A 57.4 μm (61.1, 54.5-67.8), C 100.5 μm (94.6, 67.8-137.0), Cd 40.1 μm (31.0, 18.8-43.6), D 109.3 μm (114.1, 90.4-175.8), and Dd 37.6 μm (32.0, 18.8-47.7). Claws on legs IV 17.3 μm (19.2, 17.3-23.8); spur on inner claws of legs IV; collar on legs IV with 8-15 teeth irregular in width and spacing, occasionally bifurcated at tip.

Appendages Cd and Dd are similar in length on a specimen and both are wide spines. There were no appendages C in 4 specimens, and in one specimen it was only on one side. These specimens all lacked appendages B, which is a variable recognized by Ramazzotti & Maucci (1983).

This species was found at sites 5, 7, and 8. Found in samples with this species were *E. blumi*, *E. testudo*, and *Macrobotus maucii*. *Echiniscus granulatus* was found in the mosses *Grimmia longirostris* Hook., *Schistidium trichidon* (Brid.) Poelt, and *Schistidium* sp.

This species has been reported from all continents except South America, which has not been extensively studied, and Antarctica. Ramazzotti & Maucci (1983) are doubtful of the North America record, but subsequently Maucci (1987) reported the species from Wyoming although he still questions the record of Higgins

(1959). Higgin's drawings, especially because of his specimens' Cd, do not appear to be *E. granulatus*. This species has not been previously reported from China, and is a new record.

3.6. *Echiniscus testudo* (Doyère 1840)

Eleven specimens in four samples. Body lengths 157-350 μm (ave. 271). Cuticle with pores appearing white against a dark background when viewed with phase contrast. Measurements for a 323 μm specimen are followed in parentheses by the average and range: appendage A 84.2 μm (77.6, 31.4-99.2), B 167.1 μm (118.8, 67.8-167.1), C 129.4 μm (107.2, 46.5-175.8), Dd 15.4 μm (43.9, 15.4-148.2), and E 218.5 μm (193.9, 138.2-263.8). Claws on legs IV 28.2 μm (24.6, 16.8-30.2); interior claws of legs IV with spur; collar on legs IV with 5-6 teeth.

Most of the specimens were the quadrifilis form having lateral appendages A, B, C and Dd. Two specimens were the trifilis form, lacking appendages B. Two specimens had a very short spine Cd 4-5.5 μm .

This species was found at sites 2, 4, 5, 6, 8, and 9. Found in the same samples with this species were *E. canadensis*, *E. granulatus*, *Cornechiniscus holmeni*, *Milnesium asiaticum*, and *M. tardigradum*. *Echiniscus testudo* was found in the mosses *Grimmia anodon* Bruch & Schimp, *G. longirostris*, *G. tergestina*, *Lescurea incurvata* (Hedw.) E. Lawton, *Pseudoleskella catenulata* (Brid. ex Schrad.) Kindb., and *Schistidium* sp.

This species has been reported from all continents except Australia and Antarctica. This species has been previously reported from China (Rahm 1936-37b, 1937, Pilato 1974; Beasley *et al.* 2006), but this is a new region record.

3.7. *Echiniscus trisetosus* (Cuénot 1932)

Thirty-three specimens in five samples. Body lengths 157-370 μm (ave. 293). Cuticle sculpture of *E. blumi* type. Measurements for a 330 μm specimen are followed in parentheses by the average and range: appendage A 61.9 μm (55.1, 20.3-72.3), C 136.1 μm (93.7, 42.6-218.5), D 110.9 μm (77.5, 35.6-111.4), Cd 111.4 μm (99.6, 24.8-136.1), and Dd 14.4 μm (16.9, 8.4-32.2). Claws on legs IV 10.9-25.7 μm (ave. 20.9); internal claws with basal spurs, exterior claws of legs IV with two tiny spurs pointed perpendicular to the axis of the claw (not observed on all specimens); collar on legs IV with 7-8 teeth. Two individuals lacked filaments D.

This species was found at sites 2, 3, 4, and 8. Found in the same samples with this species were *E. testudo* and *Bryodelphax asiaticus*. *Echiniscus trisetosus* was found in the mosses *Abietinella abietina*, *Grimmia ovalis*, and *Pseudoleskella catenulata*.

This species has been reported from all continents except Australia and Antarctica. It has not been previously reported from China.

3.8. *Macrobiotus alekseevi* (Tumanov 2005) (Fig. 2a, c)

Five specimens in four samples. Cuticle smooth with the exception of granulation on the dorsum of the legs, color unknown. Selected morphometric values for a single specimen, followed by mean value and range (n = 4) in parentheses: body length 315 μm (335, 315-363), buccal tube length 47.5 μm (45.2, 40.6-49.5), buccal tube outside diameter 9.9 μm (9.7, 8.4-11.9), pt value for buccal tube outside diameter 20.8 (21.3, 19.5-24.0), stylet supports insertion on the buccal tube 38.1 μm (36.2, 31.7-41.6), pt for stylet supports insertion 80.2 (79.8, 77.0-84.0), first macroplacoid 6.4 μm (6.4, 5.9-7.4), pt value for first macroplacoid 13.5 (14.2, 13.5-15.0), second macroplacoid 5.5 μm (5.5, 4.5-6.4), pt value for second macroplacoid 11.6 (12.1, 10.4-13.6), third macroplacoid 7.4 μm (6.1, 4.5-7.4), pt value for third macroplacoid 15.6 (13.3, 10.4-15.6), microplacoid 4.5 μm (4.5, 4.0-5.0), pt value for microplacoid 9.5 (10.1, 8.1-12.3), primary branch of claws IV length 10.4 μm (11.0, 9.9-11.9), pt for primary branch of claws IV 21.9 (24.5, 21.9-27.6). These specimens were all smaller than Tumanov's (2005) specimens. The pt values of the buccal tube diameter are slightly higher than his and the range of pt values of the stylet support insertion is approximately the same. The range of pt values of the first two macroplacoids coincide, although the range of pt of the third macroplacoid is lower though overlapping. The range of the pt values for the microplacoid is higher than Tumanov's and the range of pt values of the primary branch of the fourth claws is slightly lower.

Although no eggs were found in these samples from Xinjiang Province, samples from Anhui Province did contain eggs (Fig. 2c) and allowed identification of these specimens to be confirmed.

This species was found at sites 1 and 7. No other species were found in the same samples. *Macrobiotus alekseevi* was found in the mosses *Brachythecium albicans* (Hedw.) Schimp and *Schistidium* sp.

This species was described from Thailand by Tumanov (2005). This is only the second report of this species, and is a new record for the country.

3.9. *Macrobiotus maucii* (Pilato 1974) (Fig. 2b, d, e)

Two specimens in two samples. Cuticle smooth, color unknown. Body lengths 283 and 602 μm . Buccal tube lengths 44.1 and 60.4 μm ; outside diameters of buccal tube 6.9 and 10.9 μm (pts 15.7 and 18.1); large apophyses present. Stylet supports inserted on buccal tube at 34.7 and 46.5 (pts 78.7 and 77.0). Three macroplacoids; the first 6.4 and 11.9 μm , the second 4.0 and 8.4 μm , the third 5.5 and 8.9 μm . Microplacoid present, 1.5 and 4.5 μm . Primary branches of claws of leg IV 11.4 and 29.7 μm .

Although no eggs were found in these samples from Xinjiang Province, samples from Jiangxi Province did contain eggs. Careful quantitative comparison with

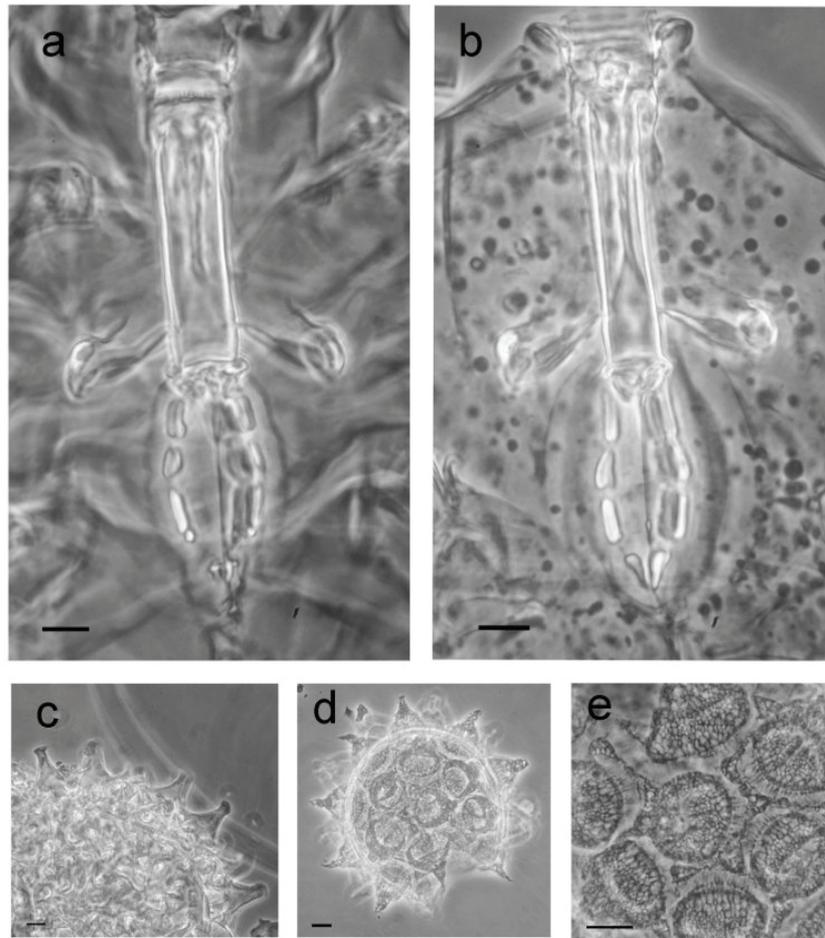


Fig. 2. **a:** Buccal apparatus of *Macrobiotus alekseevi*. **b:** Buccal apparatus of *Macrobiotus mauccii*. **c:** Egg of *M. alekseevi*. **d, e:** Egg of *M. mauccii*. Scale bars = 10 μ m.

adults from the Jiangxi sample confirmed identification of these specimens. The eggs have 8-10 projections in optical section (Fig. 2d), the tips of the projections being flexible. The projections have a ring of dots surrounding their bases, with faint lines radiating out. Between the projections there is a reticulated ridge surrounded by a relatively smooth space (Fig. 2e).

Macrobiotus alekseevi and *M. mauccii* are somewhat similar. In *M. alekseevi* the buccal tube tends to be shorter and wider, and macroplacoids shorter, but the ranges of these characters overlap in the two species. The microplacoid appears larger in *M. mauccii* in figure 2 a and b, but the size of this structure varies. But there are characters other than the eggs which appear to distinguish the two species. The buccal tube diameter has a pt value greater than 18.5 in *M. alekseevi* and less than 18.5 in *M. mauccii*. In *M. alekseevi* the first macroplacoid has a bulge on the inner surface of the posterior part and the third macroplacoid has a pre-terminal constriction (Fig. 2a). It is possible that earlier reports of *M. richtersi* from China may have been either of these species.

This species was found at site 7. This species was found in the same samples with *Echiniscus blumi* and *E. granulatus*. *Macrobiotus mauccii* was found in the moss *Schistidium* sp.

This species was described from Canton, China (Guangzhou, Guangdong Province), by Pilato (1974), later reported from South Andaman Island by Maucci & Durante Pasa (1980) and Japan by Abe & Takeda (2000, 2005). This is the second report of this species from China, and is a new region record.

3.10. *Milnesium asiaticum* (Tumanov 2006)

Ten specimens in four samples. Cuticle smooth with no sculpturing. Eyes present. Selected morphometric values for a single specimen, followed by mean value and range (n = 4) in parentheses: body length 633 μ m (624, 587-663), buccal tube length 51 μ m (41.5, 37.0-51.0), buccal tube outside diameter 20.8 μ m (17.6, 15.4-20.8), pt value for buccal tube outside diameter 38.2 (45.7, 38.2-49.9), stylet supports insertion on the buccal tube 35.5 μ m (25.7, 22.0-35.5), pt for stylet supports

insertion 69.6 (61.3, 57.2-69.6), primary branch of claws IV length 30.7 μm (28.3, 25.3-30.7), pt for primary branch of claws IV 60.2 (69.0, 55.2-79.7), claw base plus secondary branch length 20.8 μm (18.0, 15.4-20.8), pt for claw base plus secondary branch 40.8 (43.5, 39.5-48.1). Three of these four specimens were smaller than Tumanov's (2006) ten specimens, so the body part measurements are less; the range of pt values of the body parts overlaps those of Tumanov.

This species was found at sites 1, 8 and 9. This species was found together with *Echiniscus testudo* and *E. trisetosus*. *Milnesium asiaticum* was found in the mosses *G. anodon*, *G. tergestina*, *G. ovalis*, and *Schistidium* sp.

The species description was based on specimens from Kirghizia. This is the second record of the species, and is a new record for China and the region.

3.11. *Milnesium longiungue* (Tumanov 2006)

Four specimens in two samples. Dorsal cuticle smooth. Eyespots present. Selected morphometric values for a single specimen, followed by mean value and range ($n = 3$) in parentheses: body length 607 μm (563, 475-607), buccal tube length 48.5 μm (50.2, 48.5-51), buccal tube outside diameter 14.4 μm (16.2, 14.4-17.3), pt value for buccal tube outside diameter 32.3 (37.2, 32.3-41.6), stylet supports insertion on the buccal tube 30.0 μm (30.2, 30.0-30.5), pt for stylet supports insertion 61.9 (60.2, 58.8-61.9), primary branch of claws IV length 35.2 μm (35.0, 34.7-35.2), pt for primary branch of claws IV 72.6 (69.9, 68.0-72.6), claw base plus secondary branch length 19.8 μm (19.5, 18.8-19.8), pt for claw base plus secondary branch 40.8 (38.8, 36.9-40.8). Even though these specimens were small compared to Tumanov's (2006) specimens, the measurements and pt values of most characteristics are within his ranges. The claws and their pt values are smaller than those of Tumanov, although the actual sizes of the claws are only slightly smaller than his. In both cases, only small numbers of specimens were available.

This species was found at site 1. The only species found in the same samples with this species was *Echiniscus canadensis*. This species was found in the mosses *Grimmia laevigata* and *G. ovalis*.

This species was described from India, and this is the second record of this species and a new record for China and this region.

3.12. *Milnesium tardigradum* (Doyère 1840)

Five specimens in four samples. Dorsal cuticle smooth, no sculpturing. One specimen with eyes, eyes not visible in other specimens. Selected morphometric values for a single specimen, followed by mean value and range ($n = 3$) in parentheses: body length 363 μm (367, 350-388), buccal tube length 49.0 μm (43.7, 38.0-49.0), buccal tube outside diameter 12.4 μm (11.6, 10.4-12.4), pt value for buccal tube outside diameter 33.4

(31.9, 28.0-34.3), stylet supports insertion on the buccal tube 29.0 μm (25.3, 22.5-29.0), pt for stylet supports insertion 59.2 (58.0, 55.7-59.2), primary branch of claws IV length 21.3 μm (19.6, 16.3-21.3), pt for primary branch of claws IV 43.5 (44.9, 42.9-48.4), claw base plus secondary branch length 14.9 μm (12.9, 11.4-14.9), pt for claw base plus secondary branch 30.4 (29.5, 28.2-30.4). The sizes of these Chinese specimens were much smaller than Tumanov's (2006) European specimens, so all of the anatomical measurements are of lesser values also. The pt values of the main branch of the claws are within Tumanov's range, the pt of the buccal tube width overlaps his range, while the pt of the stylet support insertion and that of the base plus secondary claw branch are slightly below his range.

This species was found at sites 2 and 7. Species found in the same sample with this species were *Echiniscus canadensis* and *E. testudo*. *Milnesium tardigradum* was found in the mosses *Grimmia tergestina*, *G. ovalis*, and *Orthotrichum* sp.

This species is considered to be cosmopolitan, and has been previously reported from China (Rahm 1936-37a, 1936-37b, 1937, Beasley & Cleveland 1996, Beasley *et al.* 2006). This is a new region record.

4. DISCUSSION

Of the 270 moss specimens sampled, 78 yielded tardigrades. From these samples 12 species were identified. Some specimens have not been positively identified due to low numbers and/or condition of the specimen. A species of *Isohypsibius* close to *I. qinlingensis* is probably a new species, but more specimens are needed. New species of *Ramazzottius*, and *Cornechiniscus* have probably been found, but in each case only a single specimen was found. Three species of *Macrobotus* were recovered, but lack of eggs prevents positive identification.

Heterotardigrada are better represented in the results than the Eutardigrada, which is related to the environment of the region and the altitude at which the samples were collected. Many of the species of *Echiniscus* are considered to be xerophilic (Ramazzotti & Maucci 1983), and most of Xinjiang Region has an annual precipitation of less than 25 cm; it has been described as having "hot dry summers, very cold dry winters, low summer rainfall, high winds" (Fullard 1968). Some of the species of *Echiniscus* are considered to be montane species (Maucci 1980), and the samples containing tardigrades were collected at 1,140–4,100 m a.s.l.

5. CONCLUSIONS

This paper reports 12 species from Xinjiang Region, seven of these being new records for China.

No conclusions can be made about associations of tardigrade species with species of mosses other than that *Echiniscus testudo* was found in a wider variety of moss species than any other species of tardigrade.

Because of the relatively low number of tardigrade papers on China and the vast size of the country, it is not possible to form conclusions regarding faunal relationships of the entire country. The fauna of Xinjiang Uygur Autonomous Region does have some of the expected overlap with adjacent Kirghizia and Mongolia.

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