New records of the water mite genus *Hygrobates* Koch, 1877 from Kyrgyzstan (Acari, Hydrachnidia, Hygrobatidae), with the description of one new species

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Abstract
The present study is based on material collected in August 2013 during a collecting trip of the authors to Kyrgyzstan. *Hygrobates tienshanensis* n. sp. is described based on males collected from two springs in Tian Shian Mountains, at altitudes of 1750-2100 meters. In addition, new records of *H. kirgizicus* Sokolow, 1935 and *H. bucharicus* Sokolow, 1928 are given.

Key words: Acari, new species, running waters, taxonomy, Central Asia.

Introduction

Water mites of the genus *Hygrobates* Koch, 1877 are common in running and standing waters and have been found in all biogeographical regions except Antarctica (Gerecke et al. 2016; Pešić et al. 2017). In the Palaearctic, in addition to the nominate subgenus, the genus comprises species of *Rivobates* Thor, 1897. Most of the species of the latter subgenus have a preference for spring habitats and cold water streams, but some species, e.g., *H. zawali* Pešić, 2015, are typical lake inhabitants, found at a depth of 80 meters (Pešić 2015). Recently, several species groups of *Hygrobates* s. str. have been intensively studied, applying an integrative approach combining traditional morphology and the analysis of DNA barcodes, proving the existence of a number of previously overlooked species, and showing that traditionally defined morphospecies such as *H. fluviatilis* (Ström, 1768), *H. longipalpis* (Hermann, 1804) and *H. nigromaculatus* Lebert, 1879 (see Pešić et al. 2017, 2019a,b, 2020) in fact are representing species groups.

The present study is based on material collected by the authors during a joint collecting trip from 1-15 August 2013 to Kyrgyzstan. So far, the hygrobatid water mite fauna of this region is poorly known. It includes four recently described new species of the genus *Atractides* (*A. grigorievkae* Pešić & Smit, 2018, *A. manasi* Pešić & Smit, 2018, *A. alaarchaensis* Pešić & Smit, 2018 and *A. sonkulensis* Pešić & Smit, 2018) but no water mites of the genus *Hygrobates* (see Pešić and Smit 2018 for an overview of water mites fauna of Kyrgyzstan).
Kyrgyzstan). In this paper, the description of one new species of the subgenus Rivobates and new records of Hygrobates (s. str.) kirgizicus and H. (s. str.) bucharicus are given.

Material and Methods

Water mites were collected with a 250 µm mesh size-hand net, sorted live in the field, and preserved in Koenike’s fluid. Morphological nomenclature follows Gerecke et al. (2016). The holotype and paratypes of the new species will be deposited in Naturalis Biodiversity Center in Leiden (RMNH). In the section “Material examined” collecting, collectors of all material are Smit & Pešić, site abbreviations derive from the geographical database Pešić.

Composition of the material is given as males/females/deutonymphs. All measurements are given in µm. The following abbreviations are used: Ac-1 = first acetabulum; asl = above sea level; Cx-I = first coxae; dL = dorsal length; H = height; I-L-4-6 = fourth-sixth segments of first leg; L = length; mL = medial length; NP = National Park; P-1-P-5 = palp segment 1-5; RMNH = Naturalis Biodiversity Center, Leiden; W = width.

Systematics

Family Hygrobatidae Koch, 1842
Genus Hygrobates Koch, 1837

Subgenus Hygrobates s.s.

Hygrobates kirgizicus Sokolow, 1935
Figs. 1-2

Material examined — Kyrgyzstan: KR26 Kochkor region, rheocrenes + slow flowing stream, along road Kochkor-Balysky, 42°16.391’ N, 75°51.204’ E, 1761 m asl., 15.viii.2013 leg. Pešić & Smit, 24/21/2 (2/1/0 dissected and slide mounted).

Morphology — Both sexes: Integument finely striated; dorsal and ventrocaudal idiosoma without sclerotized muscle insertions. Posterior medial margin of Cx-I+II parabola-shaped. Cx-IV sub-triangular, with anterior and posterior margins converging towards the median line (Figs. 1A-B). Acetabula rounded, in triangular arrangement. P-2 disoventrally protruding in a short, rounded projection covered by small denticles. P-3 with denticles covering distal two thirds of ventral margin, P-4 slightly protruding near ventral setae insertions (Figs. 1F-G). IV-L-6 proximoventral seta similar in size to distoventral one (Fig. 2A), L 7-8 µm. Male: Anterior margin of genital field convex with a small knob-shaped medial projection, posterior margin indented, with a medial protrusion (Figs. 1C-D). Female: Medial margin of the genital plate indented in the centre.

Measurements. Male (n=1) — Idiosoma: L 975, W 800; coxal field: L 453; Cx-III W 575; mL of Cx-I + gnathosoma L 377; distance between lateralmost ends of Cx-II apodemes, 175; genital field L/W 225/181, ratio 1,24; LAc-1-3: 61-66, 69, 70-75. Ejaculatory complex (Fig. 3E) 163.

Palp — total L 509; dL/H, dL/H ratio: P-1, 38/47, 0.82; P-2, 144/88, 1.64; P-3, 97/73, 1.33; P-4, 167/43 [basal 42], 3.9 [4.0]; P-5, 63/23, 2.75; P-2/P-4 ratio 0.86. Chelicera total L 381, L basal segment 247, claw 140, L ratio basal segment/claw 1.8.

Legs — dL of I-L-1-6: 88, 103, 134, 200, 205, 216. dL of IV-L-1-6: 156, 159, 241, 341, 341, 312.

Female (n=1) — Idiosoma: L 950, W 750; coxal field: L 478; Cx-III W 641; mL of Cx-I + gnathosoma L 409; distance between lateralmost ends of Cx-II apodemes, 213; genital field L/W 216/291; genital plate L 184-199; gonopore L 188; L gonopore/genital plate ratio 0.95-1.02; LAc-1-3: 72-77, 75-83, 53-63.

Palp — total L 565; dL/H, dL/H ratio: P-1, 45/55, 0.82; P-2, 155/97, 1.6; P-3, 106/83, 1.28; P-4, 188/50[basal 47], 3.75 [4.0]; P-5, 71/25, 2.8; P-2/P-4 ratio 0.83. Chelicera total L 500, L basal segment 350, claw 153, L ratio basal segment/claw 2.3.

Legs — dL of I-L-1-6: 88, 116, 153, 225, 234, 234. dL of IV-L-1-6: 178, 183, 275, 375, 381, 350.
Figure 1. Photographs of *Hygrobates kirgizicus* Sokolow, 1935 (A, C-E, G – male; B, F – female): A-B – coxal and genital field; C-D – genital field; E – ejaculatory complex; F-G – palp.
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Figure 2. Hygrobates kirgizicus Sokolow, 1935, male: A – IV-L-5 and -6 (arrows indicate ventral setae, 2X); B – palp. Scale bars = 100 µm.

Remarks — Considering the morphology of palp and genital field, the specimens reported here agree with Hygrobates kirgizicus Sokolow, 1935, originally described from a tributary of the Chui River in the Ortotokey valley, Kazakhstan (Tian Shian Mountains) at altitudes of 1700-1800 m. In addition, Sokolow (1935) reported the species from a depth of 10 m in Nizhneye Mul’tinskoye Lake (Altai, 1700 m asl, Russia).

In regard to the shape of palp and idiosoma, H. kirgizicus is most similar to H. longipalpis (Hermann, 1804). For a long time, the latter had been considered a species with a Holarctic distribution, but a recent study conducted by Pešić et al. (2019) revealed within H. longipalpis the presence of two distinct lineages, with H. prosiliens Koenike, 1915, for a long time considered its junior synonym and now re-established, having a preference for standing waters, and H. longipalpis s. str. inhabiting slow flowing sectors of running waters. From both species, H. kirgizicus can be separated in Cx-IV sub-triangular in shape, with anterior and posterior margins converging towards the median line.

Distribution — Kazakhstan, Russia (Altai) (Sokolow 1935); Kyrgyzstan (this study).

Hygrobates buharicus Sokolow, 1928

Material examined — Kyrgyzstan, Side stream of Shuy River, 42°31.522’ N, 75°49.229’ E, 1511 m asl, 11.viii.2013 leg. Smit, 0/3/0.

Remarks — The specimens collected in Kyrgyzstan agree well with the description given by Pešić (2004), except for the posterior margin of Cx-I-II being rounded and not pointed.

Distribution — Uzbekhistan, Iran (Pešić 2004), Kyrgyzstan (this study).

Subgenus Rivobates Thor, 1897

Hygrobates tienshanensis sp. nov.
https://zoobank.org/urn:lsid:zoobank.org:act:7A4D922D-1FFD-4645-A0D4-54ED31DB26C7
Figs. 3-4

Material examined — Holotype male (RMNH), Kyrgyzstan, KR26 Kochkor region, along road Korchar-Balysky, rheocrenes + slow flowing stream, 42°16.391’ N, 75°51.204’ E, 1761 m asl., 15.viii.2013 dissected and slide mounted. Paratypes: 4/0/0, same place and data as the holotype (RMNH); 1/0/0,
Kyrgyzstan, spring next to road, Ala-Archa National Park, 42°34.053 N, 74°28.959 E, alt. 2118 m asl, 9.viii.2013 (RMNH).

**Diagnosis** — Posterior margin of Cx-I+II medially equally rounded; number of Ac low (5-10), anterior margin of genital field (L/W ratio 0.99) with a small knob-shaped medial projection, posterior margin with a well-developed protrusion in the centre of indentation, extending beyond posterior genital plate margin.

*Figure 3. Hygrobates tianshanensis sp. nov.*, holotype male: A – idiosoma, ventral view; B – genital field; C-D – palp; E – I-leg. Scale bars = 100 µm.
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Figure 4. Photographs of *Hygrobates tienshanesis* sp. nov., holotype male: A – idiosoma, ventral view; B – genital field; C – ejaculatory complex; D-E – palp.

**Description** — Integument finely striated; dorsal and ventrocaudal idiosoma without sclerotized muscle insertions. Coxae in three groups; posteromedial margin of Cx-I+II rounded (Figs. 3A, 4A); medial margin of Cx-IV almost straight. Genital field (Figs. 3B, 4B) rather slender, L/W ratio 0.99, with 5-10 pairs of Ac, anterior margin convex with a small knob-shaped medial projection, posterior margin with a well-developed protrusion in the centre of indentation, extending beyond posterior genital plate margin. Palp: ventral margin of P-2 proximally almost straight, distally protruding in a nose-shaped projection bearing denticles; P-3 distoventrally slightly protruding, covered by denticles; P-4 ventral margin slightly projecting near the insertion of two ventral setae, ventral setae located close together (Figs. 3C-D).
Measurements. Male (Holotype; in parentheses measurements of the paratypes) — Idiosoma: L 803 (581-911, n = 5), W 675 (472-761, n = 5); coxal field: L 397; mL of Cx-I + gnathosoma L 291; distance between lateralmost ends of Cx-II apodemes, 133; Cx-III W 503. Genital field L/W 169/171; gonopore L 85; number of Ac pairs: 6-7 (9-10 in one paratype specimen; 5-6 in juvenile paratype specimen). Ejaculatory complex (Fig. 2C) L 203.

Palp – total L 451; dL/H, dL/H ratio: P-1, 36/41, 0.88; P-2, 116/78, 1.48; P-3, 91/67, 1.35; P-4, 153/39[basal 38], 3.9 [4.1]; P-5, 55/22, 2.5; L ratio P-2/P-4, 0.76; P-3/P-4, 0.59.

Legs – dL of I-L-1-6: 66, 100, 113, 163, 172, 173. dL of IV-L-1-6: 144, 141, 197, 263, 275, 242.

Etymology — Named after the mountain range where the new species was found.

Discussion — The new species is similar to *H. diversiporus* Sokolov, 1927, *H. quanaticola* Schwoerbel & Sepasgozarian, 1976 and *H. zawali* Pešić, 2015 in the equally rounded posteromedial margin of Cx-I+II and low number of acetabula (5–10, generally <12 pairs). *Hygrobates diversiporus*, a species originally described from a first order stream in the Caucasus (Sokolow 1927) and later reported from Turkey (Erman et al. 2013) differs in the reverse heart-shaped genital field with an acute anterior angle and indented posterior margin having a broad, rounded median notch. *H. quanaticola* was originally described from a small channel which issues from a qanat near Rezayeh (= Urmia) in West Azerbaijan, Iran (Schwoerbel & Sepasgozarian, 1976). Following the original description and re-examination of the type series by Pešić (2015), the male of *H. quanaticola* can be separated from *H. tienshanensis* sp. nov. in the shape of the genital field, with straight or weakly concave posterior margin (see Fig. 2C in Pešić 2015), and minor dimensions of palp segments (L P-2 < 100, P-3 < 80, P-4 < 130 μm; data taken from the original description). *H. zawali* from Ohrid Lake, Macedonia (in parentheses measurements from Pešić 2015) differs in an ovoid male genital field (anterior margin without a medial projection, posterior margin irregularly convex), a shorter gonopore (52 μm) and the ventral setae on P-4 more distanced from each other (13–19 μm).

Figure 5. Photograph of sampling site: Kyrgyzstan, KR26 Kochkor region, rheocrenes+slowly flowing stream (*locus typicus* of *Hygrobates tienshanensis* sp. nov. and sampling site of *H. kirgizicus* Sokolow, 1935). Photo by V. Pešić.
Habitat — The collecting sites are weakly flowing rheocrenes strongly exposed to sunshine and with substrata dominated by decomposing plants and organic detritus.

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