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Torrenticolid water mites (Acari: Hydrachnidia: Torrenticolidae) from Malaysian Borneo

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Abstract

New records of water mites of the family Torrenticolidae (Acari: Hydrachnidia) from streams in two mountain ranges in northern Borneo are presented. Aims of this study were to reconstruct phylogenetic relationships of the newly collected torrenticolids using molecular methods, and describe all new species. A fragment of the mtCOI gene was successfully PCR-amplified from 18 torrenticolid specimens and 14 new species are described: *Torrenticola* (*Torrenticola*) *borneoensis* n. sp., *T. (T.) kinabaluensis* n. sp., *T. (T.) sabahensis* n. sp., *T. (T.) neoindica* n. sp., *T. (T.) schilthuizeni* n. sp., *Neoattractides* (*Allotorrenticola*) *sundaensis* n. sp., *N. (Heterattractides) uniscutatus* n. sp., *Pseudotorrenticola borneoensis* n. sp., *Monattractides* (*Monattractides*) *epiales* n. sp., *M. (M.) morpheus* n. sp., *M. (M.) phantasos* n. sp., *M. (M.) phobetor* n. sp., *M. (M.) hercules* n. sp. and *M. (M.) minuta* n. sp. Additionally, the first records for Borneo are given for *Torrenticola* (*Megapalpis*) cf. *pugionirostris* (K. Viets, 1939), *Monattractides* (*Monattractides*) *longiventris* (K. Viets, 1939), *M. (M.)* cf. *macroporus* (K. Viets, 1935) and *M. (M.) oxystomus* (K. Viets, 1935). *Monattractides tobaensis* (K. Viets, 1935) is transferred to the subgenus *Vietsclio* Pešić & Smit, 2014. A key to the species of *Monattractides* is presented.

Key words: Acari, water mites, running waters, taxonomy, new species

lowest divergences were found between *T. neoindica* n. sp. and *T. kinabaluensis* n. sp. and between *T. neoindica* n. sp. and *T. borneoensis* n. sp., respectively. The highest divergence (22 %) between *Torrenticola* species were found between *T. sabahensis* n. sp. and *T. tjiwalensis*. These high divergence values are generally indicative of distinct species. Average pairwise distances between *Monatractides longiventris* (K. Viets, 1939) and *M. morpheus* n. sp. were found to be high (21.8 %). These high divergence values suggest that these species are not closely related, what is confirmed by many morphological differences.

TABLE 7. Average pairwise maximum likelihood distances (TN model) among mtCOI sequences between each morpho-species (lower diagonal) and within morpho-species (diagonal).

	1	2	3	4	5	6	7	8
1— <i>Hygrobatas hamatus</i>	–							
2— <i>Torrenticola sabahensis</i>	0.431	0.002						
3— <i>Torrenticola neoindica</i>	0.415	0.191	0.051					
4— <i>Torrenticola kinabaluensis</i>	0.428	0.209	0.134	0.018				
5— <i>Torrenticola borneoensis</i>	0.403	0.209	0.149	0.130	–			
6— <i>Torrenticola tjiwalensis</i>	0.442	0.220	0.195	0.204	0.197	–		
7— <i>Monatractides morpheus</i>	0.455	0.251	0.245	0.238	0.241	0.251	–	
8— <i>Monatractides longiventris</i>	0.518	0.304	0.274	0.265	0.278	0.272	0.218	–

To use a threshold of genetic distance for example of 2%, has been proposed and used widely to identify samples or even to delimit species, especially in the DNA barcoding literature (e.g., Hebert *et al.* 2003, Kumar *et al.* 2007). As stated by Stålstedt *et al.* (2013), the genetic distances in the barcode region in water mites were larger than the distances among the majority of recognized, closely related species of other animal groups tested to date (see Stålstedt *et al.* 2013 for references). The differentiation in our study (4–6 %) however, is lower than in other studies on closely related species in water mites (Martin *et al.* 2010 [18–31 %], Stålstedt *et al.* 2013 [11–27 %]). Recently, Pešić *et al.* (2012b) showed that two torrenticolid species, *Torrenticola lukai* Pešić *et al.* 2011 (Montenegro) and *T. lundbladi* (K. Viets, 1930) (Spain) differed by 11.6–11.8 % in mtCOI. Both species belong to a clade with shoulder platelets fused with the dorsal plate, which include four species in our molecular analysis (*neoindica*, *kinabaluensis*, *borneoensis* and *sabahensis*).

The highest divergences within morpho-taxa were those between specimens of *Torrenticola neoindica* n. sp. (5.1 %) which came from two different sampling stations. Divergences between four specimens of *Torrenticola neoindica* n. sp. from Mahua stream were about 1.1 %. However, the single specimen examined from the first stream Minduk Sirung Trail was separated from the later specimens with a genetic distance of 11 %. The latter can be indicative of the presence of an undescribed sister species.

Divergences between three examined specimens of *T. kinabaluensis* n. sp. were about 1.8 % and three examined specimens of *T. sabahensis* n. sp. about 0.2 % (Table 7). These are all indicative of intraspecific variability.

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References

- Cook, D.R. (1967) Water mites from India. *Memoirs of the American Entomological Institute*, 9, 1–411.
 Folmer, O., Black, M., Hoeh, W., Lutz, R. & Vrijenhoek, R (1994) DNA primers for amplification of mitochondrial

- cytochrome c oxidase subunit I from diverse metazoan invertebrates. *Molecular Marine Biology and Biotechnology*, 3 (5), 294–299.
- Gerecke, R., Weigmann, G., Wohltmann, A. & Wurst, E. (2007) Order Acari – General introduction and key to major groups. In: Gerecke, R. (ed.), *Süßwasserfauna von Mitteleuropa. Vol. 7. 2–1*, Elsevier Spektrum Akademischer Verlag, München, pp. 14–57.
- Hebert, P.D.N., Cywinska, A., Ball, S.L. & deWaard, J.R. (2003) Biological identifications through DNA barcodes. *Proceedings of the Royal Society of London, Series B: Biological Sciences*, 270, 313–321.
<http://dx.doi.org/10.1098/rspb.2002.2218>
- Hebert, P.D.N., Penton, E.H., Burns, J.M., Janzen, D.H. & Hallwachs, W. (2004) Ten species in one: DNA barcoding reveals cryptic species in the neotropical skipper butterfly *Astraptus fulgerator*. *Proceedings of the National Academy of Sciences of the United States of America*, 101 (41), 14812–14817.
<http://dx.doi.org/10.1073/pnas.0406166101>
- Kumar, N.P., Rajavel, A.R., Natarajan, R. & Jambulingam, P. (2007) DNA barcodes can distinguish species of Indian mosquitoes (Diptera: Culicidae). *Journal of Medical Entomology*, 44, 1–7.
[http://dx.doi.org/10.1603/0022-2585\(2007\)44\[1:dbcdso\]2.0.co;2](http://dx.doi.org/10.1603/0022-2585(2007)44[1:dbcdso]2.0.co;2)
- Lundblad, O. (1941) Neue Wassermilben. Vorläufige Mitteilung. *Entomologisk Tidskrift*, 62, 97–121.
- Lundblad, O. (1953) Die Hydracarinafauna von Colombia. *Arkiv för zoology, Serie 2*, 5 (8), 435–585.
- Lundblad, O. (1956) Einige Wassermilben aus Java. *Bollettino del Laboratorio di Entomologia Agraria "Filippo Silvestri", Portici*, 33, 640–656.
- Lundblad, O. (1971) Weitere Beiträge zur Kenntnis der Fließwassermilben Javas. *Arkiv för zoologi, Serie 2*, 23 (5), 293–359.
- Martin, P., Dabert, M. & Dabert, J. (2010) Molecular evidence for species separation in the water mite *Hygrobatas nigromaculatus* Lebert, 1879 (Acari, Hydrachnidia): evolutionary consequences of the loss of larval parasitism. *Aquatic Science*, 72, 347–360.
<http://dx.doi.org/10.1007/s00027-010-0135-x>
- Messing, J. (1983) New M13 vectors for cloning. *Methods in Enzymology*, 101, 20–78.
[http://dx.doi.org/10.1016/0076-6879\(83\)01005-8](http://dx.doi.org/10.1016/0076-6879(83)01005-8)
- Pešić, V. & Smit, H. (2009a) Water mites of the family Torrenticolidae Piersig, 1902 (Acari: Hydrachnidia) from Thailand, Part I. The genera *Torrenticola* Piersig, 1896, *Neotractides* Lundblad, 1941 and *Pseudotorrenticola* Walter, 1906. *Zootaxa*, 1982, 38–62.
- Pešić, V. & Smit, H. (2009b) Water mites of the family Torrenticolidae Piersig, 1902 (Acari: Hydrachnidia) from Thailand, Part II. The genus *Monatractides* K. Viets. *Zootaxa*, 2012, 1–27.
- Pešić, V. & Smit, H. (2010) New records of water mites (Acari: Hydrachnidia) from Malaysia, with descriptions of three new species. *Zootaxa*, 2354, 19–34.
- Pešić, V., Chatterjee, T., Marshall, D. & Pavićević, A. (2011) New records of water mites (Acari: Hydrachnidia) from Brunei Darussalam, Borneo, with descriptions of two new species. *Zootaxa*, 3018, 50–58.
- Pešić, V. & Smit, H. (2011) Water mites of the family Torrenticolidae (Acari: Hydrachnidia) from Sulawesi, with description of one new species of the genus *Monatractides* K. Viets, 1926. *Systematic and Applied Acarology*, 16 (2), 187–191.
<http://dx.doi.org/10.11158/saa.16.2.8>
- Pešić, V., Smit, H. & Saboori, A. (2012a) Water mites delineating the Oriental and Palaearctic regions - the unique fauna of southern Iran, with descriptions of one new genus, one new subgenus and 14 new species (Acari: Hydrachnidia). *Zootaxa*, 3330, 1–67.
- Pešić, V., Valdecasas, A. & Garcia-Jimenez, R. (2012b) Simultaneous evidence for a new species of *Torrenticola* Piersig, 1896 (Acari, Hydrachnidia) from Montenegro. *Zootaxa*, 3515, 38–50
- Pešić, V., Chatterjee, T. & Marshall, D. (2013a) Marine water mites (Acari: Hydrachnidia: Pontarachnidae) from the Brunei Bay, with a description of one new species. *Cahiers de Biologie Marine*, 54 (3), 405–410.
- Pešić, V., Semenchenko, K. & Lee, W. (2013b) Torrenticolid water mites from Korea and the Russian Far East. *ZooKeys*, 299, 21–48.
<http://dx.doi.org/10.3897/zookeys.299.5272>
- Pešić, V. & Smit, H. (2014) Torrenticolid water mites (Acari: Hydrachnidia: Torrenticolidae) from Ghana. *Zootaxa*, 3820 (1), 1–80.
<http://dx.doi.org/10.11646/zootaxa.3820.1.1>
- Stålstedt, J., Bergsten, J. & Ronquist, F. (2013) "Forms" of water mites (Acari: Hydrachnidia): intraspecific variation or valid species? *Ecology and Evolution*, 3 (10), 3415–3435.
<http://dx.doi.org/10.1002/ece3.704>
- Tamura K., Nei, M. & Kumar, S. (2004) Prospects for inferring very large phylogenies by using the neighbor-joining method. *Proceedings of the National Academy of Sciences (USA)*, 101, 11030–11035.
<http://dx.doi.org/10.1073/pnas.0404206101>
- Tamura, K., Stecher, G., Peterson, D., Filipowski, A. & Kumar, S. (2013) MEGA6: Molecular Evolutionary Genetics Analysis version 6.0. *Molecular Biology and Evolution*, 30, 2725–2729.
<http://dx.doi.org/10.1093/molbev/mst197>
- Viets, K. (1925) Nachträge zur Hydracarina-Fauna von Kamerun. (Sammlungen aus Kamerun, Span. Guinea und Fernando

- Poo). *Archiv für Hydrobiologie*, 16, 197–242.
- Viets, K. (1935) Die Wassermilben von Sumatra, Java und Bali nach den Ergebnissen der Deutschen Limnologischen Sunda-Expedition. *Archiv für Hydrobiologie*, Supplement 14 (Tropische Binnengewässer), 1–113.
- Viets, K. (1939) Über Wassermilben (Hydrachnellae) aus Ost-Java. *Archiv für Hydrobiologie*, Supplement 16 (3, Tropische Binnengewässer), 8, 428–440.
- Viets, K. (1957) Neue Wassermilben (Hydrachnellae, Acari) von Borneo, Indonesia. *Abhandlungen herausgegeben vom naturwissenschaftlichen Verein zu Bremen*, 35, 8–23.
- Wiles, P.R. (1991) Rheophilic watermites (Acari: Hydrachnidia) from mainland Malaysia. *Acarologia*, 32 (1), 41–56.
- Wiles, P.R. (1996) A new family, genus and species of watermite (Acari: Hydrachnidia, Lebertioidea) from Brunei. *Quekett Journal for Microscopy*, 37, 692–695
- Wiles, P.R. (1997) Asian and Oriental Torrenticolidae Piersig, 1902 (Acari: Hydrachnidia: Lebertioidea): a revision of the family and description of new species of *Torrenticola* Piersig and *Pseudotorrenticola* Walter, from Southeast Asia. *Journal of Natural History*, 31, 191–236.
<http://dx.doi.org/10.1080/00222939700770121>
- Wiles, P.R. (1999) The water mites (Acari: Hydrachnidia) of Borneo and additional new species from Thailand and Sulawesi. *The Raffles Bulletin of Zoology*, 47, 409–439.