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A new species of the genus *Hydroporus* Clairville, 1806 from the Central Rif mountains of northern Morocco (Coleoptera: Dytiscidae)

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Abstract

Hydroporus rifensis **sp. n.** is described from Central Rif in northern Morocco. The new species is the first member of the *Hydroporus tristis*-group to be recorded from the African continent. Analyses of cytochrome oxydase 1 (CO1) and 16S rRNA partial sequences indicate unambiguously that *H. rifensis* **sp. n.** is a geographical vicariant of the widespread and common European species *Hydroporus gyllenhalii* Schiödte, 1841, whose closest Iberian populations are known from southern Spain and southern Portugal. Genetically the two species are very close, but in terms of morphology they differ considerably, to the extent that in several respects *H. rifensis* **sp. n.** is more similar to some species of the *H. striola*-group, the sister clade of the *H. tristis*-group. The new species differs from *H. gyllenhalii* notably by its larger size, lighter elytra, stronger pubescence, much finer elytral punctation, morphology of the median prosternum area, and marked differentiation of protarsal claws in male. *Hydroporus rifensis* **sp. n.** is the first dytiscid species endemic to the Rif and the second *Hydroporus* species endemic to Morocco.

Key words: Coleoptera, Dytiscidae, Hydroporini, *Hydroporus*, new species, Morocco, Rif, endemic, phylogeny

Introduction

Throughout the temperate and boreal regions of the northern hemisphere, *Hydroporus* Clairville, 1806 is one of the most species-rich genera of the family Dytiscidae (diving beetles). The total number of described *Hydroporus* species, without the new species reported here, is currently 186 (Nilsson 2014). In the western Palearctic region, the highest diversity of *Hydroporus* species is found in boreal and temperate Europe, while species number strongly decreases towards the south in the Mediterranean lowlands. Mountains of southern Europe nevertheless represent a refuge for *Hydroporus* species, which remain quite numerous for example in the orogenic complexes of the Iberian Peninsula. Further south, some *Hydroporus* species reach northern Africa, but in addition to being relatively few, they represent only a small fraction of the phylogenetic diversity of the genus at the scale of "species groups", when compared even to the southern-most European countries. Thus, the 13 species of *Hydroporus* as to now recorded from Morocco (Kocher 1958, Guignot 1959–1961, Fery & Hájek 2013, Nilsson & Hájek 2014) classify to only 5 species groups (namely the *longulus-, marginatus-, memnonius-*, *obsoletus-* and *planus*-groups, as defined by Nilsson 2014), to be compared with 29 *Hydroporus* species from 10 different groups known from continental Spain (Nilsson & Hájek 2014). Of note is that all of these Moroccan *Hydroporus* species are also present in Spain and Portugal, except the recently described *Hydroporus toubkal* Fery & Hájek, 2013, which was until now the only species of the genus endemic to Morocco (there are in addition two Moroccan endemics at the subspecific rank: *H. normandi ifranensis* Fery, 1999 and *H. n. ifnii* Fery, 1999).

In this work I describe the first species belonging to the *H. tristis*-group for Morocco (and more generally North Africa), which at the same time represents the first dytiscid species endemic to the Rif mountain chain. The new species was discovered in May 2013 during a joint botanic / aquatic beetle collecting trip to the Rif province with my friend and colleague Yann Bertrand (from the University of Gothenburg, Sweden). In about 10 days we prospected a wide variety of habitats at various altitudes in the areas of Tangiers, Moulay-Bousselham, Tetouan, Chefchaouen, Bab Taza, and Ouezzane. Specimens of the new species were found on a single occasion in a pond

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separation of the two species), or the paraphyly might simply result from insufficient phylogenetic signal in the sequences. Of note is that the available sampling of CO1 haplotypes is certainly very incomplete for both species, notably with no data on Iberian *H. gyllenhalii* populations. Once the later will be sampled, it is likely that *H. rifensis* **sp. n.** haplotypes will appear nested among *H. gyllenhalii* haplotypes, given the biogeographic scenario suggested above for the origin of *H. rifensis* **sp. n.**

Assuming a substitution rate for the CO1 sequence of 0.0162–0.0192 substitution per site per million years (Bergsten *et al.* 2012), the 0.65% observed mean distance over the 774 bp of the CO1 alignment between the *H. rifensis* **sp. n.** MM-DYT7 haplotype and the three *H. gyllenhalii* CO1 haplotypes provides an estimate for the divergence time between the two species of between 170,000 and 200,000 years. Using instead the average uncorrected distance between all three *H. rifensis* **sp. n.** vs. *H. gyllenhalii* haplotypes (1.21%) gives an estimate of 315,000–375,000 years. The Betic-Rif microplate partially detached from the eastern Iberian Peninsula and rotated clockwise between 30 and 15 million years ago, and 10 million years ago the Rif was already part of northern Africa and separated from the Betic region (south-eastern Spain) by the Alboran sea (Rosenbaum *et al.* 2002). These geological events cannot explain the speciation between *H. rifensis* **sp. n.** and *H. gyllenhalii* because these two species diverged much more recently, during the Pleistocene. This speciation therefore certainly occurred in relation to climatic fluctuations during glacial cycles, like for most Iberian endemic dytiscids (Ribera & Vogler 2004). A likely scenario would involve southwards extension of the distribution of Iberian *H. gyllenhalii* populations during a glacial period followed by later contraction after warming, with permanence of an isolate in the high altitudes of the Rif massif. The high degree of morphological divergence between *H. rifensis* **sp. n.** and *H. gyllenhalii* despite low genetic distance and recent divergence time suggests that past populations of *H. rifensis* **sp. n.** were affected by strong founder effect and/or adaptive pressures.

The finding of a dytiscid species endemic to the Rif is not surprising given that this massif represents a hot spot of endemism (Rankou *et al.* 2013), due to its exceptional geological, biogeographical and climatic singularities with respect to the rest of Morocco and North-West Africa (see above "study area", and Bennas *et al.* 2009). Previously the only species of aquatic beetle endemic to the Rif was *Hydrochus obtusicollis* Fairmaire, 1877 (Hydrochidae, Hydrophiloidea) (Bennas *et al.* 2009). There is certainly a great potential for future field prospection to uncover additional endemic diving beetle species still hidden among the rich aquatic biota of these beautiful mountains.

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