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Two new stygobiotic copepod species from the Tibesti area (Northern Chad) and a re-description of *Pilocamptus schroederi* (van Douwe, 1915)

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Abstract

Between 4th and 18th March 2014, an international group of biologists carried out a hydrobiological expedition to the Ounianga-Tibesti area of northern Chad (Africa). The Tibesti is a desert volcanic area, intersected by the beds of ancient rivers which were active in the Tertiary. In deep canyons there are small water bodies (gueltas/aguelmans), fed by rain and spring water. They are rich in zooplankton, benthos, and even fish, but their groundwater fauna has previously been unknown. Groundwater samples collected in the vicinity of one guelta contained Syncarida, Isopoda, and Copepoda. Among the latter, two new species were recognised, *Haplocyclops (H.) henrii* **sp. nov.** and *Parastenocaris joi* **sp. nov.**, together with a third species, *Pilocamptus schroederi* (van Douwe, 1915), previously known only from the littoral zone and wet mosses of Lake Victoria. The Tibesti area is thus the third known location of *P. schroederi*. All these species have a Gondwanaland distribution and are probably relicts of the Tertiary fauna, formerly widespread in the Sahara. Together with descriptions of two new species, a detailed re-description of *P. schroederi* is presented, along with remarks on their ecology.

Key words: Copepoda, Cyclopoida, desert, ground water, *Haplocyclops*, Harpacticoda, *Parastenocaris,* Sahara

Introduction

The ten Sahara countries (Algeria, Egypt, Libya, Mali, Morocco, Mauretania, Niger, Sudan, Chad and Tunisia), covering about 12.5 million km^2, are mostly covered with quartz sand or sandstone, intermixed with volcanic plateaus—the Hoggar Mountains and the Ajjer (Algeria), the Azbine (Niger), the Al Hrüj al Aswad (Libya) and the Tibesti Mountains (Chad) (Times Atlas of the World 1990; Trape 2009). Only one small area (< 0.2 million km^2) is covered by patchy limestone areas along the Mediterranean and Atlantic coasts (Juberthie & Decu 2001).

The amount of precipitation in the Sahara is small (normally less than 50 mm y^{-1}), and in some areas even lower (around 5 mm y^{-1} at Ounianga Kebir, 370 m a.s.l.; around 12 mm y^{-1} at Bardai, 1200 m a.s.l.). At higher elevations however, and especially above 2000 m a.s.l., it can be up to 100–150 mm y^{-1} (Juberthie & Decu 2001; Guo & Dumont 2014). Although low, these amounts of precipitation in some parts are sufficient to support rare surface water-bodies, called gueltas/aguelmans. These are actually lakelets, usually on the floor of deep canyons and well protected from direct sun. They are fed either by springs or directly by (fossil) groundwater. Some of these lakelets never dry up and support not only a rich community of zooplankton (Guo & Dumont 2014) and benthos (Dumont 2007, 2014), but also rich relict populations of fish (Trape 2009, 2013). The presence of permanent or long-lasting surface water bodies is normally connected with the existence of aquifers of different sizes and with different levels of salinity in sand deposits or fractured rock formations (limestone, sandstone, or even volcanic rocks).

Analyses of sediments of Lake Yoa (NE Chad) have shown that the Sahara drastically dried up relatively recently, between 5600 and 5500 years BP (Krpelin et al. 2008). Thus it is highly reasonable that a groundwater fauna exists, dating back to the Tertiary and able to survive in some local aquifers for the last five or six thousand years.

About 130 stygobionts (obligate groundwater dwellers) have so far been recorded from the Sahara, the majority of which were found in Morocco (61 taxa) and Algeria (42 taxa). They include representatives of several groups, with Isopoda (37 species), Copepoda (16 species), and Amphipoda (12 species) as the most abundant

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