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## Making future taxonomy of *Niphargus* (Crustacea: Amphipoda: Niphargidae) in the Middle East easier: DELTA database of Middle East species with description of four new species from Iran

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### Abstract

Four new species from the amphipod genus *Niphargus* are described, namely *N. borisi* **sp. nov.**, *N. bisitunicus* **sp. nov.**, *N. darvishi* **sp. nov.** and *N. sharifi* **sp. nov.** All four species of this predominantly subterranean genus were collected from springs in the Western region of Iran (Zagros region), which is the eastern borderline of the genus range. The species are morphologically diagnosed, described and illustrated. With these newly described species, the total number of *Niphargus* species in the Middle East reaches twenty-three. In order to facilitate the identification of *Niphargus* species in the region and to make future taxonomy of the genus easier, we have compiled a database in DEscription Language for TAXonomy (DELTA) using 23 diagnostic traits for these 23 species and subspecies identified in the Middle East. The database is available on the web as supplementary material whereas the dichotomous identification key automatically generated from the database for routine use is provided as a part of the paper.

**Key words:** *Niphargus*, taxonomy, subterranean environment, Iran

### Introduction

The genus *Niphargus* Schiödte, 1849 (Amphipoda: Niphargidae), with over 300 species is the largest group of freshwater amphipods in West Palearctic. It comprises an important part of subterranean biodiversity of this area (Väinölä *et al.* 2008). The members of the genus inhabit all subterranean aquatic microhabitats (Gibert *et al.* 1994; Ford & Williams 2007). Some species such as *N. valachicus* Dobreaanu & Manolache, 1933 were found even in surface waters (Sket 1981). About 20 species and subspecies were found in the eastern part of genus range, i.e., Middle East region (Fišer *et al.* 2009b; Karaman 1998, 2012a, b; Andreev & Kenderov 2012; Hekmatara *et al.* 2013; Esmaeili-Rineh & Sari 2013).

The Elburz and Zagros Mountains in Iran represent the eastern boundary of the genus distribution. These karstic areas encompass large groundwater aquifers and present a high degree of biodiversity in epigeal and hypogean environments. The first *Niphargus* species recorded from this area was *N. valachicus* (Karaman, 1998). More recently, another four new species have been described from Elburz and Zagros Mountains region; three from caves and one from spring (Hekmatara *et al.* 2013; Esmaeili-Rineh & Sari 2013).

Recent explorations showed that *Niphargus* is more common in the region than previously thought. A recent molecular analysis identified a number of populations that may belong to new, yet undescribed species (Esmaeili-Rineh *et al.* 2015). At least some of these are molecularly and morphologically distinct and can be unambiguously described and formally registered, i.e. named (Padial *et al.* 2010).

This paper has two aims. First, we contribute to characterization of amphipods and subterranean fauna of the Middle East, and formally describe four new species from karstic springs of the Zagros Mountains. Second, in