Aquatic Empididae (Diptera: Hemerodromiinae and Clinocerinae) of the Sierra Nevada, Spain, with the description of five new species

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Abstract

In total 24 species of aquatic Empididae (Clinocerinae and Hemerodromiinae) are known from the Sierra Nevada Mountains of Spain, including five new species (Hemerodromia planti Ivković & Sinclair sp. nov., Kowarzia nevadensis Sinclair & Ivković sp. nov., Wiedemannia darioi Sinclair & Ivković sp. nov., W. horvati Ivković & Sinclair sp. nov. and W. vedranae Ivković & Sinclair sp. nov.). The new species are described, illustrated and distribution of all species listed. Wiedemannia (Philolutra) angelieri Vaillant and W. (Roederella) ouedorum Vaillant are newly recorded in Sierra Nevada and nine species are endemic to this region. A key to all 24 species of aquatic empidids is presented.

Key words: Clinocerinae, Hemerodromiinae, Empididae, Diptera, new species, Sierra Nevada, Spain

Introduction

The high mountain systems of Europe (e.g., Alps, Pyrenees) have greatly influenced the evolution of species during the cyclic climatic changes (Schmitt 2009). The mountains have acted both as barriers and refugia contributing to allopatric speciation of species endemic to these ranges. The Alps have been studied most extensively and shelter the highest number of endemics (Schmitt 2009). The highest number of endemic plants in Europe and also vast numbers of endemic invertebrates are confined to the Sierra Nevada range (Gonzalez-Megias et al. 2008). Although Europe has been relatively well studied in comparison to other parts of the world, some mountain ranges, including the Sierra Nevada remain poorly known with regard to aquatic Empididae (Diptera).

The Sierra Nevada Mountains are situated in the southern region of Andalusia, Spain and have Mediterranean high mountain ecosystems that are mostly protected by a national park. This mountain range is less than 2000 km², about 100 km in length and includes more than 20 peaks higher than 3000 m a.s.l. It is the highest mountain chain in the Iberian Peninsula and the second highest in Western Europe after the Alps. Its axis is orientated in a south-west to north-east direction, and the centre of the chain forms an elongated and depressed arch, constituting a series of rounded hilltops on southern slopes, and a clear glacial geomorphology with cirques and headwalls on the northern slopes. The peripheral zones of the Sierra Nevada, although of lower altitudes, present a radically different aspect with abrupt drops, steep slopes, and deep canyons (Martín et al. 2008). Due to its combination of alpine elevation and rather low latitude (at least in comparison to other European high mountains), the Sierra Nevada range is characterized by hard snowy winters and extremely warm summers with drought periods that result in some streams and rivers drying up and disappearing. Since 1986 the Sierra Nevada has been designated a Mountain Biosphere Reserve by UNESCO (MBRs) for studying the consequences of climate change (UNESCO 2014). Thirty-four streams and rivers were surveyed for aquatic Empididae (Clinocerinae and Hemerodromiinae) in
Discussion

In total 24 species of aquatic dance flies are found on Sierra Nevada. In this research we collected 14 species, five of which are described here and *Wiedemannia (Philolutra) angelieri* and *W. (Roederella) ouedorum* are newly recorded in Sierra Nevada. Nine species (or 37% of aquatic empidid species) are endemic and currently found only in these mountains. On the data set gathered in this research and from prior sporadic research (see Ventura (2013) and above references), Sierra Nevada is possibly one of the richest regions of Europe for endemicity of aquatic dance flies. Numerous endemic species of vascular flora (Fernández-Calzado et al. 2013), terrestrial invertebrates (González-Megías et al. 2008; López-Villalta 2011), stoneflies (Tierno de Figueroa et al. 2013), and caddisflies (Sáinz-Bariain et al. 2013) are also known from this mountain range. The endemism of the Sierra Nevada is likely due to many factors, including its range in altitude and its position in the Mediterranean area, isolated from other high mountain ranges creating barriers to species dispersal and promoting allopatric speciation (Schmitt 2009).

In a recent survey of the biodiversity of aquatic families in mountainous Spanish national parks, surprisingly no Empididae were listed (Guareschi et al. 2012). The apparent absence of aquatic Empididae was likely due to the sampling protocol where localities were surveyed once using kick-nets. In contrast, the present study was based on the collection of adult specimens using sweep nets and hand collecting.

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