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Authors: Taleb, Lamia Ait, Zebsa, Rabah, and Khelifa, Rassim

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Discovery of *Pyrrhosoma cf. nymphula* (Odonata: Coenagrionidae) in Algeria

Lamia Ait Taleb[1], Rabah Zebsa[2] & Rassim Khelifa[3,4,5*]

[1] PSEMRVC Laboratory, Department of Biology, Faculty of Biological Sciences and Agronomical Sciences, Mouloud Mammeri University, Tizi-Ouzou, 15000, Algeria

[2] Laboratoire Biologie, Eau & Environnement (LBEE), Faculty of SNV-STU, University of 8 May 1945. BP. 401, 24000 Guelma, Algeria

[3] Zoology Department and Biodiversity Research Centre, University of British Columbia, Vancouver, BC Canada, V6T 1Z4; rassimkhelifa@gmail.com

[4] Institute for Resources, Environment & Sustainability, University of British Columbia, Vancouver, BC Canada, V6T 1Z4

[5] Department of Biological Sciences, Simon Fraser University, Burnaby, BC, Canada V5A1S6

* Corresponding author

Abstract. Although odonates of Algeria have been studied for more than 170 years, some habitats such as highland streams have been largely overlooked. Here, we report the first record of *Pyrrhosoma cf. nymphula* in the Kabylia region in a stream running through an oak forest at 1 200 m a.s.l., Algeria. The locality is 400 km from the nearest known population in Tunisia and 650 km from another population Morocco, suggesting a very patchy distribution at higher elevations for the species in North Africa. This new record increases the number of the Algerian odonates to 64 species. In addition, eight other species of Odonata were recorded, three of them range extensions. Further surveys of mountain streams in North Africa are needed to fully determine the distribution of rare odonates, including *P. cf. nymphula*.

Further key words. Damselfly, Zygoptera, North Africa, Meghreb, mountain, stream

Introduction

The Odonata of Algeria have been investigated for more than a century and a half since the 'Exploration Scientifique de l'Algérie' (Selys 1849). Since then a total of 63 species has been recognized in the country (Samraoui & Menaï 1999), although some species are currently regarded as doubtful (*e.g.*, *Cordulia aenea*). Recently, there have been records of several species in new localities, including species of conservation concern such as *Calopteryx exul, Urothemis edwardsii*, and *Lindenia tetraphylla* (Khelifa *et al.* 2016; Khelifa & Mellal 2017; Khelifa & Zebsa 2018; Chelli *et al.* 2019, 2020). Although many studies have been conducted in various watersheds (*e.g.*, Razkallah & Houhamdi 2018; Senouci & Bounaceur 2018; Chelli & Moulaï 2019; Chelli *et al.* 2020), mountain streams have not received much attention, despite the potential occurrence of rare specialist species (Dijkstra *et al.* 2020).

In this study, we investigate the odonate assemblages of Ait Alaoua stream in the Kabylia region, central North Algeria. This highland stream running through a dense oak forest has not only not been explored before but also represents a rarely

surveyed habitat type in odonatological surveys in Algeria. Thus, the check-list presented is an important addition to the existing odonatological knowledge of the country in particular and North Africa in general.

Guan *et al.* (2013) showed through genetic analyses that the Western Palaearctic *Pyrrhosoma* species are represented by three clades: *nymphula*, *elisabethae*, and the Middle Atlas (Moroccan), with the latter being probably the closest to the common ancestor of the three (Fig. 1). The lack of apparent morphological differences between the Moroccan populations and the European *nymphula* prevented Guan *et al* (2013) from bestowing a name on the North African *Pyrrhosoma*. Until 2014, the only North African region known to harbour *Pyrrhosoma* were the Moroccan highlands (Middle Atlas Mountains), where it was identified as *P. nymphula* and regarded as a glacial relict (Boudot *et al.* 2009). In 2014, the species was reported for the first time from Tunisia in Khroumirian streams, in the north-west of the country (Korbaa *et al.* 2014). In Algeria, despite increasing odonatological surveys over the last decade (Senouci & Bounaceur 2018; Chelli & Moulaï 2019; Demnati

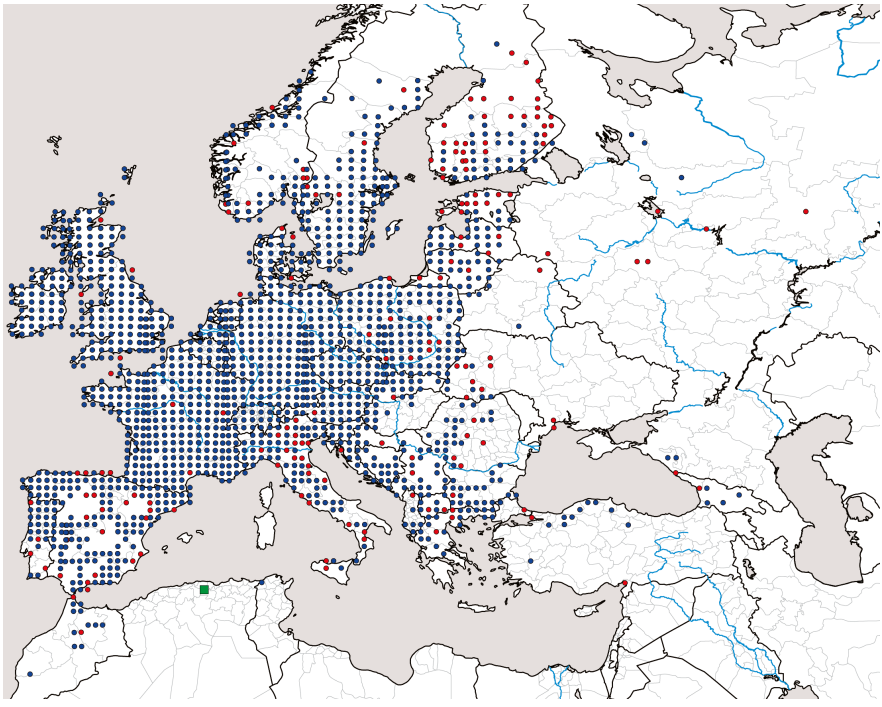

Fig. 1. Global distribution of *Pyrrhosoma nymphula*, including data recorded prior 1990 (●), from 1990 onwards (●) and the new Algerian record of *Pyrrhosoma cf. nymphula* (■). Map: Jean-Pierre Boudot

et al. 2019; Khelifa 2019), *Pyrrhosoma* has never been confirmed from any locality. Here, we refer to the Maghrebian species of *Pyrrhosoma* as *P. cf. nymphula* until its taxonomic status is clarified.

Material and methods

The study site was a stream located in Ait Alaoua at 1 207 m a.s.l., 30 km south-east of Tizi Ouzou city (36.474143°N, 4.251615°E). This locality was within the Djurjura national park which occupies 18 500 ha, encompassing dense forests of evergreen *Quercus ilex*, *Cedrus atlantica*, *Alnus glutinosa*, and *Q. suber* (Fig. 2a). The climate is typically Mediterranean with a 3–4 months dry period. Tizi Ouzou province is a relatively humid area with 900 mm annual rainfall and 20°C of annual average temperature. The stream studied was permanent, shallow, relatively fast-flowing, and bordered by bushes and trees (Fig. 2b).

A total of nine visits were conducted each month between March and November 2021. The site was visited in the morning between 10:00 and 13:00 h local time (CET; UTC+1). On each occasion, a 100 m transect along the stream was surveyed. Individuals were collected with a hand net. We retained some specimens of each species to confirm identification in the laboratory. We used the identification keys of d'Aguilar *et al.* (1998) and Dijkstra *et al.* (2020) to identify species based on adults.

Results

The study yielded a total of nine species: *Calopteryx haemorrhoidalis, Ceriagrion tenellum, Pyrrhosoma cf. nymphula*, *Aeshna cyanea, A. mixta, Boyeria irene, Onychogomphus uncatus, Sympetrum meridionale,* and *S. striolatum*.

Fig. 2. Mountain forest (a) and stream (b) studied at Ait Alaoua stream in Kabylia, Central North Algeria (23.vi.2021). Photos: LAT

Two males of *Pyrrhosoma cf. nymphula* were recorded on 23.vi.2021 (Figs 3a, b). The males were mature and perched on the bank vegetation. We did not record the species on subsequent visits. This is the only locality known for this species in the entire country (Fig. 1).

Discussion

Our survey at Ait Alaoua stream in Kabylia generated valuable information for the odonate of North Africa. *P. cf. nymphula* is new to Algeria which plugs a distribution gap between its known ranges in Tunisia and Morocco. This new record is about 400 km away from the nearest Tunisian locality reported by Korbaa *et al.* (2014) and about 650 km away from the nearest limit of the geographic range of Morocco reported by the IUCN Redlist (Kalkman 2014). This suggests that the species has a very patchy distribution in North Africa, where it seems to survive as a glacial relict. While genetic analysis revealed that the Moroccan populations of *P. cf. nymphula* are differentiated from the European populations of both *P. nymphula* and *P. elisabethae* (Guan *et al.* 2013), it would be interesting to determine whether there are any genetic differences among the isolated North African populations in Algeria, Morocco, and Tunisia, as occur in some other zygopteran species (Ferreira *et al.* 2016).

In our study, *P. cf. nymphula* was recorded at a relatively high altitude (~1 200 m a.s.l.). The recorded elevation falls within the range of elevations reported for this species in North Africa. The species was thought to be restricted to mid-high elevations in Morocco (1 000–1 500 m a.s.l.) (Jacquemin & Boudot 1999), but new studies in the north of the country revealed populations at lower elevations (El

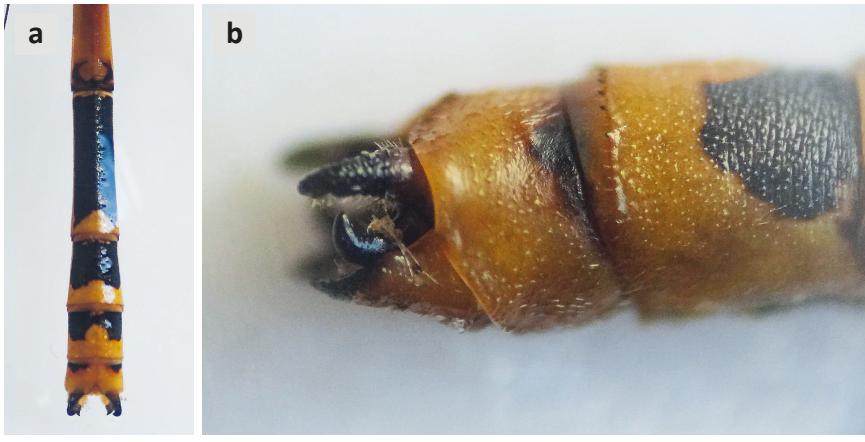

Fig. 3. Terminalia of a male *Pyrrhosoma cf. numphula* in dorsal view (a) and in lateral view (b) from Ait Alaoua stream in Kabylia, Central North Algeria. Photos: LAT

Haissoufi *et al.* 2015). Both localities that were recently reported for Tunisia were at lower altitudes (~600 m a.s.l.) (Korbaa *et al.* 2014). Furthermore, *P. cf. nymphula* was found in a relatively fast-flowing stream within a forest of evergreen oak. The lotic preference of the species is similar to that described for the Tunisian (Korbaa *et al.* 2014), and most Moroccan populations (El Haissoufi *et al.* 2015). However, the species shows a wider range of habitat in Europe with both running water and well-vegetated standing water, depending on the region (Dijkstra *et al.* 2020). In addition to *P. cf. nymphula*, the regionally rare *Aeshna cyanea*, *Onychogomphus uncatus*, and *Boyeria irene* were also recorded in this study, extending the known geographic range of these species in North Africa. We suggest that lotic mountain habitats in the Maghreb should be better surveyed and monitored to increase knowledge of rare species which may have been overlooked in the past.

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