

Rediscovery of the regionally critically endangered dragonfly *Lindenia tetrphylla* in Northeast Algeria after 170 years of apparent absence (Odonata: Gomphidae)

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Abstract. In 2018 we rediscovered the regionally critically endangered *Lindenia tetrphylla* (Vander Linden, 1825) in the El Kala National Park, Northeast Algeria, after 170 years with no record. A total of ten individuals were observed in the Ramsar listed Lac Noir along with dense populations of the regionally threatened *Urothemis edwardsii* and *Acisoma inflatum*. These findings suggest that Lac Noir, which suffered from major fire almost 30 years ago, has relatively recovered.

Further key words. Anisoptera, dragonfly, extinction, colonisation, North Africa, Maghreb

Introduction

Lindenia tetrphylla is a large gomphid which is adapted to desert and semi-desert environments, particularly in the area ranging from central Asia to Arabia, but separate populations occur patchily in the Mediterranean basin (KALKMAN & BOGDANOVIC 2015; VILENICA et al. 2016). The species inhabits various habitat types such as permanent lakes and rivers with dense riparian vegetation. Although it is listed as Least Concern by the IUCN in the global Red List (BOUDOT et al. 2013), it is listed Near Threatened in the Mediterranean (RISERVATO et al. 2009), and Critically Endangered in North Africa (SAMRAOUI et al. 2008). In Algeria, the species was first reported from 'La Calle' (i.e. El Kala) by SELYS (1849), but has not been recorded there since. Here we report the rediscovery of the species in the area after 170 years at Lac Noir, and provide information on the Odonata fauna of the site.

Study area and methods

Lac Noir is a 2 ha perched dune lake located in the dune hills of Boutelja, El Kala, Northeast Algeria (36.8547°N, 8.2068°E). It consists of two permanent basins (upper and lower) linked by a stream. The local climate is characterized by a mild winter and an annual rainfall of 880 mm. The water is acidic with a pH varying between 4.2 and 5. The plant community surrounding the lake and living in the water have witnessed extensive degradation due to anthropogenic factors over the last 50 years (DE BELAIR & SAMRAOUI 1994).

To assess the odonatofauna of Lac Noir, two visits were conducted in June 2018. At least two hours were spent at the lake during which the banks and peripheral areas of the wetland were thoroughly searched for adult odonates.

Results

A total of 16 Odonata species were recorded at the site, including 13 anisopterans (*Lindenia tetraphylla*, *Paragomphus genei*, *Anax imperator*, *A. parthenope*, *Aeshna affinis*, *Orthetrum cancellatum*, *O. trinacria*, *O. chrysostigma*, *Crocothemis erythraea*, *Trithemis annulata*, *Urothemis edwardsii*, *Acisoma inflatum*, and *Brachythemis impartita*) and 3 zygopterans (*Ischnura graellsii*, *Enallagma viridulum*, and *Lestes virens*). Of these species, two (*L. tetraphylla* and *U. edwardsii*) are listed as regionally Critically Endangered, one (*A. inflatum*) as Endangered (*sub A. panorpoides*), and the others as Least Concern in the IUCN red list of North African odonates (SAMRAOUI et al. 2008).

On 20-vi-2018, we recorded the first adult male of *L. tetraphylla* in Lac Noir in the western side of the lower basin (Fig. 1). The following day, an estimation of the number of adults throughout the entire wetland was carried out. A total of eight males were recorded, perched mostly 3–5 m away from the water. Two males showed territorial behaviour in the bank vegetation of the lake. The species interacted with *Paragomphus genei*, *Anax parthenope*, *Orthetrum cancellatum*, *Crocothemis erythraea*, and *Trithemis annulata*.



Fig. 1. *Lindenia tetraphylla* in Lac Noir. Boutelja, El Kala, Algeria (21-vi-2018). Photo: RK

Discussion

Although *U. edwardsii* and *A. inflatum* were reported extinct in the early 1990s, we found them flourishing, with reproductive activity including copulation and egg laying repeatedly recorded in 2015 and 2016 (KHELIFA et al. 2016). The total richness of the site is probably higher given that we surveyed only during summer, which excluded the winter damselfly *Sympecma fusca* and the autumnal reproductive species *Aeshna mixta*, *Sympetrum striolatum*, *S. meridionale*, *Lestes barbarus*, and *Chalcolestes viridis*.

Lac Noir was surveyed continuously between 2011 and 2018, and thus we are quite confident that this small population has only recently colonized the site (2017–2018). This is the only record involving several individuals in Algeria which suggests the presence or potential future establishment of a small population. It also represents the third record of the species in the history of Algerian odonatology. In fact, a recent observation (2013–2014), based on a single exuvia, was found in Oued Saoura in western Algeria, but further investigations are needed to confirm the presence of a population.

During the study period, *L. tetraphylla* was recorded only at Lac Noir despite visits to all major wetlands of the National Park of El Kala, namely Lac Oubeira, Lac El Mellah, Lac des Oiseaux, Lac Tonga, El Graeate, and other ponds (KHELIFA et al. 2016; KHELIFA et al. 2018). This record adds a new point in the patchy distribution of the species which extends from central Asia to the Mediterranean (cf. KALKMAN & BOGDANOVIC 2015). Considering numerous recent records, it is likely that the species is expanding its range (LOPAU 2010; DE KNIJF et al. 2013; BOUDOT 2014; WILDERMUTH & MARTENS 2014), due either to climate change, increasing field research and/or more likely, the increased creation of artificial lakes (BROCHARD & VAN DER PLOEG 2013; HAMZAOUI et al. 2015). In the literature, the species has been commonly recorded in slow-flowing rivers and lakes, which corresponds with the Lac Noir record (BOUDOT et al. 2013).

So what is the origin of the individuals of *L. tetraphylla* that colonized Lac Noir? The nearest probable population occurs in central Tunisia (KUNZ & KUNZ 2001) approximately 185 km away. This is a rather small population. The next important populations are in Sardinia where the species is well established, 230–500 km north of Lac Noir (cf. KALKMAN & BOGDANOVIC 2015). As the species is known to be a strong migrant able to cross a long distance to colonize new remote sites, including islands (BROCHARD & VAN DER PLOEG 2013; KALKMAN & BOGDANOVIC 2015) this may well be the source of the Lac Noir population.

Lac Noir experienced a catastrophic fire nearly three decades ago. It has been shown that fire leads to alteration of the hydrology, physicochemical parameters and biota of wetlands (KOTZE 2013). Some changes may be temporary while others permanent. In the case of Lac Noir, there are a few reasons to think that the site has recovered to some extent. Firstly, the successful re-colonization of *A. inflatum*

and *U. edwardsii* (KHELIFA et al. 2016) which went extinct after the fire means that their ecological requirements, loss of which at first prevented them from re-establishing at the site, are currently fulfilled. Although the odonate fauna might have fully recovered after 25 years, other less vagile taxa may take longer to re-colonize the site. Moreover, anthropic activities including water pumping and intense grazing by cattle have been commonly observed despite the protected status of the lake. Such practices should immediately be stopped to avoid another, possibly irreversible, ecological catastrophe.

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