Update to the status of *Lindenia tetraphylla* (Vander Linden, 1825) (Odonata Gomphidae) in Italy, with special reference to the Molise region

Andrea Corso^{1*}, Ottavio Janni², Lorenzo De Lisio³ & Carlo Fracasso⁴

¹Via Camastra 10, 96100 Siracusa, Italy; e-mail: zoologywp@gmail.com

²Via G.G. D'Amore 21, 81016 Piedimonte Matese, Caserta, Italy; email: coeligena@hotmail.com

³Piazza V. Cuoco 2, 86100 Campobasso, Italy; e-mail: lorenzodelisio@gmail.com

⁴Via di Sopra 19, 86018 Toro, Campobasso, Italy

*Corresponding author

ABSTRACT

Data concerning a new reproductive population of *Lindenia tetraphylla* (Vander Linden, 1825) (Odonata Gomphidae), found by the authors in Molise, Central Italy, between 2012 and 2018, are here reported. The species was recorded in some artificial farm ponds of the inland agricultural area, where localized but conspicuous reproductive populations are annually found. A single sighting from 2017 is also reported from the Abruzzo region, where the species has never been recorded before. The data here discussed update the status for Italy and enlarge the known distribution area. All the sites where the species is found in Molise are listed and mapped, brief data concerning habitat used are also reported.

KEY WORDS

Lindenia tetraphylla; Molise region; status update Italy; small farm ponds.

Received 20.01.2019; accepted 25.02.2019; published online 28.02.2019

INTRODUCTION

Lindenia tetraphylla (Vander Linden, 1825), synonym *Lindenia inkiti* Bartenef, 1929 (Odonata Gomphidae), is an Irano-Turanian species, its main range spreading over the Eremian region, going from Central Asia to Arabia (Dumont, 1991; Giles, 1998; Schröter, 2010a; Waterston, 1984; Waterston & Pittaway, 1991; Skvortsov & Snegovaya, 2014). It is distributed also from Western Pakistan to the Caucasus region, the Levant and Turkey (mostly southern Anatolia) to the Western Mediterranean (Schneider, 1981, 1988; Schneider & Dumont, 1997, 2015; Schorr et al., 1998; Kalkman, 2006; Kalkman & Van Pelt, 2006; Borisov & Haritonov, 2008; Boudot et al., 2009; Schröter 2010a, 2010b; Boudot & Kalkman, 2015). It was

recently found in Bulgaria (Gastaron & Beshkov, 2010), where it is expanding its distribution (Kolev & Boudot, 2018), and Crete (Boudot et al., 2009; Boudot, 2014; Stille et al., 2014; Boudot & Kalkman, 2015) and is now considered resident in the western Balkans and Greece (Boudot & Kalkman, 2015; Lopau, 2010; Vilenica et al., 2016). It is a very mobile nomadic species (Fraser 1936; Schneider 1981). Adults are known to migrate over long distances from their reproductive locality (Boudot & Kalkman, 2015). Many out of range records may be referred to vagrant specimens, but some isolated localities were proved to be inhabited for several consecutive years, demonstrating at least a temporary reproduction far from its core range (Boudot & Kalkman, 2015). For example, the species has been recorded occasionally in the

Maghreb: in particular, it was considered reproductive in Tunisia in summer 2000 and 2002 (Kunz & Kunz, 2001; Boudot & Kalkman, 2015), while in Algeria, where it was considered previously extinct (Samraoui & Menai, 1999; Samraoui & Corbet, 2000; Boudot et al., 2009; Boudot & Kalkman, 2015), it was rediscovered in 2014 with evidence of reproduction in one site (Hamzaoui et al., 2015). As there is no continuous monitoring for these North African countries, its present status is unknown. In Europe, this species occurs in the Mediterranean basin, where it is very localized (Kalkman et al., 2010; Boudot & Kalkman, 2015).

The species is in fact listed as vulnerable in Annexes II and IV of the Habitats Directive (Kalkman et al., 2010). The type specimen is from Campania, Southern Italy, where no confirmed records were obtained in recent time. Elsewhere in Italy, the species was reported in the past during the mid 1800 to early 1900 (Sélys-Longchamps, 1843; Bentivoglio, 1910a,b, 1913), until recently (Utzeri, 2006; Riservato et al., 2014). In this note, we report data about a recently discovered Italian population, considered wealthy and rather relevant for the status of the species in Italy and Europe as well. After the first random discovery in 2012, when one male was photographed in Molise region (Central Italy), we yearly collected numerical and distributional data. In 2017, we observed a single specimen in Abruzzo region. The results are here briefly summarised.

MATERIAL AND METHODS

From 2012 to 2018, we have mapped all the suitable sites, therefore having the right environmental characteristics, in the Molise region (Figs. 1, 2). These sites consist of small-medium sized agricultural irrigation basins (Fig. 2). For each site considered, we annually performed at least two visits between June and August. Environmental characteristics, extension and GPS coordinates of all the sites where the species was found were noted. The coordinates were recorded using the UTM WGS84 33N reference system. Cartographic processing was done using QGIS 2.14 Essen. At each visit, the number of observed specimens, sex and age was noted when possible. Many of these specimens were captured with entomological nets for photo-

graphic documentation but, given the rarity of the species, they were all subsequently released (Figs. 3–6). The specimen observed in Abruzzo was detected during a study on the dragonflies of the Majella National Park, conducted in 2017 (Corso & Biscaccianti, *ined.*).

ABBREVIATIONS. AC: Andrea Corso; CF: Carlo Fracasso; ex/exx: specimen/specimens; max: maximum count; min: minimum count.

RESULTS

All the sites where the species has been found in Molise are shown in figure 2 and listed in Table 1. The first report for Molise refers to 1 mature male photographed on 16.VI.2012 by CF and determined by AC, in the site called Montorio nei Frentani (CB) (498129, 4625799) (Table 1). A few days later, on 29.VI.2012, at the same site, we observed up to a maximum of 20–25 exx (16 males, 4 females) (Figs. 3–6). On 30.VI.12 on the site called Laghetto Iacoluto, Salcito (CB), 4 males and 1 female were observed (Table 1). Between 2013 and 2018, the observation sites rose to six, for a total of 205 exx observed (min–max: 13–57 exx), mostly males, with an average of 29.3 exx per year and 34.2 per site (Table 1). The most relevant site was always the first one we discovered, with 148 exx in total observed in the seven years of study and a range of 8–50 exx. (average of 21.2 exx/year) (Table 1). Here in 2016 and 2017 at least 20 exuviae have been found along the muddy banks of the irrigated artificial basin (AC). For Abruzzo, we obtained a single observation, referred to 1 male observed on 18.VII.2017 in the Piana del Sagittario, between Sulmona and Pratola Peligna (L'Aquila) (4264695, 13522446) (AC & A. Pulvirenti, *ined.*). It is not clear, in the current state of knowledge, whether it was simply an erratic exemplar or if there is a small reproductive nucleus in the area that has so far escaped research.

Habitat characterized by arable crops with prevalence of cereal crops attributable to the land use category “arable land in non-irrigated areas” (CLC 211), within which there are artificial water basins created for irrigation purposes with an average size of about 150 square meters. In only one case (Sant'Angelo Limosano, Laghetto Cascapere) the lake is of natural origin. The distance from the

sea is on average 20 km (min–max: 2.4–43.9 km). In all cases, there is a dense vegetation along the banks, mainly *Phragmites* sp. and *Typha latifolia* (L.). The immediate vicinity is invariably wide cultivated fields with low and dense vegetation, flat or hilly, always very rich in numerous species of Or-

thoptera, one of the main prey of the species. The observation site of Abruzzo is a fluvial plain (Fiume Sagittario) with dense arboreal coverage, with numerous temporary flooded fields but with the presence of permanent scattered swampy areas with rich typhus and reed beds.

Figure 1. Typical habitat where *Lindenia tetraphylla* was found in Molise region, Central Italy.

Figure 2. *Lindenia tetraphylla* in Molise region, Central Italy: in green are indicated the two provinces .

3

4

5

6

Figure 3. The first captured specimen of *Lindenia tetraphylla* from Molise region, Central Italy, 29.VI.2012 (photo A. Corso). Figures 4–6. Males of *L. tetraphylla* from Molise region, Central Italy (various date from 2013 to 2017) (photos C. Fracasso).

DISCUSSION

Stable reproductive populations for Tuscany and Sardinia, referred to about 10 different areas, have been reported and were considered the only in Italy. For the other known areas to date (about 15 additional sites), only anecdotal observations are available, like for Campania, Umbria, Puglia (Galletti, 1978; Terzani, 2002; Utzeri et al., 2006; Hardersen & Leo, 2011; Riservato et al., 2014). Even though there have been no confirmed recent observations for Campania and Lazio (Riservato et al., 2014; Janni & Corso, ined.), in 2017 a new reproduction site was reported for Sicily (Surdo, 2017).

For Abruzzo, no previous records were known (Riservato et al., 2014). Therefore, our observation is currently the first for the region. Here, more careful and extensive future studies will have to clarify its status and real distribution. The sites considered to be of major national importance were all located in Tuscany, for example those of Lago Accesa and Lago della Rancia, with observations referable to a maximum of 20–30 exx, and secondarily in Sar-

dinia (Utzeri, 2006; Hardersen & Leo, 2011). From what is available in the literature, the Molise population we discovered in 2012 should today be the most consistent in Italy, and at the current state of knowledge probably among the most relevant in Central and Western Europe (Boudot & Kalkman, 2015; Vilenica et al., 2016).

CONCLUSIONS

The species seems to be expanding its range: the increasing number of observation / reproduction stations discovered in Sardinia, Tuscany and Umbria, as well as from the new area in Sicily, in fact seem to indicate a positive trend (Hardersen & Leo, 2011; Surdo, 2017). However, we do not know if these data reflect a real colonization of new areas, or more simply a greater coverage of the territory and a greater effort in odonatological research, which actually happened in the last decade in Italy. It is probable that the colonization of Molise took place through the arrival of erratic individuals of Balkan origin rather than from Tuscany, even if it

SITO	UTM WGS 84 33N		Lat. Long.	2012	2013	2014	2015	2016	2017	2018
	X	Y								
<i>Montorio nei Frentani</i>	498129	4625799	41°47'0.80"N 14°58'38.25"E	5 exx (16.VI) 16♂♂, 4♀♀ (some mating pairs) (29.VI)	10 exx (16.VI) ≥15 exx (some mating pairs) (07.VII)	8 exx (22.VI) ≥5 exx (28.VII)	≥2♂♂ (21.VI) 15+ exx (some mating pairs) (12.VII)	≥10 exx (27.VI) 4 exx (14.VII)	>50 exx (14.VI) ≥4 exx (02.VII)	40 exx (16.VI) 12 exx (20.VII)
<i>Salcito (Laghetto Iacolutto)</i>	460786	4619256	41°43'27.25"N 14°31'42.64"E	4♂♂ 1♀ (30.VI)	X	X	X	1♂ (06.VII)	1♂ (05.VII)	2♂♂ (07.VII)
<i>Sant'Angelo Limosano (Laghetto Cascapere)</i>	469518	4617742	41°42'38.27"N 14°38'1.16"E	1♀ (30.VI)	X	X	0	0	0	0
<i>Petacciato 1</i>	485211	4652180	42° 1'18.09"N 14°49'16.35"E	/	/	/	/	>30 exx (27.VI) (several mating pairs) ≥2 exx (14.VII) ≥3 exx (17.VII)	≥2 exx (05.VII)	15 exx (15.VI)
<i>Petacciato 2</i>	484967	4652670	42° 1'33.19"N 14°49'5.44"E	/	/	/	/	≥ 1 ex (14.VII) 2 exx (17.VII)	0	1♂ (19.VII)
<i>Ururi</i>	504726	4627485	41°47'57.40"N 15° 3'25.30"E	/	/	/	/	/	≥ 2 exx (5.VII)	0

Table 1. Number of *Lindenia tetraphylla* observed per site in Molise region, central Italy, from 2012 to 2017. Site name and GPS coordinates are reported (both UTM WGS 84 33N X,Y that Latitude and Longitude), number of specimens (exx) per year (sex reported when noticed). The symbol X indicate that the site was not visited / site not known before (data lacking), 0 that no specimens were recorded. In brackets, date of observations and notes (as in mating pairs recorded).

is not possible to establish with certainty the origin of the colonizers. Further future researches are necessary in order to extend the knowledge related to its distribution in Molise, Abruzzo, Umbria and Sicily, as well as on the actual presence or not in Lazio and Campania, in order to collect more extensive data on the actual consistency of the populations present in Italy. In addition, targeted research should also be carried out in Puglia, where the species is likely to be found but it is yet to be discovered, while in Sicily a larger portion of territory should be monitored.

ACKNOWLEDGEMENTS

We wish to thank Prof. Carlo Utzeri (Roma, Italy) for his help with references and useful suggestion. Verena Penna (Roma, Italy), Andrea Pulvirenti (Roma, Italy), Roberto Casalini (Roma, Italy), Mario Cappelli (Roma, Italy), Alessandro Biscaccianti (Roma, Italy) are thanked for their help in the field. The Majella National Park Authority (Abruzzo) and in particular Dr. Pino Marcantonio (Sulmona, Italy), is sincerely thanked for the funds for the research in their park as part of studies to monitor and protect dragonflies species in the Habitats Directive. The Leica Sport Optics is thanked (in particular Dr. Francesco Corrà and Nanette Roland) for providing the optical instruments used by A. Corso during this study.

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