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New records of four Odonata species of Community interest in central and southern Italy, with conservation notes

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Abstract
This paper provides new data on the following four species of dragonflies and damselflies (Odonata Coenagrionidae, Gomphidae, Synthemistidae, Cordulegastridae), which contribute to updating their known distribution in central-southern Italy: *Coenagrion castellani* Roberts 1948, *Lindenia tetraphylla* (Vander Linden 1825), *Oxygastra curtisii* (Dale, 1834) and *Cordulegaster trinacriae* Waterston, 1976. These species are all included in Annexes II and IV of the Habitat Directive 92/43/EC. New sites of *C. castellani* and *C. trinacriae* were discovered in the Latium, Campania, Abruzzo and Molise regions, while the presence of *O. curtisii* was observed in Molise and southern Latium, after a 70-year absence of records. *Lindenia tetraphylla* was observed at two new sites in southern Apulia. The presence of populations morphologically attributable to *C. trinacriae* was confirmed in southern Latium, reaching at least the Liri river (FR). Some bibliographic sites of *C. castellani*, *C. trinacriae* and *L. tetraphylla* were also confirmed. All the sites were listed and mapped, accompanied by brief data on habitat types and on their inclusion within Natura 2000 network sites. Information on persistent threats to these sites is provided, along with conservation notes.

Key words: *Coenagrion castellani*, *Oxygastra curtisii*, *Cordulegaster trinacriae*, *Lindenia tetraphylla*, distribution, Odonata.

Introduction

Odonates (Insecta: Odonata) are an ancient group of insects with an aquatic larval stage and terrestrial adults. They are one of the most well-known and studied groups of insects, due to their bright colours, large size and visibility. Even though some recent papers investigated the distribution of some species of conservation concern in central-southern Italy (Corso et al. 2019a, b, 2020), knowledge about the Odonates in these regions remains fragmentary, especially when considering the species of Community interest. Eleven species of Odonata are listed in Annex II of the EU Habitat Directive, and five of them are reported in peninsular Italy: *Coenagrion ornatum*, *Coenagrion mercuriale* (the Italian populations belong to the species *C. castellani*) (Dijkstra et al. 2023), *Cordulegaster trinacriae*, *Oxygastra curtisii* and *Lindenia tetraphylla* (Riservato et al. 2014).

Studying species distribution is crucial for identifying areas of high conservation value and prioritizing actions such as habitat and connectivity restoration to enhance landscape-scale conservation (Beale et al. 2013). This information guides land use decisions and is fundamental for effective conservation efforts for the following reasons. First, targeted conservation strategies benefit from knowing species' distributions, allowing conservationists to focus efforts on regions with high species richness or concentrations of endangered species (Politi et al. 2021). Second, it aids in habitat protection and restoration by identifying critical habitat types needing preservation (Venter et al. 2014). Third, it helps to predict and mitigate threats to biodiversity by mapping areas vulnerable to habitat destruction, climate change, or invasive species, enabling proactive measures (Tulloch et al. 2015; Ridley et al. 2024). Fourth, knowledge of species distribution serves as a baseline for monitoring changes in biodiversity, in species distributions, population sizes, and habitat quality over time, and for assessing the effectiveness of conservation interventions'. Finally, it is important to recognize the complexity of species distribution, which is also related to species-specific ecological traits (e.g. Gaston 2003; Holt &

Dawson 2003; Lomolino et al. 2006). For instance, some species are often present in small and isolated populations within a vast distributional area, and discovering, as far as possible, all the populations still present in fragmented landscapes, is important in guiding efforts to protect suitable habitats or facilitate species' movements to new areas (Shoo et al. 2006; Rubenstein et al. 2023; Carvalho et al. 2011). Additionally, local conditions are of vital importance for some species, so it is important to incorporate the concept of the "favourable conservation status" of local populations, as defined by the Habitats Directive, enhancing comprehensive conservation planning. This status reflects the ecological conditions under which species and their habitats thrive, guiding conservation efforts to ensure that local populations remain viable and sustainable.

The aim of this work is to provide pertinent presence data in new locations for *Coenagrion castellani, Cordulegaster trinacriae* and *Oxygastra curtisii* in the Latium, Campania and Molise regions and for *Lindenia tetraphylla* in the Apulia region, thereby enhancing the cognitive framework of their distribution. Furthermore, during the surveys, we identified threats to the habitats of certain sites that could jeopardize the persistence of existing dragonfly and damselfly populations. Consequently, we have also formulated conservation recommendations for these sites.

Material and Methods

Study species

The Italian endemic *Coenagrion castellani* Roberts, 1948, recently recognised as a full species, distinct from *Coenagrion mercuriale* (Charpentier 1840), based on both morphological and molecular differences (e.g. Dijkstra et al. 2023; La Porta et al. 2023), mostly inhabits streams, springs and rivulets with slow running waters, soft beds and usually rich vegetation growing on the banks (Riservato et al. 2014). It is listed as Near Threatened in the IUCN Red List and included in Annex II of Council Directive 92/43/EEC (as *C. mercuriale*; Boudot et al. 2009; Fabbri et al. 2014a). *Coenagrion castellani* is distributed in Piedmont, Emilia-Romagna, Liguria, and across central and southern Italy, except Sardinia (Riservato et al. 2014; Dijkstra et al. 2023). In Latium, historical records are concentrated in the province of Latina, including the Pontine plain (Castellani 1936; Conci 1949; Nardi 1993; Stella 1955), Terracina (Castellani 1951), Fondi, and Formia (Consiglio 1953). Recent findings extend its range to new sites in the Frosinone, Rome, Rieti, and Viterbo provinces (Domeneghetti et al. 2017; Sarrocco et al. 2018). However, several areas of the region still appear to be poorly investigated, especially in the south.

The Italian Goldenring, *Cordulegaster trinacriae* Waterson, 1976, endemic to southern-central Italy from Sicily to the Latium and Abruzzo regions (Dijkstra & Schröter 2021; Riservato et al. 2014), is classified as "Near Threatened" in both the European and Italian Red Lists (Kalkman et al. 2010; Fabbri et al. 2014b). The species inhabits tree-covered streams with rapid currents and sandy/gravelly substrate (Riservato et al. 2014). Recent updates by Corso et al. (2020) identified stronghold populations in Abruzzo, but its northern range limit is uncertain due to hybridization with *C. boltoni* in the Marche and Latium regions in central Italy (Corso et al. 2020; Solano et al. 2018). Individuals morphologically attributable to pure *C. trinacriae* have only been confirmed in Latium for the province of Frosinone, including the Volsci Mountains (Avellinese & Utzeri 2012; Corso et al. 2020). In Campania and Molise, its presence is well-documented (D'Antonio 1994, 1995; Terzani 2004; Corso et al. 2020).

The Orange-spotted Emerald, *Oxygastra curtisii* (Dale, 1834), is primarily distributed in Western Europe (Portugal, Spain, France, Belgium), Morocco, and Italy, where it reaches its eastern range limit (Dijkstra & Schröter 2021). It inhabits rivers with slow flowing waters and riparian arboreal vegetation, particularly *Alnus glutinosa* (Ott et al. 2007). In Italy, it is more common in the northwest, with scattered sightings in the central and southern regions (Riservato et al. 2014). Recent sightings include Abruzzo and Molise (Corso et al. 2019b), and in Latium's northern provinces of Rome and Viterbo, with only one historic sighting on the Garigliano river shore (Castellani 1951; Riservato et al. 2014).

The Bladetail, *Lindenia tetraphylla* (Vander Linden, 1825), is an Irano-Turanian species ranging from Central Asia to Arabia (Boudot & Kalkman 2015; Kolev & Boudot 2018). Its distribution extends from Western Pakistan to the Caucasus, the Levant, Turkey, and sporadically into Europe, notably in the Balkan Peninsula (Kolev & Boudot 2018; Dijkstra & Schröter 2021). Highly mobile, adults are known to travel long distances from their breeding grounds (Boudot & Kalkman 2015). Preferring medium to large lakes with open surroundings, it often inhabits areas with *Phragmites australis* and *Typha* sp. (Kalkman 2021). In Italy, stable populations were originally found in Tuscany, Umbria, and Sardinia (Riservato et al. 2014), with more recent sightings near Trapani in Sicily, in Apulia, Abruzzo, and Molise (Mastropasqua 2015; Surdo 2017; Corso et al. 2019a). Formerly reported in Campania at the Averno Lake, it is now sporadic (D'Antonio 1987, 1995). In the Latium region, after the first record at Fondi Lake (LT) (Consiglio 1953), the only recent sightings have been in the northern Viterbo province (Crescia et al. 2020).

Data collection

The study area includes the southern portion of the Latium region, the upper valley of the Volturno and Sangro rivers (part of Abruzzo, Molise and Campania), the Cilento massif (southern Campania) and the provinces of Lecce and Brindisi (southern Apulia). Field samplings were conducted during 2020-2024, between April and July for *C. castellani*, and between early June and early August for *O. curtisii*, *C. trinacriae* and *L. tetraphylla*,

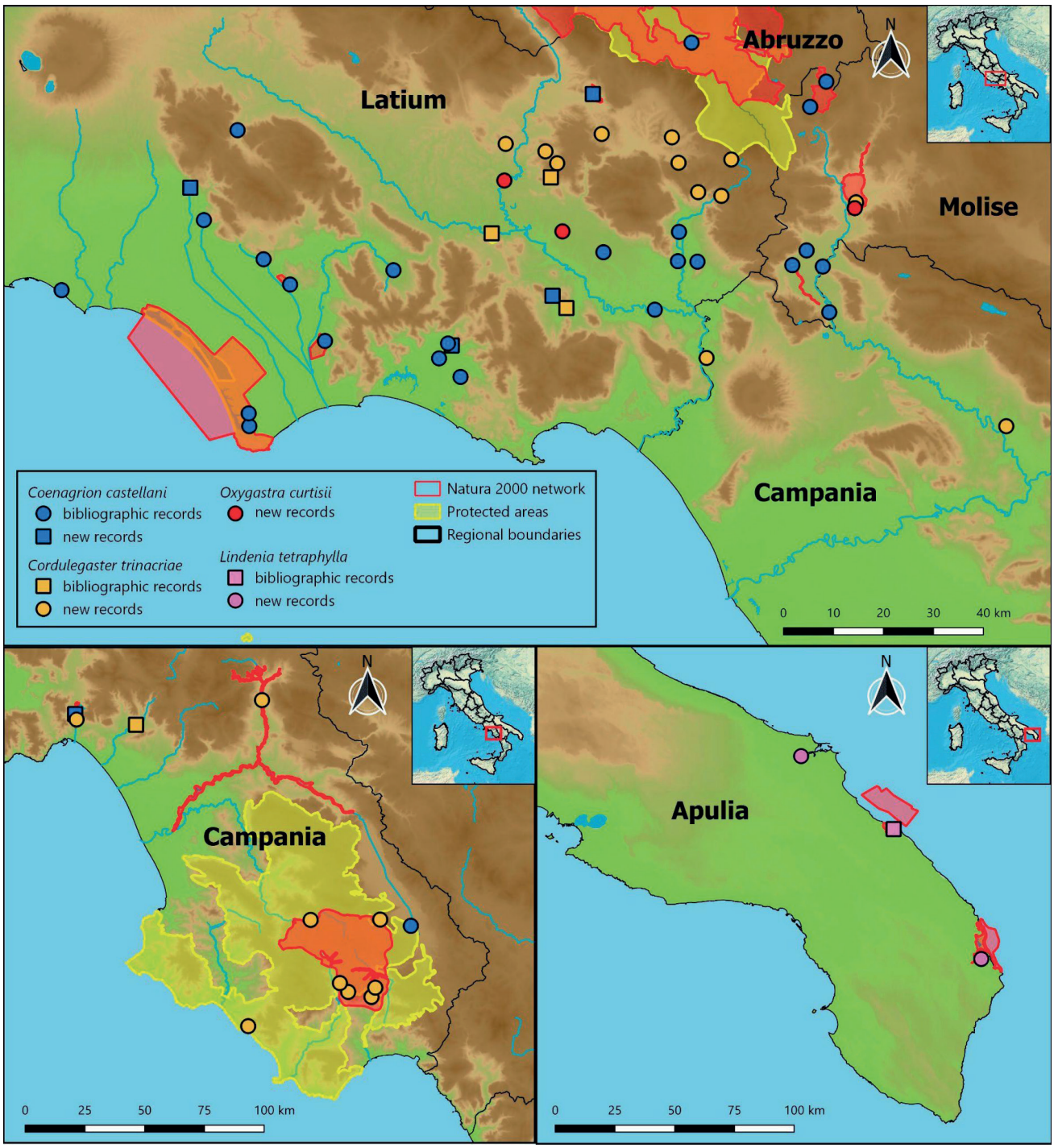

Fig. 1 – Map displaying both the newly recorded sites and the confirmed bibliographic sites of Odonata of Community interest in Latium, Abruzzo, Campania, Molise and Apulia regions. Protected areas where the sites fall are also reported.

to take advantage of each maximum period of activity of the species (Riservato et al. 2014). The individuals observed were caught with a hand butterfly net, identified following the morphological characters reported by Dijkstra & Schröter (2021), and then immediately released. Due to the presence of hybrids between *C. trinacriae* and *C. boltoni* in the Latium region, only populations where adults were sampled have been considered to assure a reliable morphological identification. Consequently, all the adults were identified after their capture using a 10× magnifying lens. This examination involved checking the appendages and observing the pattern of several diagnostic characters: the frons, occipital triangle, abdomen and thorax (cf. Corso 2019). In Southern Campania, where

hybridization phenomena are not known to occur (Solano et al. 2018; Corso 2019), the discovery of larvae alone was also considered sufficient to record the presence of *C. trinacriae*. Larvae were identified following the identification keys available in literature (Carchini 2016; Carletti & Terzani 2002) and then immediately released. The GPS coordinates of all sites were noted using the WGS84 Lat./Long. geodesic system. The environmental characteristics (habitat types, elevation) of the occurrence sites were also recorded and the sites were divided into categories: wooded rivers, wooded streams, karstic low running springs, spring-fed lakes, artificial lakes, coastal sandy rivulets, seasonal streams. The presence of ongoing threats to the sites (e.g. water collection, polluting discharges, invasive alien fauna, riverbed artificialization and mechanical disturbance) was also recorded.

Results

Twenty-five new populations of *Coenagrion castellani* were discovered (17 in southern Latium, 5 in Molise, 1 in Abruzzo and 2 in Campania), and 5 locations previously known from literature in southern Latium and Campania were confirmed, for a total of 30 populations (Tables 1-2, Fig. 1). The sites vary from an altitude of 1 (San Giovanni spring, LT) to 1090 m (Val Fondillo springs, AQ) (Table 1). All 30 sites can be divided into three categories based on habitat type: sunny karstic springs in the foothills, with slowly running waters (21 sites, 83%), coastal rivulets on sandy substrate surrounded by riparian forests (3 sites, 10%), and seasonal streams on limestone soil (2 sites, 7%) (Tables 1-2, Fig. 2). All sites are characterised by abundant helophytic and hydrophytic vegetation and a soft bed substrate (silt, sand or clay). Reproductive activity was recorded in many sites with the observation of couples in tandem (Fig. 4).

Twenty-one new populations of *Cordulegaster trinacriae* were found (9 in Latium, 11 in Campania and 1 in Molise), and the presence of the species was confirmed in 3 sites in Latium and 1 in Campania where it had already been reported (Tables 1-2, Fig. 1). Larvae were found in all the sites in southern Campania, confirming the presence of reproductive activity. All the sites fall into two environmental typologies: rivers (6) or streams (14) surrounded by a belt of riparian forest, with patches of sandy/gravelly substrate (Tables 1-2, Fig. 3).

Fig. 2 – Habitat types where *Coenagrion castellani* and *Lindenia tetraphylla* were found in the study area: a, coastal rivulet (site 3); b, karstic spring (site 8) c, spring-fed lake (site 61).

Three new populations of *Oxygastra curtisii* were discovered, 2 in Latium and 1 in the Molise region (Table 1, Fig. 1). All the sites are fast running rivers with a belt of riparian forest. The presence in the southern part of Latium is confirmed for the Liri-Garigliano drainage basin after about 70 years, when it was reported by Castellani (1951). Populations were recorded both in the main Liri river and in its tributary, the Melfa river (FR). Numerous individuals were also observed in Molise (IS) at the Cavaliere river, a tributary of the Volturno, which is part of the ZSC IT7212168 "Valle Porcina - Torrente Vandra – Cesarata". This finding is in accordance with the abundance of the species in the Volturno drainage area reported by Corso et al. (2019b).

Two new populations of *Lindenia tetraphylla* were identified in southern Apulia, at Alimini piccolo lake (LE) and at the Cillarese lake (BR) (Table 1, Figs 1-4). These lakes are respectively situated about 35 km south and 20 km north of the closest known site, the Idume springs in the Province of Lecce, where the species has also been confirmed (Table 2, Figs1-3). All three environments are freshwater coastal lakes (one of artificial origin and two fed by karstic springs), and two of them are included in the Natura 2000 network (ZSC "Alimini" IT9150011 and ZSC "Rauccio" IT9150006).

Discussion

This study shows that our knowledge of the distribution of odonate species of Community interest is far from complete, particularly in the Mediterranean biogeographic region. A case in point is the discovery of 25 new populations of *C. castellani.* Our data also confirm the presence of this species in the known localities of Ninfa (LT), Posta Fibreno (FR), Settecannelle (LT), Fonte la Torre (FR) and the Irno river (SA) (Avellinese & Utzeri 2012; Nardi 1993; De Filippo 2013). However, they also reveal a wider distribution of the species, especially in the Garigliano valley and in the Pontine plain (Table 1, Fig. 1). One site is located in the Abruzzo region, inside the Abruzzo, Latium and Molise National Park, where the species is reported for the first time, and is situated at 1090 m above the sea level, while another site in the Molise region is situated at 960 m (site 23-24, Table 1). They represent the new known altitude limit for *C. castellani*, which was previously reported up to

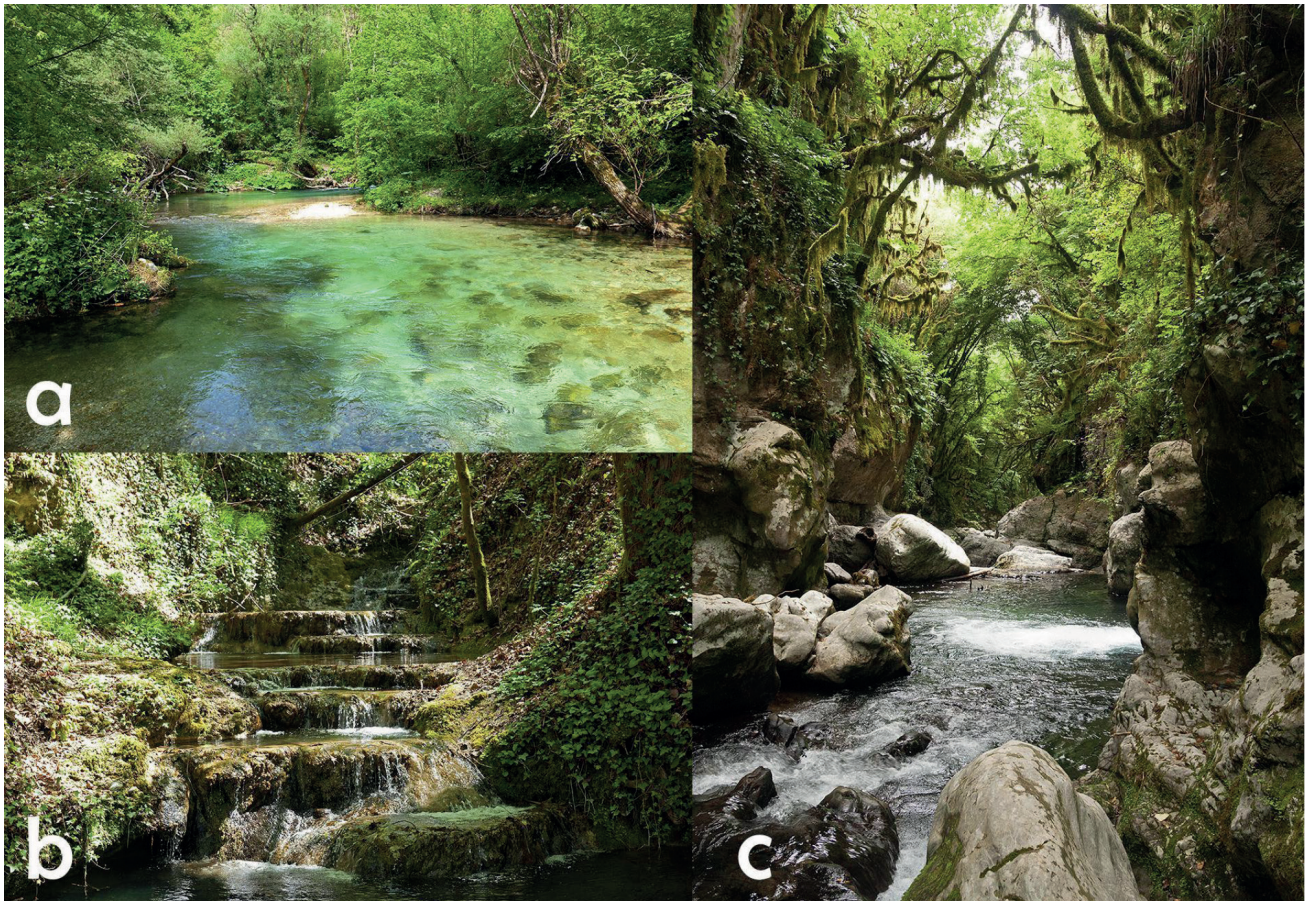

Fig. 3 – Habitat types where *Oxygastra curtisii* and *Cordulegaster trinacriae* were found in the study area: a, wooded river (site 27); b, wooded stream (site 39); c, wooded river (site 31).

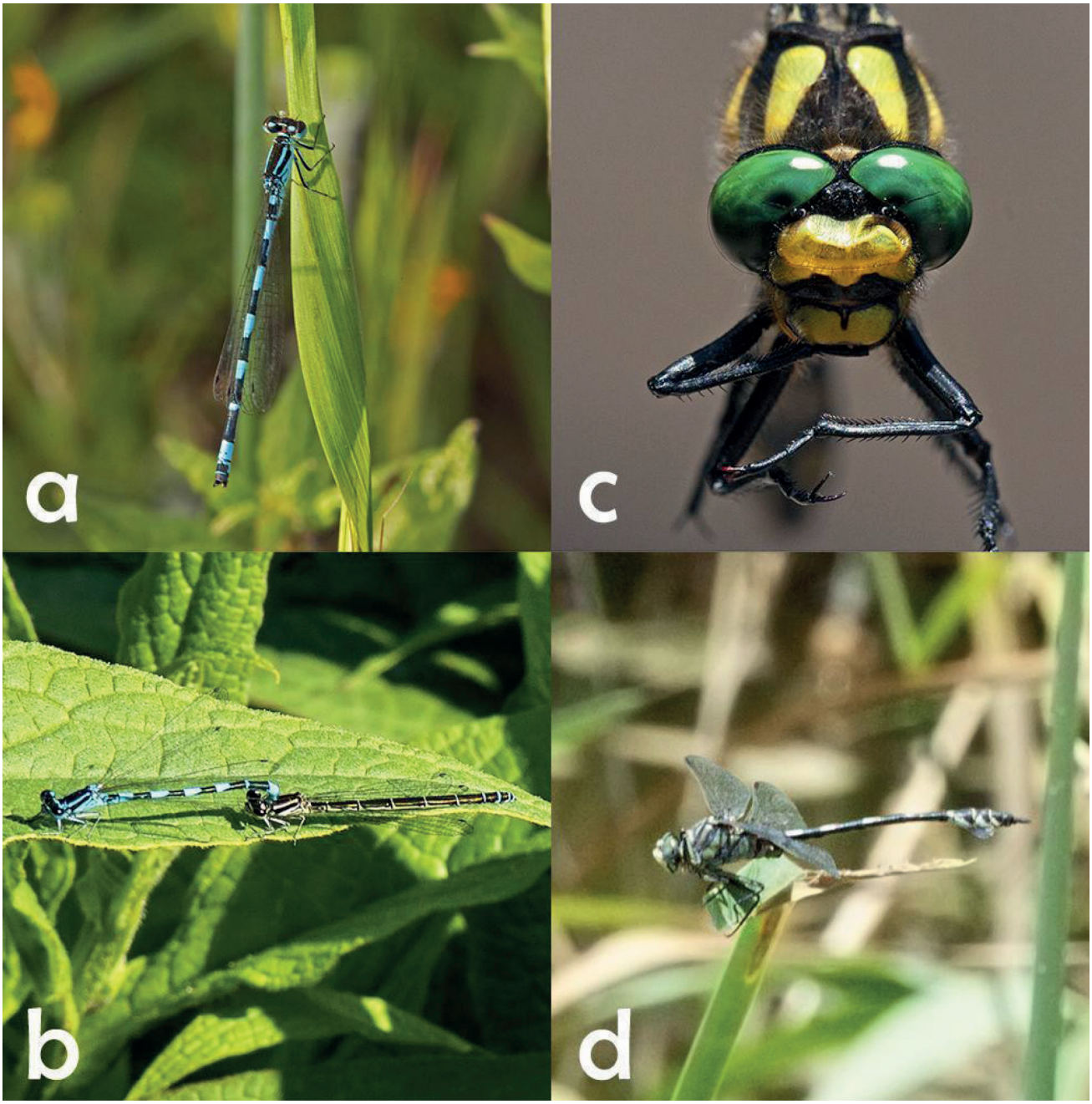

Fig. 4 – Individuals observed and photographed in the study area by Novaga R. **a**, *Coenagrion castellani* ♂, site 5; **b**, *C. castellani* ♂ and ♀ in tandem, site 6; **c**, *Cordulegaster trinacriae* ♂, site 42; **d**, *Lindenia tetraphylla* ♂, site 29.

a maximum altitude of 850 m (Fabbri et al. 2014a). Furthermore, we discovered three coastal populations respectively situated 2700, 2000 and even 300 metres from the sea (Table 1, Figs 1-3). Two of these are located in the Circeo National Park (LT), where the species had never been reported before, and the third is within the military base of Nettuno at Torre Astura (RM). The historical records from the Pontine marshes (Castellani 1936; Conci 1949) attest that *C. castellani* was once widespread in the area, and the few remaining populations are now restricted to isolated springs and rivulets. These new sites are likely relics of pre-reclamation habitats, preserved due to the protection provided by the Circeo National Park and the Nettuno military base (where access is prohibited to visitors). However, the majority of the newly discovered populations are located near karstic resurgences, indicating a strong association with limestone mountain chains in southern Latium, Molise and Campania, where such environments are prevalent (Gazzetti et al. 2016). This also underlines the importance of correctly managing the ecosystems of springs for the conservation of

Table 1 – New records of *Coenagrion castellani*, *Oxygastra curtisii*, *Cordulegaster trinacriae* and *Lindenia tetraphylla* found in southern-central Italy. Province Codes: **FR** = Frosinone, **LT** = Latina, **RM** = Rome, **AQ** = L'Aquila, **IS** = Isernia, **LE**=Lecce, **BR** = Brindisi, **CE** = Caserta, **AV** = Avellino, **SA**=Salerno. Threats Codes: **WC** = Water collection, **PD** = Polluting discharges, **IAS** = Invasive alien species, **RA** = Riverbed artificialization, **MD** = Mechanical disturbance.

Site	Species	Locality	Habitat type	Latitude	Longitude	Natura 2000	Threats
1	*Coenagrion castellani*	Vallone Carnevale, Nettuno (RM), 10 m	Coastal rivulet	41.434939°	12.729724°	IT6030048	WC
2	*C. castellani*	Fosso di Molella, Sabaudia (LT), 5 m	Coastal rivulet	41.274070°	13.059989°	IT6040015	IAS
3	*C. castellani*	Fonte di Lucullo, Sabaudia (LT), 5 m	Coastal rivulet	41.255992°	13.060885°	IT6040015	
4	*C. castellani*	Monticchio, Sermoneta (LT), 11 m	Karstic spring	41.533797°	12.979717°		MD, IAS
5	*C. castellani*	Mola Muti, Sezze (LT), 3 m	Karstic spring	41.481079°	13.086288°		MD
6	*C. castellani*	San Giovanni, Fondi (LT), 2 m	Karstic spring	41.349646°	13.401388°		MD, PD
7	*C. castellani*	Fontana del Muro, Priverno (LT), 2 m	Karstic spring	41.448351°	13.135504°	IT6040003	IAS, MD
8	*C. castellani*	Capodacqua, Fondi (LT), 11 m	Karstic spring	41.367833°	13.417765°		
9	*C. castellani*	Fonte Schiavoni, Amaseno (FR), 87 m	Karstic spring	41.467200°	13.319410°		
10	*C. castellani*	Forme d'Aquino, Aquino (FR), 84 m	Karstic spring	41.490483°	13.697049°		RA
11	*C. castellani*	fiume Rapido, Cassino (FR), 58 m	Karstic spring	41.517909°	13.832845°		RA
12	*C. castellani*	Acquasanta, San Giorgio a Liri (FR), 28 m	Karstic spring	41.413146°	13.789386°		
13	*C. castellani*	Fosso di Nallo, Cassino (FR), 61 m	Karstic spring	41.478097°	13.866185°		RA
14	*C. castellani*	San Bartolomeo, Venafro (IS), 167 m	Karstic spring	41.472065°	14.038586°		
15	*C. castellani*	San Bartolomeo, Sesto Campano (IS), 140 m	Karstic spring	41.409759°	14.102953°		RA
16	*C. castellani*	Reuglio, Ciorlano (CE), 163 m	Karstic spring	41.445581°	14.118342°		
17	*C. castellani*	Sette acque, Fondi (LT), 6 m	Karstic spring	41.319675°	13.434511°		MD, IAS
18	*C. castellani*	Torrente Rava, Venafro (IS), 188 m	Seasonal stream	41.492975°	14.061988°		RA
19	*C. castellani*	Fontanile nuovo, Montelanico (RM), 258 m	Karstic spring	41.654562°	13.039787°		
20	*C. castellani*	Fonte Margherita, Monte San Giovanni Campano (FR), 150 m	Seasonal stream	41.602592°	13.520845°		MD
21	*C. castellani*	Le Mortine, Venafro (IS), 175 m	Karstic spring	41.471395°	14.091352°	IT8010030	IAS
22	*C. castellani*	Valla, Sassano (SA), 465 m	Karstic spring	40.321700°	15.610667°		
23	*C. castellani*	Val Fondillo (AQ), 1090 m	Karstic spring	41.772194°	13.855375°	IT7110205	
24	*C. castellani*	Pantanello (IS), 960 m	Karstic spring	41.685971°	14.068262°		
25	*C. castellani*	Pantano della Zittola (IS), 820 m	Karstic spring	41.709980°	14.092940°	IT7212126	

26	*Oxygastra curtisii*	fiume Cavaliere, Macchia d'Isernia (IS), 242 m	Wooded river	41.549870°	14.143456°	IT7212168	
27	*O. curtisii*	fiume Melfa, Roccasecca (FR), 91 m	Wooded river	41.520422°	13.624312°		WC
28	*O. curtisii*	fiume Liri, Monte San Giovanni Campano (FR), 117 m	Wooded river	41.588822°	13.519912°		PD
29	*Lindenia tetraphylla*	Alimini Piccolo, Otranto (LE), 0 m	Spring fed lake	40.184183°	18.447292°	IT9150011	
30	*L. tetraphylla*	Lago di Cillarese, Brindisi (BR), 18 m	Artificial lake	40.632737°	17.910404°		
31	*Cordulegaster trinacriae*	Calore Lucano, Valle dell'Angelo (SA), 545 m	Wooded river	40.335722°	15.359970°	IT8050024	
32	*C. trinacriae*	Acquaro, Rofrano (SA), 490 m	Wooded stream	40.212968°	15.433488°	IT8050024	PD
33	*C. trinacriae*	Cerzito, Rofrano (SA), 570 m	Wooded stream	40.195770°	15.453846°	IT8050024	
34	*C. trinacriae*	Torrente Strazza, Caselle in Pittari (SA), 490 m	Wooded stream	40.204169°	15.521990°	IT8050024	
35	*C. trinacriae*	Vallone grande, Caselle in Pittari (SA), 290 m	Wooded stream	40.186370°	15.512620°	IT8050024	
36	*C. trinacriae*	Torrente Zia Francesca, Monte San Giacomo (SA), 685 m	Wooded stream	40.333797°	15.534341°	IT8050024	
37	*C. trinacriae*	Fiumicello, Pisciotta (SA), 85 m	Wooded stream	40.130998°	15.204973°		
38	*C. trinacriae*	torrente Amaseno, Monte San Giovanni Campano (FR), 200 m	Wooded stream	41.633768°	13.516590°		PD, WC
39	*C. trinacriae*	Rio Arimucci, Arpino (FR), 255 m	Wooded stream	41.626318°	13.593073°		
40	*C. trinacriae*	Fosso di Santopadre, Santopadre (FR), 535 m	Wooded stream	41.610117°	13.614091°		
41	*C. trinacriae*	fiume Rapido, Vallerotonda (FR), 435 m	Wooded stream	41.566420°	13.908849°		
42	*C. trinacriae*	Valleluce, Sant'Elia Fiumerapido (FR), 320 m	Wooded stream	41.571667°	13.867465°		WC
43	*C. trinacriae*	Valenti, Villa Latina (FR), 405 m	Wooded stream	41.610954°	13.832069°		
44	*C. trinacriae*	Fosso di Cocuruzzo, Rocca d'Evandro (CE), 20 m	Wooded stream	41.348319°	13.882795°		
45	*C. trinacriae*	torrente Adventus, Gioia Sannitica (CE), 56 m	Wooded river	41.256306°	14.420768°		
46	*C. trinacriae*	fiume Irno, Salerno (SA), 85 m	Wooded river	40.712496°	14.777354°	IT8050056	
47	*C. trinacriae*	Rio Fontechiari, Fontechiari (FR), 365 m	Wooded stream	41.652303°	13.693193°		
48	*C. trinacriae*	fiume Sele, Calabritto (AV), 200 m	Wooded river	40.750039°	15.239509°	IT8050049	
49	*C. trinacriae*	Rio Settefrati, Gallinaro (FR), 380 m	Wooded stream	41.646276°	13.821188°		PD, WC
50	*C. trinacriae*	Fiume Cavaliere, Macchia d'Isernia (IS), 240 m	Wooded river	41.552990°	14.149926°	IT7212168	
51	*C. trinacriae*	Fiume Mollarino, San Biagio Saracinisco (FR), 840 m	Wooded river	41.613766°	13.930831°		RA, WC

Table 2 – Bibliographic records of *C. castellani*, *C. trinacriae* and *L. tetraphylla* in southern-central Italy confirmed during the field samplings. Province Codes: FR=Frosinone, LT=Latina, RM=Rome, LE=Lecce, CE=Caserta, AV= Avellino, SA=Salerno. Threats Codes: WC=Water collection, PD= Polluting discharges, IAS = Invasive alien species, RA = Riverbed artificialization, MD = Mechanical disturbance.

Site	Species	Locality	Habitat type	Latitude	Longitude	Natura 2000 site	References	Threats
52	*Coenagrion castellani*	Ninfa, Cisterna di Latina (LT), 25 m	Karstic spring	41.580412°	12.951796°	IT6040002	Nardi 1993; Stella 1955	MD, IAS
53	*C. castellani*	Lago di Posta, Posta Fibreno (FR), 290 m	Karstic spring	41.703326°	13.678138°	IT6050015	Avellinese & Utzeri 2008	IAS
54	*C. castellani*	Settecannelle, Fondi (LT), 10 m	Karstic spring	41.367653°	13.421715°		Avellinese & Utzeri 2012	WC
55	*C. castellani*	Fonte la Torre, Pontecorvo (FR), 83 m	Karstic spring	41.431511°	13.605498°		Avellinese & Utzeri 2012	
56	*C. castellani*	fiume Irno, Pellezzano (SA), 126 m	Karstic spring	40.723242°	14.773683°	IT8050056	De Filippo 2013	
57	*Cordulegaster trinacriae*	Rio Verde, Arce (FR), 380 m	Wooded stream	41.593722°	13.605683°		Corso et al. 2020	
58	*C. trinacriae*	Forma Quesa, Pontecorvo (FR), 63 m	Wooded stream	41.413443°	13.623467°		Avellinese & Utzeri 2012	RA, MD, WC
59	*C. trinacriae*	fiume Picentino, Giffoni Valle Piana (SA), 120 m	Wooded river	40.699627°	14.920842°		Corso et al. 2020	
60	*C. trinacriae*	Rio Obaco, Falvaterra (FR), 90 m	Wooded stream	41.517081°	13.496980°		Corso et al. 2020	PD
61	*Lindenia tetraphylla*	Idume, Lecce (LE), 1 m	Spring fed lake	40.466960°	18.187560°	IT9150006	Mastropasqua 2015	

the species. The seasonal maintenance activities that impact spring-fed watercourses, often involving complete riparian vegetation removal and riverbed dredging, typically occur between March and June. These activities pose a significant threat to the survival of *C. castellani* and necessitate reconsideration. Six of the new populations (24%) are situated within Natura 2000 sites (Tables 1-2), while 7 are included within protected areas: the Circeo National Park (site 2-3), the Abruzzo, Latium and Molise National Park (site 23), the Regional Natural Monument (RNM) "Giardino di Ninfa" (site 47), the RNM "Fiume Fibreno e Rio Carpello"(site 48), the RNM "Area sorgiva di Monticchio" (site 4) and the Cilento, Vallo di Diano and Alburni National Park (site 22).

The results of our samplings also revealed the presence of a greater number of populations morphologically attributable to *Cordulegaster trinacriae* in southern Latium, where only a few sites had been reported before (Corso et al. 2020; Solano et al. 2018). Specifically, the Liri river was identified as the putative Tyrrhenian boundary of the species (Table 1; Figs 1-4). However, further molecular analyses are required to assess the level of the genetic purity of these populations, given the presence of an extended introgression belt in Latium (Solano et al. 2018). In addition to southern Latium, new populations of *C. trinacriae* have also been discovered in Molise and Campania, particularly in the province of Salerno. Many of these populations are located within the protected areas of the Cilento massif (Tab.1, Fig.1). Nine of the new sites (43%) are within the Natura 2000 network (Table 1), and 3 of them are protected by the Cilento, Vallo di Diano and Alburni National Park (sites 27, 30, 33). The main threats encountered include polluting discharges and water collection, but also the riverbed artificialization caused by mechanical interventions of cleaning, leveling and widening of the riverbed, as happened in the Mollarino river (FR), where the species was observed only upstream of the intervention area.

The presence of *Oxygastra curtisii* in the Latium part of the Garigliano drainage basin has been confirmed after about 70 years (Castellani 1951). Two populations were identified (Melfa and Liri rivers, FR), outside any protected area or Natura 2000 site. The population along the Melfa river faces a significant threat from increasingly severe droughts exacerbated by climate change. Water abstraction for the Sant'Elia Fiumerapido hydroelectric plant and agricultural irrigation further exacerbate the situation, often without ensuring the minimal vital flow of the watercourse. In June 2022 and May 2024, for instance, the river experienced complete desiccation lasting about 6 months, affecting the stretch where the species had been observed. The newly discovered population in Molise lies in the Vandra stream (Volturno drainage, IS), within the Natura 2000 site IT7212168 "Valle Porcina-Torrente Vandra-Cesarata". This discovery underlines the importance of this drainage basin for the protection of the species in central-southern Italy (Corso et al. 2019b).

Lindenia tetraphylla was sighted in the Alimini Piccolo lake, a basin fed by karstic springs located approximately 1800 m from the sea, in the municipality of Otranto (LE, Apulia region) and in the Cillarese lake, a small artificial lake close to the town of Brindisi (BR, Apulia region). The first site, which is part of the Natura 2000 network (IT9150011 "Alimini"), is surrounded by a lush reedbed of *Phragmites australis*, representing an optimal habitat for the species (Kalkman 2021), while the second one is a more unusual habitat type, being an artificial basin in the proximity of a very populated area. These mark two new known populations for Apulia in addition to the Idume springs (LE) site, where the presence of the species was also confirmed (Mastropasqua 2015).

Since 6 of the newly discovered sites of *Coenagrion castellani*, 9 of *Cordulegaster trinacriae*, 1 of *Oxygastra curtisii* and 1 of *Lindenia tetraphylla* are part of the Natura 2000 network (Table 1), it is important to update the Standard Data Form and revise the conservation objectives and measures for each Natura 2000 site. This update will ensure that the site managers are aware of the presence of these rare, protected species, improve our knowledge of their population status, and facilitate the adoption of adequate conservation actions. During our site visits, we observed potential or actual threats in at least 17 cases for *Coenagrion castellani* (57%), 7 cases for *Cordulegaster trinacriae* (28%) and 2 cases for *Oxygastra curtisii* (66%). These risks include water collection, pollution caused by discharges, the introduction of invasive non-native fauna, the cementation and artificialization of the banks and the riverbed, and, most frequently, mechanical disturbance caused by the seasonal cutting of the riparian vegetation and dredging of the riverbed. In conclusion, given that many newly discovered sites are within the Natura 2000 network, updating the Standard Data Form is imperative to ensure effective conservation management. Our observations of potential or actual risks in several cases underline the urgent need for conservation actions to mitigate anthropogenic impacts on these species' habitats. Preserving riparian vegetation and controlling water use are crucial steps in safeguarding the habitats of these dragonflies and damselflies. Urgent interventions are essential to prevent further degradation of their environments and ensure the long-term survival of these protected species.

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