Confirmation of Crepidophorus mutilatus (Rosenhauer, 1847) in Italy (Coleoptera: Elateridae), with Notes on Its Distribution and Conservation

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Confirmation of *Crepidophorus mutilatus* (Rosenhauer, 1847) in Italy (Coleoptera: Elateridae), with Notes on its Distribution and Conservation

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Abstract

The occurrence of *Crepidophorus mutilatus* (Rosenhauer, 1847) (Coleoptera: Elateridae), a saproxylic beetle of old-growth forests in the Palearctic region, is confirmed for Italy. The species has a discontinuous and localized distribution in central and northern Europe and Siberia, with isolated populations in the Iberian and Balkan peninsulas, and is included in the risk categories of the Italian Red List for saproxylic beetles. *Crepidophorus mutilatus* was found in the Matese Mountains, central-southern Apennines, during July 2018 while surveying the beetle fauna in a beech woodland at about 1,719 m elevation as part of the LIFE project "AForClimate". This extends its known distribution into southern Europe and further confirms the important biogeographical role of this mountainous territory, recently designated a national park. We discuss distribution and conservation issues and provide recommended conservation measures that may be useful for protecting many other saproxylic beetles (*e.g.*, safeguarding of large trees with cavities).

Key Words: beech forest, biogeography, Matese Massif, new record, veteran trees

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Introduction

The genus *Crepidophorus* Mulsant and Guillebeau, 1853 (Coleoptera: Elateridae: Dendrometrinae) currently includes four Palearctic species. Only one of these, *Crepidophorus mutilatus* (Rosenhauer, 1847), occurs in Europe (Cate 2007; Laibner 2000), while the others are found in eastern Siberia and one reaches North America. *Crepidophorus mutilatus* is widespread in central and northern Europe eastward to Turkey (Platia *et al.* 2011) and is one of the most rarely collected European saproxylic elaterids. It is currently listed by the IUCN on the Near Threatened (NT) category of the Red List of Threatened Species (Carpaneto *et al.* 2015).

In Italy, *C. mutilatus* is at the apparent limit of its southern distribution. Until now, only one unconfirmed record from 1930 was known from the Italian mainland (Platia 1994). It was reported from nearby sites in France by du Buysson (1893–1906) and additional sites were reported by Leseigneur (1972) and Delnatte (2009). Here, we report the expansion of its known distribution into the central-southern Apennines on the eastern side of the Matese mountain range and present an assessment of its distribution in Europe, contextualizing the biogeographical

importance of the mountain massif. Finally, being a species included in the Italian Red List for saproxylic beetles, appropriate conservation measures are proposed.

Material and Methods

The forest landscape considered in this study is located in Molise, southern Italy. The study area is a Site of Community Importance (SCI) and is included in the Natura 2000 network (IT 7222287 "La Gallinola - Monte Miletto - Monti del Matese"), located in southern Molise along the borders between Molise and Campania (41°28′20″N, 14°23′10″E). The SCI is located in the southern part of the Apennine Mountains and covers about 25,000 ha with an elevation ranging from 275 to 2,050 m. It represents a wide calcareous mountain. The highest peaks are Mt. Miletto (2,050 m), La Gallinola (1,923 m) and Mt. Mutria (1,823 m) (Santopuoli *et al.* 2012). Forest covers 70% of the total area and is represented by nine different forest types (EEA 2006), the most common being beech forest, which comprises about 8,000 ha of mostly coppices resulting from past forest management (Vizzarri *et al.* 2015).

The Matese SCI is included in the temperate oceanic sub-Mediterranean bioclimate (Rivas-Martínez *et al.* 2004), with abundant annual precipitation (1,614 mm per year) and no aridity during the summer months. The average annual temperature is about 11.5 °C and is less than 10 °C for six months per year (Blasi *et al.* 2007). In this area, the priority habitat 9210 (Apennine beech forests with

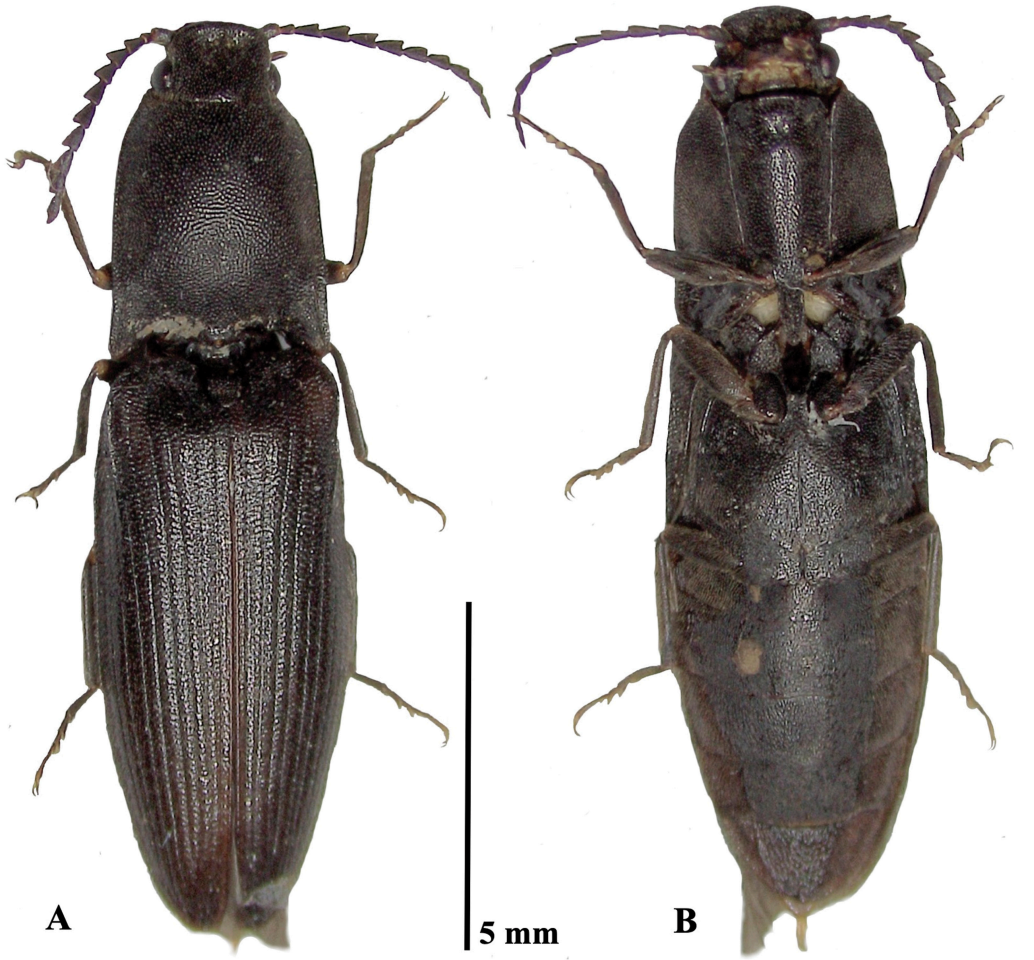

Fig. 1. Female specimen of *Crepidophorus mutilatus* collected in Italy. A) Dorsal habitus, B) Ventral habitus. Photos by F. Parisi.

Taxus and *Ilex*) is prevalent. Associated trees in the beech forests include *Taxus baccata* L., *Acer pseudoplatanus* L., *Ilex aquifolium* L., *Sorbus aria* (L.) Crantz, and *S. aucuparia* L., while the herbaceous layer consists mainly of *Daphne laureola* L., *Lathyrus venetus* (Mill.) Wohlf., *Melica uniflora* Retz., *Geranium versicolor* L., and *Potentilla micrantha* Ram. ex DC.

Results and Discussion

While surveying saproxylic beetles during 2018 in a beech forest on the eastern slope of the Matese Mountains (central-southern Apennines), we encountered the first specimen of *C. mutilatus* found in Italy (**confirmed country record**) since the 1930 specimen reported by Platia (1994). The specimen (Fig. 1), a female, was collected in the territory of Roccamandolfi (Isernia, Molise Region, Italy), in the locality known as "Bosco Macchia Celano" (14°21′01.01″N, 41°27′08.88″E) (Fig. 2), on 7 July 2018 at an elevation of 1,719 m (leg. F. Parisi). The specimen was captured in a window flight trap (see Zanetti and Parisi 2019).

Fig. 2. Beechwood and fallen dead trees in Matese National Park, where *Crepidophorus mutilatus* was collected (Bosco Macchia Celano, Molise Region, Italy). Photo by M. Mancini.

Crepidophorus mutilatus has a discontinuous distribution within its broader range (Fig. 3), with most of its known populations concentrated in central and northern Europe (Laibner 2000). It is apparently absent from the Netherlands, Great Britain, and Ireland (Cate 2007) but is listed for central Russia, Ukraine, Belarus, Bulgaria, Slovenia, and Switzerland (Cate 2007). Recalde Irurzun *et al.* (2007) discovered a relict population in Spain, thus expanding its known distribution to the southwest. *Crepidophorus mutilatus* is an obligate saproxylic species that lives in the cavities of decayed trees with rotten wood (Bouget *et al.* 2005). In France, Leseigneur (1972) observed that larvae never develop in cavities in contact with the ground. This species is found mainly in old-growth forests, riparian corridors, and agro-pastoral systems, although it is also possible to find it in city parks (Mertlik 2014). It prefers oak, beech, and linden stands (Laibner 2000). The larvae live in high, rather wet cavities and develop preferentially in dead wood, where they are predaceous and feed on larvae and pupae of other saproxylic beetles (Mertlik 2014). As with many other saproxylic elaterid larvae, they are likely to also feed on mold, dead insects, and decaying wood during the early instars (Leseigneur 1972) and may occasionally be myrmecophagous (Delnatte 2009). The larval stage lasts about three years (Mertlik 2014). Adult beetles overwinter in host trees and emerge during May and June, during which time they may be encountered in the evening near the hollows of the trees in which they developed (Laibner 2000). While adults are mainly active at dusk (Mertlik 2014), Telnov *et al.* (2005) reported a daytime capture in Latvia. Adults disperse by flight in search of new oviposition sites, as evidenced by the captures made by our window traps in beech forests.

The threats to *C. mutilatus* are numerous and quite similar to the threats identified for all the species included in the IUCN Red List of Threatened Species (Carpaneto *et al.* 2015). In fact, in Italy, as in the rest of Europe, species associated with tree cavities have suffered from extreme reduction in habitat (Ranius *et al.* 2005; Vignon 2015) due to forest management (Ranius *et al.* 2009), conversion to agriculture (Ranius *et al.* 2005; Vignon 2015), and urban development (Lauri 2007). Excessive use of forest resources presents a serious problem, but equally harmful may be long-term changes in forest management that have led to excessive canopy closure. This may lead to a reduction of available host trees due to management systems that often exclude mowing and/or grazing in the mountains. In this sense, forest management, which aims to protect veteran trees by favoring open areas, can be a key factor in reducing isolation of beetle populations (Carpaneto *et al.* 2015). This

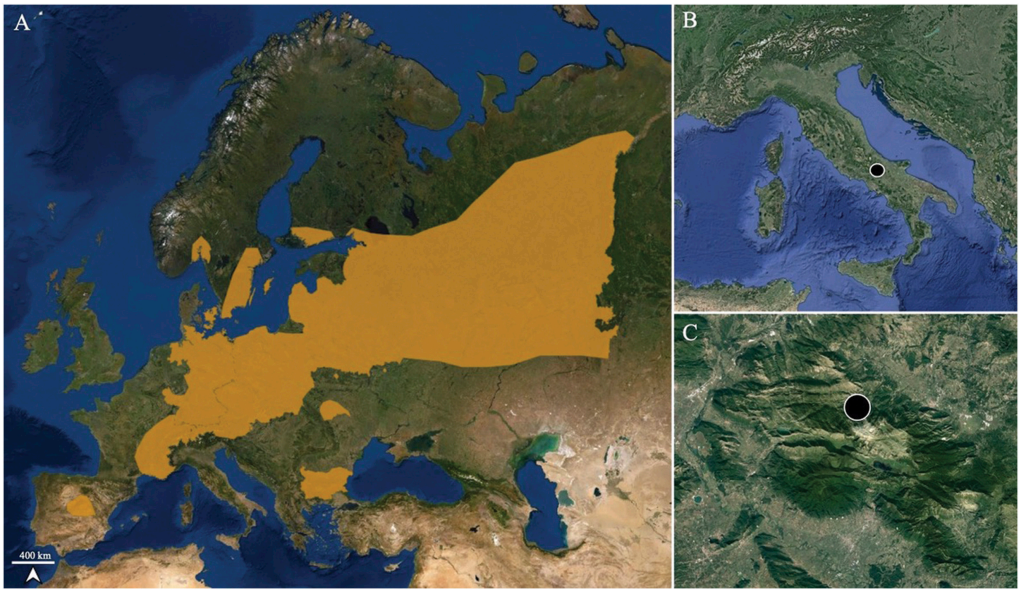

Fig. 3. A) Distribution of *Crepidophorus mutilatus* per IUCN (2010) (Mannerkoski *et al.* 2010), B) Location of discovery in south-central Europe, C) Location of discovery in Matese Massif (Roccamandolfi, Isernia).

species is classified as threatened by the International Union for Conservation of Nature (IUCN) in most European countries where it has been reported. In the Czech Republic, where larger populations are concentrated, it is still considered as Critically Endangered (CR). This condition is attributable to the presence of virgin forests of beeches and firs that characterize the area (Mertlik 2007).

As with most saproxylic beetles, *C. mutilatus* has no protection status at the European level or in the various countries where it is present. In Italy, the preservation of rare and threatened species such as *C. mutilatus* to this point has relied on the complementary conservation of species at higher risk such as *Rosalia alpina* (Linnaeus, 1758) (Coleoptera: Cerambycidae), which is also present in the Matese mountains (see Parisi 2016), and *Osmoderma eremita* (Scopoli, 1763) (Coleoptera: Scarabaeidae) (Mosconi *et al.* 2017), which, therefore, serve as "umbrella species" (Ranius 2002). However, although these three species share roughly the same microhabitats, their distributions differ significantly. Only 60% of *C. mutilatus* sites actually or potentially host *O. eremita* (Barnouin *et al.* 2017), thus limiting its ability to serve as an "umbrella species" for *C. mutilatus*. Additionally, *C. mutilatus* has not been found in similar habitats (priority habitat 9210 Apennine beech forests with *Taxus* and *Ilex*) in the central and southern Apennines in Italy (Gran Sasso and Cilento protected areas; Abeti Soprani and Bosco Pennataro wood in the central Apennines) during previous studies by authors using the same sampling techniques (Parisi *et al.* 2016, 2019, 2020; Sabatini *et al.* 2016).

Senescent trees and cavities should be a priority conservation issue for saproxylic diversity and more (Parisi *et al.* 2018). *Crepidophorus mutilatus* is usually found in protected areas where the level of protection is satisfactory for maintaining saproxylic insect populations. In fact, the most important conservation measure to be recommended is the protection of large trees with cavities (Parisi *et al.* 2018). Since *C. mutilatus* is a rare and threatened species, we suggest its inclusion in a higher risk category than its current assignment as "Near Threatened".

Implications for Habitat Conservation. Useful measures that have been adopted for the conservation of saproxylic beetles in Italy and are suitable for other Mediterranean countries include: i) Management of natural forest habitats to favor age and size heterogeneity among trees, promote ecological corridors, and allow fallen trees to remain *in situ*; ii) encouraging measures favoring the quality of forest ecosystems, ensuring the presence of old-growth forest, and using artificial techniques to accelerate the formation of useful microhabitats for saproxylic organisms; iii) preserve and restore relict forest edges; iv) conserve host trees in agricultural and urban landscapes along with planting new potential host trees (Parisi *et al.* 2018).

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