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First records of *Ischyropsalis lithoclasica* Schönhofer & Martens, 2010 (Arachnida: Opiliones) for Trentino-Alto Adige (Italy)

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Key words

- Endemic species
- New records
- Pleistocene glaciations
- Southern Alps
- Troglophilic behaviour

Summary

We report the first records about the presence of the harvestman species *Ischyropsalis lithoclasica* (Arachnida: Opiliones) in Trentino-Alto Adige Region (Italy). The new records are reported on Monte Nozzolo Grande (TN) 2010 m asl. inside military fortifications, and inside the abandoned mine Galleria Impero in Darzo (TN), 1110 m asl. The morphological characters and some notes about the ecological preferences of the newly recorded populations are provided. The new records permit to fill the gap of *Ischyropsalis* distribution range in the Italian Prealps, from Monte Baldo to Orobian Alps.

Parole chiave

- Specie endemiche
- Nuove segnalazioni
- Glaciazioni pleistoceniche
- Alpi meridionali
- Comportamento troglolofico

Riassunto

Si forniscono le prime segnalazioni relative la presenza in Trentino-Alto Adige dell'opilione *Ischyropsalis lithoclasica* (Arachnida: Opiliones). Le nuove segnalazioni sono riportate per il Monte Nozzolo Grande (TN) a 2010 m s.l.m. all'interno di fortificazioni militari, e in una miniera abbandonata di Darzo (TN) di nome Galleria Impero a 1110 m s.l.m. Vengono forniti i caratteri morfologici e alcune note relative le preferenze ecologiche delle nuove popolazioni. Il ritrovamento permette di colmare la lacuna conoscitiva nell'areale di *Ischyropsalis* nella porzione di Prealpi italiane compresa tra il Monte Baldo e le Alpi Orobie.

Introduction

Ischyropsalis C.L. Koch, 1839 (Opiliones: Ischyropsalididae) is a genus of harvestman comprising 22 species all geographically limited to Europe (Schönhofer, 2013). It is one of the most recognizable harvestmen by their large chelicerae and dark coloration. *Ischyropsalis* can be found in cold and wet forest habitats such as scree slopes and mossy landscapes in high altitude mountains or caves and other subterranean habitats at lower altitudes (Martens, 1969; Schönhofer, 2013; Schönhofer et al. 2015). The species of this genus have a high level of endemism, in fact, they are often restricted to a single mountain chain (Martens 1969, 1978; Schönhofer et al. 2015). A direct relationship between the Pleistocene glaciations and the

current distribution of Alpine *Ischyropsalis* species have shown by Mammola et al. (2019), thus, new *Ischyropsalis* records are significant as they allow to redefine the boundaries of the ancient glaciers.

Eight species belonging to the genus *Ischyropsalis* are currently known from Italy; three of them have been recorded in Trentino-Alto Adige Region (Italy) : *I. kollari* C. L. Koch, 1839 (on Passo Rolle and the north-eastern part of the Region in Martens 1969, Marcellino 1988, Schönhofer et al. 2015), *I. ravasinii* Hadži, 1942 (on Cansiglio, Lagorai mountains in Martens 1978, Schönhofer et al. 2015, Petri et al. 2022), *I. strandi* Kratochvil, 1936 (on Monte Baldo, Lessini mountains and South-eastern part of Trentino-Alto Adige Region in Juberthie 1963, Martens 1969, Chemini 1995, Schönhofer et al. 2015).

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In this paper we report the first records of *Ischyropsalis* in an area where bibliographical data were absent (Schönhofer et al. 2015). The area is located in northern Italy; specifically, it ranges from Monte Baldo (Lake Garda, Trentino-Alto Adige and Veneto Regions) to Orobian Alps (Lombardy Region), where there is a theoretical distributional gap between *I. lithoclasica* and *I. ravasinii* shown in Schönhofer et al. (2015). The species that we found in this area, *I. lithoclasica*, was described by Schönhofer and Martens in 2010, separating it from *I. dentipalpis* Canestrini, 1872, and was defined as an endemic species of Orobian Alps. With our new records, we can extend the eastern borders of the distribution of this species of approximately 60 km (Fig. 1).

Area of study

The study focuses on the western area of the Trentino-Alto Adige Region, in the province of Trento, near the border of the Lombardy Region. We sampled two localities (Fig. 1). The first locality (Fig. 1, point 1) called Monte Nozzolo Grande (2010 m asl) is a mountain that belongs to Garda Mountains. Based on the SOIUSA classification (Marazzi, 2005), the first locality is included in the Southeastern Alps, section Brescia and Garda Prealps (code II/C-30.II-A.1). The second locality (Fig. 1, point 2) called Galleria Impero (1110 m asl) is an abandoned artificial cave of Darzo mines located in the Chiese Valley, Southeastern Alps, section Southern Rhaetian Alps (code II/C-28.III-A.2). In the Darzo mines complex, the Galleria Santa Barbara was

also analysed, but since it did not report any results, it was not included in this work.

Materials and methods

The specimens of Monte Nozzolo Grande were captured by hand during field collection in summer of 2019 and 2022. The population of Darzo Mines was discovered during a research project of Darzo Mines, in collaboration with MUSE-Science Museum, focused on cave fauna. In this project two abandoned mines were surveyed, using pitfall traps consisting of a glass jar with an open diameter of 6 cm filled with white vinegar, salt and 1 drop of detergent (Latella & Gobbi, 2015). Two pitfall traps were placed for each mine (Galleria Impero, Galleria Santa Barbara). For the parietal fauna we did two session of hand samplings in 07.VI.2022 and 24.VI.2022 in each mine. The temperature of each mine was recorded during each sampling session by mercury thermometer.

Identification of the specimens was carried out under a stereomicroscope (Bresser Advance ICD 10-160x) following Martens (1978), Schönhofer & Martens (2010) and Schönhofer (2013). The morphological characters used for identification are the larger distal apophyses on basal cheliceral article with extended bristle areas and the pronounced spines on the chelicerae (Fig. 2A), together with the genital morphology (Fig. 2B). The specimens analysed in this study are preserved in the collections of the MUSE-Science Museum, Trento and in the personal collection of the first author.

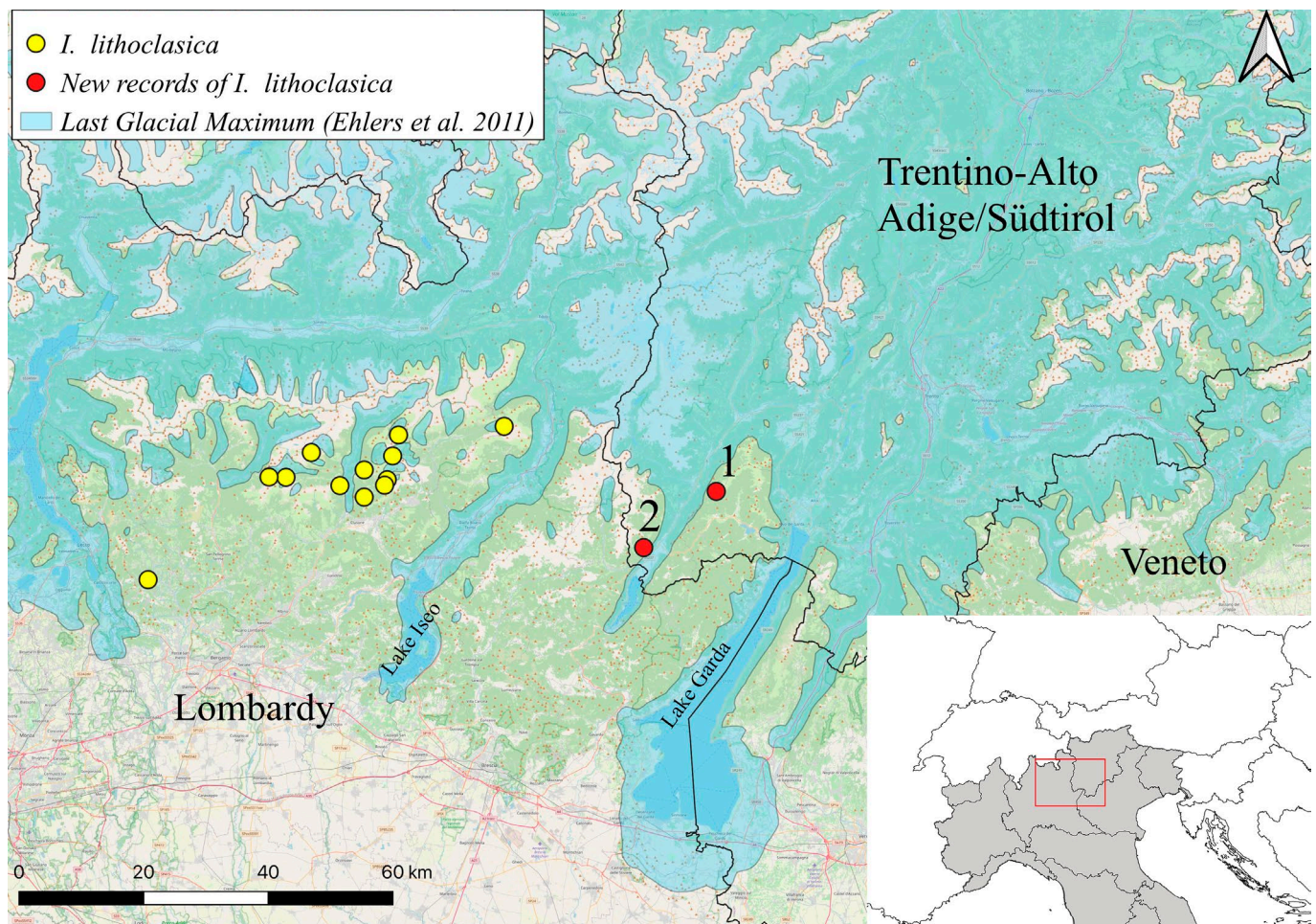


Fig. 1 – Distribution of *Ischyropsalis lithoclasica* in Northern Italy. Point 1: Monte Nozzolo Grande. Point 2: Darzo, Galleria Impero. Yellow points indicate records in Schönhofer & Martens (2010). The area in light blue represents the extent of the Last Glacial Maximum (Ehlers et al. 2011). / **Fig. 1** – Distribuzione di *Ischyropsalis lithoclasica* nel Nord Italia. Punto 1: Monte Nozzolo Grande. Punto 2: Darzo, Galleria Impero. I punti gialli indicano le segnalazioni riportate in Schönhofer & Martens (2010). L'area in azzurro rappresenta l'estensione dell'Ultimo Massimo Glaciale (Ehlers et al. 2011).

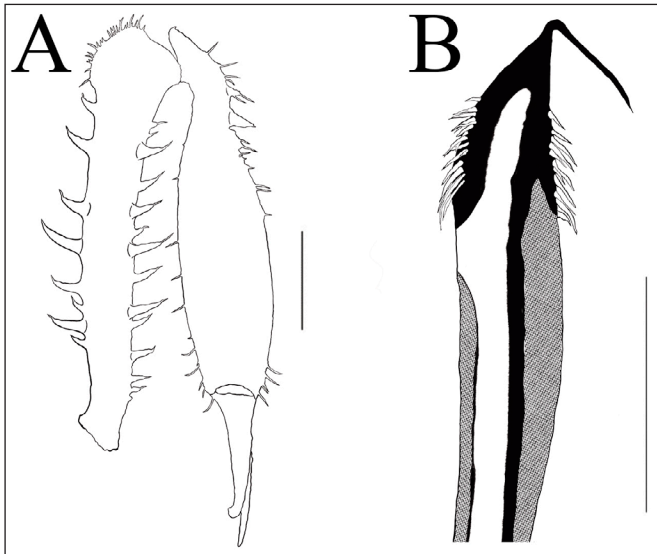


Fig. 2 – Morphological characters of *Ischyropsalis lithoclasica* from Darzo, Galleria Impero. A. right chelicera, prolateral view, scale bar 1 mm B. distal part of the penis glans and stylus, lateral view, scale bar 0.5 mm. / **Fig. 2** – Caratteri morfologici di *Ischyropsalis lithoclasica* di Darzo, Galleria Impero. A. chelicero destro, visione prolaterale, scala della barra 1 mm B. parte distale del pene e stilo, visione laterale, scala della barra 0.5 mm.

Results and Discussion

Material investigated: ITALY, Trentino Alto-Adige (TN), Monte Nozzolo Grande (2010 m asl), 1♂, 1♀, 16.VI.2019, leg. Bozzo R., det. Petri I.; 2♂, 2♀, 11.VI.2022, leg. Bozzo R., det. Petri I.; Darzo, Galleria Impero (1110 m asl), 2♂, 2♀, 07.VI.2022, leg. & det. Petri I.; 1♂, 3♀, 24.VI.2022 leg. & det. Petri I..

The morphological characters (Fig. 2A, B) allow to distinguish *I. lithoclasica* from *I. ravasinii* which chelicerae tend to be more thick and spines are less pronounced, and has a clearly different genital morphology (Schönhofer & Martens, 2010). In Schönhofer & Martens (2010) it is said that the distribution areas of *I. lithoclasica* and *I. ravasinii* is separated by the alpine mountain massifs between Lake Iseo and Lake Garda, because there were not yet any records of *Ischyropsalis*. Our new records allow to extend the eastern distribution area of *I. lithoclasica* of 60 km, and it is possible to expand the boarding zone of *I. lithoclasica* and *I. ravasinii* to the Lake Garda, a geographic barrier that caused isolation in these two species.

Ischyropsalis lithoclasica (Figs 3, 4) is a troglophilous species who preferably lives in subterranean habitats due to the presence of cool and moist microclimate (Schönhofer & Martens, 2010). The new records on Monte Nozzolo Grande (Fig. 1, point 1) are all from artificial caves and fortifications from the First World War. In this kind of man-made rocky environment, the species found a hospitable habitat due to the presence of several interstitial holes between stones. The habitat outside the artificial cave is characterised by the presence of rocky slopes of limestone, where *I. lithoclasica* moves in the rock beds and can come to the surface preferably at night when air is moist and cool. There, specimens have been collected in addition to the artificial cave where the species can be easily observed during the summer thanks to the presence of cool microclimate. The populations found in Darzo mines (Fig. 1, point 2) are located in the Galleria Impero, an abandoned porphyry cave used until 2009 for the extraction of the mineral barite, in which there is a constant emission of cold air due to a complex siphons system into the mine (Tommaso Beltrami *pers. comm.*). This system causes a lowering of temperature, reaching 5°C during summer, while in the other abandoned gallery called Galleria Santa Barbara the temperature is around 14°C. As expected, any individual was found. In Schönhofer & Martens (2010), it is reported that *I. lithoclasica* prefers interstitial habitat where cold air emanates from thick



Fig. 3 – Adult male *Ischyropsalis lithoclasica* from Darzo, Galleria Impero. Photo Fabio Pupin/MUSE Archive. / **Fig. 3** – Maschio adulto di *Ischyropsalis lithoclasica* di Darzo, Galleria Impero. Foto di Fabio Pupin/Archivio MUSE



Fig. 4 – Adult female *Ischyropsalis lithoclasica* from Darzo, Galleria Impero. Photo Fabio Pupin/MUSE Archive. / **Fig. 4** – Femmina adulta di *Ischyropsalis lithoclasica* di Darzo, Galleria Impero. Foto di Fabio Pupin/Archivio MUSE

layers of clastic gravel. In fact, we found specimens only in caves that have an emanating cold air (5°C) due to a siphon system. With increasing altitude, the species is probably less strongly linked to underground habitats. Over 1600m most of the records refer to epigeic populations (Schönhofer & Martens, 2010).

Conclusions

This study allowed us to find the first population of *Ischyropsalis* in the area between Lake Iseo and Lake Garda, an area considered uninhabited by the species of this genus and a geographic barrier for *I. lithoclasica* and *I. ravinii* (Schönhofer & Martens, 2010). Finding an endemic species of the genus *Ischyropsalis* allows us to state that opilions of the western area of Trentino-Alto Adige have scarcely been collected in the last years, specifically in caves. We can state that probably future studies will show some other new records of endemic species still unknown. Finally, the area investigated is in a peripheral Alpine region, only partially covered by ice during the Last Glacial Maximum as shown in Fig. 1. It is interesting to note that the records of *I. lithoclasica* are all at the limit of the Last Glacial Maximum (LGM) (Ehlers et al. 2011), confirming the correlation highlighted by Mammola et al (2019) between its current distribution and the maximum extension reached by the glaciers tongue during the LGM (ca. 20,000 years ago).

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