

The subterranean ant *Strumigenys argiola* (Insecta, Formicidae) newly reported from South Tyrol, Italy

Abstract

Strumigenys argiola (Emery, 1869) is reported for the first time from South Tyrol. Several gynes were captured using pitfall traps and workers were collected with the Berlese method from soil core samples. The records originated from five different sites and we consider the species as likely occurring in a wider area of low altitudes in the Adige/Etsch valley. It is possible that the species has extended its distribution northwards colonizing the region more recently. The fact that the sites of record were all human-made (one river dam, one recently abandoned and one managed vineyard) underlines the potential of this cryptic and subterranean species to colonize also anthropogenically influenced sites.

Introduction

Strumigenys argiola is a species of the Myrmicinae subfamily and the Attini tribe with 859 described species in the same genus (BOLTON 2023) and eight species recorded for Europe (ANTWEB 2023). As typical for this genus, *S. argiola* is equipped with a trap-jaw mandible that is used for hunting small invertebrates, such as collembolans within the soil interstices (HÖLDOBLER & WILSON 1990, LARABEE & SUAREZ 2014). Consequently, the life of this small species is almost entirely limited to the soil as a small and light-colored body indicates. However, this concealed life form limits the recording efficiency making the species most likely under-recorded throughout its distribution range (SEIFERT 2018).

The natural habitat of the species is mostly described as summer-warm sites of xerothermic grasslands and dry pine forests (SEIFERT 2018). Also, anthropogenic biotopes, like river dams, gardens, and urban areas are reported to be colonized by this species (BOROVSKY 2009, FELLNER et al. 2009, HOLECOVÁ et al. 2015).

The species' range is so far reported from North Africa throughout the entire Mediterranean basin from Portugal in the west to the Balkan peninsula, Turkey, southern Russia and Azerbaijan in the east (BOROWIEC 2014). The northernmost records are reported from Switzerland (KUTTER 1973), Austria (FELLNER et al. 2009), Slovakia (HOLECOVÁ et al. 2015), and – with a doubtful record – Germany (BUSCHINGER 1997). So far, records within the Alpine area are restricted to Switzerland (NEUMEYER & SEIFERT 2005) and Austria (FELLNER et al. 2009).

Keywords: biodiversity monitoring, dry grassland, soil biodiversity, leaf litter ants, vineyards

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submitted: 3.10.2023
accepted: 31.10.2023

DOI: 10.5281/zenodo.10062685
online publication first on 30.12.2023

Methods and Results

The first records of *Strumigenys argiola* from South Tyrol originated from a project investigating the ant community on the dam of the Adige/Etsch river close to the locality of Salorno/Salurn (hereafter named Etsch-Damm project; GLASER 2012). This survey (commissioned by former Abteilung 30 – Wasserschutzbauten from the Autonomous Province of Bolzano/Bozen-South Tyrol) aimed to evaluate the effect of mowing versus mulching on the ant community on the outer slope of the dam (Fig. 1). The applied field methods were pitfall traps (0.25 l plastic cups with 7.5 cm diameter, filled with saturated salt solution and a few drops of detergent), litter/soil sieving, nest counts and netting/beating the vegetation. From 8.4.2010 to 1.1.2011 a total of 20 pitfall traps (five per site) were exposed on four sites (two mown and two mulched) (see also SCHATZ 2012). Within this project, four gynes (three dealate, one alate) of the species were recorded on two mulched sites at Salorno/Salurn and one mown site at Cortina/Kurtinig (Fig. 2, Table 1). Additionally, 12 sites at the same locations (six mown and six mulched, each 4 m²) were sampled by nest counts, by 25 sieving and 59 vegetation samples (by netting/beating). All these additional methods did not score further records of this species. Investigations in nearby dam biotopes by the same methods in the years 2002 and 2003 at Cortina/Kurtinig and Egna/Neumarkt delivered no findings of *S. argiola* (GLASER 2004). At the three positive sites the syntopic ant fauna consisted of *Anergates atratulus*, *Camponotus piceus*, *Formica cunicularia*, *F. fusca*, *Lasius myops*, *L. niger*, *L. umbratus*, *Plagiolepis pyrenaica*, *Ponera testacea*, *Tapinoma subboreale*, *Temnothorax flavicornis*, *Tetramorium cf. impurum*.

The second part of the records here reported originated from the Biodiversity Monitoring South Tyrol (hereafter named BMS project; HILPOLD et al. 2023), a biodiversity monitoring program that includes a variety of habitats and sampling methods including soil core sampling, beating, sweeping, and pitfall trapping performed on over



Fig. 1: Pictures of the location of record from above left: two mulched and one mowed sites along the Etsch dam. Below from left: the abandoned vineyard with dry-grassland character and the steep vineyard (Photos: above by Timo Kopf, below by Eurac Research/BMS Team).



Fig. 2: Pictures of *Strumigenys argiola*. Left: alate gyne (Etsch-Damm Project. Photo by H. Müller); middle and right: workers collected from soil core samples (BMS project. Photos by E. Guariento).

320 single sampling sites. Pitfall traps were installed at each site twice a year, two in late spring/early summer and two in late summer/early autumn. Four soil core samples (10×10 cm and max. 15 cm deep) per site were taken during late spring and summer months. Soil samples were taken to the laboratory and invertebrates were extracted by heat in a modified Kempson apparatus (KEMPSON et al. 1963). For more details on collection methods in the BMS project see HILPOLD et al. (2023). With all approaches only two records of *Strumigenys argiola* workers from soil core samples were made on two different sites in Gargazzone/Gargazon and Nalles/Nals (Fig. 2, Table 1), a dry grassland and a managed vineyard. At the two sites where the species was recorded (Fig. 1) the syntopic ant fauna consisted of *Aphaenogaster subterranea*, *Camponotus aethiops*, *C. piceus*, *Formica cunicularia*, *Lasius alienus* group, *L. emarginatus*, *L. myops*, *L. niger*, *Pheidole pallidula*, *Plagiolepis* sp., *Ponera testacea*, *Solenopsis fugax*, *Tapinoma subboreale* and *Tetramorium* sp.

Table 1: *Strumigenys argiola*: Information on record location and circumstances.

Site/Project	Site/Biotope	Latitude	Longitude	Elevation (m a.s.l.)	Method	Specimen & Date
Gargazon/BMS	070_PAC_3 Dry pasture, abandoned and cleared vineyard, exposed to SW.	46.57537	11.21777	322	Soil core	1 worker 31.05.2022
Nals/BMS	205_WYS_3 Steep managed vineyard exposed to S.	46.54519	11.19592	404	Soil core	1 worker 31.05.2022
Salurn 1/Etsch-Damm	Mul-1, mulched, semidry oligotrophic grassland, exposed to SE.	46.24096	11.19669	210	Pitfall trap	1 alate gyne 24.8.–11.9.2011 1 dealate gyne 11.9.–5.10.2011
Salurn 2/Etsch-Damm	Mul-2, mulched, semidry oligotrophic grassland, exposed to SE.	46.24163	11.19873	210	Pitfall trap	1 dealate gyne 6.7.–2.8.2011
Kurtinig/Etsch-Damm	Mäh-4, mown, semidry oligotrophic grassland, exposed to ESE.	46.25933	11.22583	210	Pitfall trap	1 dealate gyne 2.8.–24.8.2011

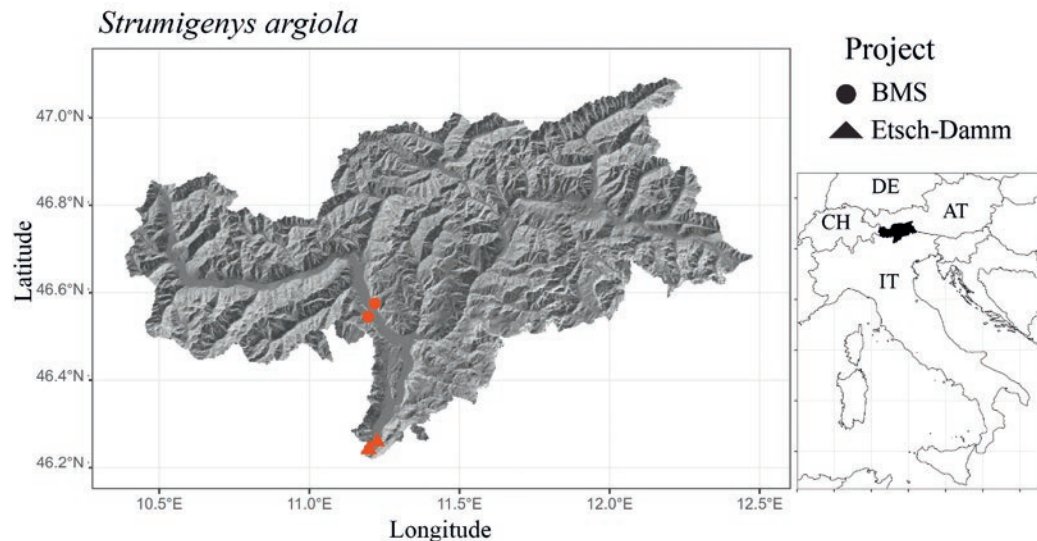


Fig. 3: *Strumigenys argiola*: Records of the species in South Tyrol. The different symbols mark the projects in the framework of which the findings were made (see legend in the figure above right).

All samples from the other sites included in the two projects and appearing to be suitable biotopes (such as extensive dry pastures $N=10$ and steep vineyards $N=10$ and river dams $N=4$) were screened looking for the species in the collected samples but with no additional findings. A map was created with the locations where the species was recorded using “sf” package (PEBESMA & BIVAND 2023) in the R environment (Fig. 2). The species were identified using a stereo microscope (Etsch-Damm: Nikon-SMZU with 150 magnification; BMS: Laica M125c with 120 magnification) and the identification keys of SEIFERT (2007, 2018).

Discussion

The presence of *Strumigenys argiola* in South Tyrol could have been expected considering the general distribution range and the preferred habitat of the species. However, it represents one of the few records within the Alpine arch and is characterized by five sites of occurrences making the species likely wider distributed in the area. The capture probability is very low for workers with 0.5% samples recording the species (two of 400 single soil core samples in suitable sites of the BMS project). Also, within the Etsch-Damm project 20 pitfall traps exposed for one vegetation period caught 4,856 ant individuals and 15 species. The four *Strumigenys argiola* specimens represent just 0.08% of all sampled ant individuals. All other sampling methods used in one or the other project, such as colony sampling (nest counts) and vegetation sampling (beating and sweeping), did not deliver any additional records. Interestingly, no pitfall record originated from the BMS project and no one from soil sieving in the Etsch-Damm project, a well-suitable method to collect ground-dwelling ants (e.g. FELLNER et al. 2009). Furthermore, the species was never recorded on other recent studies that used both pitfall traps and soil core samples in extensive and dry grasslands of South Tyrol in suitable elevations (GLASER 2004, GUARIENTO et al. 2020). The best method for capturing workers is undoubtedly the use of soil or litter samples (FELLNER et al. 2009, HOLECOVÁ et al. 2015, PURKART et al. 2021). Alatae were previously caught with pan traps and also with water containers, rather rarely in pitfall traps (PURKART et al. 2021), as was the case in the Etsch-Damm Project. Nevertheless, it is difficult to assess if *S. argiola* is a rare species in South Tyrol or just hard to find, maybe both is true.

The swarming of this species is described to occur in August (SEIFERT 2018) and PURKART et al. (2021) reported nuptial flights between 30.7. and 5.9. in Slovakia. This phenological information is confirmed also from our pitfall trap records (one dealated gyne

collected in September-October might have originated from the semi-claustral colony founding strategy of the species). Furthermore, the finding of three dealated gynes in the traps supports the semi-claustral colony foundation hypothesis (SEIFERT 2018) which was recently confirmed by the artificial rearing of one colony (PURKART et al. 2021). The species' natural habitat is described as dry and warm grasslands (SEIFERT 2018). Adequate biotopes are threatened in South Tyrol by the abandonment of pastoralism and the intensification of agriculture at lower elevations (HINOJOSA et al. 2019). However, secondary grasslands on river dams can substitute natural xerothermic open biotopes on elevated river banks and there are at least some hints indicating this for ants (GLASER 2004, 2005). On the other hand, this conservation aspect seems not essential for *Strumigenys argiola*, which is also reported from cultivated sites like gardens (BOROVSKY 2009, PURKART et al. 2021) and vineyards (this study). Syntop-occurring ant communities on all record sites are dominated by xerothermophilic species. Finally, the difficulty of recording *Strumigenys argiola* cannot fully explain the lack of historical records in many regions. *S. argiola* may be small and live concealed in the soil, but it is also easily recognized by non-myrmecologists. For this reason, we cannot exclude the possibility that recent range expansion has occurred, facilitated by anthropogenic transportation and global warming.

Acknowledgement

We want to thank the Autonomous Province of Bolzano-South Tyrol for financing both projects in the framework of which the species was found and Willigis Gallmetzer (Amt für Bevölkerungsschutz, formerly Amt für Wasserschutzbauten) for commissioning and coaching the project on the Etsch dams in 2011. Furthermore, we thank Simone Ballini, Timo Kopf, Irene & Heinz Schatz, Karl-Heinz Steinberger, and Julian von Spinn for intensive fieldwork, sorting, and labeling. We are indebted to Johann Müller for photographs of *Strumigenys argiola* from the Etsch-Dam-project. Finally, we want to thank Herbert C. Wagner who reviewed the manuscript.

Riassunto

Strumigenys argiola (Emery, 1869) è segnalata per la prima volta nella provincia autonoma di Bolzano–Alto Adige. La specie è stata trovata con trappole a caduta che contenevano diversi individui sessuati femmine e usando campioni di suolo ed estrattori Berlese che contenevano operaie. I record provengono da cinque siti differenti, e pensiamo che la specie possa essere presente in un'area più ampia delle quote più basse nella valle dell'Adige. Inoltre, non possiamo escludere che la specie abbia colonizzato la provincia in tempi recenti. Il fatto che i siti di segnalazione siano tutti originati da attività umane (una diga, un vigneto abbandonato di recente ed uno ancora in uso) evidenzia la capacità di questa specie criptica di colonizzare anche siti antropizzati.

Zusammenfassung

Strumigenys argiola (Emery, 1869) wird zum ersten Mal aus Südtirol gemeldet. Gynen wurden mit Barberfallen gefangen, Arbeiterinnen mit Bodenproben. Die Nachweise stammen von fünf verschiedenen Standorten. Wir halten es für wahrscheinlich, dass die Art in tieferen Lagen Südtirols im Etschtal an weiteren Standorten vorkommt. Weiters kann nicht ausgeschlossen werden, dass sich die Art rezent in der Provinz ausgebreitet hat. Die Tatsache, dass es sich bei allen Fundorten um anthropogen geschaffene Standorte handelt (ein Flussdamm, ein kürzlich aufgelassener und ein bewirtschafteter Weinberg), unterstreicht das Potenzial dieser kryptischen und unterirdischen Art, auch anthropogen geschaffene Standorte zu besiedeln.

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