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SHORT COMMUNICATION

Meta menardi and *M. bourneti* (Araneae: Tetragnathidae) segregate along the altitudinal gradient of Mount Etna (Sicily, S–Italy)

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Abstract. *Meta menardi* (Latreille, 1804) and *M. bourneti* Simon, 1922 (Araneae: Tetragnathidae) are ubiquitous inhabitants of the twilight zone of most hypogean sites across Europe. Recent observations in volcanic caves pointed out the presence of both species in Sicily, with *M. menardi* occurring in a small number of caves. On the basis of field investigations conducted in 2017–2021, we analyzed the distribution and the habitat frequency of the two species along the altitudinal gradient of Mount Etna. Our results demonstrate a significant effect of climate and altitude on the segregation of the two species, with *M. menardi* occurring exclusively above 1200 meters in caves opening in areas characterized by low temperatures (mean ± SD = 10.1 ± 0.68°C) and high precipitations (682 ± 19 mm). Conversely, *M. bourneti* preferably occurred in areas with higher temperatures (14.5 ± 2.1°C) and lower precipitations (606 ± 46 mm). Substrate age was not affecting the distribution of the two species, as both occurred in volcanic caves of ancient and recent formation (from 350 to >1,000 years). In light of the ongoing global warming, a possible increase in temperature could favor the upshift of *M. menardi* towards upper areas on the volcano subjected to high volcanic disturbance and thus unsuitable for hosting stable populations through time. In this regard, investigations on the response of *Meta* spiders to increases in temperature on the Etna volcano would be an asset to establish an appropriate management plan for the conservation of the newly discovered population of *M. menardi* in Sicily.

Keywords: Cave-dwelling spiders, conservation, niche segregation, subterranean habitats, lava caves
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Spiders are one of the most diverse and successful groups of terrestrial predators (Hormiga & Griswold 2014). Competition among spiders with similar ecological requirements is minimized in different ways, including resource partitioning (Richardson & Hanks 2009) and temporal or spatial segregation (Nieto-Castañeda et al. 2009; Villanueva-Bonilla et al. 2019).

The genus *Meta* CL Koch, 1835 (Araneae: Tetragnathidae) in Europe is represented by two of the most frequent species that can be encountered in the twilight zone of caves and other hypogean sites: *Meta bourneti* Simon, 1922 and *M. menardi* (Latreille, 1804). Both species have a widespread distribution, especially when compared to the most specialized subterranean spiders (Koponen 1993; Deltshev 2011; Mammola & Isaia 2017; Hesselberg 2021). Such broad ranges can be explained in light of their life cycle, which includes a sedentary hypogean phase and an epigean one (Mammola & Isaia 2014), allowing efficient dispersion across suitable habitats.

Meta bourneti is widely distributed in the Mediterranean basin (Nentwig et al. 2022), from Europe to Georgia and North Africa (World Spider Catalog 2022). Its ecological preference for warm hypogean sites (above 9°C) makes it particularly abundant in southern Europe. Conversely, *M. menardi* is mainly distributed in the Palaearctic region, reaching the Scandinavian Peninsula in the North and Ukraine and Turkey in the East (World Spider Catalog 2022). It generally occurs in cool hypogean sites (5–9°C) (Isaia et al. 2007; Mammola & Isaia 2014).

In Italy, both species are widely distributed (Pantini & Isaia 2019), with abundant populations of *M. bourneti* in the South and *M. menardi* in the North (Pantini & Isaia 2019). In Sicily, the presence of *M. bourneti* has been widely documented since 1963 (Dresco 1963), whereas *M. menardi* has never been recorded so far.

In this paper, we reviewed available literature data on *Meta* spiders in Sicily and present a number of original occurrences gathered in recent years, including the first record of *M. menardi* for the island, one of the southernmost populations in Europe. In light of the geographical isolation of the newly discovered population, the possible competition with *M. bourneti* driven by ongoing increasing global temperature, we also provide insights about the ecological factors driving the segregation of these two species along the altitudinal gradient of Mount Etna.

METHODS

Literature survey.—We examined all available literature data referring to the presence of *Meta* spiders in Sicily. For the bibliographic survey, we referred to the reference list of the updated version of the checklist of Italian spiders (Pantini & Isaia 2019).

Field survey.—Field activities were set up on Mount Etna, an active stratovolcano of 3,350 m formed at the beginning of the Quaternary in northeastern Sicily (Rittman 1976), representing the highest peak on the island. More than 200 volcanic caves are censused on the Etna Volcano (Centro Speleologico Etneo 1999), opening at different altitudes and showing an extremely diversified range of ecological and microclimatic conditions. Caves closer to the sea coast are generally warm and dry, whereas caves opening nearby the summit of the volcano are cold and humid. The volcanic and associated seismic risk increases with the altitude, making the caves close to the summit structurally unstable and highly subject to volcanic disturbance.

We investigated 28 lava caves opening at different altitudes and on different slopes of the volcano. Caves were selected among the most accessible based on both security of access and practicability of the galleries, aiming at minimizing risk in highly active sectors of the volcano due to frequent collapse of cave structures. Although they greatly vary in length, most caves developed horizontally. The

presence of *Meta* spiders at each site was verified through visual census and occasional hand sampling along the main gallery of the lava tube.

Although *M. menardi* shows some seasonal migrations along the cave gradient (Gasparo & Thaler 2000), and *M. bourneti* performs vertical movements along cave walls (Lunghi 2018), adult spiders were regarded as sedentary in the cave, with no evidence of migration outside (Smithers 2005; Mammola & Isaia 2014). Consequently, a single sighting was considered as a valid occurrence point.

Field activities covered a period of five years, discontinuously from February 2017 to September 2021, covering all seasons, and at least twice per year. At each visit, we spent at maximum of one hour searching for spiders inside the lava cave.

Statistical analysis.—Environmental occurrences of *Meta bourneti* and *M. menardi* living in Mount Etna lava caves were tested using data on bioclimatic factors derived from WorldClim 2.1 generated on climate data across years 1970–2000 (online at https://www.world clim.org/; Fick & Hijmans 2017). Lava ages were obtained from Etna Volcano's Geological map (1:50,000 scale) (Branca et al. 2011).

We selected the following continuous covariates as potential variables explaining the presence of the two species in the study area: annual mean temperature (BIO1), annual precipitations (BIO12), elevation, and land use.

Data on the distribution and environmental frequency of the two species were elaborated in R environment (R Core Team 2021). Each variable was analyzed separately with the nonparametric Mann–Whitney test for non–normally distributed variables. Normality was tested using the 'shapiro.test' function from 'stats' package (R Core Team and Contributors Worldwide 2021).

RESULTS

The bibliographic survey led us to record the occurrence of *Meta bourneti* in 10 localities, encompassing 5 Sicilian provinces (Appendix 1). Our field activities led to the discovery of a number of new records for both *M. menardi* and *M. bourneti*, mostly within the Regional Park of Mount Etna (EUAP0227) (Appendix 1, Fig. 1). For each cave, we report speleological cadastre numbers in square brackets when available/applicable [regional code, provincial code, cave number].

All faunistic data have been deposited in the Spider Trait Database (Pekár et al. 2021), accessible at https://spidertraits.sci.muni.cz/datasets/106.

Material.—*Meta bourneti* Simon, 1922: CATANIA Prov.

1 ♀; Parco dell'Etna, Zafferana etnea, Grotta del Gatto [SiCT1124]; 37°40′59.0″N, 15°05′08.7″E; 06 Feb. 2017; Nicolosi legit.;
1 ♀; Parco dell'Etna, Trecastagni, Grotta di Monte Cicirello, [SiCT1156]; 37°40′11.2″N, 15°04′14.7″E; 06 Mar. 2017; Nicolosi leg.;
1 juv; Parco dell'Etna, Ragalna, Grotta della Catanese I [SiCT1037]; 37°38′54.0″N, 14°56′21.0″E; 09 Jun. 2017; Nicolosi leg.;
1 ♀; Parco dell'Etna, Linguaglossa, Grotta di Piano Porcaria [SiCT1101]; 37°47′52.1″N, 15°06′28.8″E; 12 Nov. 2017; Nicolosi leg.;
1 ♀; Catania, Grotta dei Roditori [SiCT1234]; 37°31′55.7″N, 15°04′27.5″E; 16 Dec. 2017; Nicolosi vidit;
1 ♀; Catania, Grotta Lucenti; 37°30′47.4″N, 15°03′54.6″E; 01 Mar. 2018; Nicolosi vid.;
1 ♀; "Complesso Immacolatelle e Micio Conti" Nature Reserve [ITA070008], San Gregorio di CT, Grotta della Tesi; 37°33′40.7″N, 15°06′47.1″E; 11 Feb. 2019; Nicolosi vid.;
1 ♀; "Complesso Immacolatelle e Micio Conti" Nature Reserve, San Gregorio di CT, Grotta Micio Conti [SiCT016]; 37°33′39.5″N, 15°07′01.0″E; 11 Feb. 2019; Nicolosi vid.;
1 ♀; Parco dell'Etna, Ragalna, Grotta della Catanese I [SiCT1037]; 37°38′54.0″N, 14°56′21.0″E; 21 Jan. 2021; Nicolosi vid.;
2 ♀; Parco dell'Etna, Trecastagni, Grotta di Monte Cicirello [SiCT1156]; 37°40′11.2″N, 15°04′14.7″E; 16 Jun. 2021; Nicolosi vid.;
1 ♀; Parco dell'Etna, Nicolosi, Grotta Lunga (Grotta di Monpeloso) [SiCT1029]; 37°37′47.0″N, 15°02′08.4″E; 16 Jun. 2021, Nicolosi vid.;
2 ♀; Parco dell'Etna, Adrano, Grotta del Santo (di San Nicola) [SiCT1032]; 37°42′33.1″N, 14°52′33.2″E; 18 Jun. 2021, Nicolosi vid.;
1 ♀; Parco dell'Etna, Milo, Grotta Pietrabuca; 37°44′47.4″N, 15°05′21.1″E; 20 Jul. 2021; Nicolosi vid.;
3 ♀; Parco dell'Etna, Linguaglossa, Grotta di Piano Porcaria [SiCT1101]; 37°47′52.1″N, 15°06′28.4″E; 28 Jul. 2021; Nicolosi vid.;
1 ♀; Parco dell'Etna, Linguaglossa, Grotta del Porcospino [SiCT1033]; 37°47′54.0″N, 15°07′04.8″E; 28 Jul. 2021; Nicolosi vid.;
1 ♀; Mascali, Grotta Forcato [SiCT1013]; 37°46′49.3″N, 15°08′46.8″E; 04 Aug. 2021; Nicolosi vid.;
1 ♀; Parco dell'Etna, Pedara (Tarderia), Cava dell'Istrice; 37°38′58.1″N, 15°03′19.3″E; 07 Sep. 2021; Nicolosi vid.

SIRACUSA Prov. 1 ♀; "Complesso Speleologico Villasmundo–S. Alfio" Regional Nature Reserve [EUAP1147], Melilli, Grotta Villasmundo [SiSR7032]; 37°13′00.9″N, 15°06′01.4″E; 02 Dec. 2017; Nicolosi leg.

TRAPANI Prov. 1 ♀; Santa Ninfa, Grotta di Santa Ninfa, "Grotta di Santa Ninfa" Nature Reserve; 37°46′50.1″N, 12°54′46.9″E; 28 Feb. 2017; Isaia and Nicolosi leg.

***Meta menardi* (Latreille, 1804)**: CATANIA Prov.

1 ♀; Parco dell'Etna, Bronte, Grotta dei Ragazzi [SiCT1241]; 37°45′57.0″N, 14°55′32.7″E; 09 Sep. 2021; Nicolosi vid.;
1 ♀; Parco dell'Etna, Randazzo, Grotta del Nano; 37°49′23.6″N, 14°58′44.9″E; 29 Aug. 2021; Nicolosi vid.;
1 ♀; Parco dell'Etna, Randazzo, Grotta del Faggio; 37°49′19.5″N, 14°58′43.4″E; 29 Aug. 2021; Nicolosi vid.;
1 ♀; Parco dell'Etna, Castiglione di Sicilia, Grotta delle Femmine [SiCT1046]; 37°49′31.6″N, 15°01′24.9″E; 03 Aug. 2021; Nicolosi vid.;
1 ♀; Parco dell'Etna, Ragalna, Grotta dell'Immacolata [SiCT244]; 37°40′49.1″N, 14°57′31.7″E; 08 Jul. 2021; Nicolosi vid.;
3 ♀; Parco dell'Etna, Belpasso, Grotta di Monte Giacca [SiCT1145]; 21 Jun. 2021; 37°40′58.3″N, 14°59′12.4″E; Nicolosi vid.;
1 ♀; Parco dell'Etna, Adrano, Grotta del Gallo Bianco I [SiCT1193]; 37°43′32.0″N, 14°54′50.3″E; 18 Jun. 2021; Nicolosi vid.;

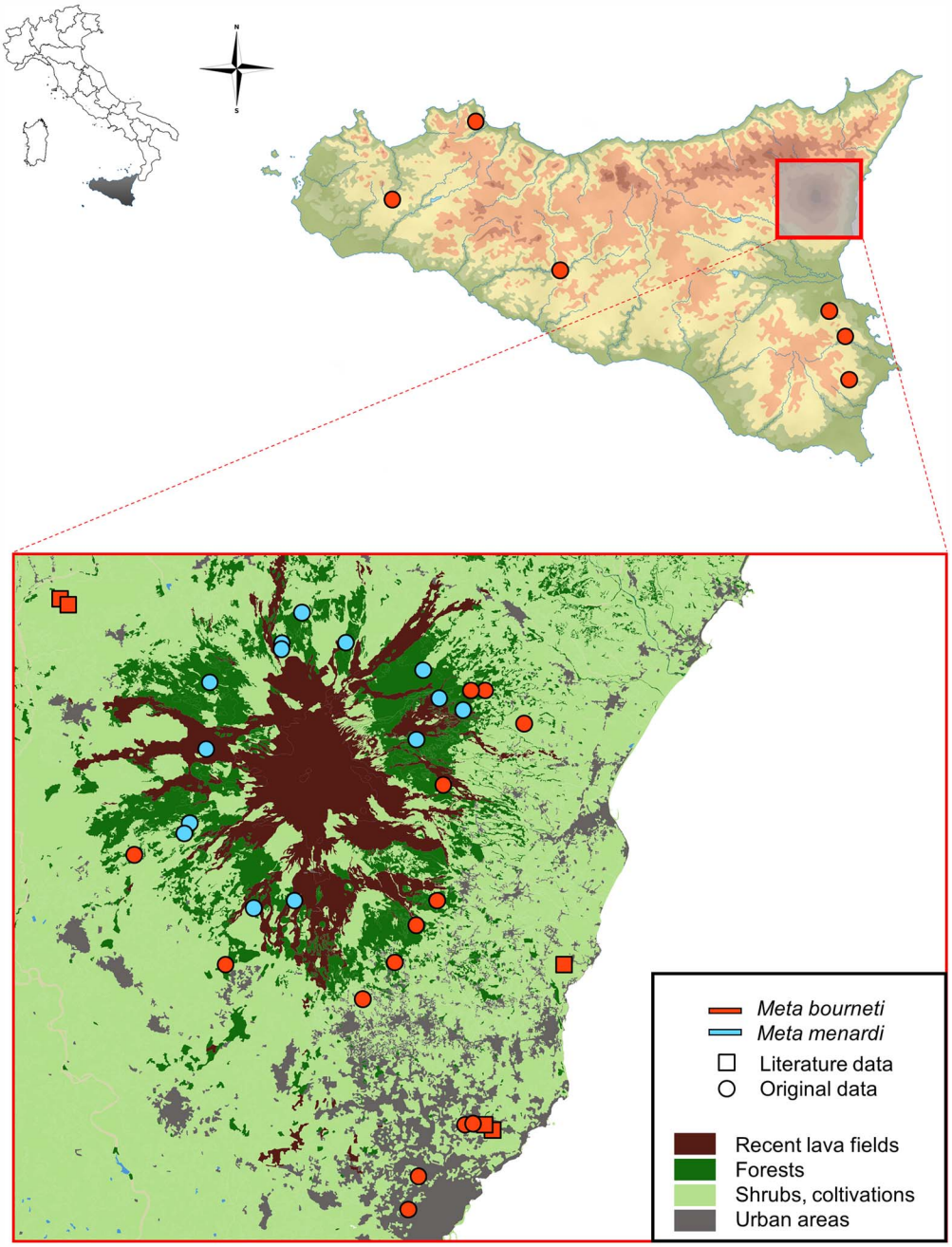

Figure 1.—Distribution of *Meta bourneti* (red) and *M. menardi* (blue) in Sicily (above) and on Mount Etna (inset below) with reference to literature and original data.

1 ♂; Parco dell'Etna, Adrano, Grotta di Monte Intralio [SiCT1007]; 37°43′13.0″N, 14°54′33.0″E; 18 Jun. 2021; Nicolosi vid.;
2 ♀; Parco dell'Etna, Linguaglossa, Grotta di Monte Crisimo [SiCT1170]; 37°47′42.5″N, 15°05′15.2″E; 13 Jun. 2021; Nicolosi vid.;
2 ♀; Parco dell'Etna, Castiglione di Sicilia, Grotta di Monte Corruccio [SiCI1056]; 37°48′37.4″N, 15°04′30.6″E; 08 Jun. 2021; Nicolosi vid.;
1 ♀; Parco dell'Etna, Sant'Alfio, Grotta della Neve (dei Ladri) [SiCT1117]; 37°46′16.9″N, 15°04′17.5″E; 08 Jun. 2021; Nicolosi vid.;
1 ♀; Parco dell'Etna, Randazzo, Grotta Piano Cavoli; 37°50′29.0″N, 14°59′29.0″E; 02 Jun. 2021, Nicolosi vid.;
1 ♀; Parco dell'Etna, Maletto, Grotta del Cernaro [SiCT1068]; 37°48′13.0″N, 14°55′44.0″E; 29 Nov. 2017; Nicolosi leg.;
1 ♂; Parco dell'Etna, Adrano, Grotta di Monte Intralio [SiCT1007]; 37°43′13.0″N, 14°54′33.0″E; 18 Nov. 2017; Nicolosi leg.;
1 ♀; Parco dell'Etna, Piedimonte etneo, Grotta di Piano Noce; 37°47′18.1″N, 15°06′18.3″E; 12 Nov. 2017; Nicolosi leg.;
1 juv.; Parco dell'Etna, Sant'Alfio, Grotta della Neve (dei Ladri) [SiCT1117]; 37°46′17.7″N, 15°04′18.7″E; 29 Oct. 2017; Isaia and Nicolosi leg.

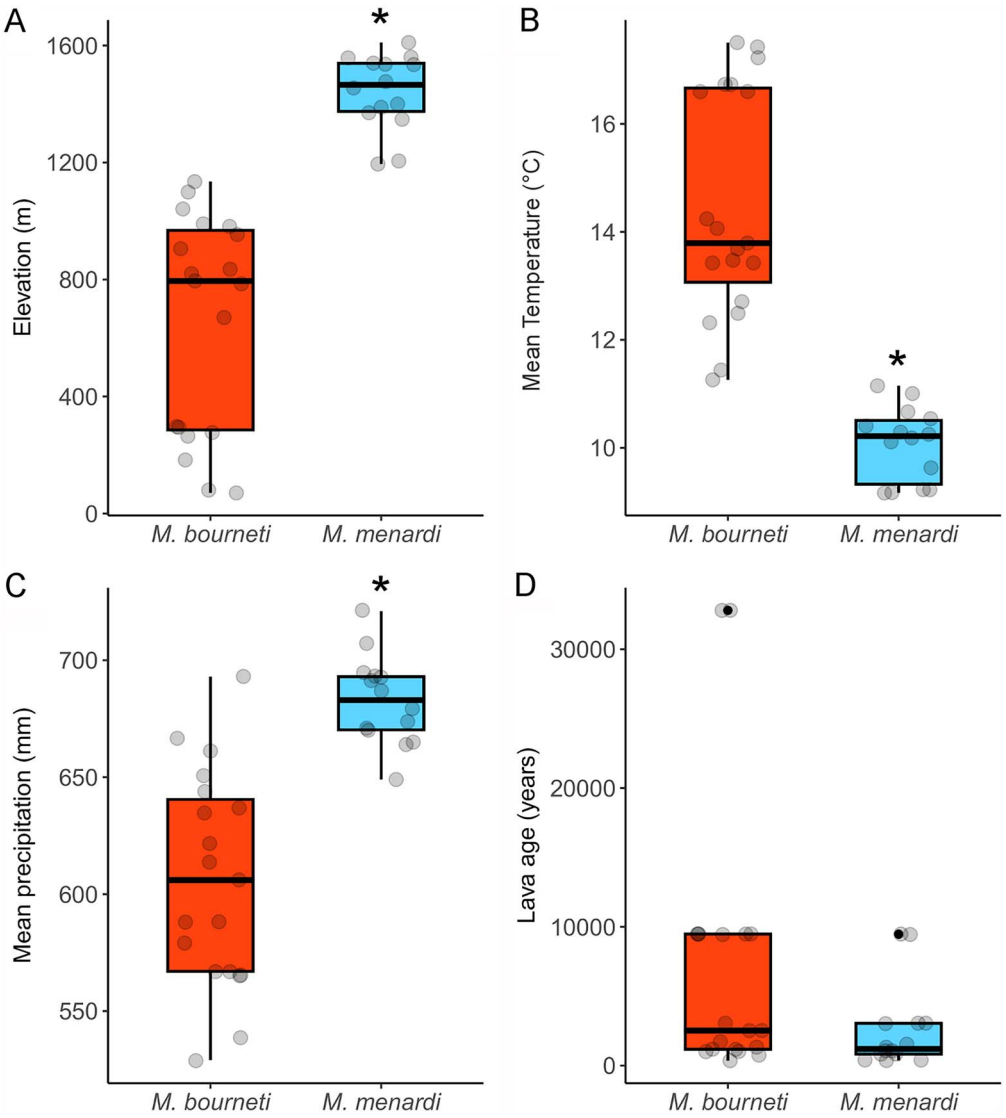

Figure 2.—Boxplots representing species preferences of *Meta menardi* and *M. bourneti* in volcanic caves on Mount Etna in terms of elevation (A), mean temperature (B), precipitation (C), and lava age (D). Asterisks indicate statistical significance (Mann–Whitney test with $P < 0.05$).

Habitat occurrence.—Our field activities led us to record the presence of *Meta bourneti* and *M. menardi* 14 caves each. As expected, according to *Meta* spiders' general preference for the twilight zone (Smithers 2005, Mammola & Isaia 2014, 2017; Lunghi 2018), most individuals occurred in the vicinity of the cave entrance.

Our results support a significant effect of altitude (Mann–Whitney test: $n = 33$, W = 266, $P < 0.001$), temperature ($n = 33$, W = 266, $P < 0.001$) and precipitation ($n = 33$, W = 251, $P < 0.001$) in determining the segregation of the two species along the altitudinal gradient of Mount Etna.

Accordingly, *Meta menardi* is preferably found in caves above 1,200 meters a.s.l. (mean ± SD = 1441 ± 130 m) while *M. bourneti* occurs more frequently at lower altitudes (656 ± 372 m) (Fig. 2A–D). Neither of the species occurred over 1,600 meters and were never found to occur in the same caves. The minimum distance between a site colonized by *M. bourneti* and one by *M. menardi* is approximately 1 km and an altitude difference of 100 m.

In particular, when considering our results in terms of temperatures, *M. menardi* occurs more frequently in colder sites (mean ± SD = 10.1 ± 0.68°C) and with higher precipitation (682 ± 19 mm) compared to *M. bourneti,* occurring in sites with higher temperature (14.5 ± 2.1°C) and with lower precipitation (606 ± 46 mm).

Lastly, both species seem able to colonize lava caves irrespectively to subtrate age, occurring both in sites of recent and old formation (from 350 to >1,000 years). Accordingly, the Mann–Whitney test did not show any significance in respect to this factor ($n = 33$, W = 85, $P > 0.05$).

DISCUSSION

Recent research on subterranean organisms proved their sensitivity to microclimatic fluctuations (Culver & Pipan 2019; Nicolosi et al. 2021). Accordingly, sensitivity is particularly high in spiders characterized by high development of troglomorphic traits, exhibiting low ranges of thermal tolerance (Mammola et al. 2019, 2020).

Although *Meta bourneti* and *M. menardi* are not strictly subterranean, a certain relation with microclimate has been proven to be among the most important factors determining niche segregation in these species (Mammola & Isaia 2014 but see also Brignoli 1971; Ribera 1978; Gasparo & Thaler 2000 for further evidence).

Based on literature sources and recent field activities, in this work we report a number of unprecedented occurrences of *Meta* spiders in Sicily, with particular emphasis on the first regional record of *M. menardi*. *Meta bourneti* was previously known in Sicily for several locations. The species was first detected by Dresco (1963) in "Grotte di Baida", in the province of Palermo. Subsequently, it was reported from the provinces of Trapani, Siracusa, and Catania (Brignoli 1979), including the occurrence of the species in lava caves of Mount Etna. Our field investigations led to the discovery of several new occurrences of *M. bourneti* and to the first record of *M. menardi* for Sicily, representing the southernmost population in Italy and figuring among the southernmost in Europe (Nentwig et al. 2022).

When considering the altitudinal distribution of Meta spiders on Mount Etna, an interesting pattern emerges (Fig. 1). *Meta menardi* colonizes caves from 1,200 to 1,600 m a.s.l., confirming its preference for colder and wettest areas seen in Mammola & Isaia (2014). Instead, *M. bourneti* generally occurs at lower altitudes, with records spanning from the coastline up to 1,200 m a.s.l. confirming its preference for warm sites and its wide climatic tolerance.

A possible mechanism favoring the coexistence of spiders in subterranean environments is represented by the shift in the trophic and temporal niche (Novak et al. 2010). Pavlek & Mammola (2021) suggested that food specialization in subterranean spiders may be a possible way to avoid direct competition. Moreover, Mammola et al. (2016) pointed out dynamic niche partitioning in syntopic troglophile spiders in the twilight zone of Western Alpine caves. As for *Meta* spiders, Mammola & Isaia (2014) demonstrated a complete niche partitioning between *Meta menardi* and *M. bourneti,* here corroborated, achieved through conditional differentiation, with *M. menardi* more competitive at narrow ranges of cooler temperatures and higher relative humidity.

Accordingly, we have never observed the two species inhabiting the same cave, despite the small distribution of *M. menardi* on Mount Etna and the short distance between sites of occurrences. As far as our data show, the two species get the closest within the SIC "Monte Baracca e Contrada Giarrita" (ITA070014) in Grotta di Piano Porcaria (with *M. bourneti* at 1099 m a.s.l.) and Grotta di Piano Noce (with *M. menardi*, 1195 m), located approximately at a linear distance of 1 km one from the other. It goes without saying that this location represents an ideal system where to monitor the possible replacement of *Meta menardi* by *M. bourneti,* especially in the perspective of the ongoing temperature rise due to climate change.

Neither of the species seems able to colonize volcanic caves of Mount Etna over 1,600 meters, probably due to unfavorable microclimatic conditions or, more likely, to the lack of suitable habitat in the volcanic uplands for the survival of the epigean juvenile stages. The latter seems a reasonable hypothesis given that this species has been observed in caves opening in vegetated areas (pastures) up to 2,000 m a.s.l. (Isaia et al. 2011; Mammola et al. 2021). Moreover, Smithers (2005) has noticed a seasonal increase in the abundance of juveniles climbing on the branches of the shrubs growing in the vicinity of a mine entrance, attesting the role of vegetation in determining higher habitat suitability for *Meta menardi*. Tentatively, volcanic rocky uplands may represent a hostile environment for the epigean juvenile phase of *M. menardi*, due to the presence of lava substrates devoid of vegetation and being frequently affected by volcanic disturbance (i.e., volcanic ash fall and presence of lava flows). These conditions may hamper dispersal and inhibit the expected elevational upshift of the species due to the ongoing temperature increase, posing a serious threat to the survival of the Sicilian populations of *M. menardi*. In turn, species replacement may occur at lower altitudes, where sites abandoned by *M. menardi* may become suitable for *M. bourneti*.

CONCLUSIONS

Due to the scarce biospeleological research activities (but see, Caruso 1982; Sendra et al. 2019; Sabella et al. 2019, 2020), and the general lack of arachnological investigations in Sicily, the new record of *Meta menardi* on Mount Etna represents an important outcome from both the faunistic and the ecological point of view, especially considering the high level of isolation of this population. Considering the preference of *M. menardi* for cold caves (around 10°C) and the unlikely migration towards unsuitable volcanic uplands, we hypothesize that the ongoing climatic change may lead to a possible reduction of the Sicilian population of *M. menardi* and a corresponding expansion of the local range of *M. bourneti*. Further investigations and monitoring of the response of *Meta* spiders to temperature increases on the Etna volcano would be therefore an asset to establish an appropriate management plan for the conservation of the newly discovered population of *M. menardi* in Sicily.

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APPENDIX 1

Occurrences of *Meta bourneti* Simon, 1922 and *M. menardi* Latreille, 1804 in Sicily, with details on localities and source of reference. CL – Caltanissetta Prov., CT – Catania Prov.; PA – Palermo Prov.; SR Siracusa Prov., TP –Trapani Prov.

Locality [cadastral number]	Municipality (Province)	Reference
Meta bourneti		
Grotta di Santa Ninfa [SiTP8000]	Santa Ninfa (TP)	Brignoli 1979; Caruso 1982
Grotta Scannato [SiCT 1060]	Scillichenti, Acireale (CT)	Brignoli 1979; Caruso 1982; Caruso 1999
Grotta Immacolatella I [SiCT1015]	San Gregorio (CT)	Brignoli 1979; Caruso 1982; Caruso 1999
Grotta di Maniace [SiCT1098]	Maletto (CT)	Brignoli 1979; Caruso 1982; Caruso 1999
Grotta delle Balze Soprane I [SiCT131]	Bronte (CT)	Brignoli 1979; Caruso 1982; Caruso 1999
Grotta del Fico I [SiCT1081]	San Gregorio (CT)	Brignoli 1979; Caruso 1982; Caruso 1999
Grotta Scrivilleri [SiSR7003]	Priolo Gargallo (SR)	Brignoli 1979; Caruso 1982
Grotta San Marco [SiSR3512]	Noto (SR)	Brignoli 1979; Caruso 1982
Sotto il convento di Baida	Palermo (PA)	Dresco 1963; Caruso 1982
Inghiottitoio di Monte Conca [SiCL3000]	Campofranco (CL)	Nicolosi et al. 2022
Grotta Villasmundo [SiSR7032]	Melilli (SR)	Original data
Grotta Forcato	Mascali (CT)	Original data
Grotta della Catanese I [SiCT1037]	Ragalna (CT)	Original data
Grotta del Gatto [SiCT1124]	Zafferana (CT)	Original data
Grotta del Porcospino [SiCT1033]	Linguaglossa (CT)	Original data
Grotta di Monte Cicirello	Trecastagni (CT)	Original data
Grotta di Piano Porcaria [SiCT1101]	Linguaglossa (CT)	Original data
Grotta del Santo (di San Nicola) [SiCT1032]	Adrano (CT)	Original data
Grotta Lunga (Grotta di Monpeloso) [SiCT1029]	Nicolosi (CT)	Original data
Grotta Pietrabuca	Milo	Original data
Grotta dei Roditori [SiCT1234]	Catania (CT)	Original data
Grotta Micio Conti [SiCT016]	San Gregorio (CT)	Original data
Grotta della Tesi	San Gregorio (CT)	Original data
Grotta Lucenti	Catania (CT)	Original data
Cava dell'Istrice	Tarderia, Pedara (CT)	Original data
Meta menardi		
Grotta di Piano Noce	Linguaglossa (CT)	Original data
Grotta di Monte Crisimo [SiCT1170]	Linguaglossa (CT)	Original data
Grotta di Monte Intralio [SiCT1007]	Adrano (CT)	Original data
Grotta di Monte Corruccio [SiCI1056]	Castiglione di Sicilia (CT)	Original data
Grotta del Cernaro [SiCT1068]	Maletto (CT)	Original data
Grotta dell'Immacolata [SiCT244]	Ragalna (CT)	Original data
Grotta del Gallo Bianco I [SiCT1193]	Adrano (CT)	Original data
Grotta di Monte Giacca [SiCT1145]	Belpasso (CT)	Original data
Grotta della Neve (dei Ladri) [SiCT1117]	Sant'Alfio (CT)	Original data
Grotta delle Femmine [SiCT1046]	Castiglione di Sicilia (CT)	Original data
Grotta Piano Cavoli	Randazzo (CT)	Original data
Grotta del Nano	Randazzo (CT)	Original data
Grotta del Faggio	Randazzo (CT)	Original data
Grotta dei Ragazzi [SiCT1241]	Bronte (CT)	Original data