Euscorpius

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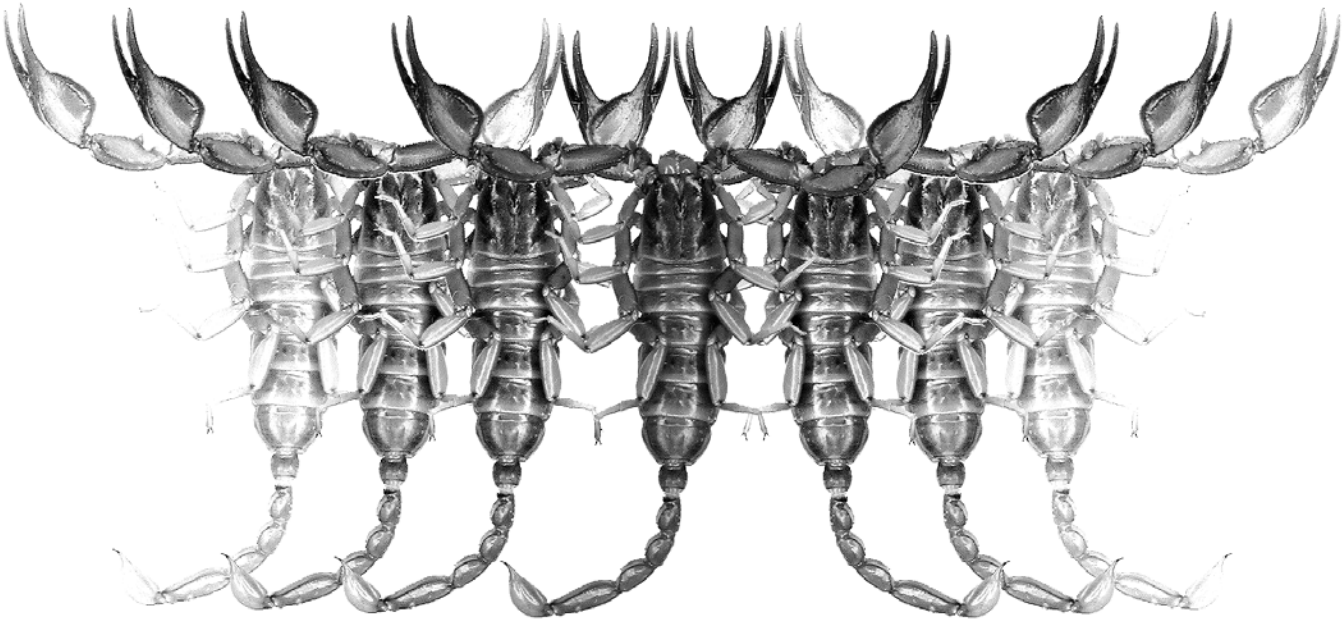

On Two Syntopic Species of *Euscorpius* Thorell, 1876 (Scorpiones: Euscorpiidae) in and Nearby San Marco Fortress (Veneto, Italy): a Preliminary Investigation

Marco Colombo

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EDITOR: **Victor Fet**, Marshall University, **'fet@marshall.edu'**

ASSOCIATE EDITOR: **Michael E. Soleglad, 'soleglad@la.znet.com'**

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Derivatio Nominis

The name *Euscorpius* Thorell, 1876 refers to the most common genus of scorpions in the Mediterranean region and southern Europe (family Euscorpiidae).

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On two syntopic species of *Euscorpius* Thorell, 1876 (Scorpiones: Euscorpiidae) in and nearby San Marco fortress (Veneto, Italy): a preliminary investigation

Marco Colombo

Busto Arsizio, Varese Province, Italy
e-mail: oryctes@libero.it

Summary

The author found syntopic specimens of *Euscorpius italicus* and *E. tergestinus* inside and nearby an abandoned fortress in Verona Province, Veneto, Italy. This discovery highlights a possibility of coexistence of congeneric species not only in the same territory, as already observed, but also in the same habitat and microhabitat, bringing some interesting questions about interspecific competition within the genus *Euscorpius*.

Introduction

Syntopic animal species with similar ecological demands are an interesting challenge in ecological studies, among various vertebrate (e.g. geckos: Petren & Case, 1998; plethodontid salamanders: Cimmaruta et al., 1999; snakes: Filippi et al., 1996) and invertebrate taxa. The presence of two well differentiated but ecologically similar species has usually been explained through differences in their trophic, ethological and microhabitat requirements, e.g. in Lycosidae spiders (Carrel, 2003). For scorpions, available literature is quite poor in detailed studies on this interesting matter, but some observations of this kind can be extrapolated from various works. The coexistence of more than one congeneric species, as it happens in the studied area, usually implies some adaptation to reduce interspecific competition, in order to avoid extinction of the ecologically weaker species (Smith & Smith, 2007).

Methods and Material

Study area

San Marco fortress (Figs. 1–2) was built between 1888 and 1913 as a huge defensive military post on Monte Cordespino, within Adige (Etsch) valley, together with other fortresses (Cimo, Masua, Ceraino, and Rivoli) located on other ridges (Cipriani, 1999). Monte Cordespino mountain range is of a high naturalistic importance. It hosts such species as *Ophrys benacensis* (Reisigl) O.Danesch & E.Danesch, 1975, an endemic wild orchid from northern Italy great lakes area, heavily threatened due to anthropic causes (Delforge, 2001; Fig. 3A), as well as uncommon or rare invertebrate species, such as the cryptic spider *Uroctea durandi* (Latreille, 1809) (Fig. 3B) or the magnificent predatory bush cricket *Saga pedo* (Pallas, 1771), whose fascinating French name is "magicienne dentelée" (Fig. 3C). The presence of the latter, xerothermophylous species, also confirmed by past findings (Rizzotti Vlach & Zanini, 1997), evidences the microclimatic characterization of "xerothermic oasis" of the area (Galvagni & Prosser, 2004).

Within rooms and galleries of the abandoned building of San Marco fortress, it is possible to find numerous spiders (e.g. *Tegenaria* sp.) and sparse specimens of greater horseshoe bats, *Rhinolophus ferrum-equinum* (Schreber, 1774). In this area, one also finds two scorpion species: *Euscorpius (Polytrichobothrius) italicus* (Herbst, 1800) and *Euscorpius (Euscorpius) tergestinus* (C.L. Koch, 1837) (Colombo, 2006).

Methods

Scorpions were found during six study trips by picking up blocks of crumbled walls and pieces of plaster, inside and around San Marco fortress, Verona Province, Italy (45°35'42.17''N, 10°49'54.08''E), and along the trails in the surroundings, by picking up stones in woodlands or grassy slopes (for further information see Table 1). Scorpion remains and live specimens were also found inside the fortress with the aid of UV lamps, inspecting floors and debris. Specimens were observed, photographed as was possible, and left where found; only one adult specimen of *E. tergestinus* was collected

Figure 1: San Marco fortress, a view of the inner northern side (photo by G. Colombo).

for the collection of Natural Sciences Museum of Valsassina, in preparation by Giampiero Goggi, and three other specimens (two *E. italicus* and one *E. tergestinus*) were collected and sent to Frantisek Šťáhlavský (Prague, Czech Republic) for DNA analysis. Forest types were identified according to Del Favero (2006). Fortress photographs were taken with a FujiFilm Finepix Z1 digital compact camera, while all other pictures were taken with a Nikon D700 digital reflex camera; a scale bar was added in Figure 8 using Adobe Photoshop 7.0.

Results and Discussion

Two scorpion species are reported from Monte Cordespino area: Colombo (2006) found *Euscorpius italicus* under stones along the dug-up road to the fortress, near small rocky cliffs, with some tree cover, while *E. tergestinus* was observed inside the abandoned building, in cracks of the walls and under large debris pieces on the floor of wet and often cool, dark rooms. This spatial distribution of the two taxa was explained as "relegation" of *E. tergestinus* to the cooler abandoned building by the more thermophylic, larger *E. italicus*, occupying its most favorable habitat, i.e. warm slopes and rocky cliffs.

Later (in 2007), the author found a juvenile *E. tergestinus* under a stone along the dug-up road to the fortress, in similar habitat but different place from that of *E. italicus*: in this case it was argued that, although *E. tergestinus* occupied both the anthropogenic and the natural habitat in the area, ecological competition should have separated the species.

On April 29, 2009, the author found several *E. italicus* under stones (Fig. 4), on a slope facing westward covered by trees (mainly *Fraxinus ornus* L., 1753, *Ostrya carpinifolia* Scop., 1772 and *Quercus pubescens* Willd., 1805) and bushes (e.g. *Cotynus coggygria* Scop., 1772), also in more open areas, with different vegetation (e.g. *Corylus avellana* L., 1753) along the path to the fortress (Figs. 5–6). An adult female of *E. tergestinus* was observed inside the building, in a cool room underground, under a block probably fallen from a wall, near an old broken exuvium (Fig. 7). While inspecting another room, a piece of plaster of approximately 20 cm^2 of size was detached from a wall, and two scorpions fell to the ground: unexpectedly, one of them was an adult male of *E. tergestinus*, while the other was an adult female of *E. italicus* (Fig. 8). Even if, when fallen to

Figure 2: San Marco fortress, one of the largest rooms, quite dry and not very dark (photo by G. Colombo).

Field Record No.	Date	Species, number of specimens, sex and age	Comments
109	25 April 2005	*Euscorpius tergestinus* (2 adult ♀♀ and remains of 5 dead specimens)	Two adult females observed in cracks of the walls in dark wet rooms inside the fortress; remains of other five specimens were observed with UV light on the ground, especially inside long dark galleries, where they had probably penetrated through openings in the walls.
168	29 April 2009	*Euscorpius italicus* (1 adult ♀, 3 adult ♂♂ and 1 juvenile)	Under stones in shady rocky W slopes covered by trees (mainly *Fraxinus ornus*, *Ostrya carpinifolia* and *Quercus pubescens*) with rich undergrowth (e.g. *Cotynus coggygria*) and in more open areas with bushes (e.g. *Corylus avellana*) along the path to the fortress.
169	29 April 2009	*Euscorpius tergestinus* (1 adult ♀)	Inside the fortress, in a dark and cool room, under a block fallen from a wall, near an old exuvium.
170	29 April 2009	*Euscorpius tergestinus* (1 adult ♂) *Euscorpius italicus* (1 adult ♀)	Together under a ~20 cm^2 piece of plaster on the wall of a quite dark room inside the fortress; at the moment of removal of the plaster from the wall, both specimens fell to the ground.
139	2 June 2007	*Euscorpius tergestinus* (1 juvenile)	Under a stone, near a stony wall, along the dug-up road to the fortress, under tree cover (mainly *Quercus pubescens*).
140	2 June 2007	*Euscorpius italicus* (1 adult ♀ and 1 adult ♂)	Under stones, near small rocky cliffs, along the dug-up road to the fortress, under tree cover (mainly *Quercus pubescens*).
181	25 June 2009	*Euscorpius italicus* (1 adult ♀ and 1 adult ♂)	Under stones on a W slope with tree cover (*Fraxinus ornus*, *Ostrya carpinifolia* and *Quercus pubescens*) and rich undergrowth (e.g. *Cotynus coggygria*) along the path to the fortress; the female was found eating an unidentified myriapod (Diplopoda: Julida).
182	25 June 2009	*Euscorpius italicus* (1 adult ♀) *Euscorpius tergestinus* (1 adult ♀)	Together under the same stone, on a W slope covered by trees (*Fraxinus ornus*, *Ostrya carpinifolia* and *Quercus pubescens*), with rich undergrowth (e.g. *Cotynus coggygria*) along the path to the fortress.
183	25 June 2009	*Euscorpius italicus* (2 juveniles)	Inside the fortress, one specimen under a piece of plaster of the wall, the other under a block fallen to ground; both rooms were quite dry and had enough light.
184	25 June 2009	*Euscorpius tergestinus* (1 adult ♀, 1 adult ♂, 1 exuvium belonging to a juvenile specimen, and many remains of dead specimens)	Inside the fortress, the female was found under a block fallen to the ground in a long, dark and wet gallery, where also were many remains of dead specimens (two of which were devoid of mesosoma and metasoma), also inside *Tegenaria* sp. webs, were found thanks to UV light; the male and the exuvium were found under blocks fallen to the ground in a dark, wet room.
204	16 October 2009	*Euscorpius tergestinus* (6 adult ♀♀)	On a SE slope, a female under a stone at the base of a big scree, with sparse vegetation cover (*Carpinus betulus*, *Cotynus coggygria* and *Ficus carica*); other five specimens under stones in a shady holm oak (*Quercus ilex*) relict forest.
205	16 October 2009	*Euscorpius italicus* (1 adult ♀, 1 subadult ♂ and 1 juvenile)	A female and a juvenile under stones, on a SE slope, in an area with quite thick vegetation cover (mainly *Quercus pubescens*, *Carpinus betulus* and *Ruscus aculeatus*); another specimen under small argyllous stone slabs on a little cliff near the path, in a shady holm oak (*Quercus ilex*) relict forest.
152	9 December 2007	*Euscorpius italicus* (1 adult ♀)	Under a stone on a grassy S slope in the surroundings of the dug-up road to the fortress; the slope colonized by low vegetation (bushes) with sparse rocks.

Table 1: *Euscorpius italicus* and *E. tergestinus* findings; all data refer to Monte Cordespino area (Lubiara and Canale Municipalities, Verona Province, Veneto, Italy), ca. 200-451 m a.s.l.

Figure 3: Some interesting elements of flora and fauna from San Marco surroundings. **A**, wild orchid *Ophrys benacensis*, endemic to northern Italy great lakes area; **B**, an uncommon spider, *Uroctea durandi*, adult female; **C**, the rare predatory bush cricket *Saga pedo*, female (all photos by M.Colombo).

ground after removal of the plaster, the two specimens found themselves close to each other, we cannot know if they actually were few centimetres away when in the retreat, or if they had never met, because occupying it from a short time, maybe at the opposite sides of the crack, before discovery; it is highly possible that after its wanderings looking for partners, the *E. tergestinus* male hid by chance, in the early morning, in the same shelter as the *E. italicus* female, and we cannot also exclude possibility of a successive cannibalism episode if they were not disturbed (M. Braunwalder, pers. comm.). However, this finding seems to be relevant, because the two species in San Marco fortress can share the same habitat and also, probably in uncommon situations, the same retreat. Therefore, they are not only sympatric, as it happens in other regions (e.g. Tuscany; Vignoli & Salomone, 2009), and not simply syntopic, as it happens with other pairs of species (Table 2): in this case, then, it seems there is no strong ecological "segregation" between *E. italicus* and *E. tergestinus*, as instead in Friuli-Venezia Giulia (Vignoli et al., 2005) and, at least as observed, in a near fortress (Ceraino; Colombo, 2006). Maybe, this case is comparable to situation in Ljubljana (Fet et al., 2001), although findings of specimens together in the same retreat are not reported. Kovařík (pers. comm.) observed a similar situation in central Italy: in some neglected buildings, it was possible to find conspicuous populations of *E. italicus*, together with less numerous *E. tergestinus*, usually marginalized to less suitable portions of the habitat. In these cases, adult *E. tergestinus* could be occasionally found within the same shelter together with immature *E. italicus*, while cohabitation of adult specimens of both species is much rarer.

On June 25, 2009, another investigation was organized in order to clarify coexistence of these scorpion species. Two adult *E. italicus* were found under stones on the stony slope with tree cover of the previous research: a female was eating remains of an unidentified myriapod (Diplopoda: Julida); also, an adult female *E. italicus* and an adult female *E. tergestinus* were found in two different niches of the ground under the same stone (Fig. 9). This seems to be another case of strict syntopy between these species, in a different habitat and also microhabitat from the previous finding.

Inside the fortress, several live *E. tergestinus* were found in dark, wet and often underground rooms; also, many remains were observed with the help of an UV

Figure 4: *Euscorpius italicus*, close-up of an adult male found under a stone on a slope covered by trees, along the path to the fortress (photo by M. Colombo).

light on the floor (Fig. 10), and sometimes in the webs of *Tegenaria* sp. (this kind of predation upon *Euscorpius* by spiders had already been observed in Liguria; Colombo, 2006). Two juvenile *E. italicus* were also found under a piece of plaster on a wall and under a fallen block, respectively, inside drier and lighted rooms, confirming the presence of more than one specimen belonging to this species inside the abandoned building. Further observations (16 October 2009) resulted in the finding of some specimens of *E. tergestinus* (Fig. 11) on the south-eastern slope of Monte Cordespino, along the path bringing from Canale to Tessari, inside an interesting relict forest of holm oak (*Quercus ilex* Linnaeus, 1753) where *E. italicus* seemed to be less common. In conclusion, it was observed that *E. italicus* seems to be abundant on the western slopes around the fortress, where *E. tergestinus* seems to be rare, while the latter is abundant inside the fortress and on the south-eastern slopes, where the first seems to be more uncommon. These records attest that, at least in some Italian habitats, ecological differentiation could be not so strong as previously thought. Indeed, although a slight difference in ecological demands can be observed among the two species inside San Marco fortress (*E. italicus* occupies drier rooms, while *E. tergestinus* lives in dark, cool and wet rooms and galleries), it is evidently possible to find both species in rooms with intermediate parameters. Available data for natural habitats around the fortress (i.e. wooded and grassy areas) are too scarce to make any speculation about ecological segregation there, even if also in this case scorpions share same microhabitats, although demographic proportions of the two species seem to vary according to forest types and/or slopes of different exposure.

The coexistence of more than one scorpion species, belonging to different families, within the same geographical territory (i.e. sympatric species) is not uncommon, and it has often been observed. Also, the coexistence of sympatric species belonging to the same family or genus is not unusual, and it was observed at least within Buthidae (genus *Mesobuthus* Vachon, 1950 in Central Asia: V. Fet, pers. comm.), Euscorpiidae (genus *Euscorpius* Thorell, 1876: Kinzelbach, 1975; Colombo, 2006; Crucitti, 1999; Vignoli & Salomone, 2009), and various Vaejovidae (Polis, 1990; M. R. Graham, pers. comm.). The finding of syntopic specimens belonging to different families was also reported by some authors: Colombo (2006) reports the finding of a subadult female of *Euscorpius naupliensis* (C. L. Koch, 1837) near a monastery, under a stone, together

Figures 5–6: Top. A stony slope with vegetation cover where both *Euscorpius italicus* and *Euscorpius tergestinus* were found. **Bottom.** A more open, sun-exposed area where *Euscorpius italicus* was found (photos by M. Colombo).

Figure 7: *Euscorpius tergestinus*, adult female found under a fallen block, inside the fortress, near an old exuvium (photo by M. Colombo).

Species	Geographic locality	Comments (ecological relationship in brackets)	Reference
Bulgaria			
E. hadzii - *E.* sp. 1 - *E.* sp. 2	Pirin Mountains	Under stones in open areas, but not listed together under the same stone (also *M. gibbosus* was found) (SYMPATRY and possibly SYNTOPY)	Teruel et al., 2004
Greece			
E. sp. - *E. sicanus*	Mt. Olympos	Both species found under stones, but not under the same stone (SYNTOPY)	Kinzelbach, 1975; V. Fet, pers. comm.
Italy			
E. alpha - *E. italicus*	Monte Isola, Brescia, Lombardy	*E. alpha* was found under stones, in wet forests, while *E. italicus* was found in cracks of dry, sun-exposed rocky cliffs, near the road (SYMPATRY)	Colombo, 2006
E. concinnus - *E. sicanus*	Castel San Gimignano, Siena, Tuscany	*E. concinnus* was found under stones in wet forests, few metres away from where *E. sicanus* was found, in cracks of the walls of cellars and inside inhabited houses (SYNTOPY)	Colombo, 2006; a similar case is reported from Montalbuccio (Siena, Tuscany) by Salomone et al., 2007
E. concinnus - *E. tergestinus*	Tuscany	*E. concinnus* was mainly found in natural habitats, while *E. tergestinus* was mainly found in anthropogenic habitats (SYMPATRY)	Vignoli et al., 2005
E. italicus - *E. concinnus*	Latium and northeastern Tuscany	*E. italicus* was found in anthropogenic habitats, while *E. concinnus* was found in natural habitats (SYMPATRY)	Vignoli et al., 2005
E. italicus - *E. tergestinus*	Ceraino, Verona, Veneto	*E. italicus* was found under stones near some small rocky cliffs, along the dug-up road to the fortress, while *E. tergestinus* was found inside cool and wet rooms of the fortress, in cracks of the walls and under fallen pieces of roof or plaster (SYNTOPY)	Colombo, 2006
E. italicus - *E. tergestinus*	Sistiana, Trieste, Friuli-Venezia Giulia	*E. italicus* was found in anthropogenic habitats, while *E. tergestinus* was found in natural habitats (SYMPATRY)	Vignoli et al., 2005
E. italicus - *E. tergestinus*	Central Italy	Inside some abandoned buildings, *E. italicus* is more abundant than *E. tergestinus* and marginalizes it to less suitable parts of the habitat; it is sometimes possible to find adult *E. tergestinus* in the same shelter together with immature *E. italicus*, more rarely adults of both species together (SYNTOPY)	F. Kovařík pers. comm.
E. italicus - *E. concinnus* - *E. sicanus* - *E. tergestinus*	Siena, Tuscany	All species live in the same area but seem to prefer precise and distinct microhabitats (SYMPATRY and probably SYNTOPY)	Vignoli & Salomone, 2009
Slovenia			
E. gamma - *E. germanus*	Vranja Jama, Planinsko Polje	Both species were mainly collected under the bark of fallen trees, but not listed together under the same piece of bark (SYNTOPY)	Fet et al., 2001
E. italicus - *E. tergestinus*	Galjevica, Ljubljana	Both species were found inside a residence, human introduction is highly possible (SYNTOPY)	Fet et al., 2001

Table 2- Examples of sympatric or even syntopic findings of *Euscorpius* species according to available literature, with comments about specific ecological demands.

Figures 8–9: Top. *Euscorpius tergestinus* adult male (left) and *Euscorpius italicus* adult female photographed when fallen to ground after removal of plaster from the wall of a room inside the fortress; scale bar on the right (photo by M. Colombo). **Bottom.** *Euscorpius tergestinus* adult female (left) and *Euscorpius italicus* adult female, photographed when found in different niches under the same stone on a slope with tree cover, along the path to the fortress (photo by M. Colombo).

Figure 10: Remains of an adult *Euscorpius tergestinus*, probably preyed upon, discovered with UV light on the floor in a gallery of the fortress: only pedipalps, prosoma and legs were left (photo by M. Colombo).

with a *Mesobuthus gibbosus* (Brullé, 1832) specimen on Zakynthos Island (Greece); Graham (pers. comm.) reports the finding of *Centruroides* sp. (maybe *C. suffusus* (Pocock, 1902)) and *Pseudouroctonus reddelli* (Gertsch & Soleglad, 1972) under the same log in the Sierra Madre Occidental, Mexico; Kovařík (pers. comm.) found several species belonging to the genus *Buthus* Leach, 1815 to cohabit with *Scorpio maurus* L., 1758 in Morocco.

Syntopy is usually avoided by very similar species, mainly due to same way of exploitation of food and spaces, territoriality (Polis, 1990), and cannibalism (Polis & McCormick, 1987). This is the reason why, within the same scorpion species, it is possible to find some specimens in the same retreat (e.g. under the same stone as it happens for example in Liguria, Italy for *Euscorpius concinnus* (C.L. Koch, 1837); Colombo, 2006), but never in contact each other, if not involved in mating or cannibalism processes, at least within *Euscorpius* (M. Colombo, pers. obs.; V. Fet, pers. comm.), in order to minimize intraspecific competition.

Syntopic *Euscorpius* species have been repeatedly observed by some authors, although Crucitti & Bubbico (2001) underline rareness of this event in Peloponnese for *Euscorpius sicanus* (C. L. Koch, 1837) and *E. naupliensis*, as Braunwalder (2005) does for *Euscorpius alpha* Caporiacco, 1950 and *E. italicus* in Switzerland. In Italy, it is possible to find two or more sympatric species, and at least two syntopically in some cases, depending on geographic locality (Colombo, 2006; Salomone et al., 2007; Vignoli & Salomone, 2009). Similar occurrences have been reported from Bulgaria (Teruel et al., 2004), Greece (Crucitti, 1999), and Slovenia (Fet et al., 2001).

Sympatric and syntopic species seem to have different ecological demands, in order to avoid strong competition, and occupy adjacent but different habitats (M. Braunwalder, pers. comm.; see also Table 2). Crucitti (1999) reports some interesting cases of species belonging to three different families, with various ecological "differentiation" in Greece: *Mesobuthus gibbosus* was abundant in olive grooves at the base of Platy Vounò mountain, whose shady slopes host *Iurus dufoureius* (Brullé, 1832) and *E. sicanus*; also, in a phrygana near Krini (Gytheio), *Mesobuthus* specimens were found in open areas, while the other two species were relegated to a stony wall with higher humidity.

On the contrary, when a single species is found in a certain territory, it can colonize most of the available habitats due to the absence of any competition: for

Figure 11: An adult female *Euscorpius tergestinus* under a stone near a land snail (probably *Chilostoma sp.*) inside a relict forest of *Quercus ilex* on the south-eastern slope of Monte Cordespino (photo by M. Colombo).

example, we found *Euscorpius concinnus* in some areas of western Liguria under stones in forests and open grassy/rocky areas, but also in cracks of stone walls inside villages. The anthropogenic microhabitat of stone walls seems to be utilized and highly preferred by a number of various *Euscorpius* species such as *E. mingrelicus* (Kessler, 1874) in Georgia, *E. hadzii* Caporiacco, 1950 in Bulgaria, and *E. flavicaudis* (DeGeer, 1778) in Provence (V. Fet, pers. comm.).

However, it would be interesting to understand which parameters influence retreat choice when two or more species share the same habitat and even the same microhabitat, i.e. under stones and bark (see Mt. Olympos, Pirin Mountains and Planinsko Polje cases) or in the same house (see Ljubljana case); another example are specimens of *Androctonus amoreuxi* (Audouin, 1826), *Hottentotta franzwerneri* (Birula, 1914), and *Orthochirus innesi* Simon, 1910 observed on the same adobe wall in Figuig, Morocco (F. Kovařík, pers. comm.).

According to the competitive exclusion principle (Gause's law), two similar species sharing similar ecological and trophic demands will compete, and, in absence of an evolutional differentiation that allows survival of both with slightly different specializations, the ecologically weaker will become extinct from this habitat (Smith & Smith, 2007).

This principle is fundamental in community ecology, and its application has also been observed within scorpions. For instance, Quinlan et al. (1995) report that two syntopic congeners, *Urodacus armatus* Pocock, 1888 and *U. novaehollandiae* Peters, 1861 have different hunting strategies and prey on different size classes of invertebrates in Australia. Unfortunately, the current level of knowledge of *Euscorpius* does not permit to formulate any hypothesis about a possible differentiation in this sense. However, we know that some *Euscorpius* species have an opportunistic diet (e.g. *Euscorpius flavicaudis*; Benton, 1992). Thus, the finding of *E. italicus* and *E. tergestinus* occupying the same microhabitats in the same locality opens a number of questions, mainly about the way of differentiating ecological niche among the two species. It should be argued that habitats maintaining these two species together have to be quite rich in prey (V. Fet, pers. comm.; F. Kovařík, pers. comm.). Indeed, a huge, dark and wet abandoned building located in a natural framework can be colonized by many sciophilous and hygrophilous invertebrate species, and some rooms can also host other flying/walking invertebrates hiding from

dehydration during hot periods (i.e. summer), and sheltering from cold during bad season (i.e. winter), owing to lower thermic excursions which also occurs in other environments, such as caves (Stoeva & Stoev, 2005). Also, the natural areas surrounding the fortress seem to host a relevant invertebrate community under stones and upon vegetation.

Although local stone has been used to build the fortress, human passive introduction of at least one of the two scorpion species could be possible, maybe with other material; indeed, we cannot exclude human influence on the distribution of both species in the area. It should be noticed that molecular (DNA) analysis of *E. tergestinus* highlighted an extremely low intraclade genetic diversity, interpreted as result of repeated artificial colonization of Italy, from Trieste to Rome (Salomone et al., 2007). Moreover, little or no genetic divergence has been found within *E. italicus* across its entire range, and it is possible that its modern range is the outcome of dispersal with humans, from French Riviera to Black Sea coasts (Fet et al., 2006). In fact, similar cases of coexistence between these species have been linked to anthropogenic introductions in literature (e.g. Fet et al., 2001); also, it is possible that ecological relationships can be altered when two species are introduced in anthropogenic habitats and nearby, as it happens in spiders (G. Lowe, pers. comm.).

Furthermore, it is possible that, if one of the species has been introduced, there are no specializations permitting syntopy and intraguild competition reduction, and we are dealing with a transitional scenario, in which the ecologically stronger species is gradually overtaking the weaker one, especially in marginal areas (V. Vignoli, pers. comm.). It is also important to notice that both species show similar size in adulthood (see Fig. 8 scale bar), and this could be meaningful in terms of interspecific predation reduction (V. Vignoli, pers. comm.).

Further studies are required to determine consistence of *E. italicus* and *E. tergestinus* populations inside and around San Marco fortress, in order to eventually establish which specializations, if present, permit them to share their ecological demands and reduce competition within the same microhabitats.

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