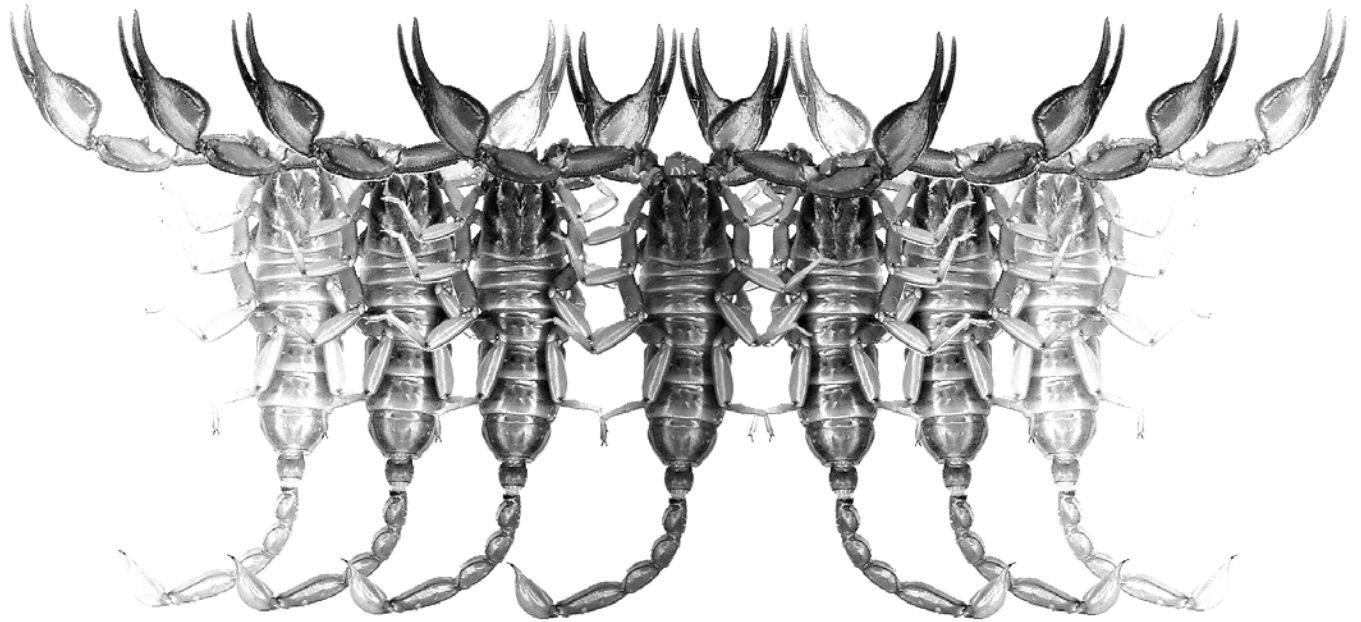


Euscorpius

Occasional Publications in Scorpiology



**New Data on Distribution and Ecology of Seven Species of
Euscorpius Thorell, 1876 (Scorpiones: Euscorpiidae)**

Marco Colombo

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Euscorpilus

Occasional Publications in Scorpiology

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Derivatio Nominis

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

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- **ZISP**, Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia
- **WAM**, Western Australian Museum, Perth, Australia
- **NTNU**, Norwegian University of Science and Technology, Trondheim, Norway

New data on distribution and ecology of seven species of *Euscorpius* Thorell, 1876 (Scorpiones: Euscorpiidae)

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Summary

The author observed seven species of *Euscorpius* in 1999–2005 (*E. alpha*, *E. sicanus*, *E. tergestinus*, *E. concinnus*, *E. naupliensis*, *E. italicus*, and *E. flavicaudis*) in their natural environment, mainly in Italy but also in France, Switzerland, and Greece. Ecology of these species is discussed as well as predatory behavior occasionally observed in nature. This work provides new data on the distribution and ecology of European Euscorpiidae.

Introduction

A few years ago, only four European scorpion species belonging to the genus *Euscorpius* Thorell, 1876 (family Euscorpiidae Laurie, 1896) were recognized: *Euscorpius carpathicus* (Linnaeus, 1767), *E. flavicaudis* (DeGeer, 1778), *E. germanus* (C.L. Koch, 1837), and *E. italicus* (Herbst, 1800). During the recent years, the intensive research on this genus took place (e.g. Gantenbein et al. 2000, 2002; Fet & Soleglad, 2002; Fet et al. 2001, 2003, 2004). At this moment, there are 16 recognized European species of *Euscorpius* (Fet et al., 2004; Vignoli et al., 2005); among them, eight are found in Italy (*E. alpha*, *E. concinnus*, *E. flavicaudis*, *E. gamma*, *E. germanus*, *E. italicus*, *E. sicanus*, and *E. tergestinus*). The updated list of all valid *Euscorpius* species recorded for Europe (Fet et al., 2004; Vignoli et al., 2005) is given below; species discussed in this paper are marked with an asterisk*:

Subgenus *Alpiscorpius* Gantenbein et al., 1999

**Euscorpius alpha* Caporiacco, 1950
Euscorpius germanus (C. L. Koch, 1837)
Euscorpius beroni Fet, 2000
Euscorpius gamma Caporiacco, 1950
Euscorpius mingrelicus (Kessler, 1874)

Subgenus *Euscorpius* Thorell, 1876

Euscorpius balearicus Caporiacco, 1950
Euscorpius carpathicus (Linnaeus, 1767)
Euscorpius hadzii Caporiacco, 1950
Euscorpius koschewnikowi Birula, 1900
**Euscorpius sicanus* (C. L. Koch, 1837)
Euscorpius tauricus (C. L. Koch, 1837)
**Euscorpius tergestinus* (C. L. Koch, 1837)
**Euscorpius concinnus* (C. L. Koch, 1837)

Subgenus *Polytrichobothrius* Birula, 1917

**Euscorpius italicus* (Herbst, 1800)
**Euscorpius naupliensis* (C. L. Koch, 1837)

Subgenus *Tetratrachobothrius* Birula, 1917

**Euscorpius flavicaudis* (DeGeer, 1778)

Methods and Material

Scorpions were found by picking up stones, flower pots, or household furniture during the day, as well as by searching with UV light at night; in this way they were not disturbed and followed in their activities. In total, 430 specimens were studied. Scorpions were either collected or left where found. Additional recorded information included the data on humidity (based on qualitative observations), temperature, presence of other scorpions of the same or different species, presence of other invertebrates (potential prey), reaction of scorpions to other arthropods (predatory behavior, prey, predators), tree species, type of soil, etc.

Map distribution was plotted using geographical coordinates estimated from atlases, web sources, and, in particular, Google Earth program (©2005 Google). Schematic maps were built using OMC (Online Map Creation) software (Geomar, Germany) (<http://www.aquarius.geomar.de>) and modified with Windows Paint accessory. Altitudes (Tables 3–9) were estimated from geographical atlases.

Photographs of scorpions were taken both in nature and in captivity to illustrate morphological differences among analyzed species; additional pictures were taken to give a general idea of scorpions' environment and behavior.

Species	Number of specimens	% of specimens found in different habitats				
		Forests	Rocky cliffs or nearby	Ruins, abandoned castles, houses, and churches	Inhabited houses	Maquis, or border between maquis and forests
<i>E. alpha</i>	44	93.2	4.5	-	2.3	-
<i>E. concinnus</i>	92	63.0	15.2	13.0	5.4	3.4
<i>E. flavicaudis</i>	118	0.8	3.4	62.7	28.0	5.1
<i>E. italicus</i>	80	1.3	50.6	39.2	8.9	-
<i>E. naupliensis</i>	11	36.4	27.3	27.3	9.0	-
<i>E. sicanus</i>	66	20.3	-	-	79.7	-
<i>E. tergestinus</i>	19	-	-	94.4	5.6	-
Total	430					

Table 1: Habitat distribution of studied *Euscorpius* species. *Note:* Specimens No. 9, 42, and 50 included only in the first column due to the lack of habitat data.

Species	Altitude, m a.s.l.						
	0–200	200–400	400–600	600–800	800–1000	1000–1200	1200–1400
<i>E. alpha</i>	-	32	2	7	2	-	1
<i>E. concinnus</i>	16	65	8	3	-	-	-
<i>E. flavicaudis</i>	41	74	2	1	-	-	-
<i>E. italicus</i>	55	20	-	4	-	-	-
<i>E. naupliensis</i>	4	1	6	-	-	-	-
<i>E. sicanus</i>	-	62	3	-	-	1	-
<i>E. tergestinus</i>	1	10	7	-	-	-	-

Table 2: Vertical distribution of studied *Euscorpius* species (number of specimens). *Note:* Specimens No. 9 and 50 omitted due to the lack of data.

Below is a list of the localities where specimens were collected or observed. Tables 1–2 depict the general habitats and elevations where these specimens were encountered. More detailed information is given in Tables 3–9, where specimens are listed according to the date of their observation. All specimens were found by the author unless noted otherwise.

Euscorpius alpha: ITALY. **Lombardy**: Sombreno (Bergamo), Eupilio (Como), Brunate (Como), Cislano (Brescia), Cure, Monte Isola (Brescia), Colico (Lecco), Piani Resinelli mine (Lecco), Campione d'Italia (Como; a small Italian enclave within Switzerland); **Piedmont**: Romagnano Sesia (Novara). SWITZERLAND. **Ticino**: Mt. Caslano, Mt. San Giorgio.

Euscorpius sicanus: ITALY. **Sardinia**: near Baunei (Nuoro), Genna Silana pass (Nuoro); **Tuscany**: Castel San Gimignano (Siena), Mt. Argentario (Grosseto), Giglio Castello, Giglio Island (Tuscan Archipelago; V. Vignoli leg.).

Euscorpius tergestinus: ITALY. **Emilia Romagna**: Torrecchiara (Parma); **Lombardy**: Cislano (Brescia);

Veneto: Venice (Venezia), Ceraino (Verona), Lubiara (Verona).

Euscorpius concinnus: FRANCE. **Haute-Provence**: Entrevaux; **Var**: Le Muy. ITALY. **Emilia Romagna**: Gropparello (Piacenza); **Liguria**: Pignone (La Spezia), Vernazza (La Spezia), Gambatesa mine (La Spezia), Breccanecca, near Cogorno (Genova), Rapallo (Genova), Pigna (Imperia), coast between Levanto and Monterosso (La Spezia), near Colla Micheri, Capo Mele (Savona); **Piedmont**: Mondovi (Cuneo), La Morra (Cuneo); **Tuscany**: Castel San Gimignano (Siena), Codiponte (Massa), Vagli (Lucca), Castelnuovo di Garfagnana (Lucca), San Vivaldo (Firenze).

Euscorpius italicus: ITALY. **Emilia Romagna**: Felino (Parma), Montechiarugolo (Parma), Torrecchiara (Parma), Ferrara (Ferrara), Castell'Arquato (Piacenza), San Pietro in Cerro (Piacenza); **Lombardy**: Onno (Lecco), Busto Arsizio (Varese), Cittiglio (Varese), Cernobbio (Como), Peschiera Maraglio, Monte Isola (Brescia), Cislano (Brescia), Montichiari (Brescia), Isola Comacina (Como); **Marche**: Fermo (Ascoli Piceno; A. Colombo leg.);



Figure 1: *Euscorpium (Alpiscorpius) alpha*, adult female, Cislano (Lombardy, Italy) (photo by Giorgio Colombo).

Veneto: Campo (Verona), Ceraino (Verona);
Piedmont: Varallo Pombia (Novara).

Euscorpium naupliensis: GREECE. **Zakynthos Island:** Skoulikado (Alykes), Volimes (Elation), near Volimes (Elation), Anafonitria (Elation), Louha (Artemision).

Euscorpium flavicaudis: FRANCE. **Var:** Fayence, Mont Faron (near Toulon). ITALY. **Liguria:** Finale Ligure (Savona), Toirano (Savona), Andora Castello (Savona); **Sardinia:** Sedinì (Sassari), Cala della Barca (Sassari), Maristella (Sassari), Olmedo (Sassari), near Ittiri (Sassari), Martis (Sassari), Chiaramonti (Sassari), Monteleone Roccadoria (Sassari); **Tuscany:** Castelfalfi (Firenze), Levigliani (Massa).

Results and Discussion

Subgenus *Alpiscorpius* Gantenbein et al., 1999

Euscorpium alpha Caporiacco, 1950

(Figs. 1–3, Table 3)

Described as a subspecies *E. germanus alpha* by Caporiacco (1950), this taxon was elevated to species status by Gantenbein et al. (2000); their molecular

analysis showed a 7% DNA divergence between *E. germanus* and *E. alpha*.

This species is found only in Italy and Switzerland. In Italy, it is recorded from the north (Alpine and Prealpine mountain ranges), as far eastward as Adige River (Trentino-Alto Adige region); beyond this river it is substituted by *E. germanus* (Marcuzzi, 1961). It is also abundant in southern Switzerland (Braunwalder, 2001, 2005). Caporiacco (1950) reported it from the Lombardian Prealps, as far as Brembo River; also, he mentions some localities from Piedmont for *E. germanus beta* that now is a synonym of *E. alpha*. The maps of Crucitti (1993) show numerous records from eastern Lombardy, and less from western Lombardy, Piedmont, and Valle d'Aosta. Gantenbein et al. (2000) report several Italian localities, especially from Bergamascan Prealps, and also some Swiss localities.

In this study, localities from both Italy and Switzerland (Fig. 3) were surveyed in order to obtain a detailed picture of ecological conditions across the range of *E. alpha*. In Italy, this species was found by the author eastward from Piedmont (Romagnano Sesia) in many localities within Lombardy (as far as Lake Iseo). In Switzerland, *E. alpha* was studied in two localities (Monte San Giorgio and Monte Caslano), and in a small (1.7 km²) Italian enclave (Campione d'Italia).



Figure 2: *E. alpha* forest habitat in Cislano (Lombardy, Italy) (photo by Marco Colombo).

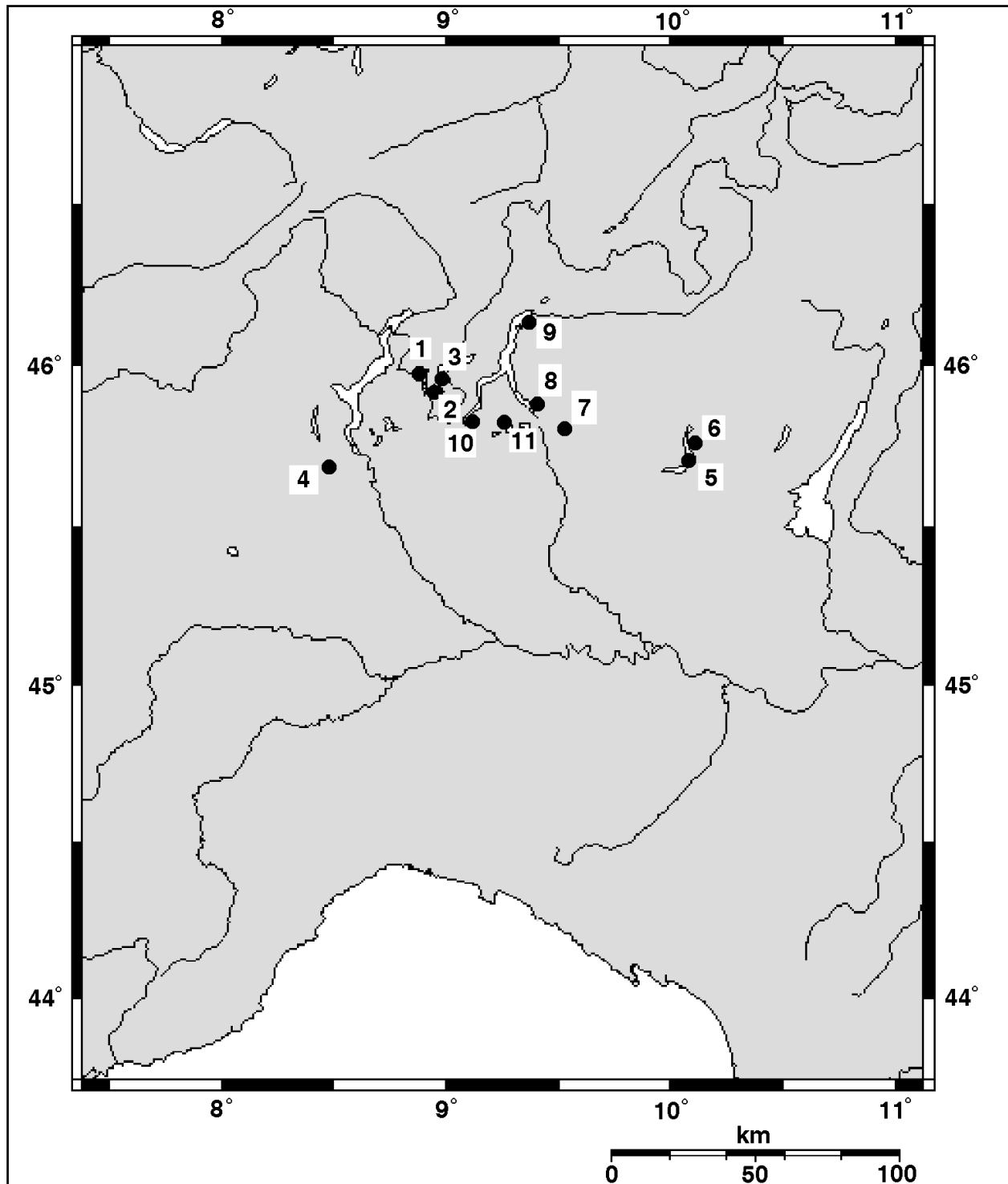


Figure 3: *E. alpha* collecting sites. Lombardy, Piedmont (Italy) and Ticino (Switzerland): 1. Monte Caslano; 2. Monte San Giorgio; 3. Campione d'Italia; 4. Romagnano Sesia; 5. Monte Isola; 6. Cislano; 7. Sombreno; 8. Piani Resinelli; 9. Colico; 10. Brunate; 11. Eupilio.

E. alpha is usually found in mountainous areas (up to 2000 m a.s.l.; Crucitti, 1993) or even in hilly areas, so it could be defined as orophilous (Crucitti, 1993). Ecol-

ogy of *E. alpha* seems to be similar to that of other related European species, such as *E. germanus* and *E. gamma*; the last species was found down to the sea level

No.	Date	Number of specimens, age and sex	Geographic locality	Altitude a.s.l.	Comments
80	7 April 2004	<i>E. alpha</i> (1 adult male and 4 adult females)	Campione d'Italia (Como), a small Italian enclave within Switzerland	280 m	Under stones in a quite humid <i>Castanea</i> forest; some trees were cut down, and seemed that it changed humidity conditions, so scorpions are now available only in more humid parts of the woodland. A female was found near the remains (elytrae and legs) of a beetle (<i>Chrysolina fastuosa</i>)
41	23 April 2003	<i>E. alpha</i> (2 adult females)	Campione d'Italia (Como), a small Italian enclave within Switzerland	280 m	Under stones in a humid <i>Castanea</i> forest
86	25 April 2004	<i>E. alpha</i> (1 adult female and 1 juvenile)	Ceriola Sanctuary, near Cure, Monte Isola (Brescia), Lombardy, Italy	600 m	Under a large stone, together, in a humid <i>Fagus</i> forest
47	3 May 2003	<i>E. alpha</i> (1 adult male and 1 adult female)	near Cislano (Brescia), Lombardy, Italy	650 m	Female under a stone; male in crack on a small rocky cliff in a humid mixed forest
48	3 May 2003	<i>E. alpha</i> (1 adult male)	near Cislano (Brescia), Lombardy, Italy	650 m	Different site from the previous, on a wall near the road (observed with UV light)
16	June 2002	<i>E. alpha</i> (4 adult females)	Campione d'Italia (Como), a small Italian enclave within Switzerland	280 m	Under stones in a quite humid and shady <i>Castanea</i> forest, also in groups of two specimens. Scorpions were not found here on 23 December 2002; they could spend winter deeper in the cracks in the ground
7	1 June 2002	<i>E. alpha</i> (1 male and 2 females)	Romagnano Sesia (Novara), Piedmont, Italy	268 m	Under stones on sandy substrate in a cool and humid area near the Sesia River; protected from direct sun heat by tree cover
10	2 June 2002	<i>E. alpha</i> (3 adult females)	Sombreno (Bergamo), Lombardy, Italy	329 m	All together under the same stone, in a very humid and shady <i>Castanea</i> forest
56	12 June 2003	<i>E. alpha</i> (5 adult females)	Campione d'Italia (Como), a small Italian enclave within Switzerland	280 m	Under stones in a humid <i>Castanea</i> forest
58	17 June 2003	<i>E. alpha</i> (1 adult male and 1 adult female)	Campione d'Italia (Como), a small Italian enclave within Switzerland	280 m	Under stones in a humid <i>Castanea</i> forest
19	28 June 2002	<i>E. alpha</i> (1 adult male and 1 adult female)	Monte Caslano, Canton Ticino, Switzerland	272 m	Female found under a stone in a humid forest (mainly <i>Castanea</i>) with thick undergrowth; male found in a quite unusual hot and not very humid environment, under a marble slab near inhabited houses. This population is endangered, mainly due to its isolation from the others (J.O. Rein, pers. comm.)
66	1 July 2003	<i>E. alpha</i> (2 adult females and 1 adult male)	Fuentes Fortress, Colico (Lecco), Lombardy, Italy	209 m	Under stones in a quite humid mixed forest (<i>Pinus</i> , <i>Corylus</i> , and <i>Robinia</i>) near the fortress
92	9 July 2004	<i>E. alpha</i> (1 adult female)	Piani Resinelli (Lecco), Lombardy, Italy	1276 m	Under a stone on a wall at the exit of the mine, in a quite humid <i>Fagus</i> forest; according to the guide, scorpions are also found inside the mine
20	15 July 2002	<i>E. alpha</i> (2 adult males)	Monte San Giorgio, Canton Ticino, Switzerland	800 m	Under stones near big tree stumps, in a humid and shady forest of <i>Castanea</i> and <i>Ostrya</i> ; one specimen in association with an ant colony
21	19 July 2002	<i>E. alpha</i> (2 adult males and 1 adult female)	Eupilio (Como), Lombardy, Italy	383 m	Under stones in a humid mixed forest on the rivers of Segrino lake; one specimen in association with an ant colony
25	6 October 2002	<i>E. alpha</i> (2 adult males and 2 adult females)	woodland between Brunate and Torno (Como), Lombardy, Italy	225 m to 716 m	Under stones (and probably also under wood stumps, abundant in the area) in a quite humid forest of <i>Castanea</i> and <i>Fagus</i> with thick undergrowth

Table 3: *Euscorpius alpha*: specimen and locality data.

in Slovenia (mouth of Rizana River; Fet et al., 2001). During this study, *E. alpha* was mainly found between 200 and 800 m a.s.l., but one specimen was collected at 1276 m a.s.l. in Piani Resinelli, Lecco, Lombardy (the highest scorpion locality found in this study).

Most of the specimens (93.2%) were found in forests dominated by high trees such as chestnut (*Castanea*), birch (*Betula*), beech (*Fagus*), and oak (*Quercus*), which cover the ground and create a humid and dark environment (Fig. 2). Temperature in such forests usually is not very high, and humidity is always medium, as sunlight is filtered by the leaves and never reaches the litter. In these conditions scorpions are usually found under stones (sometimes more than one specimen [up to three] together) in the leaf litter, or under bark of stumps and dead trees, but always near the ground. Some specimens (4.5%), however, were found on medium-sized rocky cliffs located in the woods, or also in the cracks on those cliffs located high above ground.

This preference of *E. alpha* for natural habitats could also be considered, in cases of its sympatry with larger species such as *E. italicus* (e.g. Cislano, Lombardy, Italy), as a result of this species being relegated to more harsh environmental conditions (larger scorpion species usually occupy more favorable microhabitats; Polis & McCormick, 1987, quoted after Vignoli et al., 2005).

Braunwalder (2005) also reports that 95% of *E. alpha* in Switzerland were found in *Castanea*, *Fagus*, and *Quercus* forests in hilly area, in *Larix* forests at higher altitudes.

In Campione d'Italia (Como, a small Italian enclave within Switzerland), where *E. alpha* was found in forest habitats with leaf litter covered by ferns, small bushes and higher trees such as chestnut (*Castanea*), these scorpions were not usually found under stones located directly on the ground, but only under stones (including smaller ones) located on the top of other stones. There, scorpions were sometimes found in couples. The author also observed during winter, from November to March, *E. alpha* could not be found in natural habitats in Campione d'Italia. Scorpions probably spend colder periods underground.

Usually, *E. alpha* specimens are found far away from houses and human activities, but in some cases (2.3%) they were found near inhabited houses; Braunwalder (2005) reports that in Switzerland *E. alpha* prefers, among anthropogenic habitats, old stony walls and abandoned houses.

From the composition of invertebrate species found under stones along with *E. alpha*, we assume that this species could eat small beetles, wasps, crickets, harvestmen, centipedes, grasshoppers, and moths (both adults and larvae). In one case an adult female was found near the remains of the beetle *Chrysolina fastuosa* (Scopoli, 1763) (Coleoptera: Chrysomelidae); the scor-

pion had left only harder parts of the victim, such as elytrae and legs. Braunwalder (2005) shows a photo of *E. germanus*, a closely related species, killing a centipede. *E. alpha* was found twice in association with an ant colony, under stones. Both cases were recorded in July, the first in Switzerland (Monte San Giorgio, Ticino) and the second, a few days after, in Italy (Eupilio, Como, Lombardy).

Adult males and females were found together from April to October, so we can assume that the mating period includes spring, summer, and maybe the beginning of fall. An adult female collected in Sombreno (Lombardy, Italy), as well as another one collected in Campione d'Italia, gave birth in captivity in the end of June.

Subgenus *Euscorpium* Thorell, 1876

Euscorpium sicanus (C.L. Koch, 1837)

(Figs. 4–8, Table 4)

In the revision by Fet & Soleglad (2002), the old *E. carpathicus* was split into several species. Later, Fet et al. (2003) also elevated *E. sicanus* to the species status. This species has a southern Mediterranean distribution: northern Africa (Egypt, Libya, Tunisia) and Madeira, central and southern Italy (including Sicily, Sardinia, and some minor islands), Malta, and Greece (center and south, with some islands). In Sicily it was already studied (as *E. carpathicus*) by Valle (1975), who recorded presence of two different forms not recognized at the moment. However, *E. sicanus* was also recorded from a few northern localities, possibly due to introductions (e.g. Trieste, Friuli-Venezia Giulia, northern Italy, collected by F. Werner in 1891, and C. Attems in 1901, both cited in Fet et al., 2003). In Italy, this species is found from Tuscany in the center (author's most northern record: Castel San Gimignano) south to Calabria, Sicily, and Sardinia; on the Adriatic coast it is distributed from southern Marche down to Apulia (Fet et al., 2003). The author studied this species in Tuscany (Fig. 7) and Sardinia (Fig. 8).

No detailed data about preferred altitudinal range was found in literature, mainly because the species was not distinguished by the earlier authors; in older works, such as Crucitti & Bubbico (2001) for Peloponnese, it is treated as *E. carpathicus*, reaching 2000 m a.s.l. In this study, most specimens were found between 200 and 600 m a.s.l., with the highest record in Sardinia (1017 m a.s.l., Genna Silana Pass).

Ecological demands of *E. sicanus* are similar to those of *E. tergestinus*. A high percentage of specimens (79.7%) was found in old inhabited houses, while others were found in forests (20.3%). Both of these habitat types were quite humid and cool. In central Italy (Tuscany), *E. sicanus* was found only in anthropogenic habi-



Figure 4: *Euscorpius (Euscorpius) sicanus*, adult male, Monte Argentario (Tuscany, Italy) (photo by Marco Colombo).



Figure 5: *Euscorpius (Euscorpius) sicanus*, subadult male, Baunei (Sardinia, Italy) (photo by Marco Colombo).



Figure 6: *E. sicanus* habitat: wall of a cellar under inhabited houses in Castel San Gimignano (Tuscany, Italy) (photo by Marco Colombo).

tats, while sympatric *E. concinnus* (see below) inhabited predominantly forests. In southern Italy (south of Mount Argentario, Tuscany) *E. sicanus* tends to occupy all habitats, and can be also found in forests (under stones in the litter; personal observations; see also Rein, 2006). In Sardinia (northern areas), *E. sicanus* tends to occupy natural habitats, probably due to ecological competition with the sympatric species *E. flavicaudis* (which could be introduced there; Crucitti, 1993).

E. sicanus was found several times inside inhabited houses in Tuscany; there, it seems to prefer cooler places, such as cellars (Fig. 6). These scorpions usually occupy cracks in the walls, catching passing invertebrates with their pedipalps. In March, night temperatures are still low (about 6°C), and scorpions are inactive; they can be seen at night stretching their pedipalps out of the cracks and waiting for prey. Despite low temperatures, some specimens were seen at night outside of their shelters, maybe hunting (these were mostly males, but also some females). One specimen was also found dead, maybe due to lower temperatures that occurred the night before.

E. sicanus feeds mainly on small invertebrates. In Tuscany (Castel San Gimignano), a subadult was observed under a brick on the top of a wall near some re-

mains of an earwig (*Euborellia moesta* (Genè, 1837)) (Dermaptera: Carcinophoriidae), probably eaten by this scorpion. In a small cellar, where eight specimens were observed, there was a variety of arthropods representing potential prey (perhaps except the last, which usually secrete toxic substances): crickets (*Gryllomorpha dalmatina* (Ocskay, 1832) (Gryllidae: Gryllinae), isopods (*Porcellio* sp.) (Isopoda: Porcellionidae), earwigs (*Euborellia moesta*), wolf spiders (Araneae: Lycosidae), and beetles (Coleoptera: Carabidae). Two specimens, an adult female and an adult male, were observed in the same place, with UV light, each eating an unidentified (due to advanced digestion by scorpions) invertebrate; this prey could be a cricket, an isopod, or a spider, all of which were commonly found on the stone wall near the cellar. On the floor of the same cellar, remains of scorpions were also found: chelae, legs, carapaces, and metasomas. These remains could easily be a results of predations by mice or, possibly, conspecifics (cannibalism is not unusual among scorpions; Polis, 1990).

Adult males and females were found together in March and April; a subadult male was found in August, so it seems that this species has its mating period earlier than the other *Euscorpium* species, in the end of winter and in early spring. A female collected in Castel San

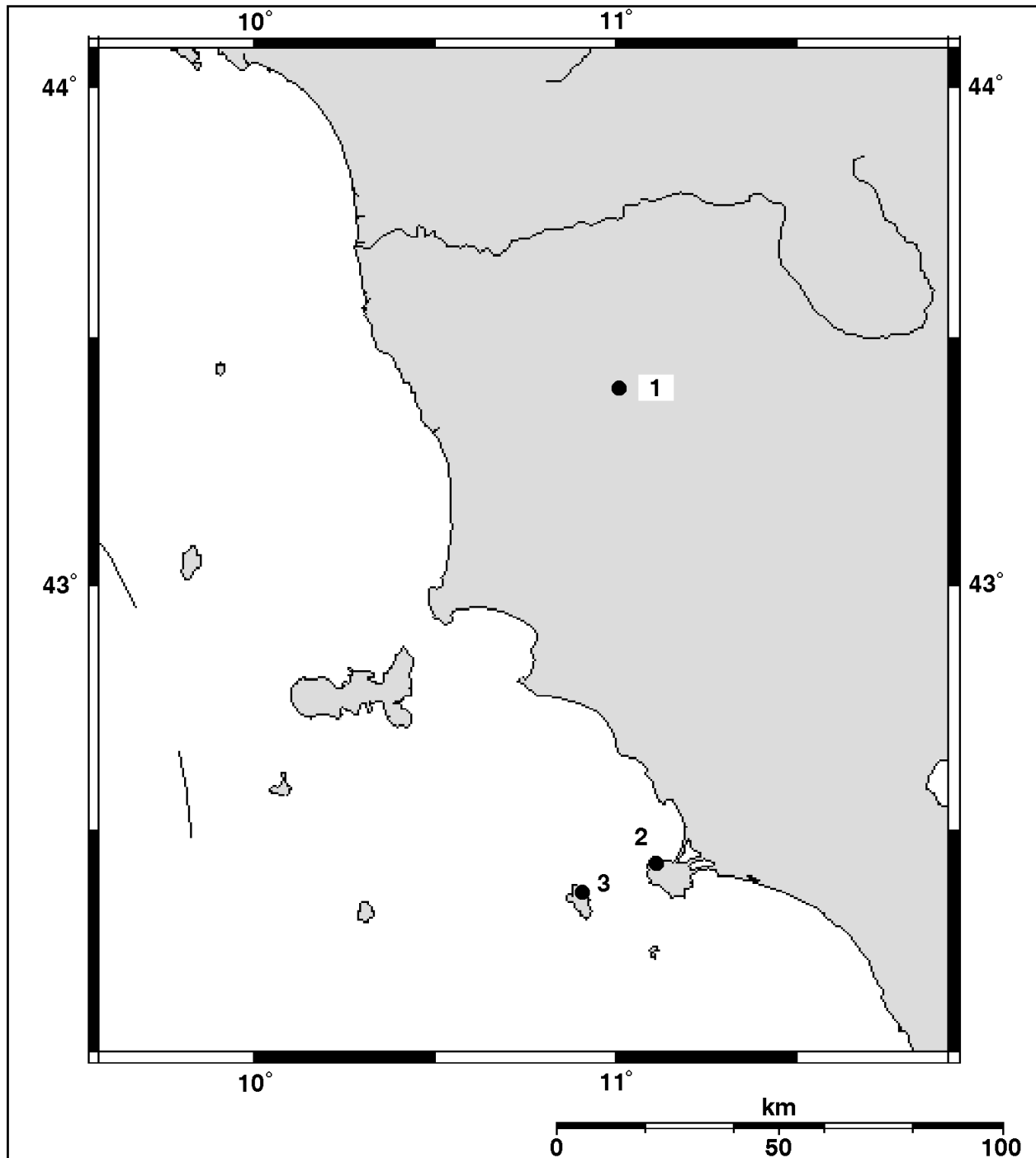


Figure 7: *E. sicanus* collecting sites. Tuscany (Italy): 1. Castel San Gimignano; 2. Monte Argentario; 3. Giglio Island.

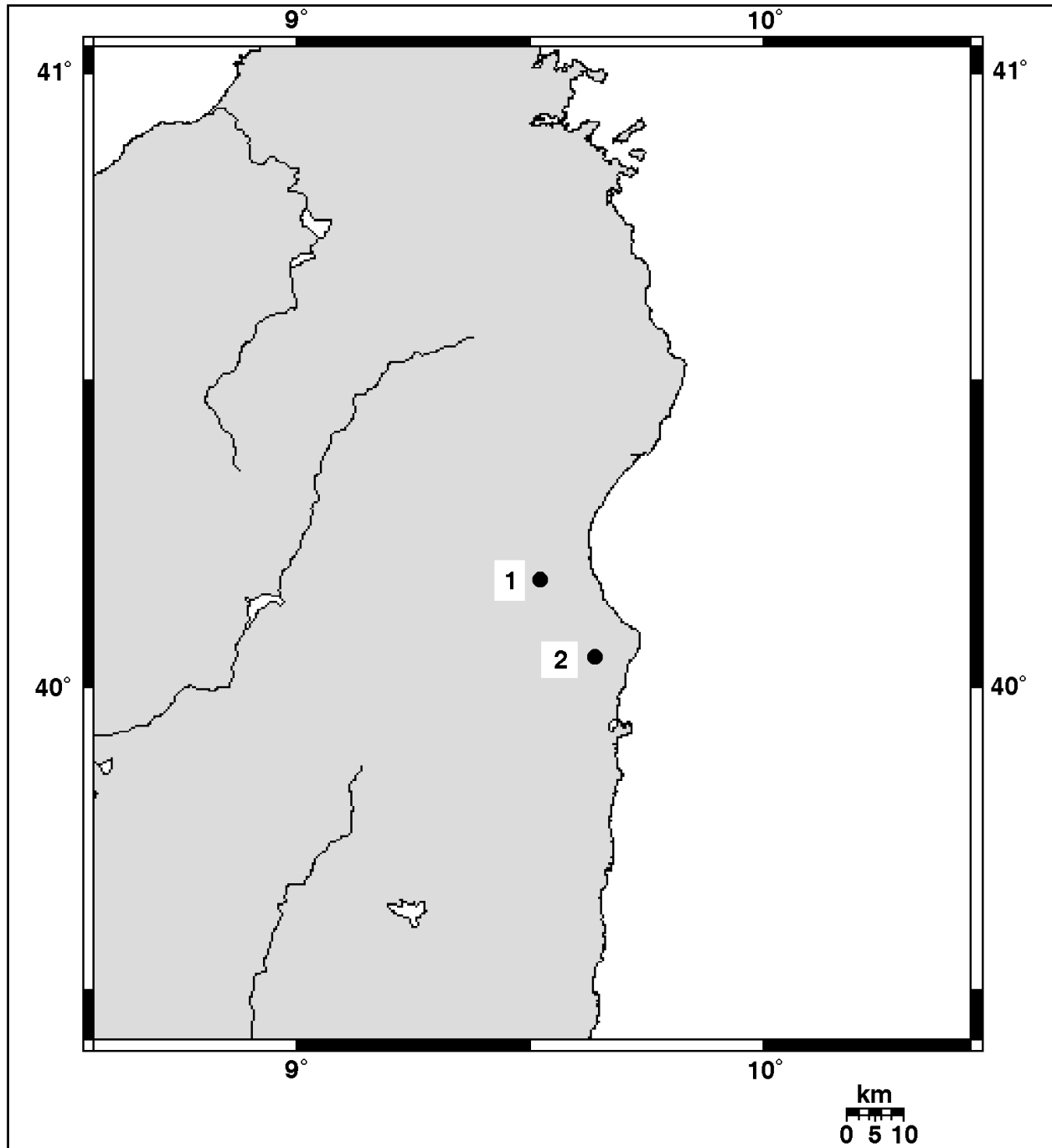


Figure 8: *E. sicanus* collecting sites. Eastern Sardinia (Italy): 1. Genna Silana Pass; 2. Baunei.

No.	Date	Number of specimens, age and sex	Geographic locality	Altitude a.s.l.	Comments
42	24 April 2003 (collected on 3 March 2003)	<i>E. sicanus</i> (1 adult male and 1 adult female) V. Vignoli leg.	Giglio Castello (Giglio Island), Tuscany, Italy	405 m	No data
30	7 March 2003	<i>E. sicanus</i> (4 adult males, 4 adult females)	Castel San Gimignano (Siena), Tuscany, Italy	350 m	In cracks under plaster on the walls of a small abandoned cellar, near (or under) inhabited houses; due to low temperatures scorpions were not very active; a male was found freshly dead (observed with UV light)
103	25 March 2005	<i>E. sicanus</i> (1 adult male)	Castel San Gimignano (Siena), Tuscany, Italy	350 m	Under a small stone, perhaps fallen from a stone wall, near inhabited houses; medium humid environment
106	25 March 2005	<i>E. sicanus</i> (4 adult females and 2 adult males)	Castel San Gimignano (Siena), Tuscany, Italy	350 m	In the cracks of a quite humid stone wall, near an abandoned cellar, under inhabited houses; two specimens, a male and a female, were found eating an invertebrate each, but unfortunately the prey species was not recognised due to partial digestion; however, on the wall, small crickets, spiders, and isopods were commonly found (observed with UV light)
107	27 March 2005	<i>E. sicanus</i> (1 adult female, 1 adult male, 2 juv.)	Castel San Gimignano (Siena), Tuscany, Italy	350 m	In the cracks of a quite humid stone wall, near an abandoned cellar, under inhabited houses; a weak rain falls at the moment of observation (observed with UV light)
81	9 April 2004	<i>E. sicanus</i> (1 subadult)	Castel San Gimignano (Siena), Tuscany, Italy	350 m	Under a tile on the top of a wall, kept humid by a field of grass, near some inhabited houses; the remains of an earwig (<i>Euborellia moesta</i>) were found near the specimen. The same specimen was observed again on the night of 9 April 2004 (with UV light) and on 10 April 2004, under a tile near the first one
82	9 April 2004	<i>E. sicanus</i> (5 adult males and adult females, and 3 subadults)	Castel San Gimignano (Siena), Tuscany, Italy	350 m	One female was found squashed on a door near the wall where the previous specimen was found; the others inside (or just outside) a humid abandoned cellar, in wall cracks and under the plaster; due to low temperatures (6°C), specimens do not leave their shelters but only protrude their pedipalps outside to catch prey (observed with UV light)
83	10 April 2004	<i>E. sicanus</i> (7 adult males and adult females, and 2 subadults)	Castel San Gimignano (Siena), Tuscany, Italy	350 m	In cracks of the walls inside a humid abandoned cellar; although temperatures were still low, a female was found outside her shelter. Scorpions could feed on crickets (<i>Gryllomorpha dalmatina</i>), isopods (<i>Porcellio</i> sp.), earwigs (<i>Euborellia moesta</i>), spiders (Lycosidae), and ground beetles (Carabidae), observed inside the cellar. Remains of <i>E. sicanus</i> were found on the ground, probably a result of predation by mice or cannibalism (observed with UV light)
84	11 April 2004	<i>E. sicanus</i> (10 adult males and adult females, and 1 juvenile)	Castel San Gimignano (Siena), Tuscany, Italy	350 m	In cracks of the walls inside a humid abandoned cellar; a male was found wandering, maybe due to higher temperature (12°C) (observed with UV light)
40	20 April 2003	<i>E. sicanus</i> (10 adult females and 1 adult male)	near Porto San Stefano, Monte Argentario (Grosseto), Tuscany, Italy	270 m	Under stones (also two specimens together) in shady and humid <i>Quercus</i> forests; a molted female was found with the typical whitish coloration near its old exuvium
2	21 April 2000	<i>E. sicanus</i> (1 subadult female)	Castel San Gimignano (Siena), Tuscany, Italy	350 m	On a wall in inhabited house in the countryside
3	23 April 2000	<i>E. sicanus</i> (2 adult males)	Castel San Gimignano (Siena), Tuscany, Italy	350 m	On humid stone walls near old inhabited houses; scorpions occupied cracks in the wall but came out at night
97	13 August 2004	<i>E. sicanus</i> (1 subadult)	Fonte Isilai, Genna Silana Pass, Dorgali-Baunei Street (Nuoro), Sardinia, Italy	1017 m	Under a stone on the top of a stone wall, in a partly humid <i>Quercus</i> forest; humid places were easily recognizable due to the presence of ferns
98	13 August 2004	<i>E. sicanus</i> (1 subadult male)	near Baunei (Nuoro), Sardinia, Italy	480 m	Under a stone near a dry river; environment very shady, humid, and quite cool due to tree cover (<i>Quercus</i> , <i>Pinus</i> and <i>Ficus</i>). The specimen (still with the typical whitish coloration) was found near its exuvium

Table 4: *Euscorpius sicanus*: specimen and locality data.



Figure 9: *Euscorpius (Euscorpius) tergestinus*, adult female, Venezia (Veneto, Italy) (photo by Giorgio Colombo).

Gimignano (Tuscany, Italy) gave birth in captivity on 9 July 2003; another one collected in March by Valerio Vignoli on Giglio Island (Tuscany, Italy) gave birth on 30 June 2003.

***Euscorpius tergestinus* (C.L. Koch, 1837)**
(Figs. 9–11, Table 5)

In the detailed work of Fet & Sologlad (2002), *E. carpathicus* (L., 1767) *sensu stricto* was restricted to Romania, while some subspecies of the “*carpathicus*” complex were elevated to species status. One of these is *E. tergestinus*, which was further reduced by Vignoli et al. (2005) who separated the sibling species *E. concinnus* (see below). As accepted now, *E. tergestinus* is found in Albania, Austria (introduced), Croatia, southern France (Corsica), Greece, Italy (mainly north, but also central part, where it is sympatric with *E. sicanus* and *E. concinnus*), Monaco, San Marino, Slovenia, and maybe Spain (at French boundary). It also was introduced in Austria, and was introduced, but now extinct, in Czech Republic (Fet et al., 2004).

In Italy, *E. tergestinus* is widely distributed through Lombardy, Trentino-Alto Adige, Friuli-Venezia Giulia, and Veneto, while the southeastern boundary of its range is less exactly known (Umbria and Marche). According

to Vignoli et al. (2005), this species is also common in Tuscany and Latium. The author studied *E. tergestinus* in northern Italy (Emilia Romagna, Lombardy, Veneto; see Fig. 11).

Few altitudinal data can be determined from the literature, mainly because *E. tergestinus* was not distinguished by the earlier authors. Fet et al. (2001) report (as *E. carpathicus*) a maximal altitude of 400 m a.s.l. in its northeastern part of its range (Slovenia). During this study, most of the specimens was found between sea level (2 m a.s.l., Venice) and 600 m a.s.l., with the maximal altitude near Cislano, Lombardy (about 650 m a.s.l.).

The ecological demands of *E. tergestinus* are similar to those of *E. sicanus*; *E. tergestinus* also shows ecological competition with *E. concinnus*. Author’s observations confirm the data of Vignoli et al. (2005), with a very high percentage (94.4%) of specimens found in abandoned houses or ruins (Fig. 10); there they seemed to colonize both humid and dry rooms. A small fraction (5.6%) of *E. tergestinus* was found in and around inhabited houses. However, the walls colonized by this species are usually humid and often covered by moss. An adult male from Ceraino (Veneto, Italy) was observed nearly dead because of low temperatures, on a wall inside a fortress.



Figure 10: Old abandoned fortresses are favorable environments for *E. tergestinus* in Lubiara (Veneto, Italy) (photo by Marco Colombo).

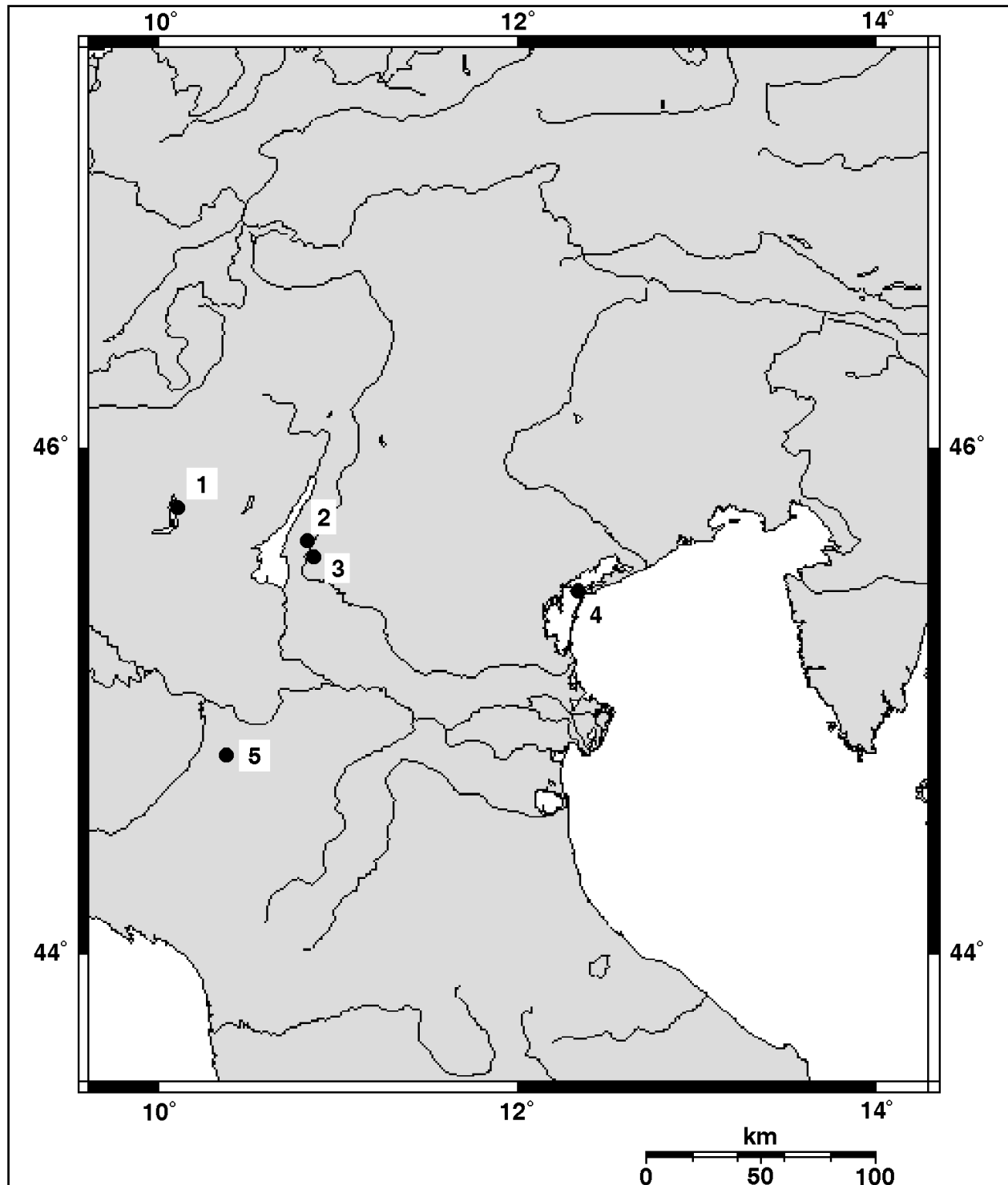


Figure 11: *E. tergestinus* collecting sites. Emilia Romagna, Lombardy, and Veneto (Italy): 1. Cislano; 2. Lubiara; 3. Ceraino; 4. Venezia; 5. Torrechiara.

No.	Date	Number of specimens, age and sex	Geographic locality	Altitude a.s.l.	Comments
109	25 April 2005	<i>E. tergestinus</i> (2 adult females, 5 dead specimens undetermined)	San Marco Fortress, Lubiara (Verona), Veneto, Italy	451 m	Two live females were found in cracks of the walls inside the fortress, in quite dark, cool, and humid rooms; the remains of other five specimens were found on the ground in long and dark galleries that had no cracks in the walls; maybe they penetrated there from the small openings on a side (observed with UV light)
5	26 April 2002	<i>E. tergestinus</i> (1 adult female)	Scala Contarini del Bovolo, Venice (Venezia), Veneto, Italy	2 m	Under a flower pot located in a larger flower pot full of clay balls, in a cool and quite humid courtyard
50	3 May 2003	<i>E. tergestinus</i> (?) (1 juvenile)	near Cislano (Brescia), Lombardy, Italy	650 m	Under a stone in a humid <i>Castanea</i> forest near a road; doubtful identification due to small size and premature death in captivity
4	19 May 2002	<i>E. tergestinus</i> (1 adult male)	Torrechiara (Parma), Emilia Romagna, Italy	265 m	Behind a door in a warm and dry room of a castle
115	26 June 2005	<i>E. tergestinus</i> (1 adult male, 1 juv., 2 dead adult females, remains of at least 4 undetermined specimens)	Ceraino Fortress, Ceraino (Verona), Veneto, Italy	236 m	The male was found in a wall crack, in a humid, dark and cool room; the juvenile was found under a stone in an underground room, cool and humid; dead specimens were found all over the fortress, on the ground; only some remains were found in the wall crack under the one inhabited by the living male (cannibalism?) (observed with UV light)
77	18 December 2003	<i>E. tergestinus</i> (1 adult male)	Ceraino Fortress, Ceraino (Verona), Veneto, Italy	236 m	On a wall, inside an abandoned Hlawaty fortress, surrounded by a <i>Quercus</i> forest. Inside the fortress, rooms have different degree of light and humidity, due to their geographic exposure: the room with the scorpion (that was found nearly dead maybe due to the low temperature, 1°C) was not very humid but had light

Table 5: *Euscorpius tergestinus*: specimen and locality data.

Vignoli et al. (2005) reported the unusual case of a specimen of *E. tergestinus* from Sistiana (Friuli-Venezia Giulia, Italy) found in a natural habitat, and suggested this is due to the presence there of the larger *E. italicus* that would occupy anthropogenic habitats. Larger species usually occupy most favorable habitats against smaller species, then segregated to harder environmental conditions (Polis & McCormick, 1987; quoted after Vignoli et al., 2005). This kind of interaction, observed with other pairs of sympatric and sometimes syntopic species, was noticed once by the author in Ceraino (Veneto, Italy). Several *E. tergestinus* specimens were found inside an abandoned fortress, while an adult female (maybe pregnant) of *E. italicus* was found under a stone next to the path leading to the fortress. We can only suggest that other specimens could be inhabiting cracks in the rocky cliff; however, no other scorpions were found under stones. In this case the larger species, *E. italicus*, would occupy the most favorable habitat, considered by Vignoli et al. (2005) as the anthropogenic one. It could be that rocky cliffs are more ecologically favorable than abandoned buildings. The cliffs are heated considerably to convection by the stone, but they are also drier due to their exposure to sunlight. On the contrary abandoned buildings are not sufficiently heated (especially in underground portions); however, they have a quite stable range of temperatures and humidity during the year. Protection from predators should be similar in both habitats, mainly due to the similar way of life of scorpions, which occupy cracks in both cases.

As indicated by Crucitti (1993) and by observations in this study (see below), *E. italicus* is a thermophilous species, more tolerant to water scarcity than other *Euscorpium* species. In this case it could be that this larger species occupied its most favorable habitat, the hotter and drier one (rocky cliffs), while the smaller one (*E. tergestinus*) occupied the remaining habitat that, however, is preferred by most *Euscorpium* species.

Regarding intraspecific relations, inside the same fortress some scorpion remains (*E. tergestinus*) were found on the ground under the shelter of an adult male (maybe the result of cannibalism). During this study, males were not found together with live females; only, in a fortress in Ceraino (Veneto, Italy; June), live males were found in same room with females' remains, that, however, were not very old.

***Euscorpium concinnus* (C.L. Koch, 1837)**

(Figs. 12–16, Table 6)

Treated as a subspecies *E. carpathicus concinnus* by Caporiacco (1950), this taxon was listed as a synonym of *E. tergestinus* by Fet & Soleglad (2002); however, Vignoli et al. (2005) revalidated it and elevated to species status.

E. concinnus is widely distributed in Italy, both in northern (Lombardy, Liguria, Friuli-Venezia Giulia, Emilia Romagna), center (Tuscany, Marche, Umbria) and southern regions (Latium and Campania) (Vignoli et al., 2005). All French populations, not analyzed in detail in Vignoli et al. (2005) but whose distribution is reported in detail by Dorier (1935) and Lacroix (1991), should also belong to this species according to their morphological characters. The author studied this species in Italy (Emilia Romagna, Liguria, Piedmont and Tuscany) and France (Fig. 16).

Vignoli et al. (2005) report a wide range of altitudes for *E. concinnus*, from sea-level to 1500 m a.s.l. In this study, the species was mainly found between 0 and 400 m a.s.l. (81 specimens), with a maximal altitude at ca. 638 m a.s.l. in southern France (Entrevaux).

Vignoli et al. (2005) treat *E. concinnus* as eurytopic, occupying a wide range of habitats but with a particular preference for natural ones. Author's data confirms this preference, with 63.0% of specimens found in forests (mainly of *Quercus*, *Pinus*, *Fagus* and *Robinia*; Fig. 15), and a smaller amount on small rocky cliffs (15.2%) and borders between forests and Mediterranean maquis (3.4%); only 18.4% of specimens occupied anthropogenic habitats, preferring ruins to inhabited houses. It is interesting to note that, of all seven analyzed species, only two, *E. concinnus* and *E. flavicaudis*, occupy all habitats (Table 1).

In the Italian coastal regions (e.g. in Liguria), *E. concinnus* occurs in pine forests, where scorpions hide under stones; this habitat is quite dry in summer but is strongly influenced by seasonal rains. There, over 20 specimens (often in groups of two to three under the same stone) were found along 400 m distance, nearly one scorpion for every three of four stones. It seems also that specimens of the same sex can share the same shelter, since up to three males were encountered together. In the inland regions, such as Tuscany, Lombardy, and Emilia Romagna, *E. concinnus* lives in thick beech (*Fagus*) and chestnut (*Castanea*) forests, which are humid and dark. This species is quite rare in treeless areas. Only three specimens out of 92 were found in such habitat: one specimen (Botasi, Liguria) on a mountain pasture with very low bushes (600–700 m a.s.l.), while other two specimens were observed at a lower altitude, in a *Quercus* forest. Other two specimens were found in Liguria in an area without tree cover but not too far from a pine forest where other six specimens were found. Another unusually located specimen was found on a hot and dry rocky cliff near a road (Vagli, Tuscany); according to the data based on other specimens in this study, this habitat is not typical for *E. concinnus*. It was a very young specimen, which perhaps dropped from the forest above the cliff top.

According to Vignoli et al. (2005), *E. concinnus* and *E. tergestinus* are two sympatric but not syntopic spe-



Figure 12: *Euscorpius (Euscorpius) concinnus*, adult male, Le Muy (Maures Mts., France) (photo by Marco Colombo).



Figure 13: An adult female of *E. concinnus* with remains of a queen wasp (*Vespula vulgaris*) photographed in Monterosso (Genova, Liguria) (photo by Giorgio Colombo).



Figure 14: An adult female of *E. concinnus* with offspring from La Morra (Piedmont, Italy) (photo by Giorgio Colombo).



Figure 15: Humid forests appear to host weaker species in interspecific ecological competition such as *E. concinnus* in Castel San Gimignano (Tuscany, Italy) (photo by Marco Colombo).

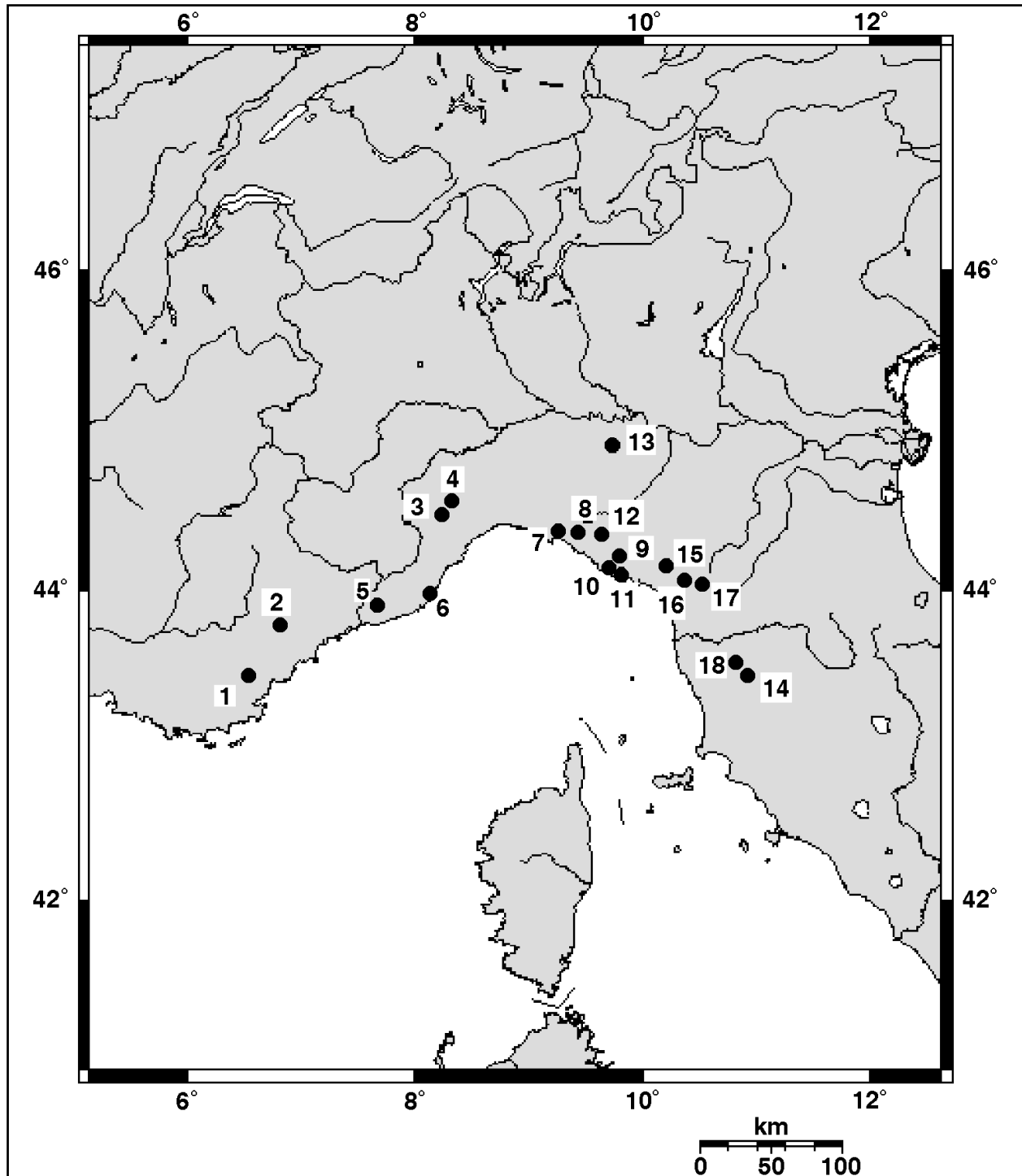


Figure 16: *E. concinnus* collecting sites. Emilia Romagna, Liguria, Piedmont, Tuscany (Italy), Haute Provence and Var (France): 1. Le Muy; 2. Entrevaux; 3. Mondovi; 4. La Morra; 5. Pigna; 6. Capo Mele; 7. Rapallo; 8. Breccanecca; 9. Pignone; 10. Levanto; 11. Vernazza; 12. Gambatesa mine; 13. Gropparello; 14. Castel San Gimignano; 15. Codiponte; 16. Vagli; 17. Castelnuovo di Garfagnana; 18. San Vivaldo.

No.	Date	Number of specimens, age and sex	Geographic locality	Altitude a.s.l.	Comments
101	1 January 2005	<i>E. concinnus</i> (1 adult female, dead)	Entrevaux (Haute-Provence), France	638 m	On the floor of a room of the abandoned «cittadelle» (little borough), located on the top of a rocky cliff ca. 160 m high, and surrounded on the others sides by pine wood. Rooms inside the building ranged from dry to humid, but the one where the specimen was found was quite dry
28	3 January 2003	<i>E. concinnus</i> (4 adult males, 2 adult females)	near Le Muy (Var), France	300 m	Under large stones (two specimens found together) in a quite dry mixed forest of <i>Pinus</i> and <i>Quercus</i> , with rocky ground covered by bark, stumps, and pine needles
31	8 March 2003	<i>E. concinnus</i> (3 adult females)	Castel San Gimignano (Siena), Tuscany, Italy	350 m	In a small <i>Quercus</i> forest (very humid, shady and cool) only 50 m from the cellar where <i>E. sicamus</i> specimens were found (No. 30)
102	25 March 2005	<i>E. concinnus</i> (2 juv.)	Castel San Gimignano (Siena), Tuscany, Italy	350 m	In a small <i>Quercus</i> forest (with a minor presence of other trees, and a rich undergrowth), very humid and cool, under a big stone, together, strangely, no adults were found
104	25 March 2005	<i>E. concinnus</i> (3 adult males?)	San Vivaldo (Firenze), Tuscany, Italy	370 m	In cracks of a wall of bricks covered by mosses, humid and cool, near a <i>Quercus</i> forest and some chapels; this environment is probably shady during the day (observed with UV light)
17	31 March 2002	<i>E. concinnus</i> (1 adult male, 5 adult females, 1 subadult and 1 juv.)	coast between Levanto and Monterosso (La Spezia), Liguria, Italy	314 m	A couple under a stone in a humid <i>Pinus</i> forest on the cool side of the mountain; other specimens in drier habitats (also covered by <i>Pinus</i> , but less shady and quite hot), sometimes in association with ant colonies; two specimens in very hot and dry environment, with no trees cover
34	18 April 2003	<i>E. concinnus</i> (2 adult females)	Codiponte (Massa), Tuscany, Italy	350 m	Under stones beneath trees near an abandoned castle; shady but not very humid environment
35	18 April 2003	<i>E. concinnus</i> (1 juv.)	Vagli (Lucca), Tuscany, Italy	575 m	Hot and dry rocky cliff near the road, an unusual habitat for this species; specimen probably dropped from the forest on the cliff-top
36	18 April 2003	<i>E. concinnus</i> (2 adult females)	Montealfonso Fortress, Caste Inuovo di Garfagnana (Lucca) Tuscany, Italy	270 m	Outside the fortress, under stones in a sparse forest
40	20 April 2003	<i>E. concinnus</i> (2 females?)	San Vivaldo (Firenze) Tuscany, Italy	370 m	In cracks of humid walls near the village chapels (observed with UV light)
43	25 April 2003	<i>E. concinnus</i> (28 specimens: adult males, adult females, and juveniles)	coast between Levanto and Monterosso (La Spezia), especially near the abandoned lighthouse on Punta del Mesco, Liguria, Italy	314 m	Under stones in quite shady and humid <i>Quercus</i> forests, but also in <i>Pinus</i> forests with a dry sandy ground; sometimes more specimens under the same stone, up to three (also of the same sex); some specimens in association with ant colonies. An adult female was found eating a queen wasp (<i>Vesputula vulgaris</i>)

Table 6: *Euscorpis concinnus*: specimen and locality data (continued on next page).

No.	Date	Number of specimens, age and sex	Geographic locality	Altitude a.s.l.	Comments
44	25 April 2003	<i>E. concinnus</i> (1 adult female, 5 undetermined)	Pignone (La Spezia), Liguria, Italy	181 m	In cracks of small rocky cliffs near the road, under a humid <i>Quercus</i> forest (observed with UV light)
45	26 April 2003	<i>E. concinnus</i> (2 adult females and 1 subadult)	coast between Monterosso and Vernazza (La Spezia), Liguria, Italy	180 m	Under stones located at the base of stone walls, on the cooler side of the mountain but also in drier olive forests
46	26 April 2003	<i>E. concinnus</i> (6 specimens, sex undetermined)	Pignone (La Spezia), Liguria, Italy	181 m	In cracks of small rocky cliffs (but also in shelters dug into the soft ground under the cliff) near the road, under a humid <i>Quercus</i> forest (observed with UV light)
87	2 May 2004	<i>E. concinnus</i> (3 adult females)	near Gambatesa mine, Botasi (La Spezia), Liguria, Italy	468 m	Two specimens together under a wood slab in a quite dry mixed forest (<i>Quercus</i> , <i>Prunus</i> and low bushes), the third at higher altitude in a mountain pasture with very low bushes (also quite dry and hot), in association with an ant colony. It was observed that when ants were disturbed, they attacked everything moving, including the scorpion
88	8 May 2004	<i>E. concinnus</i> (4 specimens, sex undetermined)	Breccanecca, near Cogorno (Genova), Liguria, Italy	300 m	Inside an abandoned house, located into a <i>Fagus</i> forest; all specimens were found dead, in <i>Tegenaria</i> sp. webs: the remains are clearly an evidence of predation of the spiders upon scorpions, which could have been fallen from the walls (observed with UV light)
89	9 May 2004	<i>E. concinnus</i> (2 adult females)	Montallegro sanctuary, near Rapallo (Genova), Liguria, Italy	612 m	Under slabs and stones in a quite humid <i>Quercus</i> and <i>Robinia</i> forest
53	1 June 2003	<i>E. concinnus</i> (1 adult female and 1 juvenile)	Mondovi (Cuneo), Piedmont, Italy	559 m	Under plaster on quite dry walls, in the town center; only some parts of the dead female were found (prosoma, mesosoma, metasoma, telson, right patella, I or II right leg, part of the I left leg, part of the II left leg, part of the II or III right leg)
54	2 June 2003	<i>E. concinnus</i> (1 adult female and 1 adult male)	La Morra (Cuneo), Piedmont, Italy	513 m	Female found under plaster of a humid wall inside public gardens; male found dead on the road
12	9 June 2002	<i>E. concinnus</i> (1 adult male, 2 adult females, 1 subadult female)	Gropparello (Piacenza), Emilia Romagna, Italy	355 m	Under stones in a humid and shady <i>Fagus</i> forest; one of the two females was found eating an earthworm (<i>Lumbricus terrestris</i>), maybe caught during the rain, which just ended
78	27 December 2003	<i>E. concinnus</i> (1 adult male)	Pigna (Imperia) Liguria, Italy	280 m	Under a marble-slab inside an abandoned church, with low humidity and light
128	27 December 2005	<i>E. concinnus</i> (1 adult male)	near Colla Micheri, Capo Mele (Savona), Liguria, Italy	95 m	In a crack of a small rocky cliff covered by low vegetation (bushes) with sparse pines

Table 6: *Euscorpius concinnus*: specimen and locality data (continued from previous page).

cies. Their material included *E. tergestinus* specimens from Monte Corchia area, in Tuscany, already listed by Caporiacco (1950) as having a “light-colored” morphotype (“*E. carpathicus apuanus*”) and even recorded, e.g., from Monte Corchia, Levigliani, Castelnuovo di Garfagnana and Monte Tambura (all in Tuscany) in the collections of Zoological Museum “La Specola” of Florence (Bartolozzi et al., 1987). However, author’s study in the same area (Castelnuovo di Garfagnana, Lucca) revealed also “dark” specimens, clearly belonging to *E. concinnus* morphotype. Also, in Emilia Romagna, some *E. concinnus* specimens were found in the wood near a castle (Gropparello, Piacenza) not so far from another castle (Torrechiara, Parma) where a *E. tergestinus* specimen was found. We could therefore assume that, although not completely syntopic (which it is still to be demonstrated), this two sympatric species could be found in adjacent localities.

Vignoli et al. (2005) state (after Polis & McCormick, 1987) that size difference between sympatric scorpion species seems to be important in determining interaction, and that larger species occupy most favorable microhabitats. According to Vignoli et al. (2005), *E. tergestinus*, the larger species, was found in anthropogenic habitats, most favorable regarding humidity, temperature, and protection from predators, while the smaller *E. concinnus* was mainly found in natural habitats. The same ecological pattern was observed and confirmed by the author for *E. alpha* and *E. italicus* (e.g. Cislano, Brescia, Lombardy), and also for *E. concinnus* (in forests) and *E. sicanus* (in inhabited houses) in Tuscany (Castel San Gimignano, Siena; J. O. Rein, pers. comm.).

An adult female from southern France (Entrevaux, Haute-Provence) was found dead on the floor of a dry room in an abandoned village, maybe due to the snowfall of the previous days.

In Emilia Romagna, an adult female of *E. concinnus* was found eating a large earthworm *Lumbricus terrestris* (L., 1758) (Oligochaeta: Lumbricidae), during a rain; worms are found in soil almost everywhere but are more common under stones in humid places such as this one (*Castanea* forest). In Liguria, another adult female was found eating a social wasp (*Vespula vulgaris* (L., 1758)) (Hymenoptera: Vespidae) that turned out to be a queen judging from abdominal pattern (Fig. 13). Queen wasps spend winter and spring in quiet places (Chinery, 1987), such as under stones, where that specimen was eaten. *E. concinnus* was found in association with ant colonies, under stones, more than one time in pine forests on the coast between Levante and Monterosso (Liguria), and also once on a mountain pasture near Gambatesa mine (Botasi, Liguria). In an old, abandoned house (Breccanecca, Liguria), remains of at least four *E. concinnus* specimens were found in the web of a very common spider, *Tegenaria* sp. (maybe *T. domestica* (Clerck, 1757))

(Araneae: Agelenidae). It is possible that when scorpions walk on the walls and accidentally fall to the ground, they sometimes get into spider webs, which are usually built in the corners.

Adult males and females were found together in January, March, April and June, but adult males were also found in December; it seems that the mating period of this species, as in *E. sicanus*, covers winter and spring. A female collected in Gropparello (Emilia Romagna, Italy) gave birth in captivity in the end of July; another one from Castel San Gimignano (Tuscany, Italy) gave birth in captivity earlier (4 June 2003). A female collected in Codiponte (Tuscany, Italy) gave birth on 24 June 2003. Another birth took place on 17 July 2003, by a female collected in La Morra (Piedmont, Italy; Fig. 14).

Subgenus *Polytrichobothrius* Birula, 1917

Euscorpius italicus (Herbst, 1800)

(Figs. 17–20, Table 7)

E. italicus is the largest species in the genus, and the largest scorpion species found in Italy, reaching about 50 mm in length. It is recorded from southern Europe and southwestern Asia: Albania, Croatia, France (introduced; Simon, 1879; Kinzelbach, 1982; Lacroix, 1991), Greece, northern and center Italy, Macedonia, Monaco, Montenegro, Romania (introduced), southwestern European Russia, San Marino, Slovenia (only coastal area; Fet et al., 2001), southern Switzerland, European and Asian Turkey; it was also introduced in northern Africa (Algeria, Tunisia) and Middle East (Iraq, Yemen) (Fet & Sissom, 2000). In Italy, *E. italicus* is common in northern and center regions, from Piedmont and Lombardy to Latium (excluding Liguria), and also on the Adriatic coast along Apennines from Friuli-Venezia Giulia south to Molise and Abruzzi (Caporiacco, 1950; Crucitti, 1993). The author studied this species in Italy from five different regions: Emilia Romagna, Lombardy (where it was already recorded by Pavesi, 1878), Piedmont, Veneto, and Marche (Fig. 20).

The altitudinal preference of *E. italicus* seems to range between 0 and 500 m a.s.l., while higher records are maybe due to its recent dispersal through human activities (Vachon, 1952, 1983; Fet & Gruodis, 1987, after Gantenbein et al., 2002). In Slovenia (Fet et al., 2001), the highest record was ca. 700 m a.s.l. In this study, most of the specimens was found between sea level and 400 m a.s.l., with the highest collecting site (four specimens) in Cislano, Lombardy (ca. 650 m a.s.l.).

Most of *E. italicus* were found on rocky cliffs (50.6%) and near or inside buildings, mostly abandoned (39.2%) but also inhabited (8.9%). This species is highly thermophilous and seems to be the most tolerant to water scarcity: indeed, lots of specimens can be found in sun-exposed dry rocky cliffs. At the same time, *E. italicus*



Figure 17: *Euscorpius (Polytrichobothrius) italicus*, subadult female, Busto Arsizio (Lombardy, Italy) (photo by Giorgio Colombo).



Figure 18: A subadult female of *E. italicus* surprised catching a caterpillar (*Malacosoma neustria*) in Peschiera Maraglio (Lombardy, Italy) (photo by Giorgio Colombo).



Figure 19: High rocky cliffs are the most favorable environment for thermophilous species as *E. italicus* (Peschiera Maraglio, Lombardy, Italy) (photo by Giorgio Colombo).

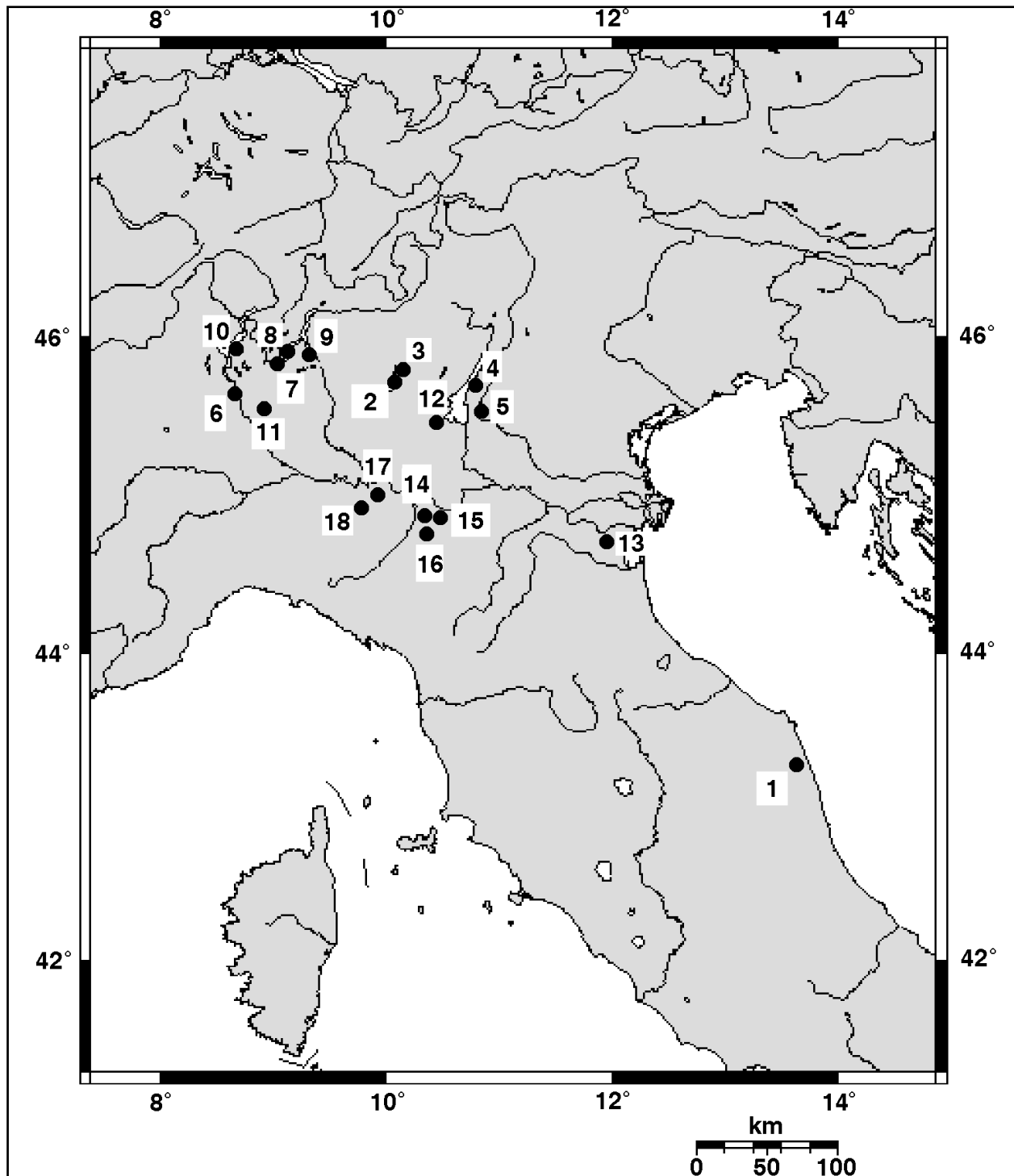


Figure 20: *E. italicus* collecting sites. Emilia Romagna, Lombardy, Marche, Veneto, and Piedmont (Italy): 1. Fermo; 2. Monte Isola; 3. Cislano; 4. Campo; 5. Ceraino; 6. Varallo Pombia; 7. Cernobbio; 8. Isola Comacina; 9. Onno; 10. Cittiglio; 11. Busto Arsizio; 12. Montichiari; 13. Ferrara; 14. Felino; 15. Montechiarugolo; 16. Torrechiara; 17. San Pietro in Cerro; 18. Castell'Arquato.

No.	Date	Number of specimens, age and sex	Geographic locality	Altitude a.s.l.	Comments
85	24 April 2004	<i>E. italicus</i> (34 adult males, adult females, and juveniles)	Peschiera Maraglio surroundings, Monte Isola (Brescia), Lombardy, Italy	190 m	In cracks of a high (hot during the day) rocky cliff near the road; specimens seem to be very active after a short rain, in moderate temperature (15°C). Specimens in shallow shelters close the entrance with pedipalps if disturbed (observed with UV light)
108	24 April 2005	<i>E. italicus</i> (2 adult females, 1 adult male, 4 subadults and 4 juveniles)	Campo (Verona), Veneto, Italy	150 m	Under the stones on and under stone walls (average humidity) among olive trees and near some abandoned houses, on the path between Castelletto di Brenzone and Campo; a juvenile was observed eating a small isopod (sp. indet.)
51	3 May 2003	<i>E. italicus</i> (1 adult male, 1 adult female, 1 subadult and 1 juvenile)	near Cislano (Brescia), Lombardy, Italy	650 m	In cracks of rocky cliffs near the road, with heat and direct sunlight during the day (observed with UV light)
52	4 May 2003	<i>E. italicus</i> (1 subadult female)	near Peschiera Maraglio, Monte Isola (Brescia), Lombardy, Italy	190 m	In a crack of a hot rocky cliff near the road; it was found catching and eating a caterpillar, <i>Malacosoma neustria</i>
110	7 May 2005	<i>E. italicus</i> (1 adult female, 1 subadult female, 1 adult male and 1 exuvium)	Varallo Pombia (Novara), Piedmont, Italy	299 m	In cracks of old stone walls in the town center, near abandoned but also inhabited houses
6	19 May 2002	<i>E. italicus</i> (1 subadult female)	Felino (Parma), Emilia Romagna, Italy	185 m	In a quiet and cool room of a castle, on the top of a wall
8	19 May 2002	<i>E. italicus</i> (3 adult females)	Montechiarugolo (Parma), Emilia Romagna, Italy	150 m	One specimen found dead on the street; two live females were found under flower pots in humid places
13	19 May 2002	<i>E. italicus</i> (1 subadult)	Torrechiara (Parma), Emilia Romagna, Italy	265 m	Under a large basket in a shady and quite humid corner inside a castle
55	7 June 2003	<i>E. italicus</i> (1 subadult female)	Busto Arsizio (Varese), Lombardy, Italy	224 m	On the external wall (made with bricks) of an old abandoned building, in the town center (observed with UV light)
11	9 June 2002	<i>E. italicus</i> (3 adult females)	Castell'Arquato (Piacenza), Emilia Romagna, Italy	225 m	Under stones fallen from the walls in a castle court, a warm and dry environment; one specimen in association with an ant colony
57	13 June 2003	<i>E. italicus</i> (1 adult female)	Cernobbio (Como) Lombardy, Italy	201 m	On the external wall of an inhabited house
14	16 June 2002	<i>E. italicus</i> (2 adult females and 1 subadult)	San Pietro in Cerro (Piacenza), Emilia Romagna, Italy	44 m	Under stones and bricks in sun-exposed dry areas near a castle; subadult together with an ant colony
60	22 June 2003	<i>E. italicus</i> (1 adult female)	Montichiari (Brescia), Lombardy, Italy	96 m	In a room inside a castle, on a wall
113	24 June 2005	<i>E. italicus</i> (1 adult male)	Ferrara (Ferrara) Emilia Romagna, Italy	10 m	In a chapel, on the ground (partially trapped in a spider net but alive), on the left side of San Francesco church, a very cool but dry place. Few hiding places, only some cracks in the walls
114	26 June 2005	<i>E. italicus</i> (1 adult female)	Ceraino (Verona), Veneto, Italy	236 m	Under a stone in a dry forest near some small rocky cliffs, on the dug-up road to the Ceraino fortress (Hlawaty)
67	4 July 2003	<i>E. italicus</i> (1 adult female)	Busto Arsizio (Varese), Lombardy, Italy	224 m	On the external brick wall of an old abandoned building in the town center; the same specimen was seen again on 5 July 2003 in the same shelter (with UV light). In February 2004, the old building was demolished to make a parking lot. We can consider this significant part of <i>E. italicus</i> population in Busto Arsizio extinct
18	15 July 2002	<i>E. italicus</i> (1 subadult female)	Omio (Lecco), Lombardy, Italy	229 m	Under a stone in a dry riverbed in a quite humid and shady in a <i>Fagus</i> forest; this is the only <i>E. italicus</i> specimen found in a forest, and not near houses or human buildings

Table 7: *Euscorpis italicus*: specimen and locality data (continued on next page).

No.	Date	Number of specimens, age and sex	Geographic locality	Altitude a.s.l.	Comments
69	17 July 2003	<i>E. italicus</i> (1 subadult)	Isola Comacina (Como), Lombardy, Italy	200 m	Under a stone inside the ruins of an old Romanic church; sunny but quite humid environment
75	10 August 2003	<i>E. italicus</i> (1 subadult female and 1 juvenile), A. Colombo leg.	Fermo (Ascoli Piceno), Marche, Italy	319 m	Inside a countryside house on the round; the juvenile was taken alive from a spider web in the bathroom
125	6 November 2005	<i>E. italicus</i> (2 adult males)	Cittiglio (Varese) Lombardy, Italy	254 m	Inside an inhabited house
26	17 November 2002	<i>E. italicus</i> (2 subadult females)	Cittiglio (Varese) Lombardy, Italy	254 m	On a wall inside an inhabited house
9	?	<i>E. italicus</i> (1 adult male), C. Ghidoni leg.	?	?	Specimen arrived in a shirt box at Castellanza (Varese), Lombardy, Italy

Table 7: *Euscorpius italicus*: specimen and locality data (continued from previous page).

No.	Date	Number of specimens, age and sex	Geographic locality	Altitude a.s.l.	Comments
61	24 June 2003	<i>E. naupliensis</i> (1 adult male and 1 adult female)	Skoulikado (Alykes), Zakynthos Island, Greece	500 m	Under bricks or pieces of fallen plaster inside an abandoned house; environment always shady, cool, and quite humid
62	24 June 2003	<i>E. naupliensis</i> (1 adult male)	Volimes (Elation), Zakynthos Island, Greece	160 m	Only prosoma and pedipalps of this dead specimen were found, under a wooden box in a humid corner in the town center
63	24 June 2003	<i>E. naupliensis</i> (1 adult female and 1 juvenile)	near Volimes (Elation), Zakynthos Island, Greece	150 m	In cracks of a small rocky cliff near the road; cool and humid environment due to the coniferous tree cover above the cliff
64	24 June 2003	<i>E. naupliensis</i> (1 subadult female)	Anafonitria (Elation), Zakynthos Island, Greece	335 m	Under a large stone outside a monastery, together with an adult male of <i>Mesobuthus gibbosus</i> ; hot and dry environment
65	24 June 2003	<i>E. naupliensis</i> (1 subadult male, 1 adult male and 1 adult female)	Louha (Artemision), Zakynthos Island, Greece	480 m	Under stones on a humid moss-covered wall, under <i>Quercus</i> tree cover; the collected male is light-colored (orange-tan), maybe due to a developmental error with consequent pigment loss (V. Fet, pers. comm.); after a molt in captivity it has become darker, but still light-colored for the species
90	29 June 2004	<i>E. naupliensis</i> (1 adult female)	Louha (Artemision) Zakynthos Island, Greece	480 m	Under a stone located near a stone wall covered by mosses; environment humid and quite shady due to tree cover
91	29 June 2004	<i>E. naupliensis</i> (1 adult female)	near Volimes (Elation), Zakynthos Island, Greece	150 m	Under a stone fallen from a small rocky cliff near the street, environment humid and shady due to some <i>Pinus</i> trees

Table 8: *Euscorpius naupliensis*: specimen and locality data.

seems to be absent in more humid areas of castles and ruins, and present only in the hotter sides. On rocky cliffs (Fig. 19), specimens live in cracks, from where they catch prey and during the day are exposed to heat from the rock. During the night, males (one in Cislano and three or four in Peschiera Maraglio) were observed to wander presumably looking for females that, on the contrary, were only seen inside shelters.

In abandoned houses and castles, *E. italicus* occupy cracks in the walls, but was also found under stones, flower pots, bricks, etc. They seem to appear inside inhabited houses (Cittiglio, Lombardy) especially at the beginning of winter, as also confirmed by Braunwalder (2005). In larger cities, most of the specimens concentrate on brick walls of abandoned, old houses and factories.

Only one specimen out of 80 (1.3%) was found in a forest, where humidity was quite high and temperature cool. Braunwalder (2001) demonstrated that it is extremely difficult to find this species in the forested areas in Switzerland (only 33 out of 1031 findings of *E. italicus* were in non-anthropogenic habitats).

Locally significant populations of *E. italicus* can be found on rocky cliffs, mainly located near the roads (Peschiera Maraglio, Lombardy, Italy, with 34 specimens found; maybe also Cislano, Lombardy, Italy, where only four specimens were found but the survey was shorter and more localized). However, this species is also synanthropic and lives inside human buildings.

According to Braunwalder (2005), in Ticino and Mesolcina (Switzerland), *E. italicus* occupies only forests of *Castanea* or *Fagus* with acid soils, with low trees density and optimal exposure to sun, and rocky cliffs with the same characteristics; in anthropogenic habitats it is very common in either inhabited and abandoned buildings.

This large species can probably eat every invertebrate living in its environment (grasshoppers, wasps, bees, moths, flies, butterflies, beetles, cockroaches, centipedes, etc.) due to its big size and powerful pedipalps. In captivity, they preferred crickets and cockroaches to moth larvae (*Galleria mellonella* (L., 1758)) (Pyralidae: Galleriinae), which are often rejected but accepted after long periods of fasting. In nature, a subadult specimen on a rocky cliff was observed on a hot and sunny day grabbing from its shelter a caterpillar, *Malacosoma neustria* (L., 1758) (Lasiocampidae Lasiocampinae), and then killing it (Peschiera Maraglio, Lombardy; Fig. 18). A juvenile *E. italicus* was observed in Veneto (Campo) eating a small isopod (sp. indet.). Sometimes, specimens were found under stones with ant colonies (one adult female in Castell'Arquato, and one subadult in San Pietro in Cerro, both Emilia Romagna, Italy).

This species could be endangered in Italy by cementation and destruction of old abandoned buildings (see

Busto Arsizio, Lombardy, Italy), as already indicated for Switzerland by Braunwalder (2005).

Adult males and females were found together in April and May (its possible the mating period may last till the end of summer or more, adult males were also found in June). Two adult females collected in Montechiarugolo (Emilia Romagna, Italy), gave birth in captivity in the end of August.

Euscorpius naupliensis (C.L. Koch, 1837)

(Figs. 21–24, Table 8)

This Greek species, closely related to *E. italicus*, was recently separated from the latter (Gantenbein et al., 2002) due to the results of detailed morphological and molecular analysis; there is 5 % DNA divergence between these two species. Taxonomic problems with *E. italicus* in the Aegean area were also earlier discussed by Fet & Braunwalder (2000). *E. naupliensis* is found only in the Peloponnese (north to Patra, the only point of the peninsula where *E. italicus* was also recorded) and Zakynthos Island (with the nearby Pelouzo islet) in the Ionian islands.

Gantenbein et al. (2002) list a number of records from Peloponnese, but few from Zakynthos (findings of J. Eiselt, K. Palmer, and K. Bilek in Laganas and Pelouzo), where the author conducted observations; Kritscher (1993) also indicates Laganas locality under *E. italicus*. Other works (such as Caporiacco, 1950, under *E. italicus zakynthi*) report, in a general way, "Zakynthos Island". No data on this species' ecology exist.

Another *Euscorpius* species, *E. hadzii* Caporiacco, 1950, has been also recorded from Zakynthos (by J. Eiselt, March 1936; see Fet & Soleglad, 2002); also Ćurčić (1972) indicates Zakynthos Island as one of the points of the dispersal of "*E. carpathicus*". No specimens belonging to the subgenus *Euscorpius* were found during this study.

The author collected 11 specimens in five different localities across the island: Skoulikado, Volimes, near Volimes, Anafonitria, and Louha (Fig. 24). Except J. Eiselt's collecting sites on Zakynthos (Laganas and nearby islet of Pelouzo) (Gantenbein et al., 2002), all other localities for *E. naupliensis* are located in the mountains (maximal altitude in this study: about 500 m a.s.l.), and distribution of the species seems to include Vrachionas, Megalo Vuno (center) and Skopos (south) mountain ranges (see map on Fig. 24). According to Crucitti & Bubbico (2001, as *E. italicus*), this species is found in the Peloponnese up to 1000 m a.s.l.

During two separate trips to Zakynthos Island (Greece), different habitats were surveyed. Most of *E. naupliensis* specimens were found in forests (36.4%), in abandoned houses located in small villages or near monasteries (27.3%), and also on small rocky cliffs near roads (27.3%). Only one (dead) specimen was found in a



Figure 21: *Euscorpius (Polytrichobothrius) naupliensis*, adult male, Skoulikado (Zakynthos Island, Greece) (photo by Marco Colombo).



Figure 22: *Euscorpius (Polytrichobothrius) naupliensis*, subadult male (color variation), Louha (Zakynthos Island, Greece) (photo by Marco Colombo).



Figure 23: Abandoned houses are a part of *E. naupliensis* habitat in Skoulikado (Zakynthos Island, Greece) (photo by Marco Colombo).

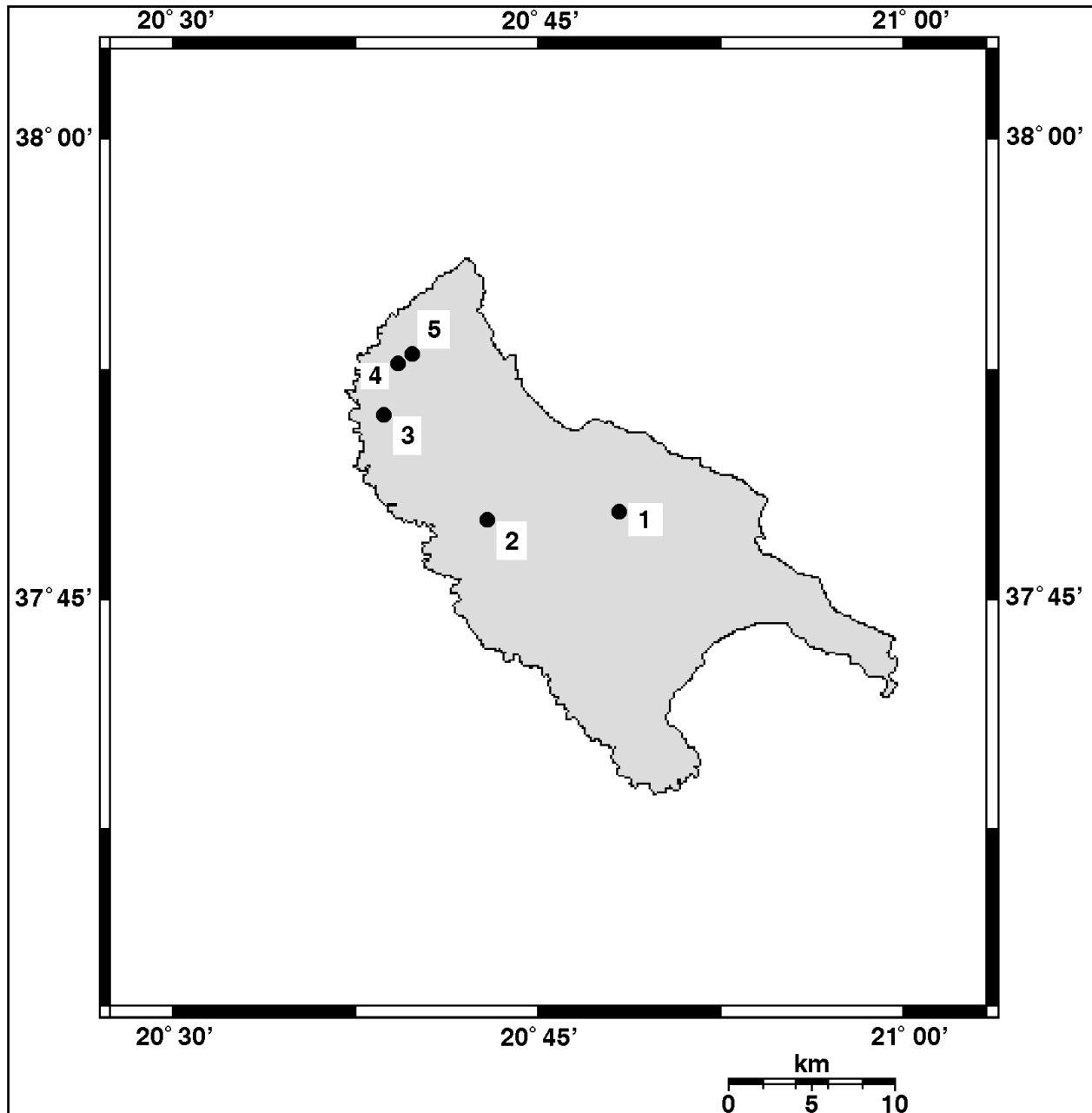


Figure 24: *E. naupliensis* collecting sites. Zakyntos Island (Greece): 1. Skoulikado; 2. Louha; 3. Anafonitria; 4. Volimes; 5. near Volimes.

village center (9.0%), but according to local people, they also occur inside inhabited houses. Therefore, as compared to *E. italicus*, this species seems to have a much wider range of natural habitats.

Inside abandoned houses *E. naupliensis* occupies cracks of the walls, but also uses shelters under furniture, bricks and pieces of wood (Fig. 23). Some specimens were found under stones in cool, dark *Pinus* forests; others, in cracks of a small rocky cliff near the road. In one case, a subadult female was found outside a monastery (Anafonitria) in a very dry and hot environ-

ment, under a stone together with a large male of the scorpion *Mesobuthus gibbosus* (Brullé, 1832) (Scorpiones: Buthidae). This encounter could be quite unusual, because according to data based on other specimens in this study, *E. naupliensis* thrives in more humid, cooler habitats; beyond all, *M. gibbosus* is usually found in these conditions but farther from human buildings (but there are some accidental records of this species in inhabited houses; Rein, 2006).

In captivity, *E. naupliensis* accepted medium to large sized invertebrates such as adults and larvae of



Figure 25: *Euscorpium (Tetratrachobothrius) flavicaudis*, subadult female, Castelfalfi (Tuscany, Italy) (photo by Giorgio Colombo).



Figure 26: Old abandoned buildings, as this one photographed in Castelfalfi (Firenze, Tuscany), are favorable environments for *E. flavicaudis* (photo by Marco Colombo).

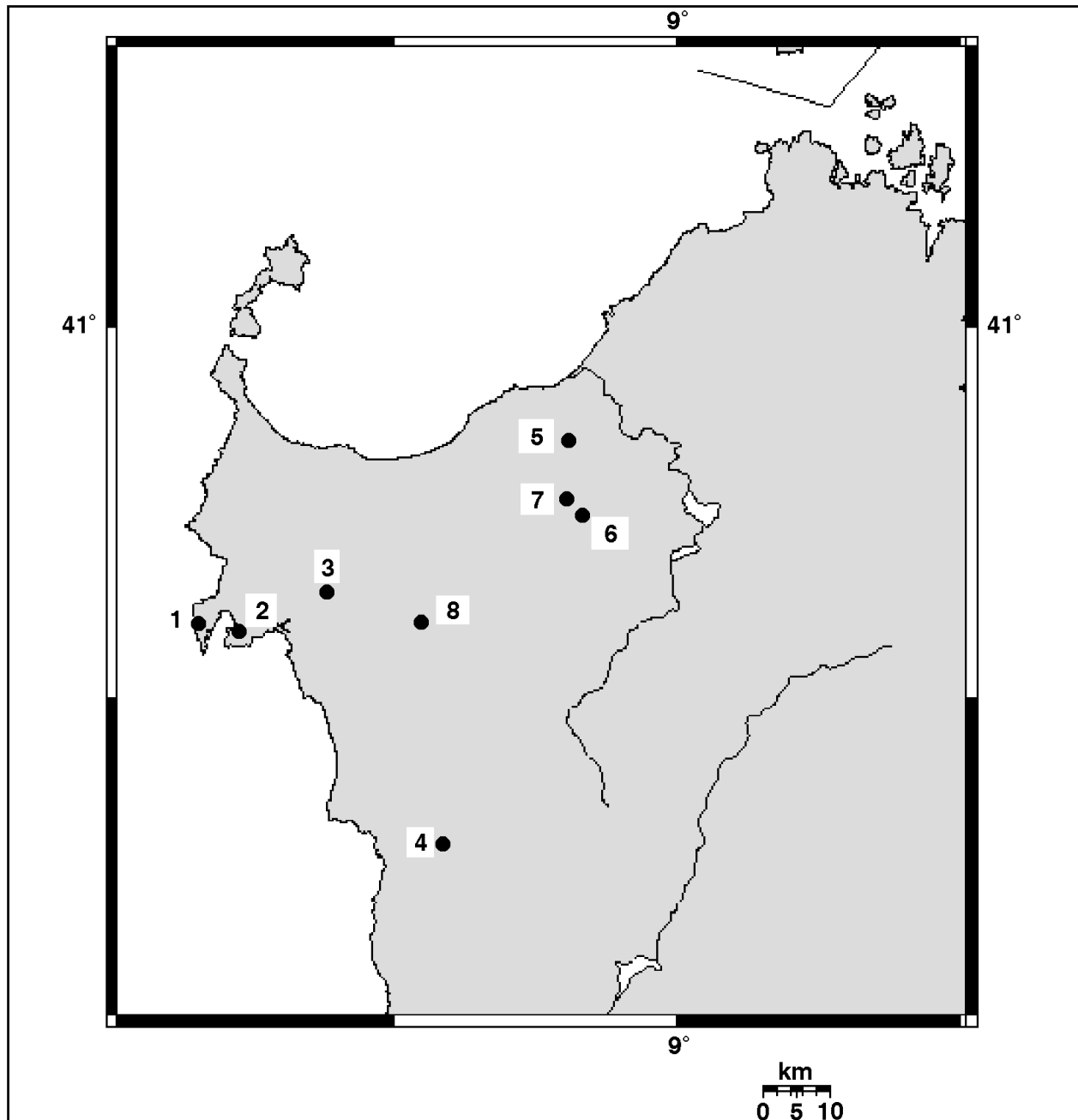


Figure 27: *E. flavicaudis* collecting sites. Northwestern Sardinia (Italy): 1. Cala della Barca; 2. Maristella; 3. Olmedo; 4. Monteleone Roccadoria; 5. Sedini; 6. Chiaramonti; 7. Martis; 8. Ittiri.

moths (*Galleria mellonella*), and subadult (rarely adult) crickets (*Acheta domestica* (L., 1758)) (Gryllidae: Gryllinae).

During the short study periods (June) both adult males and females were observed; an adult female collected in Skoulikado gave birth in captivity in August.

Subgenus *Tetratrachobothrius* Birula, 1917

***Euscorpius flavicaudis* (DeGeer, 1778)**

(Figs. 25–28, Table 9)

Euscorpius flavicaudis is one of the four “old” species (already discussed by Fanzago, 1872), which in the

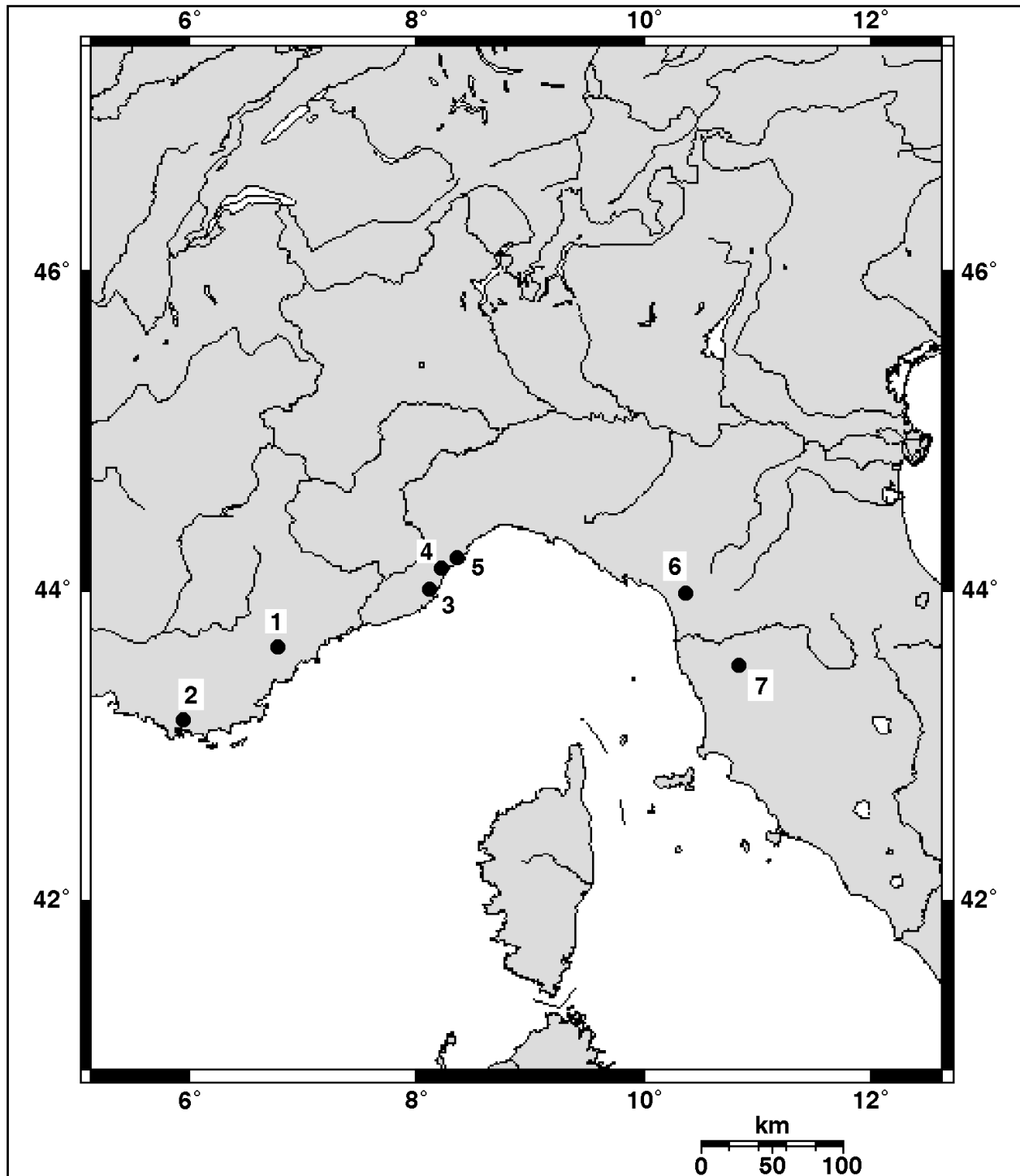


Figure 28: *E. flavicaudis* collecting sites. Liguria, Tuscany (Italy) and Var (France): 1. Fayence; 2. Mont Faron; 3. Andora Castello; 4. Toirano; 5. Finale Ligure; 6. Levigliani; 7. Castelfalfi.

recent years has not been part of any important taxonomic changes; none of the subspecies listed by Caporinico (1950) was elevated to species status. It is characterized by a typical Western Mediterranean chorotype (Crucitti, 1993), and it is found in northern Africa (Alge-

ria, Tunisia) and southern Europe (southern France and Corsica, Italy and southern Spain, including Balearic Islands); it was introduced to northern Europe (Great Britain) and southern America (Uruguay) (Fet & Sissom, 2000). In Italy, it is recorded from the entire Tyrrhenian

No.	Date	Number of specimens, age and sex	Geographic locality	Altitude a.s.l.	Comments
79	3 January 2004	<i>E. flavicaudis</i> (1 subadult)	Finalborgo di Finale Ligure (Savona) Liguria, Italy	31 m	Under a stone among Covone Castle ruins, in a lighted and not very humid place
29	4 January 2003	<i>E. flavicaudis</i> (1 subadult female)	Tourano (Savona) Liguria, Italy	150 m	Under a flower pot near a high rocky cliff, at the entrance to the famous Toirano Caves; sun-exposed dry environment
32	9 March 2003	<i>E. flavicaudis</i> (1 subadult)	Levigliani (Massa), Tuscany, Italy	650 m	Under the plaster of an old house; the specimen escaped into a crack of the wall when discovered
105	25 March 2005	<i>E. flavicaudis</i> (5 adult females, of which 2 dead, and 5 juv.)	Castelfalfi (Firenze), Tuscany, Italy	300 m	In the cracks of the walls of a large abandoned house surrounded by fields, inside (drier environment) and outside (more humid environment); two females were found dead inside an empty tank, maybe because they fell into but couldn't climb its smooth walls. At the time of observation a thick fog covers the fields (observed with UV light)
37	18 April 2003	<i>E. flavicaudis</i> (2 adult males, 3 adult females, 1 subadult, 2 undetermined)	Castelfalfi (Firenze), Tuscany, Italy	300 m	On the external walls (quite humid but sun-exposed) of a large abandoned house, surrounded by fields; a few specimens inside, mainly wandering males (observed with UV light)
38	19 April 2003	<i>E. flavicaudis</i> (24 specimens, incl. adult males, adult females, and juveniles)	Castelfalfi (Firenze), Tuscany, Italy	300 m	In the same abandoned house, but a few specimens outside the cracks, maybe due to lower temperatures and stronger wind (observed with UV light)
70	27 July 2003	<i>E. flavicaudis</i> (2 subadults)	Maristella (Sassari), Sardinia, Italy	21 m	Under flower pots exposed to sun but quite humid, near an inhabited country house
71	29 July 2003	<i>E. flavicaudis</i> (1 adult female)	Maristella (Sassari), Sardinia, Italy	21 m	Under a barbecue grill in a house garden; the specimen was found dead and without the right pedipalp (observed with UV light)
118	30 July 2005	<i>E. flavicaudis</i> (3 juveniles)	Maristella (Sassari), Sardinia, Italy	21 m	Near an inhabited house, under regularly watered flower pots; a specimen was found with the typical whitish coloration, near its old exuvium
72	31 July 2003	<i>E. flavicaudis</i> (1 adult female)	Maristella (Sassari), Sardinia, Italy	21 m	On the external wall of an inhabited house, at night
94	31 July 2004	<i>E. flavicaudis</i> (3 subadults)	Maristella (Sassari), Sardinia, Italy	21 m	Under regularly watered flower pots (also together), near an inhabited country house; scorpions were found together with some small spiders, earwigs and many specimens of the isopod <i>Armadillidium vulgare</i>
1	August 1999, August 2000, August 2001	<i>E. flavicaudis</i> (9 females and subadults)	Maristella (Sassari) Sardinia, Italy	21 m	In inhabited houses in the countryside; sometimes in association with ant colonies
22	August 2002	<i>E. flavicaudis</i> (2 adult males, 1 adult female, and 6 subadults)	Maristella (Sassari), Sardinia, Italy	21 m	In cool and quite humid places near inhabited houses in the countryside, under flower pots, slabs of wood, blocks of cement, but also under stones near shady (but not cool) <i>Pinus</i> forests
23	August 2002	<i>E. flavicaudis</i> (1 adult male and 1 adult female)	Cala della Barca (Sassari), Sardinia, Italy	30 m	Under the same stone in hot and dry environment, with low Mediterranean maquis. This area is subjected to a particularly strong wind from the northwest (locally called "Maestrale") that deposits the salt from the nearby sea water to the maquis (some stones can be more or less covered by salt)
24	August 2002	<i>E. flavicaudis</i> (1 subadult)	Sedimi (Sassari), Sardinia, Italy	306 m	Under a large stone near a nearly abandoned church, surrounded by untilled fields; very hot and dry environment

Table 9: *Euscorpius flavicaudis*: specimen and locality data (continued on next page).

No.	Date	Number of specimens, age and sex	Geographic locality	Altitude a.s.l.	Comments
95	3 August 2004	<i>E. flavicaudis</i> (2 subadults)	Olmedo (Sassari) Sardinia, Italy	68 m	Together under a tree stump, near a barbecue into a garden of an inhabited house. Some possible prey also found under the stump such as small spiders, chilopods, and pseudoscorpions (Chernetidae); the environment was quite humid, and many snails were observed at night
119	3 August 2005	<i>E. flavicaudis</i> (1 adult female)	Maristella (Sassari), Sardinia, Italy	21 m	Under a flower pot near an inhabited house
96	6 August 2004	<i>E. flavicaudis</i> (1 exuvium)	near San Leonardo church, near Ittiri (Sassar), Sardinia, Italy	400 m	In a crack of a small, hot, and dry rocky cliff near a dug-up road surrounded by untilled fields; no alive specimens were found
73	10 August 2003	<i>E. flavicaudis</i> (1 subadult female)	Maristella (Sassari), Sardinia, Italy	21 m	Inside an inhabited house, on the ground; it escaped into a crack of the wall, and then found again and released outside on 14 August 2003
120	11 August 2005	<i>E. flavicaudis</i> (1 adult female and 1 undetermined)	near Monte Leone Roccadoria (Sassari), Sardinia, Italy	268 m	Under stone slabs in a small cliff covered by bushes, not very humid itself but near the Temo lake; a specimen escaped through a gallery dug into the ground behind to slabs
99	15 August 2004	<i>E. flavicaudis</i> (1 subadult)	Maristella (Sassari), Sardinia, Italy	21 m	Under a stone in a quite humid environment, on the boundary between a <i>Pinus</i> forest (humid) and a fire-cut line (dry)
121	19 August 2005	<i>E. flavicaudis</i> (1 adult male, 1 adult female, 8 juveniles and 1 undetermined remain)	San Pantaleo church, Martis (Sassari), Sardinia, Italy	300 m	Up to four specimens together (also of different ages) under pieces of marble on the ground of the abandoned church; dusty and dry environment, shared with isopods (<i>Armadillidium vulgare</i>), pseudoscorpions, and beetles (<i>Blaps mucronata</i>)
122	20 August 2005	<i>E. flavicaudis</i> (1 adult female)	Maristella (Sassari), Sardinia, Italy	21 m	Under a stone on the border of a shady and cool pine forest surrounded by a dry and hot fire-cut line
123	22 August 2005	<i>E. flavicaudis</i> (1 adult male, 2 adult females and 3 juv.)	near Chiaramonti (Sassari), Sardinia, Italy	400 m	Under stones of a wall covered by some high trees near Santa Giusta church; two specimens, a juvenile and the adult male, were feeding on specimens of the isopod <i>Armadillidium vulgare</i> , abundant due to the recent rainfall
100	26 August 2004	<i>E. flavicaudis</i> (2 adult females, 1 adult male and 8 subadults)	San Pantaleo church, Martis (Sassari), Sardinia, Italy	300 m	Inside the abandoned church (shady but dry), under pieces of marble fallen from the walls, also together (up to three subadults or two adults); small spiders and many isopods (<i>Armadillidium vulgare</i>) were also found there
74	30 August 2003	<i>E. flavicaudis</i> (1 juvenile, maybe a male)	Maristella (Sassari), Sardinia, Italy	21 m	Inside an inhabited house, on the ground
124	30 August 2005	<i>E. flavicaudis</i> (1 adult female)	Maristella (Sassari), Sardinia, Italy	21 m	Inside an inhabited house, under some bags on the ground
127	27 December 2005	<i>E. flavicaudis</i> (1 juv.)	Andora Castello (Savona), Liguria, Italy	100 m	Under a stone on the top of a stone wall just outside the castle
129	29 December 2005	<i>E. flavicaudis</i> (1 female [subadult?])	Mont Faron, near Toulon (Var), France	506 m	Under a stone, together with some isopods, in a quite dry wood with sparse pines; presence of ice on the surface of the stone (on the side in contact with the ground)
27	31 December 2002	<i>E. flavicaudis</i> (1 adult female)	Fayence (Var), France	350 m	Under a large flower pot (where the soil was nearly flooded due to the rain) in the center of the small town

Table 9: *Euscorpis flavicaudis*: specimen and locality data (continued from previous page).

coast, from Liguria to Calabria, through Tuscany, Latium, and Campania; populations are also present on some minor islands (e.g. Tuscan Archipelago) and in Sardinia (but not in Sicily). According to Crucitti (1993), the southern limit of the range of *E. flavicaudis* in Italy (Fossa di Catanzaro, 250 m a.s.l.) is due to the sea which occupied this depression in Pleistocene. It is quite common in southern France, as reported by Simon (1879), Fage (1928), Berland & Dromaguet (1933), Drier (1935), and Lacroix (1991); Vachon & Roman (1965) reported it for the first time near Lyon. The author collected this species along Tyrrhenian coast in mainland Italy (Liguria and Tuscany) and in southern France (Var; Fig. 28), as well as in Sardinia (Fig. 27).

According to Crucitti et al. (1998) this species is common in Latium from sea level to 630 m a.s.l.; author's observations confirm this altitudinal distribution all over Italy, with highest collecting site located at about 650 m a.s.l. (Levigliani, Tuscany).

E. flavicaudis is a large species that could be considered as quite thermophilous. Most of the specimens was found in abandoned houses and castles (62.7%), characterized by sun-exposed, dry outside walls and dark rooms inside (Fig. 26). In such environment, scorpions were mostly found on the outside walls, occupying cracks and slits; inside the buildings, only wandering specimens were found with UV light, possibly during their search for mates. In ruins, dozens of specimens (in one case, 25 scorpions within about 6 m²) could be found during night observations with UV light. In other cases, when there were no cracks in the walls (e.g. San Pantaleo Church, Sardinia), the entire scorpion population of that building lived under blocks of marble or tiles fallen from roof or walls.

A high percentage of *E. flavicaudis* (28.0%) was found in inhabited houses, mainly in Sardinia. Here, scorpions enter into the buildings through door slits and then hide under household furnishings, bags, etc., but they were usually found in more humid rooms such as bathrooms (under towels and buckets). Outside, *E. flavicaudis* can be found under flower pots, cement blocks, firewood, and any other suitable place to hide from the hot sun, often together with isopods (*Armadillidium vulgare* Latreille, 1804) (Isopoda: Oniscidae), small spiders, snails, chilopods, pseudoscorpions (Pseudoscorpionida: Chernetidae), and beetles (*Blaps mucronata* Latreille, 1804) (Coleoptera: Tenebrionidae).

According to Simon (1879), in northern France *E. flavicaudis* occupies only inhabited houses, while in the south it is commonly found under stones and bark in natural habitats.

A few specimens (3.4%) were found on or near small rocky cliffs. One specimen (Liguria) was found under a flower pot near a rocky cliff, so it is possible that other specimens inhabited cracks there. An exuvium (but no live specimens) was found in a crack on a hot and dry

rocky cliff near a dug-up road in Sardinia. Also in Sardinia, two specimens were found between stone slabs on a small rocky cliff near the Temo Lake.

Some specimens (5.1%) were also found in Mediterranean maquis in Sardinia, where they lived under stones (sometimes in couples), in a very dry environment, literally “baked” by sun during the day (daily temperatures in summer usually between 25°C and 38°C); however, scorpions appeared healthy and unharmed. Among these specimens, some were found under stones on the border between shady pine forests and hot cut-fire lines with a typical maquis vegetation and sparse stones. Recently (2002-2005), it was more difficult to find specimens in this habitat; the author noticed that most of the stones had been turned by wild boars (*Sus scrofa* (L., 1758)) (Artiodactyla: Suidae), very common in the area.

Only one specimen was found in a forest habitat (pines) in southern France (Mont Faron, near Toulon). *E. flavicaudis* seems to be not active during windy nights (observation with UV lights in Tuscany).

Observations in captivity show that this species accepts all kinds of prey, such as crickets, grasshoppers, moths (both adults and larvae), beetles and cockroaches, but not isopods of the species *Armadillidium vulgare*, which are found in the same habitats and are preyed upon by *E. flavicaudis* in nature; two scorpions were observed feeding on these isopods near Chiaramonti (Sassari, Sardinia). No scorpion remains were found in the examined webs of the notorious European black widow spider, *Latrodectus tredecimguttatus* (Rossi, 1790) (Araneae: Theridiidae), which shares the same habitat in the Mediterranean maquis (Sardinia). Remains of many other arthropods (Orthoptera, Coleoptera, Blattodea, Grylloidea, Lepidoptera, Araneae, Hymenoptera) have been found in black widow webs during several years of studies. In two cases in Sardinia (Maristella, Sassari), in August, some specimens were found in association with ant colonies under stones.

Adult males and females were found together in April, July and August; assuming that it is also possible to find them in May and June, mating could occur in spring and summer. An adult female collected in southern France (Fayence, Var) gave birth in captivity on 28 May 2003; also other females, collected in Sardinia in 1999, gave birth in captivity (the exact date was not recorded).

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