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

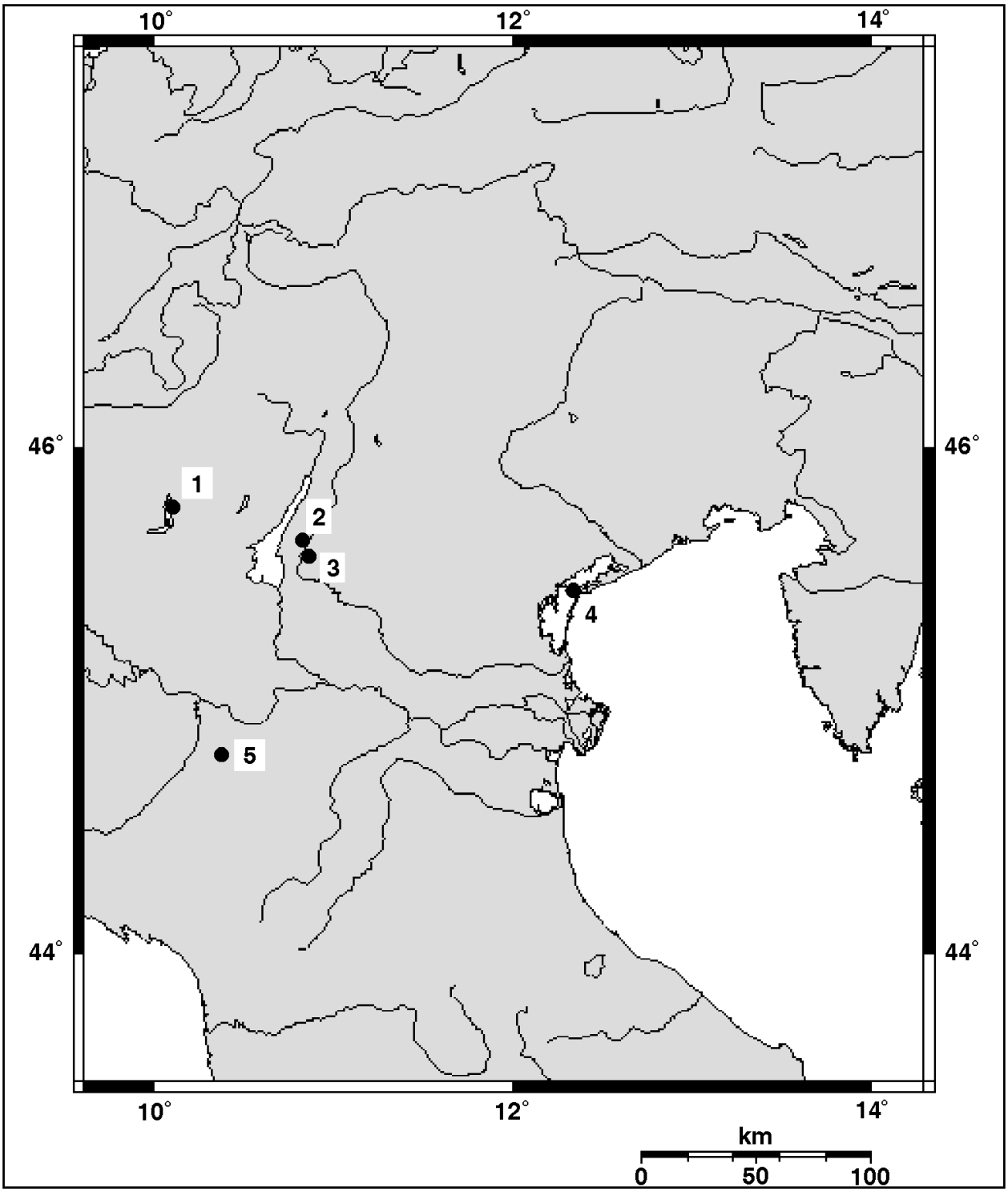

Figure 11: *E. tergestinus* collecting sites. Emilia Romagna, Lombardy, and Veneto (Italy): **1.** Cislano; **2.** Lubiara; **3.** Ceraino; **4.** Venezia; **5.** Torrechiara.

No.	*Date*	*Number of specimens, age and sex*	*Geographic locality*	*Altitude a.s.l.*	*Comments*
109	25 April 2005	*E. tergestinus* (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	*E. tergestinus* (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	*E. tergestinus* (?) (1 juvenile)	near Cislano (Brescia), Lombardy, Italy	650 m	Under a stone in a humid *Castanea* forest near a road; doubtful identification due to small size and premature death in captivity
4	19 May 2002	*E. tergestinus* (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	*E. tergestinus* (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	*E. tergestinus* (1 adult male)	Ceraino Fortress, Ceraino (Verona), Veneto, Italy	236 m	On a wall, inside an abandoned Hlawaty fortress, surrounded by a *Quercus* 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 *Euscorpius* 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 *Euscorpius* 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.

***Euscorpius 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 clifftop.

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).

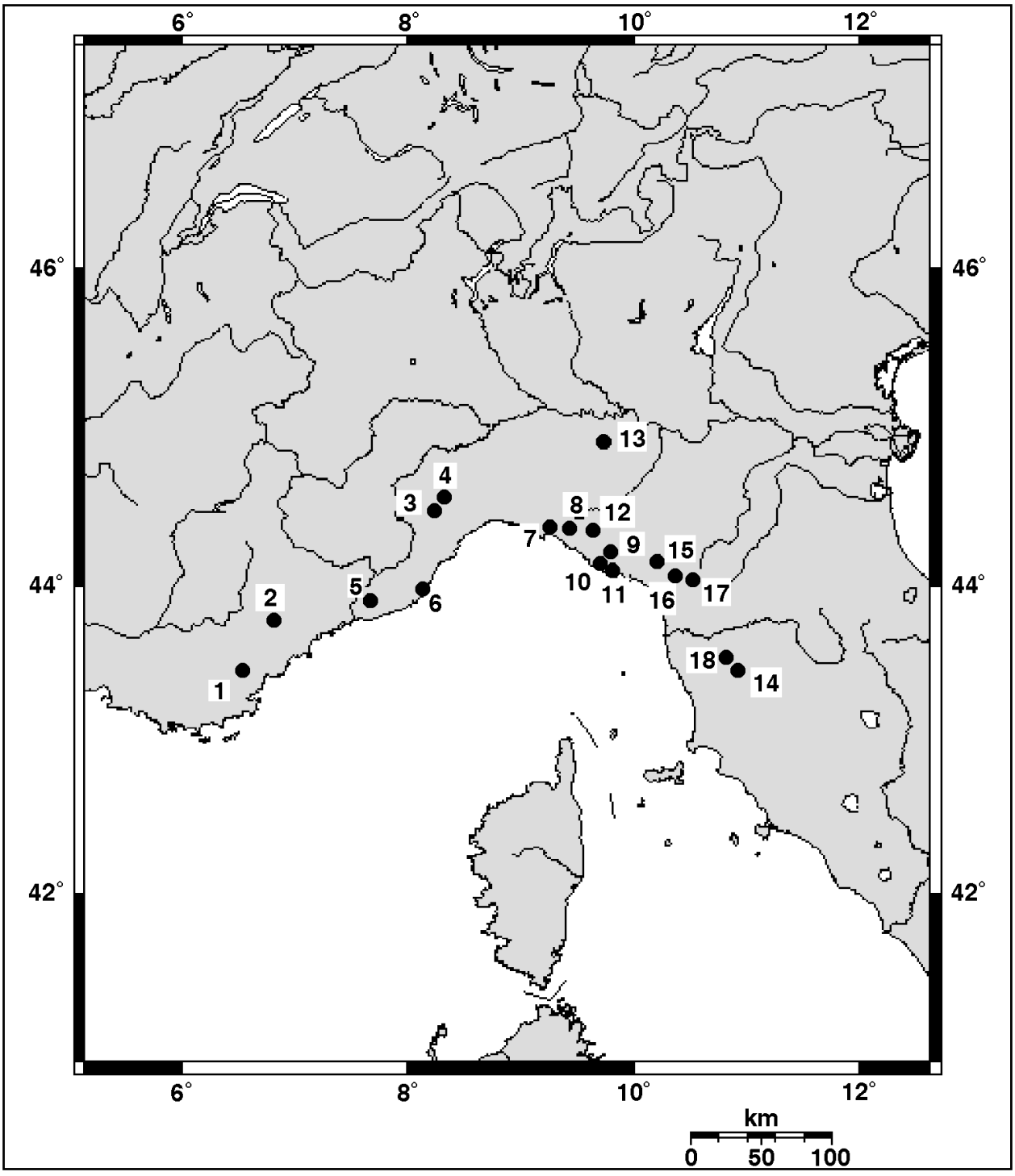

Figure 16: *E. concinnus* collecting sites. Emilia Romagna, Liguria, Piedmont, Tuscany (Italy), Haute Provence and Var (France): **1.** Le Muy; **2.** Entrevaux; **3.** Mondovì; **4.** La Morra; **5.** Pigna; **6.** Capo Mele; **7.** Rapallo; **8.** Breccanecca; **9.** Pignone; **10.** Levanto; **11.** 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	*E. concinnus* (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	*E. concinnus* (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 *Pinus* and *Quercus*, with rocky ground covered by bark, stumps, and pine needles
31	8 March 2003	*E. concinnus* (3 adult females)	Castel San Gimignano (Siena), Tuscany, Italy	350 m	In a small *Quercus* forest (very humid, shady and cool) only 50 m from the cellar where *E. sicanus* specimens were found (No. 30)
102	25 March 2005	*E. concinnus* (2 juv.)	Castel San Gimignano (Siena), Tuscany, Italy	350 m	In a small *Quercus* 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	*E. concinnus* (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 *Quercus* forest and some chapels; this environment is probably shady during the day (observed with UV light)
17	31 March 2002	*E. concinnus* (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 *Pinus* forest on the cool side of the mountain; other specimens in drier habitats (also covered by *Pinus*, 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	*E. concinnus* (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	*E. concinnus* (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 clifftop
36	18 April 2003	*E. concinnus* (2 adult females)	Montealfonso Fortress, Castelnuovo di Garfagnana (Lucca) Tuscany, Italy	270 m	Outside the fortress, under stones in a sparse forest
40	20 April 2003	*E. concinnus* (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	*E. concinnus* (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 *Quercus* forests, but also in *Pinus* 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 (*Vespula vulgaris*)

Table 6: *Euscorpius 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	*E. concinnus* (1 adult female, 5 undetermined)	Pignone (La Spezia), Liguria, Italy	181 m	In cracks of small rocky cliffs near the road, under a humid *Quercus* forest (observed with UV light)
45	26 April 2003	*E. concinnus* (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	*E. concinnus* (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 *Quercus* forest (observed with UV light)
87	2 May 2004	*E. concinnus* (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 (*Quercus*, *Prunus* 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	*E. concinnus* (4 specimens, sex undetermined)	Breccanecca, near Cogorno (Genova), Liguria, Italy	300 m	Inside an abandoned house, located into a *Fagus* forest; all specimens were found dead, in *Tegenaria* 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	*E. concinnus* (2 adult females)	Montallegro sanctuary, near Rapallo (Genova), Liguria, Italy	612 m	Under slabs and stones in a quite humid *Quercus* and *Robinia* forest
53	1 June 2003	*E. concinnus* (1 adult female and 1 juvenile)	Mondovì (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	*E. concinnus* (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	*E. concinnus* (1 adult male, 2 adult females, 1 subadult female)	Gropparello (Piacenza), Emilia Romagna, Italy	355 m	Under stones in a humid and shady *Fagus* forest; one of the two females was found eating an earthworm (*Lumbricus terrestris*), maybe caught during the rain, which just ended
78	27 December 2003	*E. concinnus* (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	*E. concinnus* (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 Levanto 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).