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## Ecology and distribution of the genus *Troglohyphantes* Joseph, 1881 in the Western Italian Alps

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### Abstract

In Italy, the Linyphiid spider genus *Troglohyphantes* is represented by 35 species distributed all over the Italian Alpine range. The known distribution is often confined to very restricted areas and several species are recorded from just one or a few localities. Knowledge of the genus has grown considerably in the last 20 years, especially in the Eastern Italian Alps. For several years we have been collecting data to study the distribution, the ecology and the biogeography of *Troglohyphantes* in the Western Alpine range. In this paper we present the first preliminary contribution to the knowledge of this genus in Piedmont and Aosta Valley, including data on taxonomy, current known distribution, ecology, habitat preferences, average altitude and average temperature of finding localities gathered from direct observations or G.I.S. processing. A few final considerations on the ecology and the biogeography are drawn.

### INTRODUCTION

In Italy the Linyphiid spider genus *Troglohyphantes* is represented by 35 species distributed all over the Italian Alpine range. The known distribution is often confined to very restricted areas and several species are recorded from just one or a few localities. Knowledge of the genus has grown considerably in the last 20 years, especially in the Central and Eastern Italian Alps, but for the Western part of the Alpine range data are lacking.

Several authors have created species-groups within the genus *Troglohyphantes*. Fage (1919) proposed the first grouping and allocated the 13 species then known into four groups (I, II, III and IV). Later, Deeleman-Reinhold (1978) proposed a revision of the

genus, grouping the species according to the shape of the epigynum into three series (A, B, and C) each with several groups named after the most characteristic species. In a recent study on the Italian fauna, Pesarini (2001) allocated the 35 Italian species into 11 "complexes" that partially overlapped Deeleman-Reinhold's groups. The different breakdowns of the species into groups currently turns out to be quite confusing, especially concerning the Italian fauna. Since Deeleman-Reinhold's revision (1978), 29 new species have been described, 19 of them in Northern Italy. The partition into complexes by Pesarini (2001) only covers the Italian fauna and does not provide a complete diagnosis for each group. Therefore, as stated by the author himself, it cannot represent a helpful

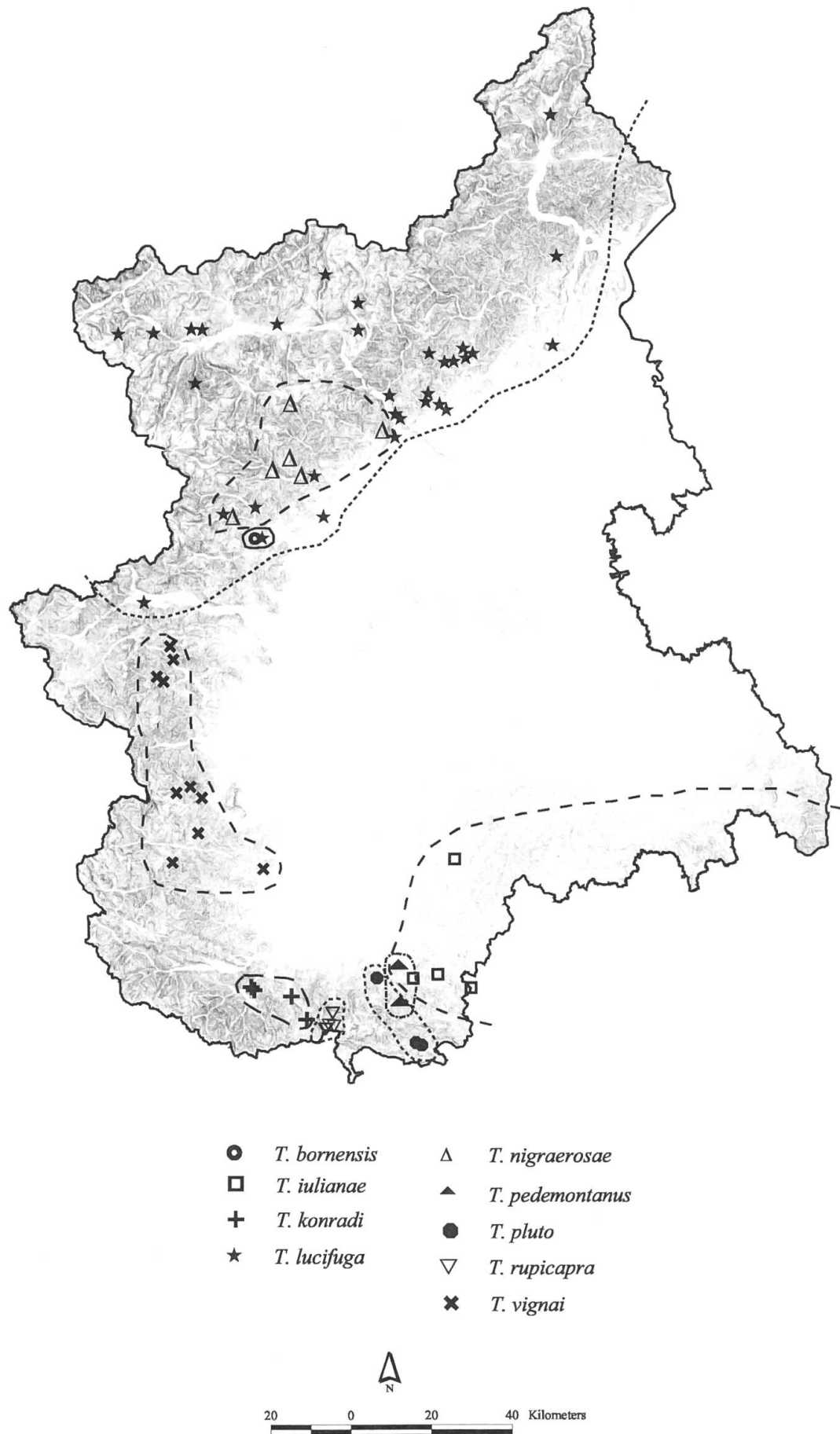


Fig. 1. Distribution of the species of *Troglolyphantes* in Western Alpine range.

alternative to Deeleman-Reinhold's (1978) system. The collection of new data concerning the species, especially from the Southern Alpine area, seems to be essential for a revision of the genus (Isaia & Pantini 2008). To achieve this, for several years we have been collecting data on the species of Western Alpine *Troglohyphantes* to study their distribution, ecology and phylogenetic development.

In this paper we present the first contribution to the knowledge of this genus in Piedmont and Aosta Valley regions. For each species we include data on:

- 1) taxonomy (referring to taxonomic groups proposed by Fage 1919; Deeleman-Reinhold 1978 and Pesarini 2001);
- 2) current known distribution;
- 3) average altitude (including number of records and SE);
- 4) average (including number of records and SE), minimum and maximum temperature of finding localities;
- 5) ecology and details on habitat preferences;
- 6) list of material (the symbol "!" indicates new records, names of the caves are accompanied by Italian cadastral numbers).

Information is gathered from literature (see the recent Catalogue of cave dwelling spiders by Arnò & Lana 2005), direct observations and G.I.S. processing. A map of current distribution of the species of *Troglohyphantes* in the Western Italian Alps (Piedmont and Aosta Valley regions) is shown in Fig. 1.

#### *Troglohyphantes bornensis* Isaia & Pantini, 2008

**Taxonomic groups:** Fage's: III; Deeleman-Reinhold's: *marqueti*; Pesarini's complex: *microcymbium*.

**Distribution:** Pugnetto Cave Complex (TO).

**Average altitude:** 850 m asl (3 records, SE: 22.81).

**Temperature:** Average: 7.8°C (3 records; SE: 0.04); Min: 7.0; Max: 7.8.

**Ecology:** Troglophilic. Specimens are mainly found among damp stony debris from 20 to 70 m from cave openings. All cave openings are located in *Fagus* woods.

#### **Material:**

1501 Pi/TO Borna Maggiore del Pugnetto, UTM 03755675014637, Mezzenile (TO). C. Arnò and E. Lana leg. 26/08/2000: 2♀, 3 juv. (C. Arnò & E. Lana leg. 2005 sub *Troglohyphantes* sp.).

#### *Troglohyphantes iulianae* Brignoli, 1971

**Taxonomic groups**<sup>1</sup>: Fage's: IV; Deeleman-Reinhold's: *polyophthalmus*; Pesarini's complex: *caporiaccoi*.

**Distribution:** Southern Piedmont to Emilian Appennine.

**Average altitude:** 864 m (4 records; SE: 115.87).

**Temperature:** Average: 10.5°C (4 records; SE:0.29); Min: 10.1; Max: 11.6.

**Ecology:** Troglophilic. Specimens are mainly found close to cave entrance, dwelling among debris. Cave openings are located in *Fagus* or *Castanea* woods.

#### **Material:**

(!) 309 Pi/CN Grotta del Baraccone, UTM 04270234903037, Bagnasco (CN). Lana E. legit 01/01/2007: 2♂.

(!) 884 Pi/CN Grotta di Rio dei Corvi, UTM 04197434906023, Lisio (CN). Lana E. legit 21/10/2001: 1♂, 1♀ (Arnò & Lana 2005 sub *Troglohyphantes* sp.); Isaia M. and Lana E. legit 23/10/2006: 7♀; Lana E. legit 29/10/2006: 2♀, 1♂.

(!) 114Pi/CN Grotta dell'Orso di Pamparato, UTM 0412732 4905465, Pamparato (CN). Lana E. legit 02/04/2000: 1 juv (Arnò & Lana 2005 sub *Troglohyphantes* sp.); Lana E. and Isaia M. legit 26/12/2007: 2♂, 10♀.

<sup>1</sup> On the basis of the examination of the sole female, Pesarini (2001: 117) allocated this species to the *henroti* complex and Deeleman-Reinhold (1978: 25) in the *henroti* group (Fage's III). After the description of the male (published later but in the same year), Gasparo (2001), allocates *T. iulianae* in the Pesarini's *caporiaccoi* complex (Fage's IV group, and Deeleman Reinhold's *polyophthalmus* group.

***Troglohyphantes konradi* Brignoli, 1975**

**Taxonomic groups:** Fage's: V (partim); Deeleman-Reinhold's: *orpheus*; Pesarini's complex: *orpheus*.

**Distribution:** Southern Piedmont, Valle Vermentagna and Valle Gesso.

**Average altitude:** 927 m (4 records; SE: 59,77).

**Temperature:** Average: 8,56°C (4 records; SE: 0.63); Min: 7.9; Max: 10.6.

**Ecology:** Troglotic. Specimens are found dwelling on the ground or hanging on webs on cave walls. With the only exception of Cava 2 (see material), cave openings are located in *Fagus* woods.

**Material:**

(!) 1214 Pi/CN Baron Litron, UTM 03730764902528, Valdieri (CN). Isaia M. legit 10/06/2007: 1♀.

(!) 1219 Pi/CN Grotta Maissa 12, UTM 03731174902530, Valdieri (CN). Lana E. legit 17/12/2006: 1♂.

(!) art Pi/CN Cava 2 della Bastia, UTM 03726154903417, Valdieri (CN). Isaia M. and Lana E. leg. 02/12/2006: 1♀.

(!) art Pi/(CN) Caverna del Comando di Limone, UTM 03866354895145, Limone (CN). Lana E. legit 19/11/2006: 1♂, 1♀ (Arnò & Lana 2005 sub *Troglohyphantes* sp.).

***Troglohyphantes lucifuga* Simon, 1884**

**Taxonomic groups:** Fage's V; Deeleman-Reinhold's: *orpheus*; Pesarini's complex: *lucifuga*.

**Distribution:** From Susa Valley to Swiss Alps (Ticino).

**Average altitude:** 986 m (33 records; SE: 83.48).

**Temperature:** Average: 7.04°C (33 records; SE: 0.43); Min: 0.1; Max: 11.5.

**Ecology:** Subtrogliphilic. Specimens are generally found in damp debris and among rocks very close to cave openings. Cave openings are located in different habitats (*Castanea* and *Fagus* woods, alpine screes, rocky lands and alpine grasslands).

**Material:**

(!) 1501 Pi/TO Borna Maggiore del Pugnento, UTM 03755675014637, Mezenile (TO).

Isaia M. legit 06/04/2006: 1♀; 16/06/2006: 1♀. (!) 1502 Pi/CN Borna Inferiore del Pugnento, UTM 03753195014668, Mezenile (TO). Isaia M. legit 17/06/2006: 1i.

(!) 1580 Pi/TO Grotta del Ghiaccio di Bosconero, UTM 03468645004275, Novalesa (TO). Lana E. legit 15/07/2006: 1♂ (Arnò & Lana 2005 sub *Troglohyphantes* sp.).

(!) 1597 Pi/TO Balma Fumarella, UTM 03453994999087, Gravere (TO), Lana E. legit 29/03/2000: 1♀ (Arnò & Lana 2005 sub *Troglohyphantes* sp.).

(!) 1605 Pi/TO Boira del Salè, UTM 04095805049200, Brosso (TO). Lana E. legit 12/11/2005: 1♂.

1609 Pi/TO Buca del Ghiaccio della Cavallaria, UTM 04059885041431, Brosso (TO). Lana E. legit 16/10/2005: 1♀ (Arnò & Lana 2005). Isaia M. and Lana E. legit 15/10/2006: 1♀.

(!) 1612 Pi/TO Grotta di Levone, UTM 03903895020097, Levone (TO). Lana E. legit 28/02/2007: 1♂.

(!) 2025Pi/VC Buco della Bondaccia, UTM 04470215064011, Borgosesia (VC). Isaia M. and Lana E. leg. 26/01/2008: 1♂, 2♀.

(!) art Pi/TO Borna del Servais, UTM 03688205020174, Ala di Stura (TO). Isaia M. and Ellena I. leg. 08/09/2007: 1♀.

(!) art Pi/TO Borna del Servais B (ex cava di pietra ollare), UTM03690165020346, Ala di Stura (TO). Isaia M. and Ellena I. leg. 08/09/2007: 1♂, 1♀.

(!) n.c. Pi/TO Boira dal Farfujet or Balma dei Folletti, UTM 03444505006570, Novalesa (TO), Lana E. legit 26/01/2000: 1♀ (Arnò & Lana 2005 sub Linyphiidae indet).

(!) nc Pi/AO Grotta di Ferretaz (Grotta dei cuccioli), Aosta (AO). Lana E. legit 24/03/2007: 2♀, 2♂.

(!) nc Pi/AO Grotta JO 13 Punta Jolanda, Gressoney (AO). Lana E. legit 23/08/2006: 2♀.

(!) nc Pi/AO Grotta JO6 di Punta Jolanda, Gressoney (AO). Lana E. legit 12/08/2006: 1♀.

(!) nc Pi/AO Grotta VM1 Val Meriana, Chatillon (AO). Lana E. legit 15/10/2006: 2♀, 2♂.

(!) art Pi/TO Miniera di Cudine, UTM 03822805017370, Corio (TO). Isaia M. and Lana E. leg. 09/06/2007; 1♂, 1♀.

(!) nc Pi/AO Pozzo 1 Punta Jolanda, Gressoney (AO). Lana E. legit 12/08/2006: 1♀; 23/08/2006: 2♀.

(!) nc Pi/AO Pozzo 2 Punta Jolanda, Gressoney (AO). Lana E. legit 23/08/2006: 2♀.

***Troglohyphantes nigraerosae* Brignoli, 1971**

**Taxonomic groups:** Fage's: III; Deeleman-Reinhold's: *henroti*; Pesarini's complex: *henroti*.

**Distribution:** Gran Paradiso massif.

**Average altitude:** 1411 m (6 records; SE: 231.05).

**Temperature:** Average: 6.19°C (6 records; SE: 1.50); Min: 0.1; Max: 10.4.

**Ecology:** Troglophilic. Specimens are found hanging on webs on cave walls. All new records refer to cold caves, ranging from 2°C to maximum 6°C mean annual temperature. Holotype comes from an epigeic locality at 2900 m. Cave openings are located in alpine screes or *Fagus* woods.

**Material:**

(!) 1609 Pi/(TO) Buca del Ghiaccio della Cavallaria, UTM04059885041431, Brosso (TO). Lana E. legit 27/07/2003: 2♀ (Arnò & Lana 2005 sub *Troglohyphantes* sp.); 20/09/2003: 2♀ (Arnò & Lana 2005 sub *Troglohyphantes* sp.); 16/10/2005: 1♂, 1♀. Isaia M. and Lana E. legit 15/10/2006: 1♂, 2♀.

(!) 1596 Pi/TO Boo' d'la Faia, UTM 03833865035908, Ribordone (TO). Lana E. legit 12.08.2001: 2♀ (Arnò & Lana 2005 sub *Troglohyphantes* sp.).

(!) art Pi/TO Borna del Servais B (ex cava di pietra ollare), UTM 03690165020346, Ala di Stura (TO). Lana E. legit 29/02/2002: 2♀; Lana E. legit 6/05/2002: 2♀ (Arnò & Lana 2005 sub *Troglohyphantes* sp.); Isaia M. and Ellena I. legit 08/09/2007: 1♂, 3♀.

***Troglohyphantes pedemontanus* Gozo, 1908**

**Taxonomic groups:** Fage's: V (partim); Deeleman-Reinhold's: *orpheus*; Pesarini's complex: *orpheus*.

**Distribution:** Southern Piedmont, Corsaglia Valley.

**Average altitude:** 1225 m (2 records; SE: 245.00).

**Temperature:** Average: 7.54°C (2 records; SE: 2.46); Min: 5.8 Max: 10.1.

**Ecology:** Troglobitic. The specimens have been found both among stony debris on the ground or hanging on webs among stalactites. Cave openings are located in beech woods.

**Material:**

108 Pi/CN Grotta di Bossea, UTM 04073744899582, Frabosa Soprana (CN) Isaia M. and Lana E. legit 13/05/2007: 4♀, 1♂.

(!) 3015 Pi/CN Pozzo del Rospo, UTM 04089404906630, Montaldo di Mondovì (CN), Isaia M. and Lana E. legit 7/07/2007: 5♀; 02/06/2006: 2♀; Isaia M. and Lana E. legit 01/03/2008: 1♂, 1♀.

***Troglohyphantes pluto* di Caporiacco, 1938**

**Taxonomic groups:** Fage's: V (partim); Deeleman-Reinhold's: *orpheus*; Pesarini's complex: *lucifuga*.

**Distribution:** Southern Piedmont, Valle Corsaglia.

**Average altitude:** 910 m (3 records; SE: 140).

**Temperature:** Average: 9.7°C (3 records; SE: 0.36); Min: 9.5; Max: 10.3.

**Ecology:** Troglophilic.

**Material:**

122 Pi/CN Grotta superiore del Caudano, UTM 04035104905317, Frabosa Sottana (CN), Isaia M. and Vinals N.H. legit 28/06/2008: 1♀.

(!) 197 Pi/CN Abisso Artesinera, UTM 04032584898809, Frabosa Sottana (CN), Lana E. legit 6/9/1993: 3♀, 1 juv. (Arnò & Lana 2005: 37 sub *Troglohyphantes lucifuga*); 7.5.1995: 1♀. (Arnò & Lana 2005 sub *Troglohyphantes lucifuga*); Isaia M. and E. Lana legit 28/06/2008: 1♂, 7♀.

**Note:** A misidentification occurred for the record from Abisso Artesinera (197 Pi/CN) cited by Arnò & Lana (2005) as *T. lucifuga*. Conceivably the same misidentification occurred for the specimen collected in the close Grotta degli *Oxychilus*, but material could not be checked. The new record substantially confirmed that the distribution of this species is restricted to Corsaglia Valley, Southern Piedmont. Cave openings are located in alpine shrublands and *Castanea* woods.

***Troglohyphantes rupicapra* Brignoli, 1971**

**Taxonomic groups:** Fage's: III, Deeleman-Reinhold's: *henroti*; Pesarini's complex: *henroti*

**Distribution:** Southern Piedmont, Alta Valle Pesio

**Average altitude:** 1750 m (6 records; SE: 181.64)

**Temperature:** Average: 4.72°C (6 records; SD: 1.14); Min: 2.7; Max: 8.6.

**Ecology:** Troglotic. Specimens are found hanging on cave walls. Cave openings are located in alpine scree and alpine grasslands.

**Material:**

(!) 221 Pi/CN Voragine di Scarasson, UTM 0393160 4893080, Briga Alta (CN). Lana E. legit 15.11.2003: 1 juv.

250 Pi/CN Grotta superiore delle Camoscere, UTM 03920004896000, Chiusa Pesio (CN). Isaia M. and Lana E. legit 27/12/2006: 1♂, 1♀.

(!) 761 Pi/CN Pozzo 1–5 delle Carsene or Abisso Rangipur, UTM 03908934892854, Briga Alta (CN). E. Lana leg. 14/07/2001: 1♂, 5♀ (Arnò & Lana 2005 sub "*T. cfr. rupicapra*").

(!) 772 Pi/CN Pozzo 2–6 delle Carsene or Abisso Arrapa Nui, UTM 03914404893664, Briga Alta (CN). E. Lana legit 13/07/2001: 2♀ (Arnò & Lana 2005 sub "*T. cfr. rupicapra*").

***Troglohyphantes vignai* Brignoli, 1971**

**Taxonomic groups:** Fage's: III; Deeleman-Reinhold's: *henroti*; Pesarini's complex: *henroti*.

**Distribution:** Alps, from Chisone to Varaita Valley.

**Average altitude:** 1400 m (10 records; SE: 182.53).

**Temperature:** Average: 6.55°C (10 records; SE: 0.87); Min: 1.8; Max: 10.9.

**Ecology:** Trogliphilic. Specimens are found hanging on webs among debris and on cave walls. Cave openings are located in different habitats (*Castanea*, *Larix*, *Fagus* woods, alpine scree and alpine grasslands).

**Material:**

(!) 1017 Pi/CN Pertus dal Draì, UTM 03591544941406, Sampeyre (CN), Lana E. legit 25/08/2001: 1♂, 6♀ (Arnò & Lana 2005 sub *Troglohyphantes* sp.).

(!) 1019 Pi/CN Tana dell'Orso, UTM 03490584935922, Casteldelfino (CN), Lana E. legit 11/07/1999: 1♀ (Arnò & Lana 2005 sub *Troglohyphantes* sp.).

(!) 1024 Pi/CN Grotta dei Partigiani, UTM 03754934932782, Rossana (CN). Lana E. legit 25/07/1994: 2♀ (Arnò & Lana 2005 sub *Troglohyphantes* sp.).

(!) 1152 Pi/CN, Grotta 2 del Nebin, UTM 03523504934270, Sampeyre (CN), Lana E. legit 18/08/2006: 2♂, 2♀

(!) art. Pi/CN, Fortino a ovest della Balma di Rio Martino, UTM 03529234951401, Opera 372 Rocca di Granè, Crissolo (CN), Arnò C. and Lana E. legit 21/12/2002: 1♀ (Arnò & Lana 2005 sub *Troglohyphantes* sp.).

1591 Pi/TO Tana del diavolo UTM 03521404987790, Roreto Chisone (TO) Lana E. legit 15/4/1995: 1♂ (Arnò & Lana 2005 sub *T. rupicapra*); Isaia M. legit 11/11/2006: 1♂, 1♀.

(!) 1621 Pi/TO, Grotta di Chiabrano, UTM 03506104978860, Perrero (TO), Lana E. legit 04/12/2005: 4♀; Isaia M. and Lana E. legit 23/10/2006: 1♂, 5♀.

(!) art. Pi/TO Prospetto di miniera di Bocchetto, UTM 03490494980178, Prali (TO). Isaia M. legit 21/02/2007: 1♀.

## CONCLUSIONS

According to several authors (Fage 1919; Thaler 1967; Deeleman-Reinhold 1978; Brigoli 1979; Pesarini 2001), the importance of this genus is a crucial point in the understanding of the dynamics that lead up to the origin of the current species assemblages in the alpine area.

Before the publication of this paper most of the species were previously known only for the type locality. This is the case, for example, for *T. pedemontanus*, that we found after exactly 100 years from the original description, in a new record, 20 Km North from the type locality.

Looking at the map shown in Fig. 1 we could draw some final considerations on the western alpine species of *Troglohyphantes*. Several interesting areas of overlapping stand out from the map, like the region of Southern Maritime Alps in Southern Piedmont (with five species partially overlapping) and the Gran Paradiso massif, at the border between Piedmont and Aosta Valley, where three species are found. The species showing the widest distributions are *T. lucifuga* (from Susa Valley up to Switzerland) and *T. iulianae* (from Piedmontese/Ligurian Apennines to Tuscany), covering, respectively, the northern and the southern borders of the study area. Interestingly, *T. lucifuga* is the only species sharing caves with congeneric, in our case *T. nigraerosae* and *T. bornensis*. The coexistence of two species is a rare phenomenon observed in *Troglohyphantes* and is only possible in case of non-close relatives (Deeleman-Reinhold, 1978), like in *lucifuga-bornensis/nigraerosae* condition.

An interesting question that is going to be discussed in a forthcoming paper (Isaia & Pantini, in press) is represented by *T. iulianae*, the most meridional species of *Troglohyphantes* recorded in Italy. The new material collected in several caves of Southern Pied-

mont leads us to discuss convincingly on the synonymy of *T. delmastroi* Pesarini, 2001 (cited by the author himself for Southern Piedmont and Emilian Apennine) with *T. iulianae*.

Another interesting question that is going to be discussed in the same paper is represented by the southern isolated population of *T. rupicapra* (= *T. vignai*). *T. rupicapra* has been in fact synonymized with *T. vignai* by Pesarini (2001). The morphological examination of new material from the Southern populations of Val Pesio (cave complex of Conca delle Carsene) and fresh topotypic material of *T. rupicapra* (Grotta delle Camoscere), highlights some noticeable differences with specimens of Northern populations of *T. vignai*. The relative isolation of Val Pesio populations and several features like shape of epigyne, position and number of functional eyes (2) may lead to re-considering the synonymy *vignai-rupicapra*.

From an ecological and biogeographical point of view, a few final considerations could be drawn. The belonging to different taxonomic groups and the spot-like distribution of the different species lead up to interpret it as the result of different fluxes of migration, combined with processes of contractions and expansions of ranges.

According to Deeleman-Reinhold's hypothesis (1978) at least several species of *Troglohyphantes* have invaded the cave environment starting from the microcavernicole habitat in moist humus. Following her interpretation for the fauna of the Dinaric Chain, during the cooler periods of the Würm (11.000 years ago), *Fagus* was restricted to refuge areas, being replaced by *Pinus*, *Betula* and *Alnus*. The Dinaric Chain was probably forested for long periods in the last part of the Tertiary and Quaternary. These areas allowed the hygrophilic fauna of the humus to spread over large areas and, wherever the possibility existed, there was ample opportunity for the burrow-inhabiting species of humus to colonize cave habitats. The elimination of the surface fauna caused isolation of the hypogean population; those small



isolated hypogean colonies that managed to survive were subject to rapid speciation. It is interesting to note that in our case most of the cited caves have openings in *Fagus* woods. The colonization of *Fagus* in this area is very recent (between 5000 and 6000 years ago, Magri et al. 2006). Strictly following this interpretation, the speciation of *Troglohyphantes* in the study area must be regarded as a very rapid process, that, at least for certain species, took place in less than 10.000 years. On the other hand, considering the biogeography of the genus in Europe and its possible oldest origin, the convergence of habitat requirements in terms of moistness and coolness seems to be a more convincing hypothesis of the possible association of *Troglohyphantes* with *Fagus*. Anyhow both interpretations could partially fit the alpine situation, the latter fitting particularly well for troglophilic species, that could be found, in cool epigeal situations, like alpine shelters and shaded overgrown rock faults.

The distribution of *Troglohyphantes* shows some interesting parallelisms with the ranges of some other cave dwelling arthropods, especially Cholevidae Leptodirinae and Carabidae Trechini. These cave dwelling coleopterans show, for example, the same chaotic overlapping of ranges in Southern Piedmont and the same three big gaps observed in the distributions of *Troglohyphantes* in Ticino Valley – North-East, Susa Valley – West and Argentera Massif – South-West. Furthermore, the range of several Cholevidae Leptodirinae (*Bathysciola tarsalis*, *B. adelinae*, *B. angeli*, *B. pumilio*, *Archeoboldoria* spp. and *Canavesiella* spp.) is the same covered by *Troglohyphantes lucifuga* and *T. nigraerosae*. Moreover, *T. bornensis* shares its punctiform distribution with *Dellabeffaella roccai* (Cholevidae Leptodirinae) and, furthermore, the range of *T. vignai* overlaps quite perfectly the range of *Doderotrechus* spp. (Carabidae, Trechini) (Giachino 1993; Giachino & Vailati 1997; Casale & Giachino 2008).

All the species of *Troglohyphantes* recorded in the study area show high preference for

montane localities, ranging from 850 to 1750 m a.s.l. (mean value: 1147), characterized by annual mean temperatures constantly below 11°C (mean value: 7.6). The cryophilic habits of the species of this genus, together with the peculiarity of their distribution and their likely interest in terms of biodiversity conservation, represent potentially interesting points to consider in the perspective of ecological research on the effects of global warming on biotic communities.

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