

A NEW SPECIES OF *TROGLOHYPHANTES* (ARANEAE, LINYPHIIDAE) FROM THE WESTERN ITALIAN ALPS

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ABSTRACT. *Troglohyphantes bornensis*, a new species from the western Italian Alps, is here described. According to the features of the male palp and female epigynum the new species can be assigned to Fage’s III Group, Deeleman-Reinhold’s *marqueti* group and Pesarini’s *microcymbium* complex. All specimens were collected in the stony debris of Pugno caves (province of Turin, Italy), a calcschist cave complex, formerly studied by biospeleologists for the presence of several endemic species. All caves have openings into beech woods at an elevation of approximately 800 m.

RIASSUNTO. Viene descritta *Troglohyphantes bornensis*, una nuova specie delle Alpi occidentali italiane. A partire dalle caratteristiche del palpo del maschio e dell’epigino della femmina, la specie viene assegnata al III gruppo di Fage, al gruppo *marqueti* secondo Deeleman-Reinhold e, secondo Pesarini, al complesso *microcymbium*. Tutti gli esemplari provengono dal detrito delle Grotte del Pugno (Provincia di Torino, Italia), un sistema di grotte impostato in calcescisto, già noto per la presenza di numerose specie endemiche. Tutte le grotte si aprono ad una quota di 800 m circa, in boschi di faggio.

Keywords: *Troglohyphantes bornensis*, taxonomy, morphology, Europe, endemic distribution

In Italy the linyphiid spider genus *Troglohyphantes* Joseph 1881 is represented by 35 species distributed all over the Italian alpine range. One of these species (*T. excavatus* Fage 1919) is known from the Trieste Karst and two others (*T. delmastroi* Pesarini 2001 and *T. julianae* Brignoli 1971) are found in the Northern part of the Apennine range. The known distribution of *Troglohyphantes* species 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 with 14 new species described since 1987, especially thanks to the work of Carlo Pesarini (1988a, 1988b, 1989, 2001).

For several years we have been collecting data on the Italian species of *Troglohyphantes* to study their distribution and their phylogenetic development. A few specimens examined in this context have been assigned to a new species, *Troglohyphantes bornensis*, here described.

METHODS

The specimens are stored in 75% ethanol at the Museo Civico di Scienze Naturali “E. Caffi”, Bergamo, Italy (MCSN), and studied using a Wild M8 stereoscopic binocular microscope. Illustrations were made using a camera lucida. All measurements

are in mm. The following anatomical abbreviations are used in the text: ALE = anterior lateral eyes; AME = anterior median eyes; PLE = posterior lateral eye; PME = posterior median eye; total leg length; TmI = position of first metatarsal trichobothrium.

TAXONOMY

Family Linyphiidae Blackwall 1859

Genus *Troglohyphantes* Joseph 1881

Type species.—*Troglohyphantes polyophthalmus* Joseph 1881 by original designation.

Remarks.—The linyphiid spider genus *Troglohyphantes* is currently represented by 124 species, predominantly distributed in the European mountain ranges: Cantabric Mountains, Pyrenees, Alps, Carpathians, and Balkans. Moreover, four species are found in Northern Africa, two in Turkey, one in Iran, three in the Caucasus and one in the Canary Islands. Spiders belonging to this genus are found in a variety of habitats: caves, humus and rocks, moist and shaded situations. For the general description of the genus and for further information on autoecology refer to Fage (1919) and Deeleman-Reinhold (1978).

Troglohyphantes bornensis new species

Figs. 1–8

Material examined.—ITALY: *Piemonte*: Torino, Mezzenile: Holotype male, Cave “Borna Maggiore del Pugnetto,” 810 m, 8 April 2006, M. Isaia (MCSN). Paratypes: 1 male, 1 female, same location as holotype, 7 July 1980, P.M. Giachino (MCSN); 1 female, same location as holotype, 1 April 2006, M. Isaia (MCSN); 1 female, same location as holotype, 17 June 2006, M. Isaia & R. Galindo (MCSN); 1 female, same location as holotype, 7 October 2006, M. Isaia (MCSN); 2 females, Cave “Borna Inferiore del Pugnetto,” 810 m, 16 June 2006, M. Isaia (MCSN); 2 females, Cave “Borna Superiore del Pugnetto,” 872 m, 1 December 2006, M. Isaia (MCSN); 1 female, Cave “Tana della Volpe,” 885 m, 1 December 2006, M. Isaia (MCSN).

Etymology.—The species epithet is derived from “borna.” In Alpine Provençal (spoken in several areas of the western Italian Alps) this term denotes a lair or a cave.

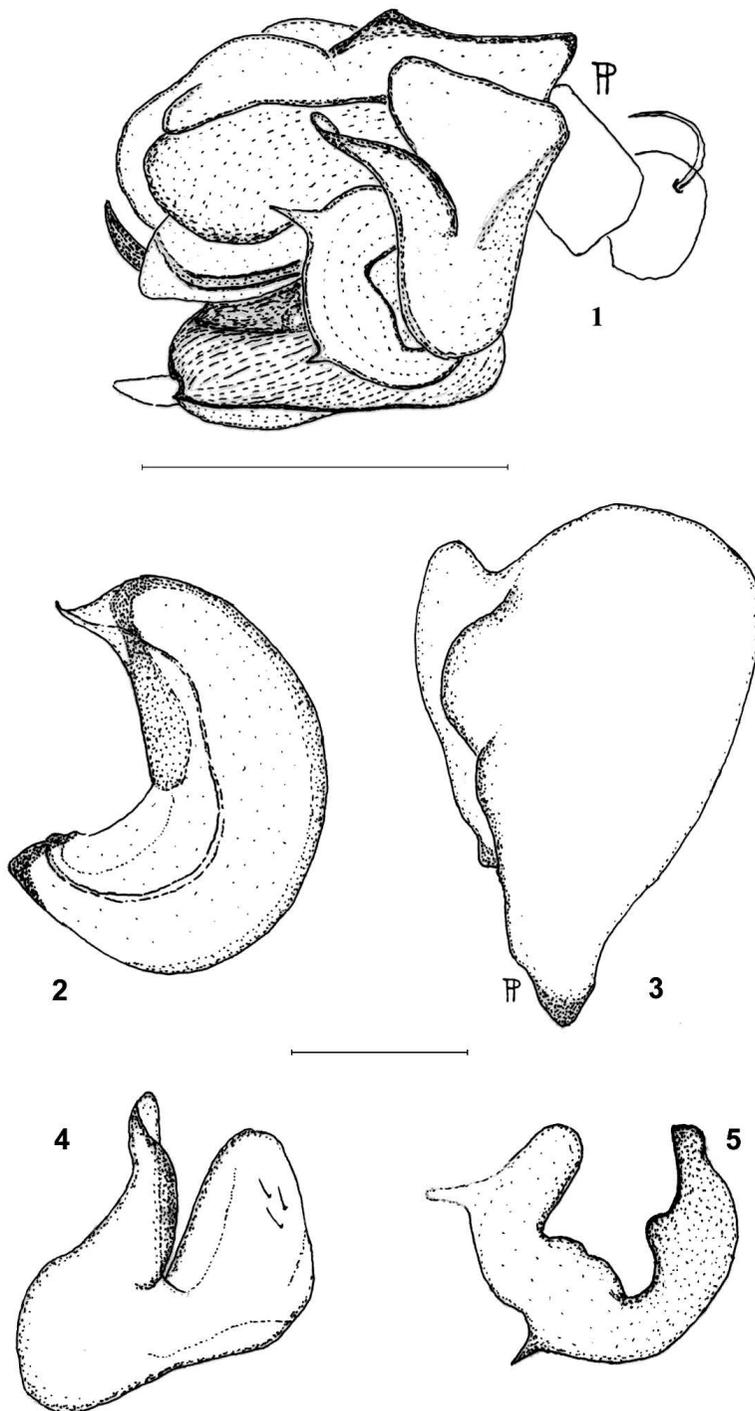
Diagnosis.—*Troglohyphantes bornensis* can be primarily distinguished from all other species of *Troglohyphantes* by the shape of lamella characteristic of the male. The shape of the female epigynum, as well as the suprathecal apophysis and cymbium of the male are also diagnostic. The lamella characteristic consists of a simple lamellar, rounded lobe directed posteriorly and armed with two short tooth-shaped tips, the lower nearly orthogonal to the profile of the lamella and the upper, less spiky but longer, directed anteriorly, nearly parallel to the lower branch of the paracymbium. The male cymbium is smooth, the profile is not rounded, and it ends in a retro-lateral sub-apical lobe, directed proximally. The suprathecal apophysis (Deeleman-Reinhold’s “median apophysis”) is directed upwards, nearly orthogonally, with a sharp end. The female epigynum is strongly protuberant with a short scape, is wider than long, and barely arched in lateral view.

Description.—*Male (holotype)*: prosoma 1.19 long, 1.06 wide, yellowish. Anterior part of prosoma darker, tending to brown. Thoracic region rounded, dorsally with a narrow ridge, marked with a dark longitudinal streak. Eye region slightly elevated with a few black bristles encircling the eye group. Clypeus slightly indented under the eyes then convex. Eyes small but normally developed, surrounded by dark rings. AME smallest and very close to one another, PLE slightly bigger than PME, ALE slightly larger than PME, ALE and PLE contiguous. PLE–PME distance = 0.080, ALE–AME distance = 0.083, PME–PME distance = 0.083, AME–AME distance = 0.020. Eye diameters: AME 0.022, PME 0.037, ALE 0.048, PLE 0.050. Inter-ocular space with dark hairs, sometimes as long as clypeus. Sternum heart-shaped, yellowish with anterior edges darkened. Chelicerae brownish armed with three conspicuous anterior teeth and furnished with stridulating ridges

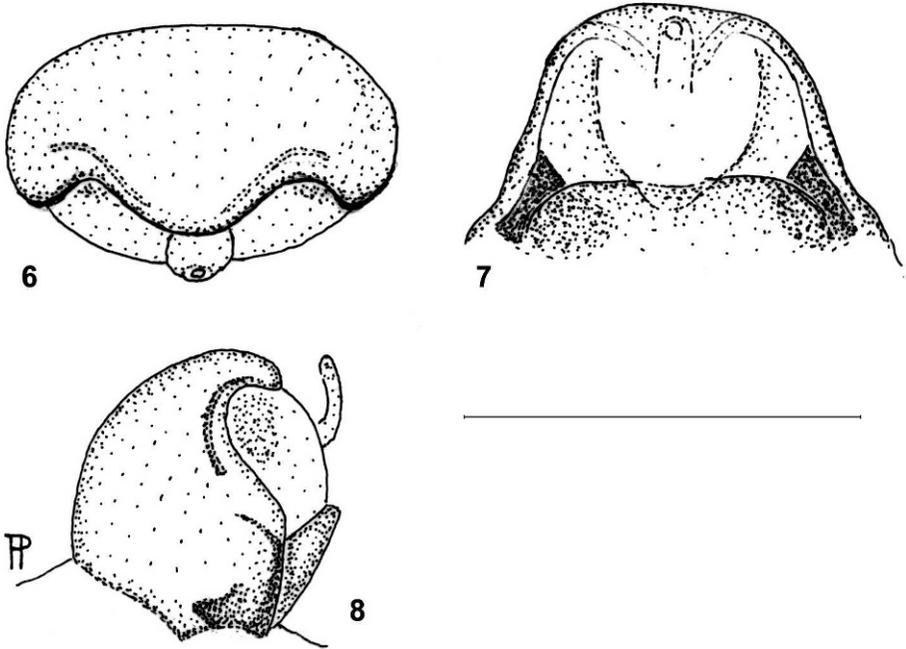
on the retro-lateral portion. Legs medium-long (femur twice as long as the prosoma), uniformly yellowish. Leg I: femur 2.32, patella 0.39, tibia (absent), metatarsus (absent), tarsus (absent); leg II: femur 2.09, patella 0.44, tibia 2.24, metatarsus 2.06, tarsus 1.12, total leg length 7.95; leg III: femur 1.8, patella 0.37, tibia 1.71, metatarsus 1.64, tarsus 0.88, total leg length 6.4; leg IV: femur 2.19, patella 0.35, tibia 2.34, metatarsus 2.12, tarsus 1.0, total leg length 7.99. Abdomen 1.41 long, 0.88 wide, whitish-grey with dark hair. Male palp (Figs. 1–5): cymbium faintly convex, with two prolateral lobes and one central small protuberance with rounded profile ending proximally in a single apophysis, proximo-mesal part simple and truncated without protrusions or ridges. Superior branch of paracymbium sub-triangular, inferior branch dimly longer than the latter and distally bent nearly at a right angle, gradually narrowed anteriorly. Lamella characteristic with two short tooth-shaped tips, the lower nearly orthogonal to the profile of the lamella and the upper, less spiky but longer, directed upwards, nearly parallel to the lower branch of the paracymbium. Lamella ending in a rounded lobe directed backwards. Suprathecal apophysis headed upwards, nearly orthogonally, with a sharp end. Tip of the embolus spiky tubular.

Female (paratype from “Borna Inferiore del Pugnetto”): prosoma 1.20 long, 1.06 wide, convex, smooth and slightly brighter than male. Thoracic region, ocular area, clypeus, sternum and chelicerae analogous to male in all features. PLE–PME distance = 0.046, ALE–AME distance = 0.063, PME–PME distance = 0.057. Eye diameters: AME 0.050, PME 0.065, ALE 0.078, PLE 0.052. Abdomen 2.13 long, 1.41 wide, whitish-grey with dark hairs. Patella of the palp armed with a dorsal noticeable spine, tibia with three long spines (one dorsal and two prolateral) and metatarsus armed with nine smaller spines of which two dorsal proximal, three prolateral, two retrolateral and two ventral apical. Leg I: femur 2.23, patella 0.39, tibia 2.38, metatarsus 2.04, tarsus 1.34, total leg length 8.38; leg II: femur 2.11, patella 0.42, tibia 2.21, metatarsus 1.87, tarsus 1.16, total leg length 7.77; leg III: femur 1.77, patella 0.35, tibia 1.67, metatarsus 1.52, tarsus 0.86, total leg length 6.17; leg IV: femur 2.28, patella 0.34, tibia 2.32, metatarsus 2.02, tarsus 1.07, total leg length 8.03. Epigynum (Figs. 6–8) strongly protuberant. Scape short, wider than long, U-shaped with two lateral incisions not pronounced and scarcely arched in lateral view.

Spinal formulae: Male and female: femur I with one dorsal, one prolateral spine; femur II and III with one dorsal spine. Patella I–IV with one dorsal spine. Tibia I with two dorsal, one prolateral, one retrolateral spine; tibia II with two dorsal, one retrolateral spine, tibia III and IV with two dorsal spines. Metatarsus I–IV with one dorsal and one prolateral spine. Position of TmI: 0.2. Trichobothrium on metatarsus IV absent.



Figures 1-5.—*Troglohyphantes bornensis*, new species, male holotype: 1. Left male palp, retrolateral view; 2. Embolus, ventral view; 3. Cymbium, dorsal view; 4. Paracymbium, retrolateral view; 5. Lamella characteristica, retrolateral view. Scale lines = 0.5 mm (Fig. 1), 0.2 mm (Figs. 2-5).



Figures 6–8.—*Troglolyphantes bornensis*, new species, female paratype from Borna Inferiore del Pugnetto: 6. Epigynum, ventral view; 7. Epigynum, dorsal view; 8. Epigynum, lateral view. Scale line = 1 mm.

Distribution.—This species is confined to four caves situated in the Pugnetto region of the Western Alps.

DISCUSSION

Several authors have created species-groups within the genus *Troglolyphantes*. 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. 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.

Several features suggest that *T. bornensis* belongs to Fage’s III and Deeleman-Reinhold’s *marqueti* group (series A): 1, shape of the male cymbium (proximomesal part simple and truncated without protrusions or ridges); 2, absence of Deeleman-Reinhold’s “pocket” on the male paracymbium; 3, structure of lamella characteristic, with external and internal branch of the same length, internal branch without apophysis; 4, tip of male embolus acuminate; 5, epigynum not much incised posteriorly, scape wider than long.

Following the features utilized by Pesarini (2001), *T. bornensis* belongs to the *microcymbium* complex, a group that shows some similarities with Deeleman-Reinhold’s *marqueti* group. Typical features of this complex are the shape of the male cymbium (roughly triangular and ending proximally in a single apoph-

ysis) and the scape of the female epigynum (short and widened, not much incised posteriorly). Pesarini’s *microcymbium* complex currently only includes *T. microcymbium* (Pesarini 2001), an eyeless species known from a single locality in the Central Southern Alps. According to Pesarini (2001) himself, this species exhibits several features, such as the shape of the epigynum and cymbium, of Deeleman-Reinhold’s *marqueti* group. Differences between *T. bornensis* and *T. microcymbium* are found in the dimensions of the male palp, the shape of the lamella characteristic, the presence of eyes, and the darker tegument.

The occurrence of a species belonging to the *marqueti* group in the Southern Alps is not surprising. The other species belonging to this group are found in the Cantabric mountains and Pyrenees, westerly, and in Istria and Anatolia, easterly. Nevertheless, Deeleman-Reinhold (1978) hypothesized that the origin of the *polyophtalmus* group (including numerous species from the Southern Alps) was from the *marqueti* group.

The composition of the various groups recognized within this genus is puzzling, especially concerning the Italian fauna. Since Deeleman-Reinhold (1978), 29 new species have been described, 18 of them from 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 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. According to several authors (see Fage 1919; Thaler 1967; Deeleman-Reinhold 1978; Brignoli 1979; Pesarini 2001), the importance of this genus is a crucial point in understanding the dynamics that lead to the origin of the current species assemblages in the Alpine area.

Biospeleological notes.—Specimens of *T. bornensis* have been found among stony debris in the four calcschist caves of the Pugnetto complex, in the vicinity of Mezenile (40 km NW of Torino), at an elevation of approximately 800 m. All caves have openings into beech woods, with a prevalent northerly aspect to the cave opening. The temperature of the major cave (“Borna Maggiore del Pugnetto”), which is nearly 800 m in length, is consistently about 10°C. The three minor caves (“Borna Inferiore del Pugnetto,” “Borna Superiore del Pugnetto,” and “Tana della Volpe”) are 64, 48 and 10 m in length respectively.

UTM ED50 coordinates for the caves are: Borna Maggiore del Pugnetto or Grotta del Pugnetto (Italian cadastral number 1501Pi/TO) UTM 32TLQ3755675014637; Borna Inferiore del Pugnetto or Tana del Lupo (Italian cadastral number 1502Pi/TO), UTM 32TLQ3753195014668; Borna Superiore del Pugnetto or Creusa d’le Tampe (Italian cadastral number 1503Pi/TO) UTM 32TLQ3752725014453; Tana della Volpe (Italian cadastral number 1504Pi/TO) UTM 32TLQ3752945014484.

The caves have been previously studied by several researchers (Capra 1924; Jeannel 1924, 1937; Capra & Conci 1931; Binaghi 1939; Arcangeli 1940; Casale 1980; Vailati 1988) and several interesting endemic species have been recognized, including *Alpioniscus feneriensis* (Parona 1880) (Isopoda, Trichoniscidae), *Dellabeffaella roccai* (Capra 1924) (Coleoptera, Cholevidae) and *Sphodropsis ghilianii* (Schaum 1858) (Coleoptera, Carabidae).

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LITERATURE CITED

- Arcangeli, A. 1940. Il genere *Alpioniscus* Racov (Trichoniscidi, Isopodi terrestri). Bollettino del Museo di Zoologia e Anatomia Comparata di Torino 48:17–30.
- Binaghi, G. 1939. Lo *Sphodropsis Ghilianii* Schaum, le sue razze e la sua diffusione nelle Alpi occidentali (Col. Carabidae). Memorie della Società Entomologica Italiana 18:177–185.
- Brignoli, P.M. 1979. Ragni d’Italia XXXI. Specie Cavernicole nuove o interessanti (Araneae). Quaderni del Museo di Speologia “V. Rivera”, L’Aquila 5(10):3–48.
- Capra, F. 1924. Sulla fauna della grotta del Pugnetto in Val di Lanzo. Atti della Reale Accademia delle Scienze di Torino 59:153–161.
- Capra, F. & C. Conci. 1931. Nota sulle grotte del Pugnetto in val di Lanzo e sulla loro fauna (Piemonte). Rassegna Speleologica Italiana 3(3):73–76.
- Casale, A. 1980. Trechini e Bathysciinae nuovi o poco noti delle Alpi Occidentali, e note sinonimiche (Coleoptera, Carabidae e Catopidae). Fragmenta Entomologica 15:305–306.
- Deeleman-Reinhold, C.L. 1978. Revision of the cave-dwelling and related spiders of the genus *Troglohyphantes* Joseph (Linyphiidae), with special reference to the Yugoslav species. Opera Academia Scientiarum et Artium Slovenica (Classis IV), Ljubljana 23(6):1–221.
- Fage, L. 1919. Etudes sur les araignées cavernicoles. III. Sur le genre *Troglohyphantes* Biospeologica XL. Archives de Zoologie Expérimentale et Générale 55:55–148.
- Jeannel, R. 1924. Monographie des Bathysciinae. Archives de Zoologie Expérimentale et Générale, Paris 63:1–436.
- Jeannel, R. 1937. Notes sur les Carabiques. (2eme note) Revision des genres des Sphodrides. Revue Française de Entomologie, Paris 4:73–100.
- Pesarini, C. 1988a. Due nuove specie di *Troglohyphantes* delle Prealpi Lombarde (Araneae Linyphiidae). Atti della Società Italiana di Scienze Naturali, e del Museo Civile di Storia Naturale, Milano 129:89–100.
- Pesarini, C. 1988b. Osservazioni su alcuni *Troglohyphantes* della fauna Italiana, con descrizione di due nuove specie (Araneae Linyphiidae). Atti della Società Italiana di Scienze Naturali, e del Museo Civile di Storia Naturale, Milano 129:237–247.
- Pesarini, C. 1989. Note su alcune specie italiane di *Troglohyphantes* Joseph, con descrizione di sei nuove specie (Araneae Linyphiidae). Atti della Società Italiana di Scienze Naturali, e del Museo Civile di Storia Naturale, Milano 130:229–246.
- Pesarini, C. 2001. Note sui *Troglohyphantes* italiani, con descrizione di quattro nuove specie (Araneae, Linyphiidae). Atti della Società Italiana di Scienze Naturali e del Museo civico di Storia naturale di Milano 142:109–133.
- Platnick, N.I. 2007. The World Spider Catalog, version 7.5. American Museum of Natural History, New York. Online at <http://research.amnh.org/entomology/spiders/catalog/INTRO1.html>.
- Thaler, K. 1967. Zum Vorkommen von *Troglohyphantes*-Arten in Tirol und dem Trentino. (Arachn., Araneae, Linyphiidae) Berichte des naturwissenschaftlich-medizinischen Vereins in Innsbruck 55:155–173.
- Vailati, D. 1988. Studi sui Bathysciinae delle prealpi centro-occidentali. Revisione sistematica, ecologia, biogeografia della serie fletica di *Boldoria* (Coleoptera Catopidae). Monografie del Museo Civico di Scienze Naturali di Brescia 11:1–331.

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