

Taxonomy, ecology and conservation of the cave-dwelling spider *Histopona palaeolithica*, with the description of *H. petrovi* sp. nov. (Araneae: Agelenidae)

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Abstract. The spider genus *Histopona* Thorell, 1869 (Araneae: Agelenidae) includes several species that exhibit a preference for subterranean conditions, being occasionally or exclusively found in caves, crevices and similar habitats. Within the genus, the species displaying the highest level of subterranean adaptation is possibly *H. palaeolithica* (Brignoli, 1971). This species was described based on a female collected in 1967 in a cave on the Western Ligurian shore (Italy), but had never been recorded thereafter. Our recent biospeleological surveys at the type locality failed to recover the species, possibly because the cave has been impacted by the expansion works of a large quarry. However, we found a new population in a cave opening a few hundred meters away from the type locality. As a result of this finding, we provide the first description of the male, as well as a re-description of the female. We also describe a new species of *Histopona* based on a female specimen that was collected in a cave in Montenegro, and was previously attributed to *H. palaeolithica*. In light of the rarity of these specialized stenoendemic species, we provide general information on their ecology and conservation status, as well as information useful for assessing their extinction risk based on International Union for Conservation of Nature (IUCN) guidelines.

Keywords: Endemism, extinction risk, Mediterranean, subterranean fauna, systematics

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The genus *Histopona* Thorell, 1869 (Araneae: Agelenidae) currently includes 22 species primarily distributed in the Central-Eastern Mediterranean basin (World Spider Catalog 2019). According to the latest overview of European subterranean spiders (Mammola et al. 2018), at least 15 of these species exhibit a preference for subterranean conditions, being occasionally or exclusively found in caves, crevices and similar habitats (Brignoli 1971, 1972, 1977a, b; Deltchev 1978; Deeleman-Reinhold 1983; Gasparo 2005; Deltchev & Petrov 2008; Bolzern et al. 2013). These ecological preferences parallel the appearance of morphological adaptations to the subterranean environment (i.e., troglomorphy; see Christiansen 2012), which in *Histopona* primarily pertains to size, loss of pigmentation and eye regression (Deeleman-Reinhold 1983). More specifically, the size of the anterior median eyes (AME) appears to be conspicuously reduced in the subterranean species, compared to their surface-dwelling relatives; for instance, a conspicuous reduction of the AME is found in *H. bidens* (Absolon & Kratochvíl, 1933), *H. dubia* (Absolon & Kratochvíl, 1933), *H. palaeolithica* (Brignoli, 1971) and *H. thaleri* Gasparo, 2005 (Absolon & Kratochvíl 1933; Kratochvíl 1938: 16, figs. 20, 24; Brignoli 1971; Gasparo 2005).

Within the genus, the species with the highest level of troglomorphy is possibly *H. palaeolithica* (Brignoli, 1971). This species was described on the basis of one female and one juvenile collected in 1967 by Augusto Vigna Taglianti in the Arma delle Arene Candide cave (Liguria, Italy). According to the original description (Brignoli 1971: 128), this species has only six eyes, because the AME are replaced by two small spots of black pigment (Fig. 1a). The species had never been collected after the original description and the male is as yet undescribed (Mammola et al. 2018; Pantini & Isaia 2019). With the aim of filling this taxonomic gap, between 2015 and 2018 we conducted repeated biospeleological searches at the

type locality and in several caves in the nearby area. While our extensive surveys at the type locality failed to recover the species, we found a new population in a cave opening a few hundred meters away from the type locality.

As a result of this finding, we provide the first description of the male of *H. palaeolithica*, as well as a re-description of the female based on specimens collected in the new locality. In parallel, we provide the description of a new species of *Histopona*, based on the record of a female specimen from the Golubova pećina cave in Montenegro, which was formerly attributed to *H. palaeolithica* by Naumova et al. (2016). In light of the rarity of these species, we give general information on their ecology and conservation status, including details allowing for the assessment of their extinction risk according to the International Union for Conservation of Nature (IUCN) Red List Categories and Criteria (IUCN 2001, 2012).

METHODS

Most specimens were stored in 75% ethanol in the Marco Isaia collection at the Department of Life Sciences and Systems Biology, University of Torino (Italy). A few specimens were further preserved in absolute ethanol for future DNA analysis, and exemplar specimens were deposited at the Museo Civico di Scienze Naturali “E. Caffi” (Bergamo, Italy). The holotype of the new species here described is lodged at the National Museum of Natural History Bulgarian Academy of Sciences (Sofia, Bulgaria). Specimens were examined using a Leica M80 stereoscopic binocular. Measurements are in millimeters (mm), and acquired using a Leica M80 stereoscopic microscope (up to 60x magnification). Measurements were taken from digital pictures made with a Leica EC3 digital camera, and calculated with the Leica LAS EZ 3.0 software (Leica Microsystems, Switzerland). All measurements are given in mm. Speleological cadastral codes

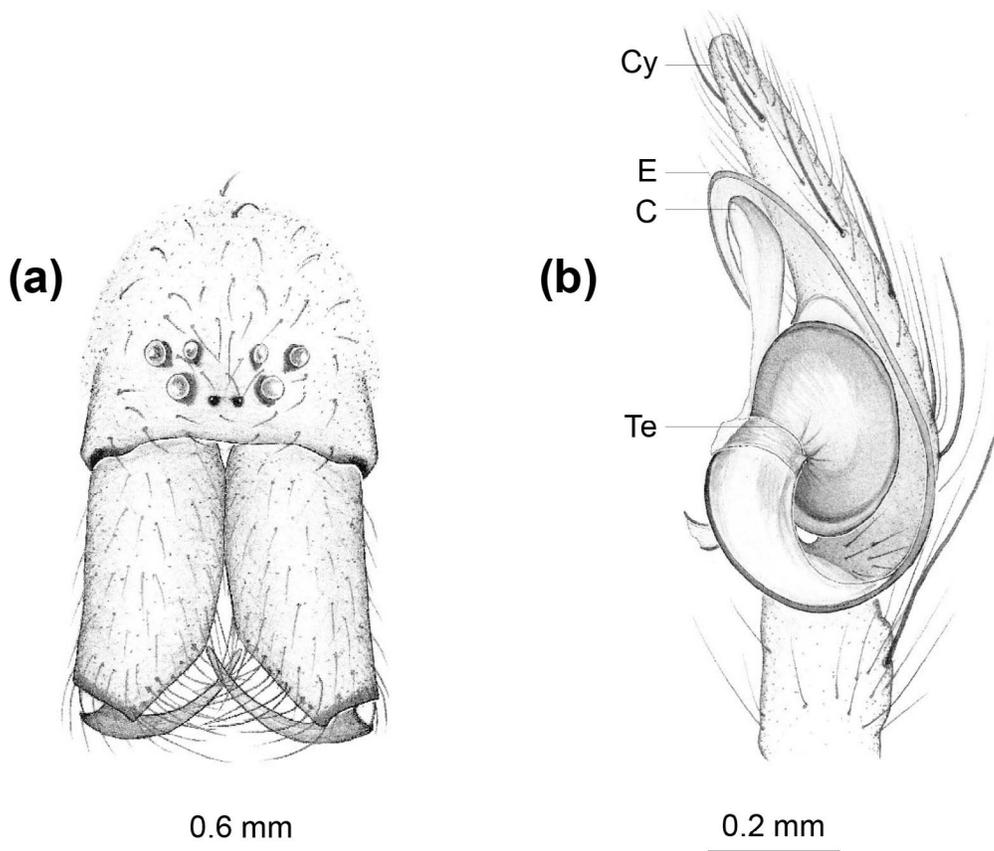


Figure 1a–b.—*Histopona palaeolithica* (Brignoli, 1971), male from Pozzo delle Cento Corde [Li 137] collected 2 June 2018: a, head region, frontal view; b, right palp, prolateral view. Abbreviations: C = conductor; Cy = cymbium; E = embolus; Te = tegulum. Illustrations by Elena Pelizzoli.

of the caves are shown in squared brackets [‘regional code’ and ‘number’], and coordinates of localities are given in WGS84 datum, in decimal degrees.

Abbreviations.—AER = anterior eye row; ALE = anterior lateral eyes; ALS = anterior lateral spinnerets; AME = anterior median eyes; AOO = Area of Occupancy; d = dorsal; EOO = Extent of Occurrence; Fe = femur; MCSNB = Museo Civico di Scienze Naturali “E. Caffi” di Bergamo; Me = metatarsus; MI-coll = Marco Isaia collection; MSNV = Museo di Storia Naturale di Verona; NMNHS = National Museum of Natural History, Bulgarian Academy of Sciences, Sofia; p = prolateral; Pa = patella; PER = posterior eye row; PLE = posterior lateral eyes; PLS = posterior lateral spinnerets; PME = posterior median eyes; PMS = posterior median spinnerets; r = retrolateral; RTA = retrolateral tibial apophysis; Ta = tarsus; Ti = tibia; v = ventral.

TAXONOMY

Family AGELENIDAE C. L. Koch, 1837
Genus *Histopona* Thorell, 1869
Histopona palaeolithica (Brignoli, 1971)
 (Figs. 1–2)

Cicurina (*Chorizomma*) *palaeolithica* Brignoli, 1971: 128, figs. 89, 90.

Histopona palaeolithica (Brignoli): Brignoli, 1977a: 952. Brignoli, 1977b: 38, figs. 13, 16. Deeleman-Reinhold, 1983: 336, figs. 20, 21.

Type material.—*Holotype female*. ITALY: *Liguria* (SV): Arma delle Arene Candide [Li 34], 44.16233°N, 8.32831°E, promontory Caprazoppa, Finale Ligure, 25 November 1967, A. Vigna Taglianti (MSNV; includes 1 juvenile specimen).

Other material examined.—ITALY: *Liguria* (SV): 4 ♀, Pozzo delle Cento Corde [Li 137], 44.16306°N, 8.31822°E, promontory Caprazoppa, Campi di Orso, Borgio Verezzi, 23 December 2016, D. Alterisio, M. Isaia, S. Mammola (MI-coll.); 1 ♀, 1 juvenile, same data except 6 March 2017, M. Isaia, S. Mammola (MCSNB); 2 ♀, 2 juveniles, same data except 20 April 2017, M. Isaia (MI-coll.); 2 ♀, 3 juveniles, same data except 18 October 2017, M. Isaia, S. Mammola (MI-coll.); 2 ♀, 1 ♂, same data except 2 June 2018, E. Biggi, M. Isaia, S. Mammola (MI-coll.).

Diagnosis.—Males of *Histopona palaeolithica* are best diagnosed by the shape of the tegulum and the positions of the origin and the distal tip of the embolus. Compared to the species of *Histopona* assigned to the *myops*-, *strinatii*- and *torpida*-groups (see Deeleman-Reinhold 1983 for species-group designations), the embolus is shorter, but it is longer in respect to the *italica*-group. Additional diagnostic characters are the shape of the conductor and the cymbium, the latter

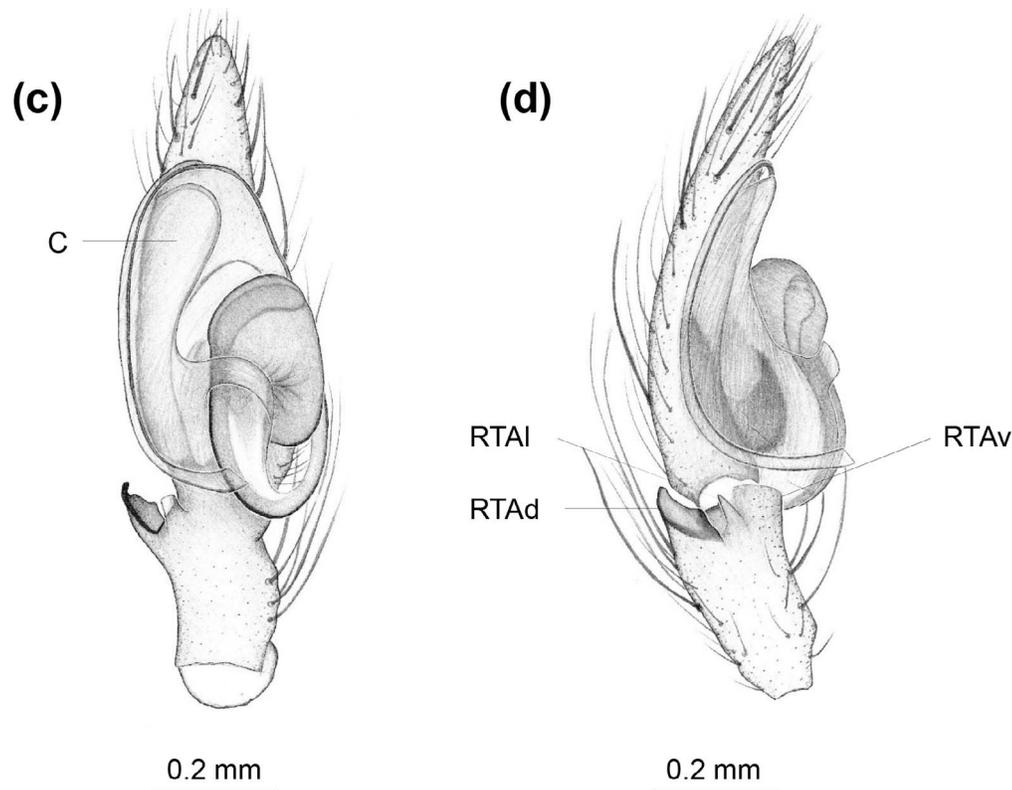


Figure 1c–d.—*Histopona palaeolithica* (Brignoli, 1971), male from Pozzo delle Cento Corde [Li 137] collected 2 June 2018: c, right palp, ventral view; d, right palp, retrolateral view. Abbreviations: C = conductor; RTAd = dorsal branch of RTA; RTAlv = lateral branch of RTA; RTAv = ventral branch of RTA. Illustrations by Elena Pelizzoli.

being less elongated compared to the *myops*-group and more elongate compared to the *torpida*- and *italica*-groups.

Description (male).—Measurements ($n = 1$; specimen from Pozzo delle Cento Corde [Li 137] collected 2 June 2018): Total length 4.98 (including spinnerets). Cephalothorax 1.77 long, 1.32 wide. Prosoma yellow-brown. Sternum yellow-brown, without pattern. Head region of the same color, 0.70 wide. PER 0.37 wide, AER 0.25. Eye diameter: AME 0.01 (no corneal lens is visible), ALE 0.06; PME 0.04; PLE 0.06. Both eye rows recurved in dorsal view. AME reduced to a small spot of pigment, other eyes normally developed (Fig. 1a). Clypeus height under AME 0.07, under ALE 0.09. Chelicerae: 0.62 long, 0.31 wide. Labium as long as wide or moderately wider than long. Sternum 1.08 long, 0.84 wide. Gnathocoxa ratio (width to length) 0.57. Chelicerae with 3 teeth on promargin and 5 teeth on retromargin. Opisthosoma 2.48 long (including spinnerets), grey-white without pattern. Colulus reduced, only two hairy plates are visible. Legs: I 6.83 (Fe 1.81) (Pa 0.52) (Ti 1.68) (Me 1.66) (Ta 1.16); II 6.03 (Fe 1.60) (Pa 0.42) (Ti 1.44) (Me 1.45) (Ta 1.12); III 5.82 (Fe 1.54) (Pa 0.39) (Ti 1.34) (Me 1.47) (Ta 1.08); IV 7.57 (Fe 1.88) (Pa 0.55) (Ti 1.84) (Me 2.13) (Ta 1.17); same color as prosoma, all trochanters notched. Chaetotaxy: I (Fe 2d, 1p, 1r) (Pa 2d) (Ti 2d, 2p, 1r, 2v) (Me 2p, 2r, 4v); II (Fe 2d, 2p, 1r) (Pa 2d) (Ti 2d, 2p, 1r, 4v) (Me 2p, 5v); III (Fe 2d, 2p, 1r) (Pa 2d) (Ti 2d, 2p, 2r, 3v) (Me 5d, 2p, 2r, 5v); IV (Fe 2d, 2p, 1r) (Pa 2d) (Ti 2d, 2p, 2r, 5v) (Me 2d, 3p, 2r, 3v) (Ta 1r). PLS longer than all others, distal segment as long as basal segment. PMS as long as ALS.

Palp (Figs. 1b–d): 2.02 (Fe 0.65) (Pa 0.21) (Ti 0.19) (Ta 0.87). RTA with a sclerotized dorsal branch, distally pointed; lateral branch forming a finger-shaped appendix; ventral branch forming a stout appendix, protruding ventrodistally. Cymbium elongated, similar to the species included in the *strinatii*-group, less elongated than in the *myops*-group, more elongated than in *torpida*- and *italica*-groups. Ratio bulb length (laterally from cymbium base to conductor tip) to cymbium length 0.68. Tegulum ring-shaped, ending in a filiform embolus originating at 7 o'clock position, with distal tip between 4 and 5 o'clock position. Embolus shorter than in *myops*-, *strinatii*- and *torpida*-groups, longer than in the *italica*-group. Conductor lamella-like, distally broadly rounded. Connection of conductor and tegulum membranous, band-like. Median apophysis and tegular apophysis absent.

Description (female).—Measurements ($n = 1$; specimen from Pozzo delle Cento Corde [Li 137] collected 20 April 2017). Total length 4.86 (including spinnerets). Cephalothorax 2.07 long, 1.35 wide. Prosoma yellow-brown. Sternum yellow-brown, without pattern. Head region of the same color, 0.83 wide. PER 0.32 wide, AER 0.25. Eye diameter: AME 0.02 (no corneal lens is visible), ALE 0.06; PME 0.03; PLE 0.07. Both eye rows recurved in dorsal view. AME reduced to a small spot of pigment, other eyes normally developed. Clypeus height under AME 0.08, under ALE 0.10. Chelicerae 0.79 long, 0.41 wide. Labium as long as wide or moderately wider than long. Gnathocoxa ratio (width to length) 0.60. Chelicerae with 3 teeth on promargin and 5 teeth on retromargin.

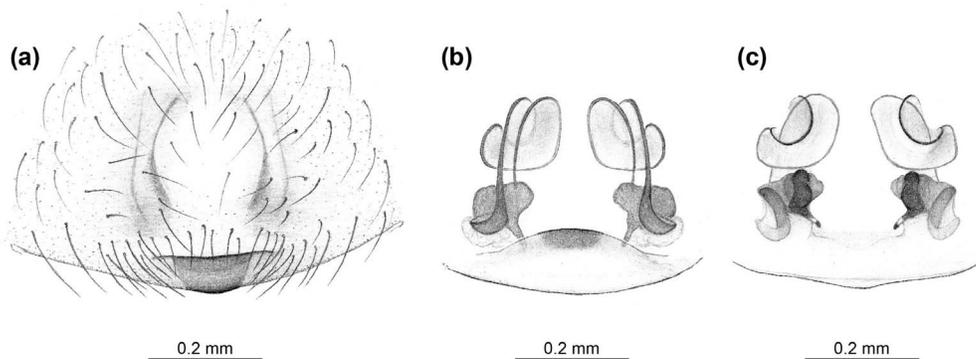


Figure 2.—*Histopona palaeolithica* (Brignoli, 1971), female from Pozzo delle Cento Corde [Li 137] collected 20 April 2017: a, epigyne, ventral view; b, epigyne cleared, ventral view; c, vulva, dorsal view. Abbreviations: Cd = copulatory duct; Ev = epigynal valve; Fd = fertilization duct; Gp = genital pouch; R = receptaculum. Illustrations by Elena Pelizzoli.

Sternum 1.14 long, 0.97 wide. Opisthosoma 2.78 long (including spinnerets), grey-white without pattern. Colulus reduced, only two hairy plates are visible. Legs: I 7.21 (Fe 2.00) (Pa 0.66) (Ti 1.71) (Me 1.64) (Ta 1.20); II 6.61 (Fe 1.77) (Pa 0.70) (Ti 1.51) (Me 1.55) (Ta 1.08); III 6.36 (Fe 1.81) (Pa 0.62) (Ti 1.35) (Me 1.57) (Ta 1.01); IV 7.15 (Fe 2.13) (Pa 0.64) (Ti 1.39) (Me 2.12) (Ta 0.87); same color as prosoma, all trochanters notched. Chaetotaxy: I (Fe 2d, 1p, 1r) (Pa 2d) (Ti 2p, 4v) (Me 2p, 3r, 3v); II (Fe 2d, 2p, 1r) (Pa 2d) (Ti 2p, 4v) (Me 2p, 2v); III (Fe 2d, 2p, 1r) (Pa 2d) (Ti 1d, 2p, 2r, 5v) (Me 2d, 3p, 3r, 1v); IV (Fe 2d, 2p, 1r) (Pa 2d) (Ti 1d, 2p, 3r, 4v) (Me 1d, 2p, 2r, 4v) (Ta 1r). PLS longer than all others with distal segment as long as basal segment. PMS as long as ALS. Palp: 2.31 (Fe 0.72) (Pa 0.27) (Ti 0.48) (Ta 0.84); chaetotaxy: (Fe 3d) (Pa 2d) (Ti 2d, 4p, 5r). Epigyne and vulva (Figs. 2a–c): epigynal plate 0.24 long, 0.30 wide, poorly sclerotized, subtriangular, marsupium-like, with a small undivided epigynal valve arising from the posterior margin (*sensu* Deeleman-Reinhold 1983) covering the copulatory openings. Copulatory ducts paired leading to the paired genital pouch, anteriorly straight or convex, directing into poorly sclerotized and pigmented rounded receptacula; fertilization ducts very short (Fig. 2c).

Distribution, sampling notes and ecology.—*Histopona palaeolithica* is restricted to subterranean habitats in the promontory of Caprazoppa (291 m elevation), located at ca. 0.5 km from the Mediterranean (Ligurian) shore. One population was reported in literature (Brignoli 1971) from the type locality, the Arma delle Arene Candide [Li 34] cave. A second population is herein documented for the Pozzo delle Cento Corde [Li 137] cave. Both caves open in stretches of Mediterranean scrubland.

Between 2015 and 2016, we conducted six visits to Arma delle Arene Candide, a 667 m long cave with restricted access due to the presence of remarkable paleontological remains (Mussi 2005; Catasto Spelologico Ligure 2018). In spite of our sampling efforts, including pitfall trapping inside the cave and in its surroundings, we were unable to find specimens of *H. palaeolithica*. In recent years, part of the cave was destroyed by the extension works of a large quarry. We believe that a secondary entrance, which was opened as a consequence of the mining activities, caused the alteration of air circulation patterns, changing local microclimatic conditions including

the drying of the cave, which now results in an abundant presence of dust. According to the original collector, at the time of the collection of the type material (1967), the climatic conditions of the cave were remarkably different from the current ones, with high humidity and mud on the floor rather than dust (A. Vigna Taglianti, pers. comm. 2016). We hypothesize that these environmental alterations are likely to be the main cause of the extinction of the local population of *H. palaeolithica* in the cave. It is worth noting that the cave is also the type locality of four other arthropod species (Conci 1952), including the arachnids *Leptoneta crypticola francisco-loi* Caporiacco, 1950 (Araneae: Leptonetidae) and *Chthonius (Ephippiochthonius) concii* Beier, 1953 (Pseudoscorpiones: Chthoniidae), which were similarly never found during our surveys.

Conversely, individuals of *H. palaeolithica* are locally abundant in the Pozzo delle Cento Corde [Li 137] cave. This is a small vertical cave, whose entrance (1 × 1.5 m) opens at the base of the limestone cliff of the “Falesia delle Cento Corde” climbing site. The cave has a drop of -24 m and a total planimetric development of 36 m (Catasto Spelologico Ligure 2018). Individuals of *H. palaeolithica* were primarily found at the base of the first pit (-10 m), especially among the humid debris on the floor of the first room (10 × 10 × 4 m). Pozzo delle Cento Corde is a dry cave with a ground temperature ranging from approximately 21°C in the entrance area to 17°C in the innermost sections (these climatic data based on winter temperature measurements by Motta & Motta 2017). In the first room, where most individuals were collected, ground temperature ranges from 19.2 to 20.9°C and relative humidity from 60 to 70% (Motta & Motta 2017).

Aside from caves, *H. palaeolithica* probably lives in interstitial habitats, such as narrow fissures in limestone rocks or under deep stones. The species spins a 5–7 cm wide sheet web, lacking a funnel (Fig. 3). The spider stands on top of the web (Figs. 3a–c). Females are abundant throughout the year, while males appear to be rare; five visits between 2016 and 2018 were necessary to find a single male specimen.

Conservation status and basic information for an IUCN Red List assessment.—*Range description, Area of Occupancy (AOO) and Extent of Occurrence (EEO):* the species is endemic to the Caprazoppa promontory (min–max elevation 0–291 m). In spite of our exhaustive searches in caves on the

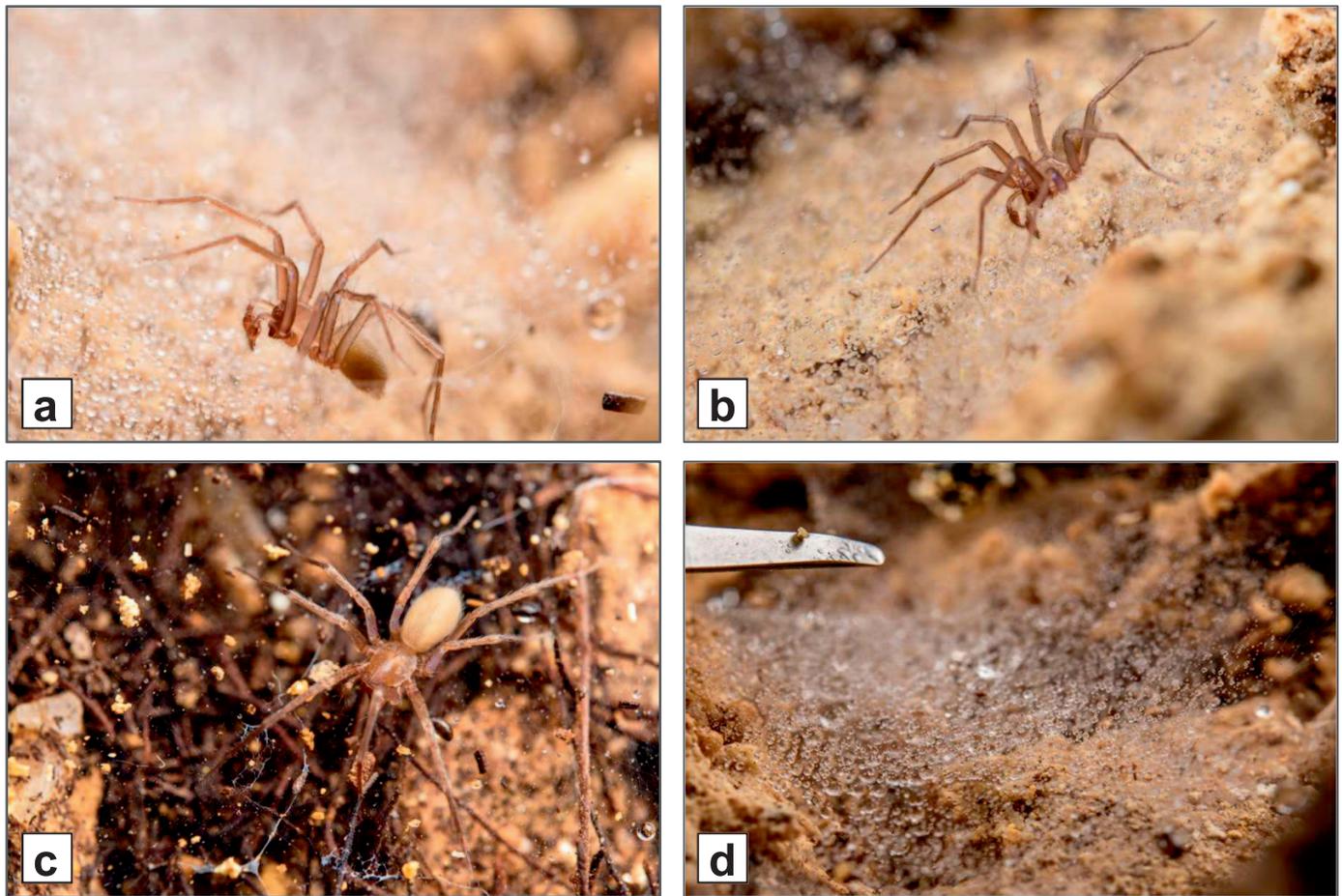


Figure 3.—*Histopona palaeolithica* (Brignoli, 1971), male from Pozzo delle Cento Corde [Li 137] collected 2 June 2018: a–c, habitus; d, shape of the web. Photo credits: Emanuele Biggi, used with permission.

Western Ligurian shore (Riviera di Ponente), and more specifically in the area of Borgio Verezzi and Finale Ligure, including the type locality (Arma delle Arene Candide), we only found a population of *H. palaeolithica* in the Pozzo delle Cento Corde cave. The estimated EOO and AOO are both extremely small, less than 1 km². We infer a decline in both EOO and AOO as a result of quarrying activities. Dispersal ability for this species is not known, but since this is a highly specialized cave-dwelling species with restricted range, it is assumed that it has a very low dispersal capacity.

Locations: Despite significant targeted surveys and search effort, the only location known for this species is the Pozzo delle Cento Corde cave. As a result of changes in local microclimatic conditions due to quarrying activity, we consider the population of the type locality, Arma delle Arene Candide cave, locally extinct. The whole area of the Caprazoppa promontory is currently subject to quarrying activities, which are likely to represent a major threat to the species' survival.

Threats: The species is potentially exposed due to its extremely narrow geographic distribution range and its presumably low dispersal capacity. Given the general low tolerance to habitat changes of subterranean organisms, it is

suspected that quarrying activities in the area may interfere with the species' survival. Secondary impacts could derive from tourism, due to the high number of climbers and hikers in the area. Moreover, the cave opening is easily accessible and located at the base of the climbing site. Even if climbing activities do not present a direct threat to the species' survival, the possible accumulation of litter thrown by tourists into the cave could cause changes in the cave environment and decrease habitat quality.

Conservation actions: In light of the mentioned threats, it is worth considering the extinction risk of *H. palaeolithica*. As very little is known about the biology and life history of this species, to date it is not possible to provide any precise management actions. However, the inclusion of this species on the IUCN Red List represents an important starting point for its conservation. As seen for other subterranean systems of conservation concern for red listed and legally protected species, *H. palaeolithica* could benefit from effective protection with adequate legislation aiming to preserve the Caprazoppa promontory from future expansion of quarrying activities. In addition, a strict code of conduct and specific guidelines for touristic, speleological and other activities inside and outside the Pozzo delle Cento Corde cave should be implemented.

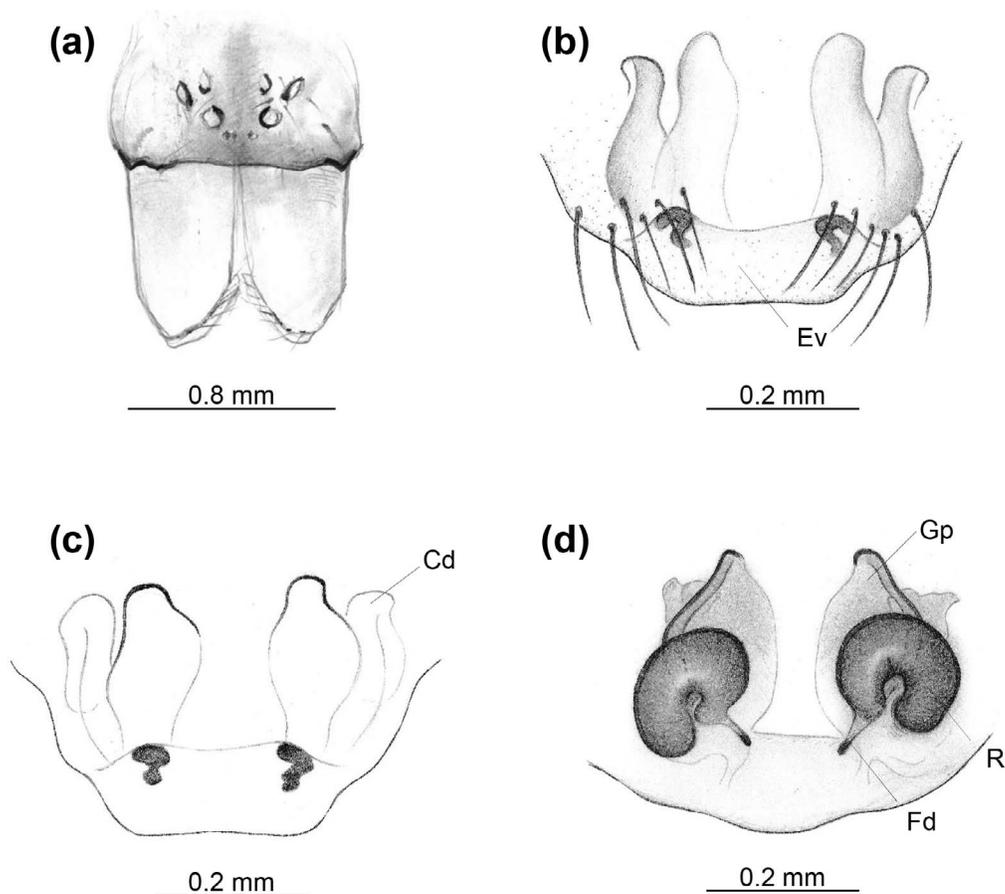


Figure 4.—*Histopona petrovi* Isaia & Mammola sp. nov., holotype female from Golubova Pečina: a, head region, frontal view; b, epigyne, ventral view; c, epigyne cleared, ventral view; d, vulva, dorsal view. Abbreviations: Cd = copulatory duct; Ev = epigynal valve; Fd = fertilization duct; Gp = genital pouch; R = receptaculum. Illustrations by Stefano Mammola and Elena Pelizzoli.

***Histopona petrovi* Isaia & Mammola, sp. nov.**

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org:act:F271C5DA-3C09-4BBA-B6B4-B9291F1B00ED
(Fig. 4)

Histopona palaeolithica Brignoli: Naumova et al., 2016: 432
(misidentified specimen from Golubova Pečina cave).

Type material.—*Holotype female*. MONTENEGRO: *Bar*: Golubova Pečina cave, 42.21°N, 19.13°E, Seoca village, Virpazar district, 12 August 2006, B. Petrov, S. Lazarov (NMNHS).

Etymology.—The species is dedicated to the Bulgarian zoologist and alpinist Boyan Petrov (1973–2018), one of the collectors of the type material. Boyan disappeared climbing his tenth eight-thousand meter peak in Himalaya, the Shishapangma (8,027 m).

Diagnosis.—*Histopona petrovi* sp. nov. is best diagnosed by the shape of the vulva (viewed dorsally), in particular by the shape of the spermathecae, which are conspicuous, tubular and arc-shaped (Fig. 4d). In comparison with *H. palaeolithica*, they are much more sclerotized and pigmented. The undivided valve of the epigyne arising from the posterior margin is also diagnostic, being trapezoidal rather than subtriangular, slightly curved in the middle and more pronounced than in

H. palaeolithica (almost protruding when seen from above or from the side) (Figs. 4b,d).

Description (female).—Measurements ($n = 1$, holotype). Total length 4.58 (including spinnerets). Cephalothorax 1.95 long, 1.37 wide. Prosoma yellow-brown. Sternum yellow-brown, without pattern. Head region of the same color, 0.84 wide. PER 0.35 wide, AER 0.22 wide. Eye diameter: AME 0.01 (no corneal lens is visible), ALE 0.04; PME 0.03; PLE 0.06. Both eye rows recurved in dorsal view. AME reduced to a very small spot of pigment, other eyes normally developed (Fig. 4a). Clypeus height under AME 0.11, under ALE 0.13. Chelicerae 0.89 long, 0.38 wide. Labium as long as wide or moderately wider than long. Sternum 1.03 long, 0.96 wide. Gnathocoxa ratio (width to length) 0.42. Chelicerae with 3 teeth on promargin and 5 teeth on retromargin. Opisthosoma 2.43 long (including spinnerets), grey-white without pattern. Colulus reduced, only two hairy plates are visible. Legs: I 7.70 (Fe 2.01) (Pa 0.66) (Ti 1.84) (Me 1.85) (Ta 1.34); II 7.05 (Fe 1.86) (Pa 0.60) (Ti 1.68) (Me 1.76) (Ta 1.15); III 6.82 (Fe 1.73) (Pa 0.58) (Ti 1.60) (Me 1.72) (Ta 1.19); IV 9.06 (Fe 2.32) (Pa 0.51) (Ti 2.31) (Me 2.50) (Ta 1.42); same color as prosoma, all trochanters notched. Chaetotaxy: I (Fe 2d, 2p, 1r) (Pa 2d) (Ti 2d, 2p, 1r, 2v) (Me 2p, 2r, 4v); II (Fe 2d, 2p, 1r) (Pa 2d) (Ti 2d, 2p, 2r, 3v) (Me 4p, 3v, 3r); III (Fe 2d, 1r) (Pa 2d) (Ti 2d, 2p, 3r,

3v) (Me 3d, 4p, 2r, 4v); IV (Fe 2d, 2p, 1r) (Pa 2d) (Ti 2d, 2p, 3r, 5v) (Me 2d, 3p, 3r, 6v) (Ta 1r). PLS longer than all others, with distal segment as long as basal segment. PMS as long as ALS. Palp: 4.92 (Fe 0.62) (Pa 0.30) (Ti 0.60) (Me 0.94) (Ta 2.46); chaetotaxy: (Fe 3d) (Pa 2d) (Ti 2d, 5r, 4p). Epigyne (Figs. 4b,c) and vulva (Fig. 4d): epigynal plate 0.30 long, 0.39 wide, poorly sclerotized, trapezoidal, marsupium-like, with an undivided epigynal valve (*sensu* Deeleman-Reinhold 1983) arising from the posterior margin and covering the copulatory openings, similar in shape to the small undivided valve of *H. palaeolithica*, but bigger and slightly curved in the central part. When seen from above or from the side, the valve is protruding (more than in *H. palaeolithica*). Copulatory ducts paired leading to the paired genital pouch, directing into the heavily sclerotized and pigmented arc-shaped receptacula, not visible in dorsal view, but clearly visible after epigyne dissection, in dorsal view; fertilization ducts short but visible (Fig. 4d).

Distribution, sampling notes and ecology.—*Histopona petrovi* sp. nov. is known from only a single specimen collected in the Golubova Pećina cave. This is a narrow cave of about 100–150 m, opening at an elevation of 440 m in rocky habitats. The specimen was collected in the dark zone, about 40 m deep, under a stone. Cave internal temperature is around 14°C (Stoev & Enghoff 2008). Based on the morphological troglomorphism, in particular the depigmentation and AME reduction, we regard *H. petrovi* sp. nov. as a subterranean adapted species and likely a troglobiont (as defined in Mammola & Isaia 2017). Further information on the natural history and ecological preferences are required to confirm this observation.

Conservation status and basic information for an IUCN Red List assessment.—*Histopona petrovi* sp. nov. is currently known from only a single cave. There is currently no information on the species' distribution, ecology or natural history, hindering the possibility of a direct or an indirect assessment of its risk of extinction. The Red List category "Data Deficient" (DD) should be therefore used in the event of a formal IUCN assessment. Basic research is needed to estimate the conservation status and the possible threats affecting this species.

DISCUSSION

Histopona palaeolithica and *H. petrovi* sp. nov. exhibit somatic characters that justify their generic placement in *Histopona* (see Deeleman-Reinhold 1983; Bolzern et al. 2013). These include the eye arrangement, elongated sternum (i.e., reaching backwards between coxae IV), notched trochanters, leg spination (i.e., two dorsal spines on Fe II and two or more prolateral spines on Mt I), reduced colulus and absence of an abdominal or leg pattern. This interpretation also fits the case of the newly discovered male of *H. palaeolithica*, showing typical characters also in the male genitalia, namely more than one palpal tibial apophysis, an elongated cymbium and a long and thread-like embolus.

Based on morphological characters referring to female and partly to male genitalia, Deeleman-Reinhold (1983) classified the extant species of *Histopona* into five species-groups. Authors describing new *Histopona* species after 1983 kept using this classification by adding species to the extant groups

or, in one case (*H. breviemboli* Dimitrov, Delshev & Lazarov, 2017), suggesting that the species could not be placed in any of the extant groups (Dimitrov et al. 2017). Excluding the latter species, the extant groups are the: *torpida*-group (7 species, from Central Europe to Caucasus); *myops*-group (7 species, Balkans), *strinatii*-group (2 species, Greece), *italica*-group (3 species, Italy) and *palaeolithica*-group (2 species, including *H. palaeolithica* from Italy and the newly described *H. petrovi* sp. nov. from Montenegro) (Fig. 5). Due to the absence of a male, Deeleman-Reinhold (1983) placed *H. palaeolithica* in a separate and self-standing group based on female characters, namely the peculiar small and undivided epigynal valve, a character shared with the monotypic genus *Hadites* Keyserling, 1862 and with some species of *Malthonica* Simon, 1898.

When considering our new findings, the male of *H. palaeolithica* exhibits some affinity with the species included in the *myops*- and *strinatii*-groups (i.e., male palp with conductor, but no apophysis on the radix). *Histopona petrovi* sp. nov. could also be placed in the *palaeolithica*-group based on the presence of a relatively small and undivided epigynal valve. From a morphological point of view, both species in the *palaeolithica*-group seem, to a certain extent, also related to *Hadites tegenarioides* Keyserling, 1862, described on the basis of one female and juvenile males from the island of Hvar (Croatia), approximately 180 km north from Golubova Pećina, along the Adriatic shore (Fig. 5), and whose taxonomical status appears in need of revision. However, in the absence of a proper morphological or molecular phylogenetic analysis, the delimitations of the species-groups and the phylogenetic position of *H. palaeolithica* and *H. petrovi* sp. nov., as well as their affinities to the genus *Hadites*, remain speculative.

The morphological peculiarity of *H. palaeolithica* is mirrored by its geographic distribution at the western periphery of the range of the genus, and by the lack of closely related species in the same area (Fig. 5). Other than for *H. torpida* (C.L. Koch, 1837) and *H. luxurians* (Kulczyński, 1897), which show wider distributions in Europe and Eastern Europe, respectively, the genus *Histopona* is represented by mid- or small-ranged species, most of them distributed in south-eastern Europe. Congeneric species occurring in Italy are represented by species included in the *italica*-group (i.e., *H. leonardo* Bolzern, Pantini & Isaia, 2013, *H. fioni* Bolzern, Pantini & Isaia, 2013 and *H. italica* Brignoli, 1977 from the Alps and Apennines; see Bolzern et al. 2013), *H. torpida* (C.L. Koch, 1837) (*torpida*-group), with recent records in north-eastern Italy (Isaia et al. 2007; Ballarin et al. 2011; Hansen 2011; Trotta & Cherubini 2017) and old, poorly reliable records on the Italian and the French slopes of the Maritime Alps (Thorell 1875; Calloni 1889; Berktau 1890).

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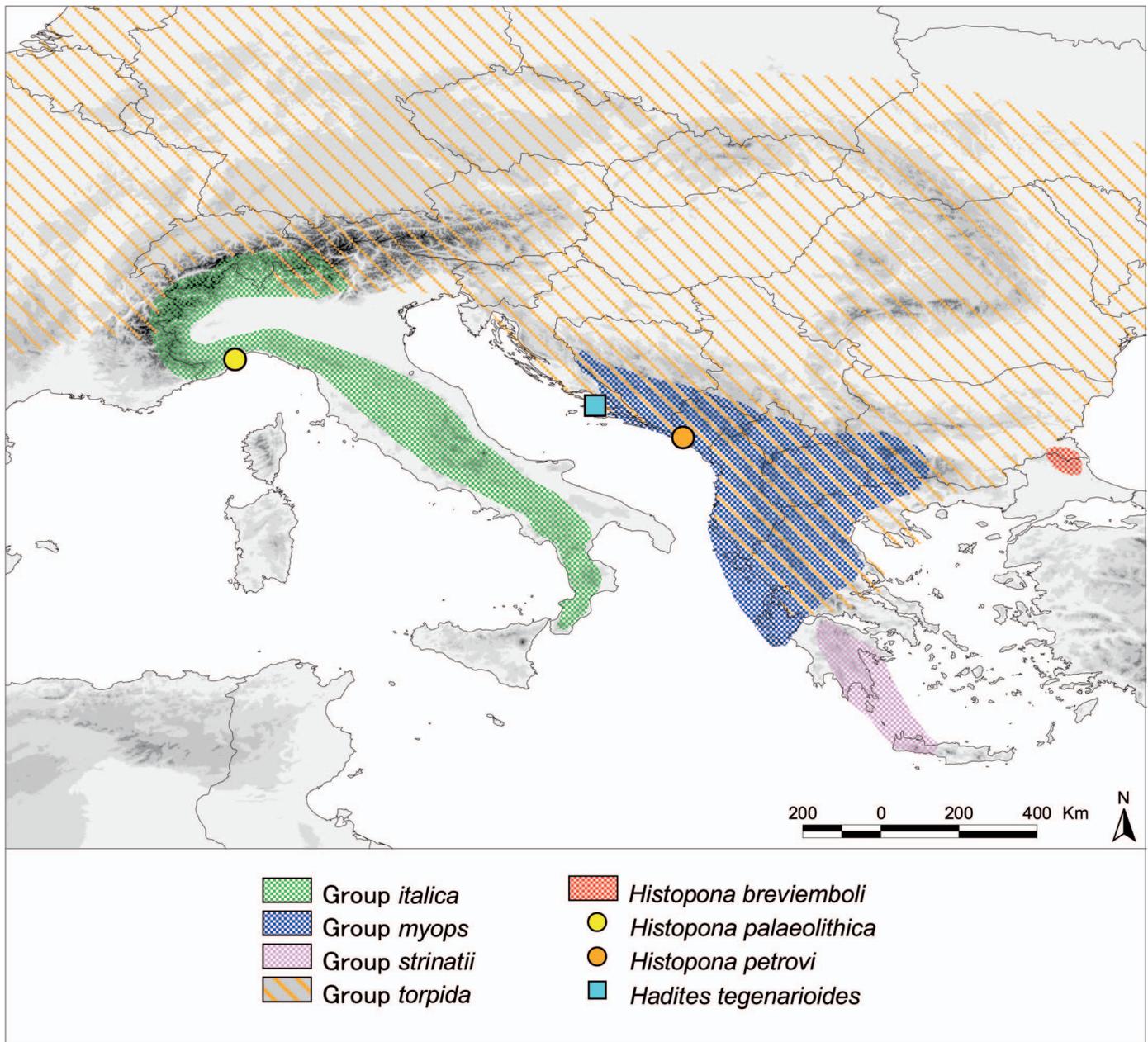


Figure 5.—Map of south-eastern Europe, showing the distribution range of the genus *Histopona* and the related species *Hadites tegerarioides* Keyserling, 1862, with reference to the species groups proposed by Deeleman-Reinhold (1983).

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finding of *H. palaeolithica* was indeed stimulated by the information he shared with us about the collection site of the type series of this species.

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