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Eresus elhennawyi sp. n. (Araneae: Eresidae), a new velvet spider mimicking mutilid wasps from north-western Africa

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Abstract

Despite their attractive appearance, the velvet spiders of the genus *Eresus* are an understudied group in some parts of their range. Such areas include the south-western Mediterranean. In this paper we present a description of a new species from Morocco and Algeria, *Eresus elhennawyi* sp. n. We named it after the Egyptian arachnologist Hisham El-Hennawy, who has worked on the arachnids of North Africa for several decades. This species lives under rocks in semi-desert habitats, so unlike most species of the genus *Eresus*, it does not burrow. Adult males seek out females in April. Their colouration is obviously a mimicry of co-occurring stinging mutilid wasps. The most morphologically similar species is *Eresus crassitibialis* Wunderlich, 1987 from the nearby Canary Islands.

Keywords: new species, mimicry, taxonomy, Algeria, Morocco.

Introduction

Eresus spiders often dig simple vertical burrows in the soil about 10 cm deep, some species live in web tubes under rocks. The burrows are lined with silk, which continue on the surface in the form of a roof on one side anchored to the ground. Velvet spider webs are light ochre in colour and are camouflaged by detritus and prey remnants. Ants and large beetles are the most abundant prey. After hatching from the cocoon, the young live for some time in the burrow of the female, which they cannibalise (matriphagy). They live for several years. The males usually mature earlier. Therefore, males tend to be smaller and more numerous than females in the population. The mating season is species-specific, lasting only a few weeks. Velvet spiders are characterised by

remarkable sexual dimorphism. Females are dark grey to black. Adult males seek out the burrows of females during the day and are thus exposed to attack by sight-oriented predators such as birds. Therefore, they have developed a range of protective colourations: males of some species have cryptic colouration that allows them to blend in with the substrate, while other species mimic co-occurring stinging or disgusting animals (wasps, mutilid wasps, tenebrionid beetles; M. Řezáč, *pers. observ.*). This colouration does not develop in males until last moulting. Young males, like females, are mostly black. *Eresus* spiders are found mainly in deserts, semi-deserts, steppes and forest steppes. Most species live on the African continent, but they are also found in warm areas of Europe and Asia (Miller *et al.*, 2012). They are also important from a medical point of view, the neurotoxic effect of their venom on humans has been observed (Kůrka *et al.*, 2015).

Despite the attractive appearance of these spiders, knowledge of their taxonomy is very poor. This is probably due to their life in burrows and low abundance. Females are very rarely found, with males only appearing on the surface for a short time of the year. They are therefore very rare in collections. It is very rare that both males and females are collected, because of the marked sexual dimorphism it is very difficult to assign males to females. Moreover, due to their burrow life, they have very limited genetic flow, which gives rise to a number of morphologically undefined, allopatric taxa with a very small distribution range. This makes *Eresus* one of the most taxonomically difficult spider groups (Řezáč *et al.*, 2008).

The situation is particularly confusing in North Africa. Several species have been described from there, but descriptions are scarce, and type material is usually lost. In the present study, we describe as a new species a species that has hitherto been regarded as *Eresus albopictus* Simon, 1873.

Material and Methods

The bodies and prosomas were photographed with a Hirox Japan digital microscope, the copulatory organs were photographed with a Nikon Eclypse 80i. To investigate the shape of vulvae, these were dissected and cleared by glycerol. The photographs were stacked using the NISElements Imaging Software. The figure plates were made in the programme PhotoShop. The nomenclature of structures of copulatory organs is described in Řezáč *et al.* (2008).

Results

***Eresus elhennawyi* sp. n.**
(Figs. 1a-e, 2a-b, 3a-b, 4a-b, 5a-b, 6, 8a-f, 9a,c,e)
Eresus albopictus El-Hennawy, 2016: 108, f. 2-4 (♀).

Remarks

Several species of the genus *Eresus* were described from North Africa in the 19th century. However, a closer analysis of these taxa showed that none of these names are applicable to our species.

The first of these taxa was *Eresus petagnae* Audouin, 1825. The type material, which came either from Egypt or Syria, is not preserved, the description is too brief, the drawings do not provide any clue to the identity of this taxon. Eugene Simon, noting that it was a juvenile of uncertain generic identity, concluded this taxon as a *nomen dubium* (Simon, 1911). This name is still considered a *nomen dubium* today (El-Hennawy, 2004).

According to the original description, it was a similar taxon to the taxon described as *Eresus frontalis* in Walckenaer (1837). The latter has ferrugineous hairs on the cephalothorax, so it is in contradiction with the morphology of our species.

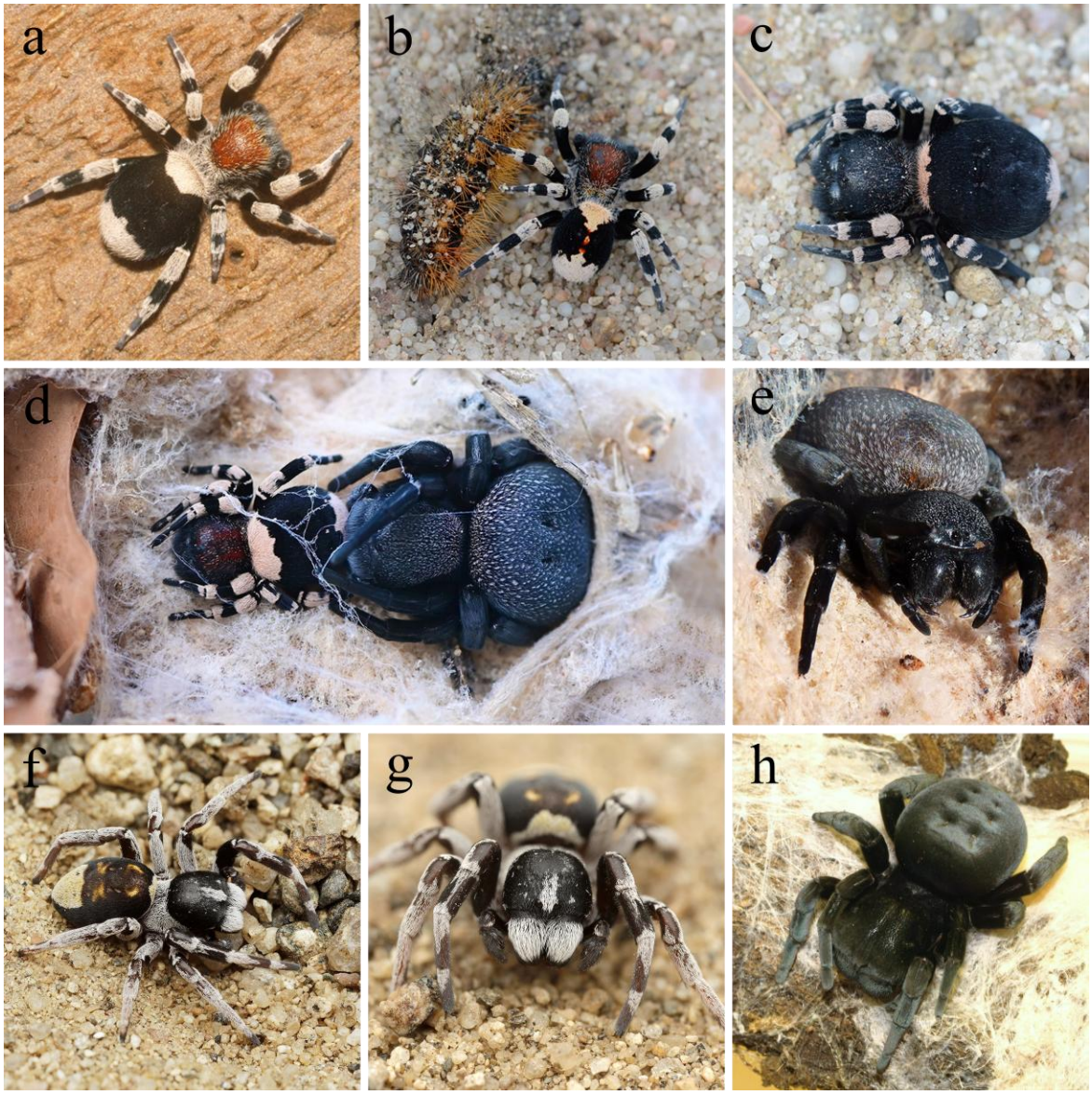

Fig. 1. a-h. habitus of *Eresus elhennawyi* sp. n. and *E. crassitibialis* Wunderlich, 1987 living specimens. a-e. *Eresus elhennawyi*. a. male (Morocco). b. male (Tafraoute, Morocco). c. male (near Algeria-Morocco border, Morocco). d. male and female in burrow (Sidi Ifni, Morocco). e. female (Mirleft, Morocco). f-h. *Eresus crassitibialis*. f-g. male (La Gomera, Canary Islands). h. female (La Gomera, Canary Islands).
Photos: (a, h) Martin Forman, (b-d) Stanislav Macík, (e) Ondřej Košulič, (f, g) Pavel Krásenský.

Another *Eresus* from North Africa is *Eresus pharaonis* Walckenaer, 1837 described from Egypt (the exact type locality is not specified). The identity of this species seems unambiguous, as the type specimen is preserved. It is, together with *Eresus walckenaeri* Brullé, 1832, the species with the largest females of the genus *Eresus*. *Eresus pharaonis* has a distinctly arched cephalic part of cephalothorax, the forehead and anterior side of the chelicerae being covered with red hairs. It also differs from our

species in the shape of the copulatory organ, the anterior margin of the epigyne being distinctly notched, the fissures being convergent, and the copulatory ducts distinctly slender (see Fig. 1 in El-Hennawy 2004).

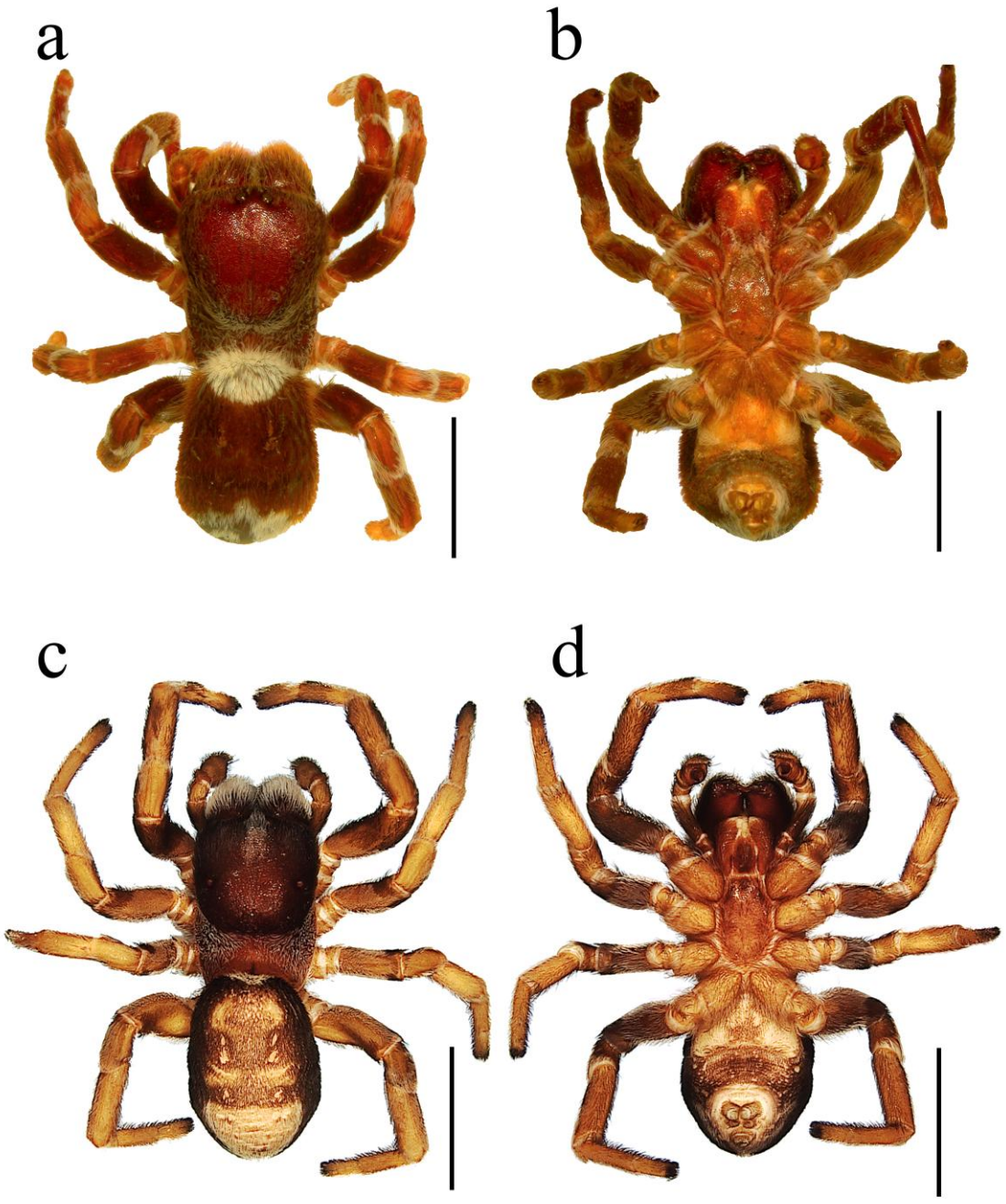

Fig. 2. a-d. Comparison of *Eresus elhennawyi* sp. n. and *E. crassitibialis* Wunderlich, 1987 male habitus from dorsal and ventral views. a-b. *Eresus elhennawyi*. c-d. *Eresus crassitibialis*. a, c. dorsal view. b, d. ventral view. (Scale bars: 3 mm).

Another African taxon is *Eresus guerinii* Lucas, 1846 described from the locality of Ténès in Algeria. It is listed as a synonym of *Eresus kollari* in the World Spider Catalog (2023), which is unjustified and certainly incorrect. According to the original description, it is a 31 mm long black female with a head and chelicerae with rusty hairs. The type specimen of this species was found in the Paris museum, although originally

mixed with other eresid specimens of Lucas. The vial designated as *E. guerinii* contained, according to Simon, *E. niger* (probably the type of *E. guerinii* itself), *E. semicanus* (probably the type of *Loureedia annulipes* (Lucas, 1857)), and *E. albopictus* (probably *Loureedia lucasi* (Simon, 1873)) (Simon 1911). It is a large female with rusty hairs on the forehead and anterior chelicerae. It also differs from our species in the shape of the copulatory organ, the anterior margin of the epigyne is notched, the fissures are more widely spaced, and the copulatory ducts are the same colour as the spermathecae.

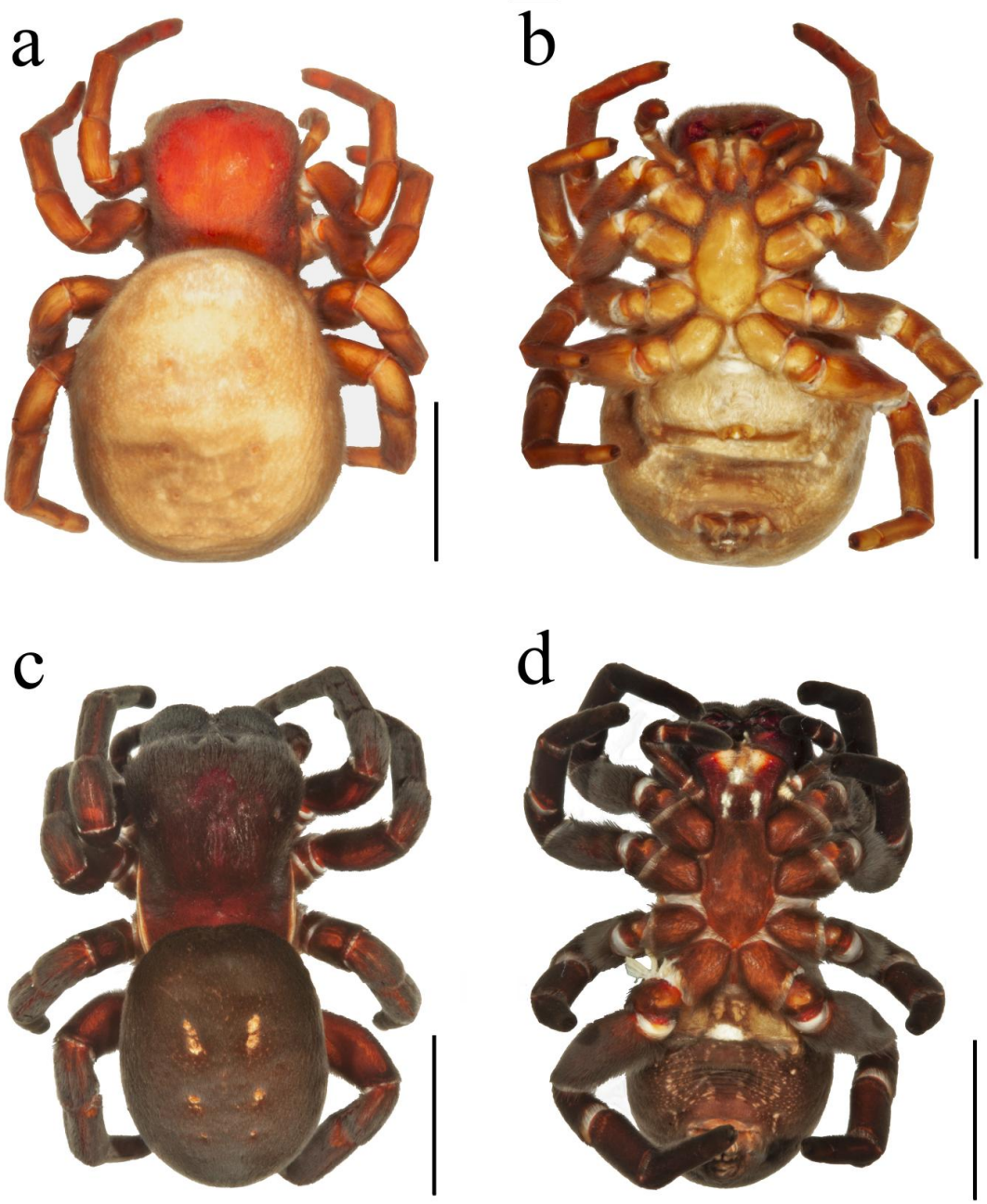

Fig. 3. a-d. Comparison of *Eresus elhennawyi* sp. n. and *E. crassitibialis* Wunderlich, 1987 female habitus from dorsal and ventral views. a-b. *Eresus elhennawyi*. c-d. *Eresus crassitibialis*. a, c. dorsal view. b, d. ventral view. (Scale bars: 10 mm).

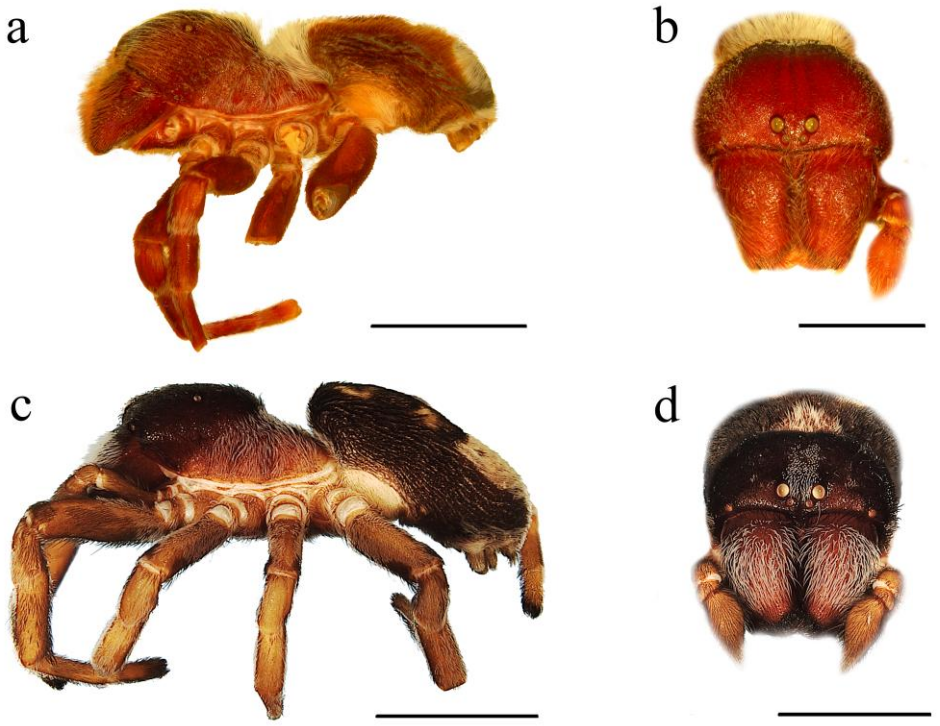

Fig. 4. a-d. Comparison of *Eresus elhennawyi* sp. n. and *E. crassitibialis* Wunderlich, 1987 male habitus from lateral and frontal views. a-b. *Eresus elhennawyi*. c-d. *Eresus crassitibialis*. a, c. lateral view. b, d. frontal view. (Scale bars: (a, c) 3 mm, (b, d) 2 mm).

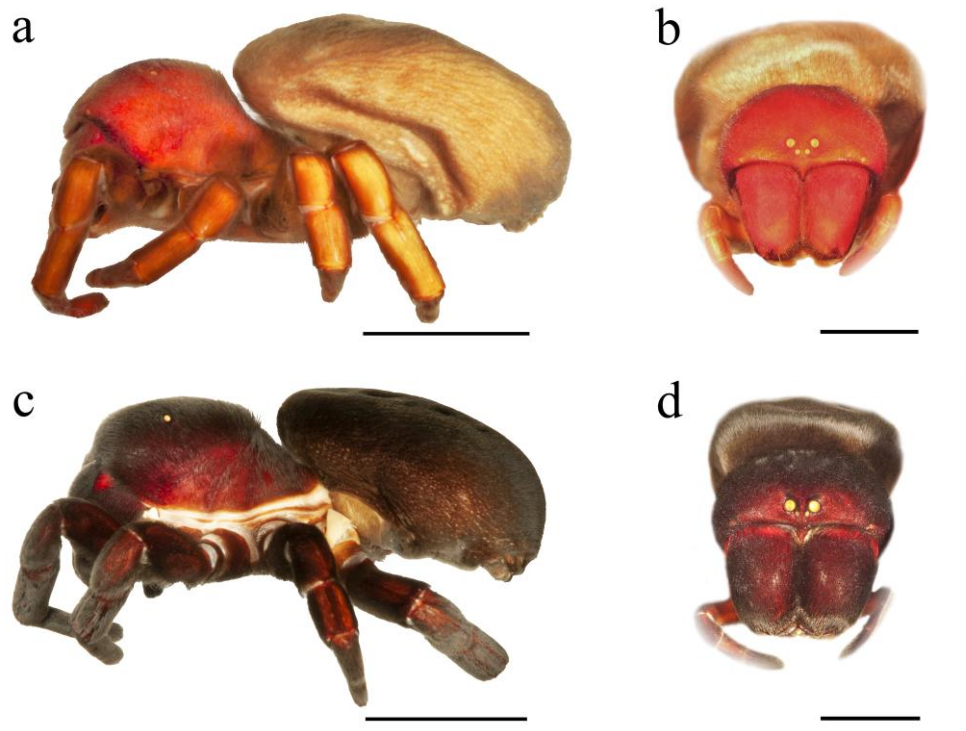

Fig. 5. (a-d) Comparison of *Eresus elhennawyi* sp. n. and *E. crassitibialis* Wunderlich, 1987 male habitus from lateral and frontal view. (a, b) *Eresus elhennawyi,* (a) lateral view, (b) frontal view, (c, d) *Eresus crassitibialis,* (c) lateral view, (d) frontal view. (Scale bars: (a, c) 3 mm, (b, d) 2 mm).

Another dubious African taxon is *Eresus albomarginatus* Lucas, 1864 described from Senegal. The description is extremely brief. We did find an individual with the label *E. albomarginatus* in the Paris museum, but it does not match the original description in sex, size or colouration. Lucas described an 11 mm long male, there was a 25 mm long female in the vial labelled *Eresus albopictus*. The description of the colouration (white margin of cephalothorax and reddish legs of the three hind pairs) leads to doubt whether this is a representative of the genus *Eresus* at all. This taxon was considered *nomen nudum* by El-Hennawy (2004), it is classified as *nomen dubium* in the World Spider Catalog (2023).

Another taxon often associated with North African fauna is *Eresus albopictus* Simon, 1873 described from Palermo, Sicily. We found the type specimen in the Paris Museum. It is a subadult female. The combination of the following characters documents that this is *Eresus walckenaeri*: pre-epigyne is immersed in the epigastric furrow (like epigyne of adult females), white spots on the abdomen (characteristic feature of *E. walckenaeri* juveniles, adults loose it), relatively long legs, and flat cephalic tubercle. Later, Simon began to doubt whether the type of *E. albopictus* really originated from Sicily and not from North Africa (Simon, 1911). And he started to use the name *E. albopictus* for female eresids from North Africa with white dots on the abdomen, in particular, for the females of *Loureedia lucasi* (Simon, 1873) (Simon, 1909; Henriques *et al.*, 2018). The material of *Loureedia lucasi* labelled as *E. albopictus* was probably being evaluated by Lehtinen when, without explanation, he suggested a transfer to the genus *Dorceus* (Lehtinen, 1967), correctly understanding that the then undescribed genus *Loureedia* did not fit into the genus *Eresus*. A further misunderstanding occurred when El-Hennawy (2002) redescribed a female from the Paris Museum erroneously labelled as *E. albopictus*. In this case, it was neither *Eresus walckenaeri* nor *Loureedia lucasi*, but a female of a species of the genus *Eresus* with the same white spots on the abdomen, which we describe in this paper as *Eresus elhennawyi* sp. n.

The last African *Eresus* is *Eresus niger latefasciatus* Simon, 1911 from the Algerian localities of Aumale, Mahadid, Ouransenis, and Talmet near Batna. A rich collection of type material of this taxon is preserved in the Paris Museum. This species is morphologically very similar to European species such as *Eresus cinnaberinus* (Olivier, 1789), *Eresus moravicus* Řezáč, 2008 or *Eresus ignicomis* Simon, 1914. Females of this taxon are not known. Based on morphological similarities with the mentioned European species and sympatric occurrence, we believe that *Eresus latefasciatus* could represent males belonging to *Eresus guerinii*.

Material

Holotype. ♂, Morocco: Taroudant, 30.4834, -8.8732, leg. Dordognin, Institut Scientifique Chérifien, coll. National Museum Prague.
Paratypes. 1♀, Morocco: Taroudant, 30.4834, -8.8732, leg. Dordognin, Institut Scientifique Chérifien, coll. National Museum Prague. 2♀♀, Morocco: Agadir, 30.4397, -9.6032, April 1939, leg. L. Berland, coll. Muséum national d'Histoire naturelle in Paris: AR5387.
Other material examined. 1♀, Algeria: Laghouat, 33.8218, 2.8879, 1932, leg. Dr Arnaud, coll. Muséum national d'Histoire naturelle in Paris: AR14377.
Comparative material examined. Eresus crassitibialis Wunderlich, 1987: Spain: Canary Islands: La Gomera, Pavón, 28.1072, -17.2702, 1♀, Dec 2008, leg. R. Sejkora; 1♀, leg. M. Řezáč; 1♂, leg. F. Šťáhlavský, coll. Crop Research Institute in Prague.

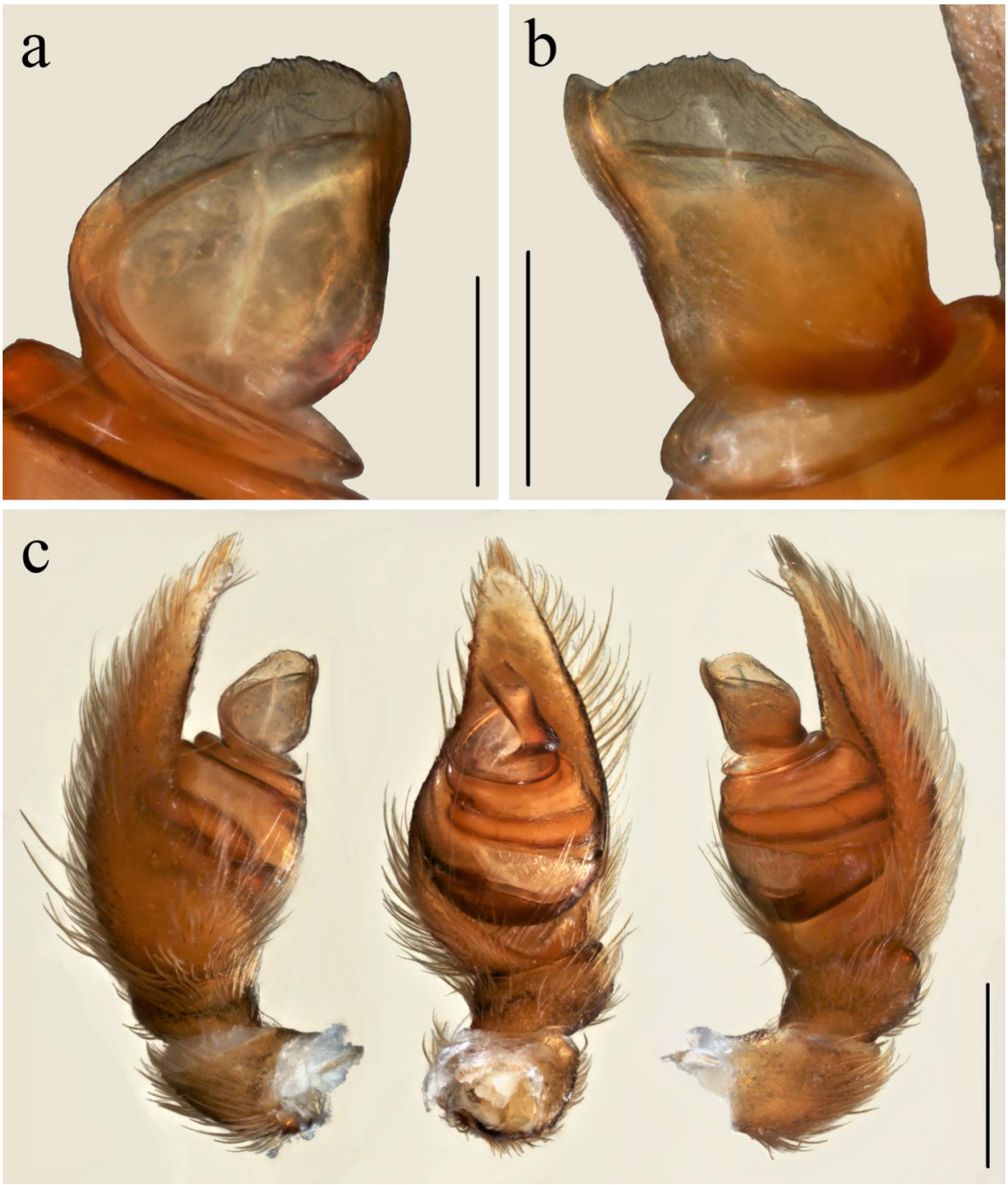

Fig. 6. a-c. Details of *Eresus elhennawyi* sp. n. holotype male pedipalp. a. prolateral view of conductor. b. retrolateral view of conductor. c. prolateral, ventral and retrolateral views (from left) of bulbus. (Scale bars: (a-b) 200 µm, (c) 750 µm).

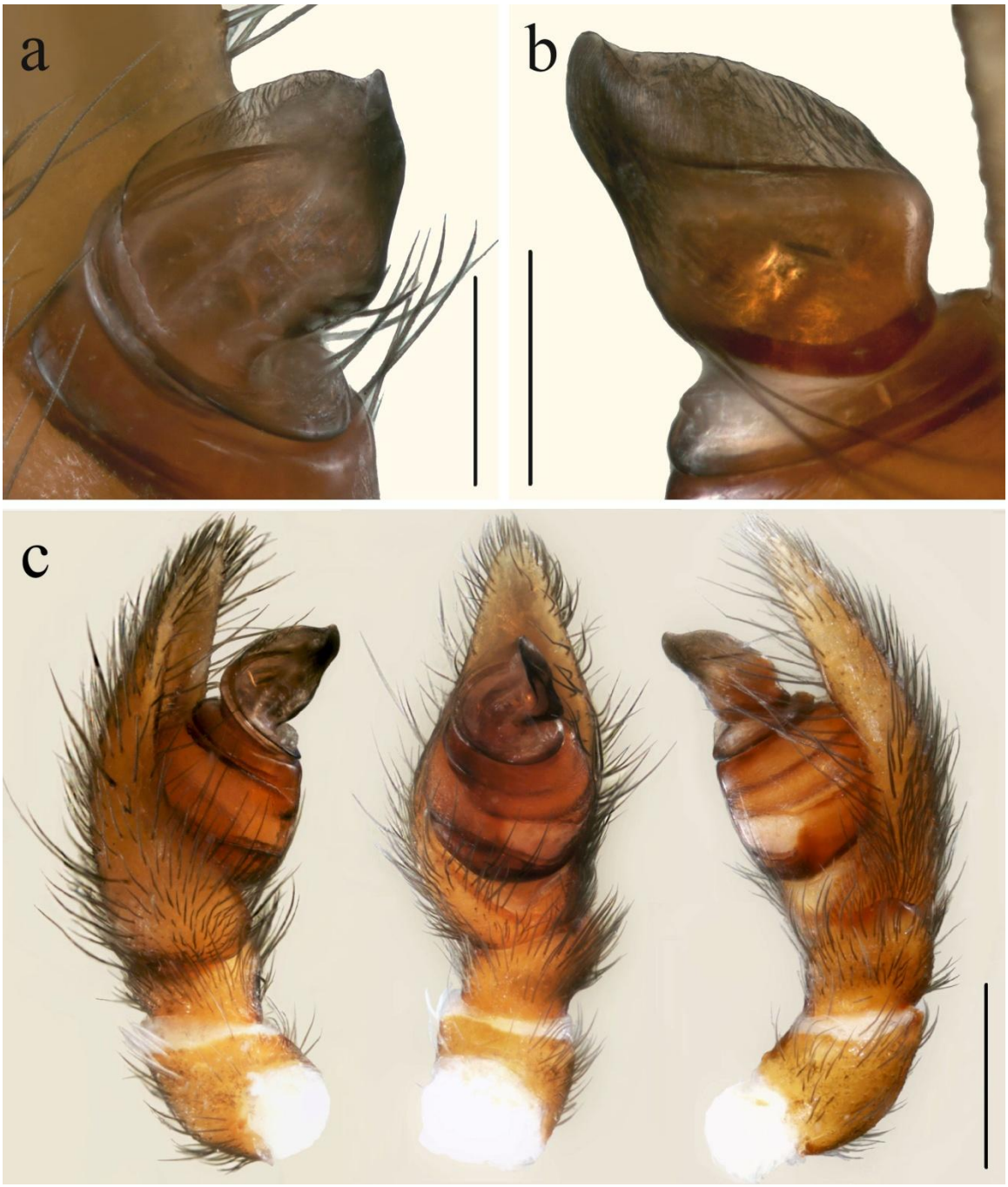

Fig. 7. a-c. Details of *Eresus crassitibialis* Wunderlich, 1987 male pedipalp. a. prolateral view of conductor. b. retrolateral view of conductor. c. prolateral, ventral and retrolateral views (from left) of bulbus. (Scale bars: (a-b) 200 µm, (c) 750 µm).

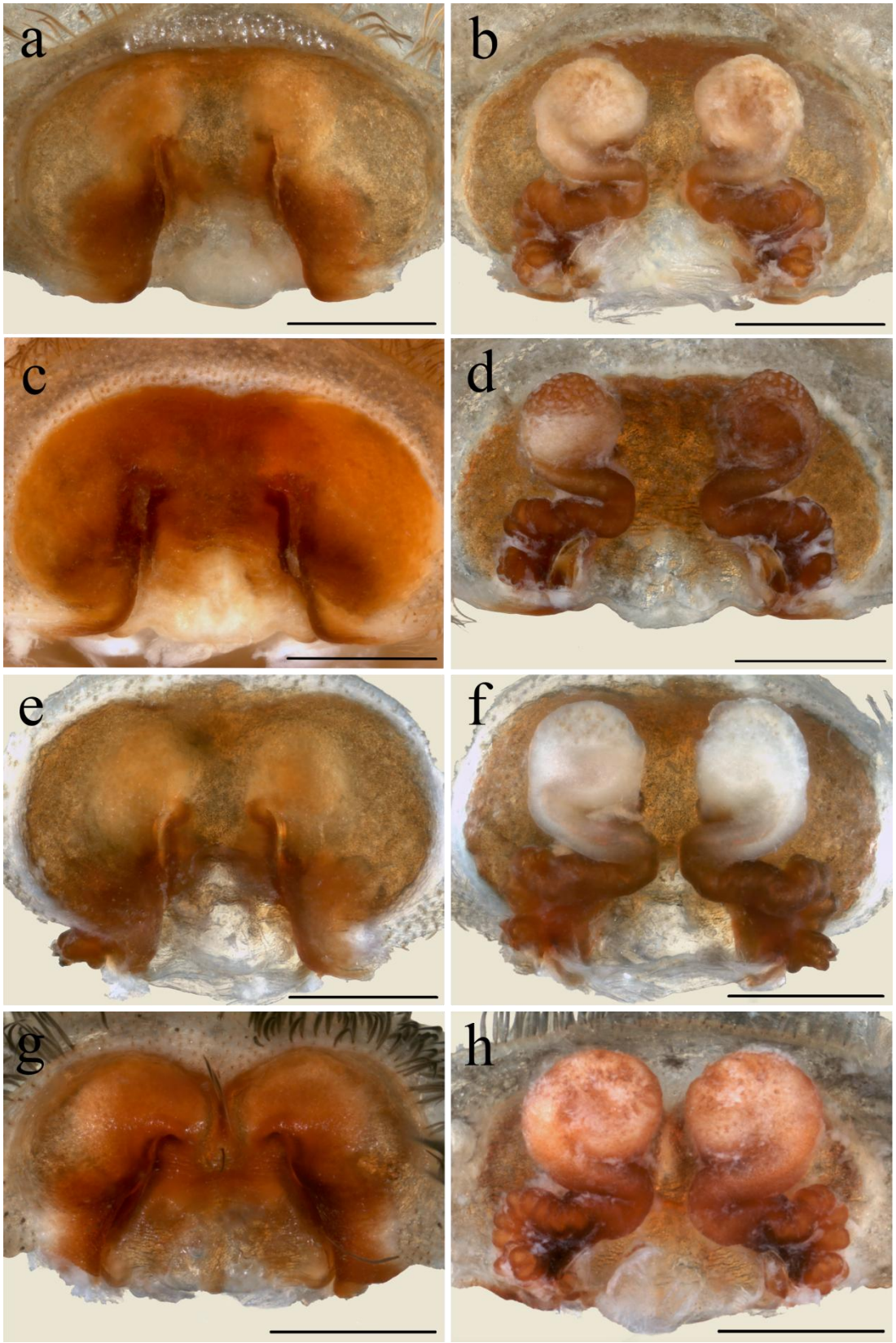

Fig. 8. a-h. Comparison of female genital structures of *Eresus elhennawyi* sp. n. and *E. crassitibialis* Wunderlich, 1987. a-f. *Eresus elhennawyi*. a-b. paratype - epigyne and vulvae (Taroudent, Morocco). c-f. epigynes (on left) and vulvae (on right) of Agadir specimens (Agadir, Morocco). g-h. *Eresus crassitibialis* (La Gomera, Canary Islands). g. epigyne. h. vulvae. (Scale bars: 300 µm).

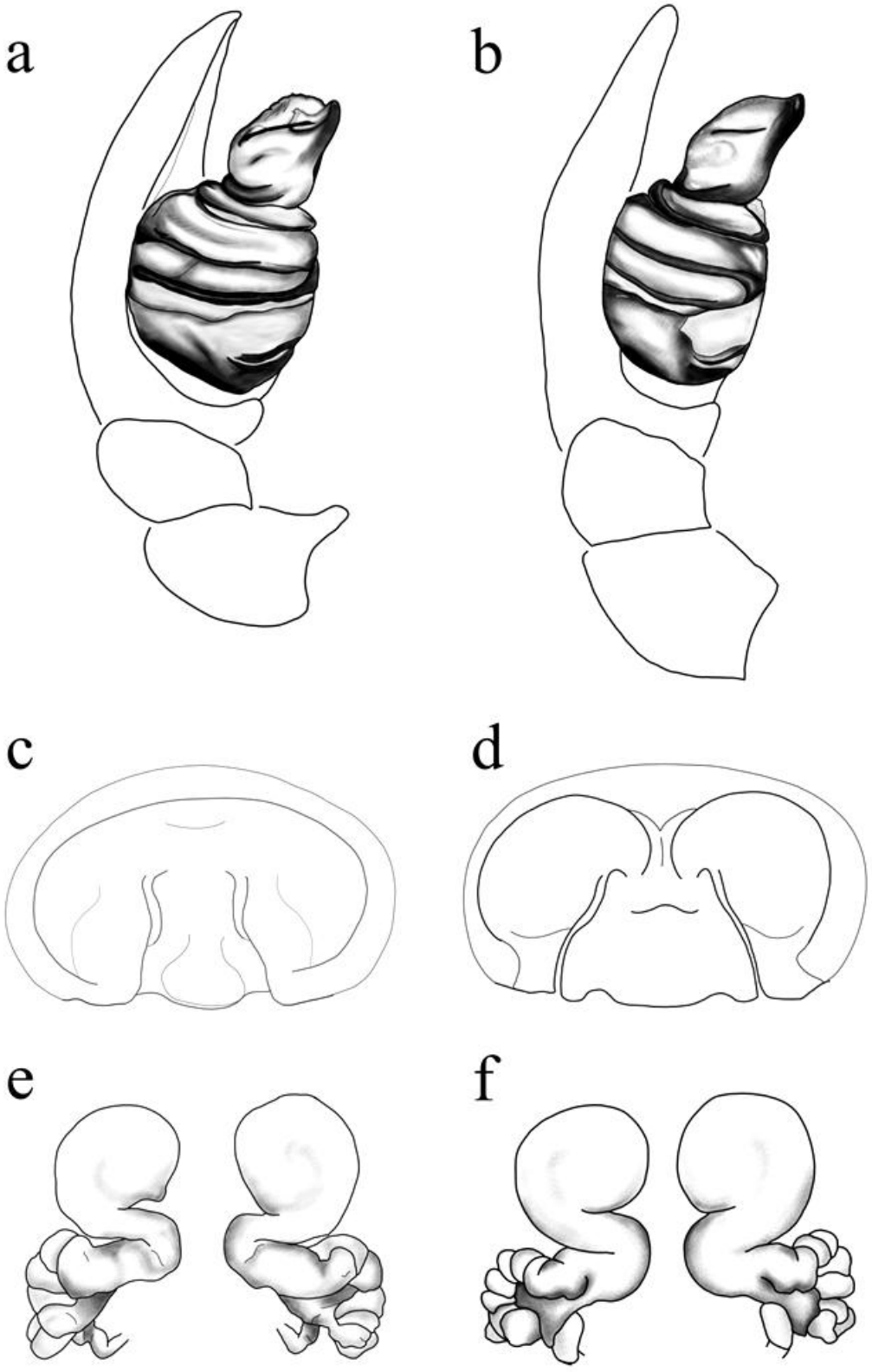

Fig. 9. a-f. Comparison of genitalia drawings of *Eresus elhennawyi* sp. n. and *E. crassitibialis* Wunderlich, 1987. a, c, e. *Eresus elhennawyi*. b, d, f. *Eresus crassitibialis*. a-b. pedipalp drawings. c-d. epigyne drawings. e-f. vulvae drawings.

Eresus guerinii Lucas, 1846: 1♀, Algeria: Ténès, Langhouat?, coll. Muséum national d'Histoire naturelle in Paris: AR5386.
Eresus pharaonis Walckenaer, 1837: 1♀ 1 juv., Egypt, coll. Muséum national d'Histoire naturelle in Paris: AR839.
Eresus niger latefasciatus Simon, 1911: 6♂♂, Algeria: Aumale, Mahadid, Ouransenis, coll. Muséum national d'Histoire naturelle in Paris: AR849
Eresus albopictus Simon, 1873: holotype, subadult ♀, Italy: Sicily, Palermo, leg. Waga, coll. Muséum national d'Histoire naturelle in Paris: AR14356, original Simon's code 716.

Etymology
Named after the Egyptian arachnologist Hisham El-Hennawy, our colleague and friend who has worked on the arachnids of North Africa for several decades.

Diagnosis
This species differs from other species of the genus *Eresus* by the shape of the copulatory organs and the colouration of the males. These features make it most similar to *Eresus crassitibialis* Wunderlich, 1987 (Figs. 1f-h, 2c-d, 3c-d, 4c-d, 5c-d, 7, 8g-h, 9b,d,f) from the Canary Island of La Gomera, near Morocco, where *E. elhennawyi* sp. n. is found. Both these species have a relatively low cephalic part of cephalothorax (Figs. 4a,c, 5a,c), the males having the dorsal side of the abdomen black, with a large light patch anteriorly and posteriorly (Figs. 1a-d,f-g, 2). The conductor is high, with a faint groove (Figs. 6, 7, 9a-b), and the copulatory ducts of the vulvae are considerably less sclerotized than the spermathecae (Figs. 8b,d,f,h).
However, there are also several differences between these two similar species. The males of *E. crassitibialis* differ from the males of *E. elhennawyi* sp. n. in having a black cephalic part of cephalothorax with a longitudinal band of grey hairs (Figs. 1f,g, 2c, in *E. elhennawyi* sp. n. it is rusty, 1a-b, 2a), chelicerae covered with grey (Figs. 1f-g, 2c, 4d, not black like in *E. elhennawyi* sp. n., 1c, 2a) hairs, especially hind legs entirely covered with grey hairs (Figs. 1f, 2c), and the dorsal side of the abdomen with ochre (Figs. 1f, 2c, not grey like in *E. elhennawyi* sp. n., 1a-d, 2a) patches. As for the male copulatory organ, the tooth on the conductor of *E. crassitibialis* is more prominent, rounded, and not separated from the rest of the lamella by a groove (Figs. 7, 9b). Females of *E. crassitibialis* differ from females of *E. elhennawyi* sp. n. by the absence of white spots (Figs. 1h, 3c). As regards the female copulatory organs, the fissures of the epigyne of *E. crassitibialis* are markedly convergent anteriorly, the fossa of the epigyne being divided by a distinct notch in the anterior part (Figs. 8g, 9d). The copulatory ducts of *E. crassitibialis* are relatively larger (Figs. 8h, 9f) than those of *E. elhennawyi* sp. n. (Figs. 8b,d,f, 9e).

Description
Male (holotype). Body length: 8.1 mm. *Prosoma* (Figs. 2a, 4a-b): 4.0 mm long, cephalic part 3.1 mm wide, 2.1 mm high. The cephalic part is ferruginous (Figs. 1a-b, 2a), is slightly prominent (Fig. 4a), slightly wider than the thoracic part (Fig. 2a). The area between PME and PLE is almost flat (Fig. 4a). The thoracic part is covered with grey hairs (Figs. 1a-b, 2a). *Sternum* (Fig. 2b): 2.2 mm long. *Chelicerae*: black (Figs. 1c, 2a). *Legs*: black with broad grey rings on patellae and joints between tibiae and metatarsi (Figs. 1a-d). Tibia of the first pair 1.3 mm long, of the fourth pair 1.2 mm long. *Opisthosoma*: dorsally black with big grey spot in front and back (Figs. 1a-d, 2a). The ventral side of the opisthosoma is black and only the branchial opercula and a ring around spinnerets have grey hairs (Fig. 2b). *Palp*: Conductor longer than wide in the lateral view;

terminal tooth small, triangular, slightly higher than lamella. The groove is shallow and triangular (Figs. 6, 9a).

a

b

Fig. 10. Habitats of *Eresus elhennawyi* sp. n. in Morocco. a. Ouassif, photo Přemysl Fabiánek. B. photo Ondřej Košulič.

Female (paratype from type locality). Body length: 19.7 mm. *Prosoma* (Figs. 3a, 5a-b): 10 mm long, cephalic part 6.9 mm wide, 4.2 mm high. Black with scattered white hairs (Figs. 1d-e). *Sternum* (Fig. 3b): 4.9 mm long. *Chelicerae*: black (Figs. 1d-e). *Legs*: Black (Figs. 1d-e). Relatively long: tibia of the first pair 3.4 mm long, of the fourth pair 3.3 mm long. *Opisthosoma*: violet-black with spots of white hairs (Figs. 1d-e). *Epigyne* (Figs.

8a,c,e, 9c): anterior part without notch and longitudinal bar, fissures almost parallel, extend only to two-thirds of the height of the epigyne. *Vulvae* (Figs. 8b,d,f, 9e): lobes of spermathecae reaching further to the sides than the copulatory ducts. Copulatory ducts constitute elliptical organs, less sclerotised than the spermathecae, in the anterior part of the vulva.

Size variation. Prosoma length of females 10–14 mm.

Ecology

This species lives under rocks in semi-desert habitats (Fig. 10), so unlike most species of the genus *Eresus*, it does not burrow. Adult males seek out females in April. Their colouration is obviously a mimicry of stinging mutilid wasps.

Distribution

It occurs only in north-western Africa, so far it is known from Morocco (Taroudant, Agadir; Guelmin – El-Hennawy, 2016; Mirleft – photo Ondřej Košulič; Ouassif – photo Přemysl Fabiánek) and Algeria (Laghouat).

Discussion

The newly described species is probably closely related to *E. crassitibialis*, an endemic of the island of La Gomera in the Canary Archipelago. These species are similar morphologically, having a relatively low cephalothorax, a high conductor with little or no groove, and males having a similar colour pattern. In addition, they are also similar in their biology; unlike other species in the genus *Eresus*, both species live under rocks and do not burrow. The greater relative leg length of females of these species is apparently related to life outside the burrows. In this, they are similar to another peculiar species of the genus *Eresus*, *Eresus walckenaeri* Brullé, 1832. This species also resembles these Northwest African species in its conductor without groove.

Thus, the species *E. crassitibialis* and *E. elhennawyi* sp. n. probably had a common ancestor in NW Africa that colonized La Gomera. Spiders of the genus *Eresus* have poor dispersal ability (Johannesen *et al.*, 1998), and colonization of La Gomera was probably achieved by rafting on tree trunks rather than ballooning through the air. The poor dispersal ability of these spiders is evidenced by the fact that only one of the Canary Islands was colonised by *Eresus*, with no dispersal within the archipelago.

The colouration of adult males is obviously a mimicry of dangerous mutilid wasps. After maturity, they emerge from their burrows and search the ground surface for females during the day. This exposes them to predation pressure from sight-oriented predators, especially birds. Mutilid wasps are known for their very painful stings. Predators therefore avoid them. This exclusion from the diet is exploited by many harmless arthropods that have learned to visually mimic these wasps.

Acknowledgments

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