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Neotype designation of Anthrenus goliath Saulcy in Mulsant & Rey, 1867 (Coleoptera, Dermestidae, Megatominae)

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Anecdotal evidence indicates that the holotype of *Anthrenus goliath* Saulcy in Mulsant & Rey, 1867 was lost along with other holotypes in Mulsant's collection through neglect and poor storage prior to transfer to Museum National d'Histoire Naturelle, Paris, in 1944. Here, a (male) neotype for *A. goliath* is designated. The only feasible confusion species, *A. corona* Holloway, 2021 is considered to ensure the neotype is definitively *A. goliath*. Images of habitus, antenna, aedeagus, and sternite IX are illustrated. A female of the species is also shown. The only known location of *A. goliath* currently known is Egypt.

Key words: Carpet beetle. *Anthrenus corona*, aedeagus, sternite IX, Anthrenini

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INTRODUCTION

The genus *Anthrenus* Geoffroy, 1767 is large containing well over 250 species distributed across 10 subspecies (Háva 2023). Over 70 of these species belong to *Anthrenus* s. str. and over one third of these 70 species constitute the Palaearctic *A. pimpinellae* Fabricius, 1775 complex. For a long time, species within this complex have been confused with each other, and only recently through the extensive use of dissection to inspect male genitalia have new species been discovered (Kadej et al. 2007, Kadej & Háva 2011, Holloway 2019, 2020, 2021) and taxonomic inaccuracies resolved (Holloway et al. 2020), all facilitating identification using habitus features (Holloway & Cañada Luna 2022). A consequence of species confusion and limited identification resources has been an inadequate understanding of distributions (Holloway et al. in press). Part of the problem has been species diagnosis without dissection in the very many published faunistic studies. An example is the distribution that was claimed for *A. goliath* Saulcy in Mulsant & Rey, 1867 (Háva 2015, Herrmann 2023) including several eastern and southern European countries and along north Africa, although this distribution has been revised to include only north Africa and parts of Asia (Háva 2023).

Kadej et al. (2007) dissected 60 specimens from the Mediterranean region believed to

be *A. goliath*, but the example of the aedeagus illustrated differed substantially from the black and white image labelled *A. goliath*. Holloway (2021) described *A. corona* Holloway, 2021, a species that exactly matched the illustration (but not the image) that Kadej et al. (2007) believed to be *A. goliath*. Háva (2023) transferred the wide distribution originally claimed for *A. goliath* (Háva 2015) to *A. corona* (excluding north Africa), essentially transferring a problem from one species to another. *Anthrenus corona* has only been definitively recorded from Turkey (Holloway 2021). To resolve the situation, the Museum National d'Histoire Naturelle, Paris, France (MNHN), was contacted to borrow the holotype to establish exactly which specimen Saulcy (Mulsant & Rey 1867) described as *A. goliath* only to find that most of Mulsant's collection was destroyed prior to WW2, including *A. goliath* (A. Mantilleri, Curator for Coleoptera, pers. comm.).

The original description of *A. goliath* by Saulcy (Mulsant & Rey 1867) is of limited value because of the confusion among species described above. However, Saulcy (Mulsant & Rey 1867) described a species that was large (presumably accounting for why he named it *A. goliath*), body length (BL) ranging from 4.5-5.5 mm, and which was found in Egypt. Saulcy (Mulsant & Rey 1867) pointed out that the species differed from all others by its large size (and the greater development of the white subbasal elytral fascia). The authors are aware of only one other species in the Mediterranean region that approaches that size, *A. corona* (Holloway 2021), the holotype of which has BL > 4.3 mm. Critically, the body width (BW)/BL value for *A. corona* exceeds 0.74 indicating that it is a broad species with rounded elytral margins. Saulcy (Mulsant & Rey 1867) only provided one value for BW, 3.3 mm suggesting BW/BL for *A. goliath* sits somewhere between 0.6 and 0.73. This is not at all accurate but implies that *A. goliath* is probably a narrow species, certainly narrower than *A. corona*. Numerous studies have measured BW/BL and found it to be a highly conserved character (e.g., Holloway & Bakaloudis 2020, Hermand & Holloway 2020) that can used sometimes to differentiate among species. A single (male) specimen was found in the Natural History Museum, London (NHML) labelled *A. goliath* determined by V. Kalik. This specimen was dissected and measured; it conformed to the original description (Mulsant & Rey 1867), published black and white image (Kadej et al. 2007), and origin of the holotype (Mulsant & Rey1867). The specimen is designated here as the neotype for *A. goliath* to conserve nomenclature stability. A second (female) specimen from NHML is also presented.

MATERIALS AND METHODS

The dry, carded specimens were macerated in a solution of 2% acetic acid for five days to allow removal from staging prior to dissection. Dissection was carried out under a Brunel BMSL zoom stereo LED microscope and involved detaching the abdomen from the rest of the insect using two entomological pins. The soft tergites were then peeled away from the harder ventrites to expose the genitalia. The aedeagus was detached from the ring sclerite, and then sternite IX was detached from the ring sclerite and the aedeagus. Habitus images, both upper and under sides, were captured at ×20 magnification using a Canon EOS 2000D camera mounted on the BMSL microscope. Aedeagus and sternite IX images were captured at ×100 magnification for measurement using a Canon EOS 1300D camera mounted on a Brunel monocular SP28 microscope. After dissection, all body parts were mounted on card. The antennae were teased out and images were taken at ×100 magnification through the SP28

microscope. All images were fed through Helicon Focus Pro version xs8.0 focus-stacking software. All measurements were made using DsCap.Ink software version 3.90. Measurements taken:

- Body length (BL): distance from anterior margin of pronotum to the apex of the elytra.
- Body width (BW): maximum distance across the elytra
- Antennal club length (AL): length of the last three antennomeres
- Antennal club width (AW): maximum width across the terminal antennomere
- Paramere length (PL): distance from the anterior end of the parameres to the apex of the parameres
- Sternite IX length (SL): distance from the tip of one anterior horn to the tip of the posterior lobe

The data for the distribution map (Shorthouse 2010) were derived from the NHML specimens and Háva (2023).

RESULTS

Neotype *Anthrenus goliath* Saulcy in Mulsant & Rey, 1867 (Figs 1, 2)
Specimen examined. male, (NHML) Cairo, Egypt (no date of collection or collector provided).
Description neotype, **external characteristics.** Habitus (Fig. 1A) large (BL = 3.9 mm) and narrow (BW/BL = 0.69). Head with a single, central, amber-coloured ocellus situated at the level of the top of the eyes. Pronotum black and elytra reddish brown. Pronotum covered in black and brown scales, the black scales located mostly on the disc, the brown scales mostly around the margins, particularly the outer pronotal angles. Head also covered in brown and black scales. Elytra covered in black, brown, white, and cream scales. The cream scales concentrated in a sub-basal, broad fascia crossing elytra from one margin to the other and reaching up to the small, dark triangular scutellum at the elytral suture. The fascia is much broader than the distance between the basal elytral margin and the anterior edge of the fascia. The cream-coloured scales of the fascia encircle a spot of black scales on each elytron just inside the elytral suture. A spot of loosely clustered sub-apical white scales on each elytron. Brown scales mostly along the elytral suture below the cream fascia, around the apices and a short way up the outer margins. Also, brown scales on the elytral disc below the cream fascia. Overall, a dull looking member of the *A. pimpinellae* complex missing the brighter orange scales possessed by most species within the complex.

Sternites (Fig. 1B) covered in off-white scales. Elongated, slim spots of black scales located along the anterior 2/3 of the outer margins of sternites II -V. Smaller, round, sub-marginal spots of black scales on sternite I. Sternite V terminates in a rectangular spot of black scales.

The 11-segmented antenna (Fig. 1C) is entirely red. The last three antennomeres form a long slim club (AL = 253 µm, AW = 167 µm)

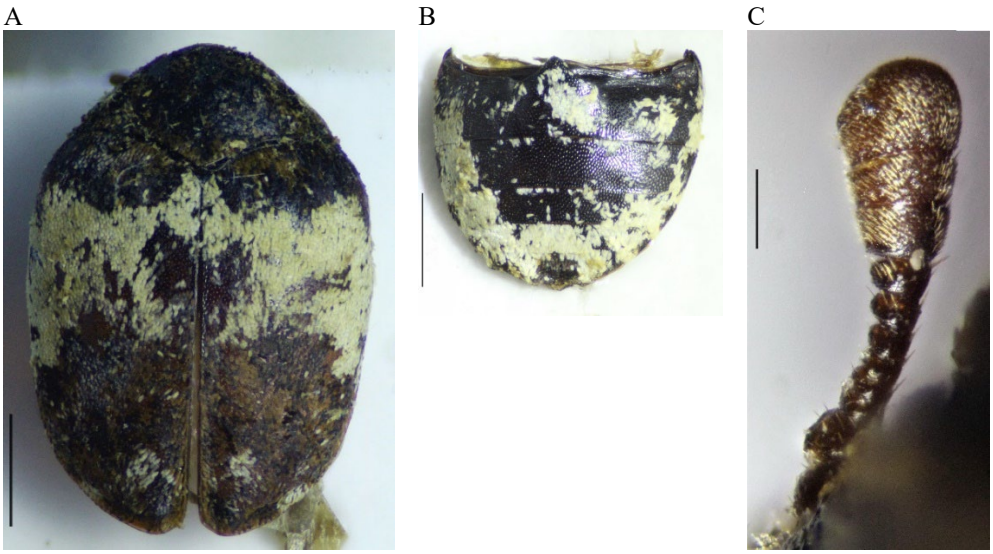

Fig. 1. Neotype (male) *Anthrenus goliath* Saulcy in Mulsant & Rey, 1867, A: habitus dorsal aspect (scale bar = 1 mm), B: sternites (scale bar = 1 mm), C: antenna (scale bar = 100 µm).

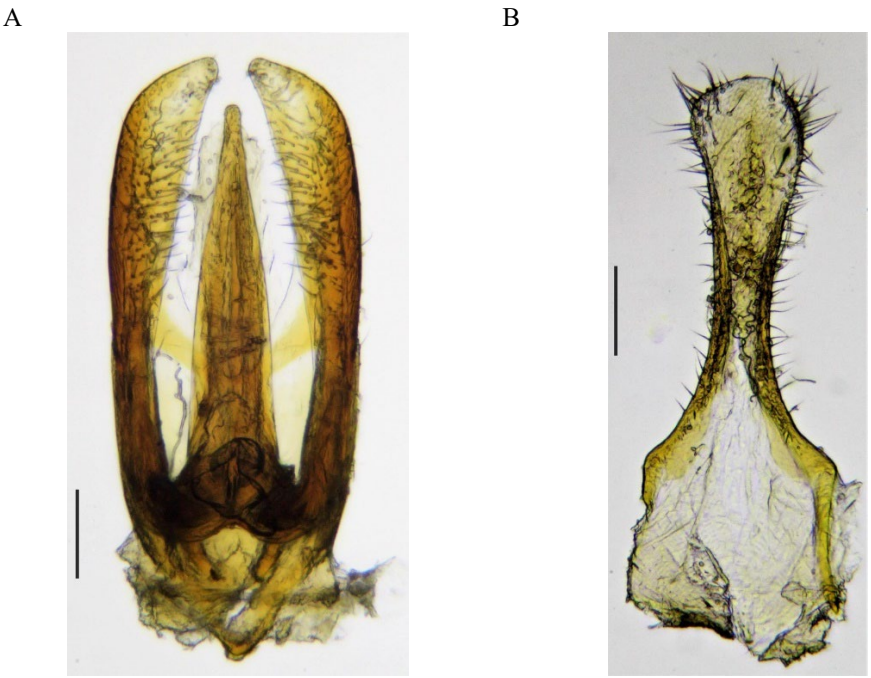

Fig. 2. Neotype (male) *Anthrenus goliath* Saulcy in Mulsant & Rey, 1867, A: aedeagus dorsal aspect (scale bar = 100 µm), B: sternite IX (scale bar = 100 µm)

Internal characteristics. The outer margins of the parameres (Fig. 2A) (PL = 546 µm) are slightly convex for most of their length before bending sharply in towards the tip. The tips are angled upwards (as displayed in Fig. 2A). The inner margins below the tips are straight and converge towards the outer margins so that the posterior half of each paramere is paddle shaped. The surface of the posterior halves of the parameres are covered in spikey, inward pointing setae. The tips of each paramere are pale suggesting they consist of thinner material than the rest of the paramere. This pale part of the paramere and the tip are virtually devoid of setae. The base of the median lobe is broad and almost parallel sided for the first 1/3-1/2 of its length. Thereafter the margins converge to a short, blunt parallel sided tip.

Sternite IX (Fig. 2B) is in poor condition. The tip of the posterior lobe is rounded, and the centre part of the tip is free from setae. The outer margins down from the tip of the posterior lobe carry many spikey setae that go down beyond the neck and progress onto the bases of the anterior horns. The setae are longest on the outer corners of the tip of the posterior lobe. The margins below the tip of the posterior lobe are folded inwards possibly exaggerating the neck. If the sternite IX was in better condition, the neck would probably not be as narrow as Fig. 2B suggests. Below the neck the margins diverge to rounded shoulders above two anterior horns. There are flaps of tissue on the inner margins above the anterior horns.

Female specimen. In addition to the holotype, an unidentified female specimen of *A. goliath* was found in NHML (Figs 3A, B, C) collected by F.C. Willcocks, labelled Gizeh, Egypt (no date). The female habitus (Fig. 3A) closely resembles the male (Fig. 1A), but the sternites (Fig. 3B) are in better condition providing a good indication of sternite patterning. The antennal club (Fig. 3C) is slender with a rounded, symmetric terminal antennomere.

Distribution. The collection point of the specimens from NHML is shown in Fig. 4. In addition, the regions claimed by Háva (2023) to hold *A. goliath* are also indicated. There is agreement between the point data and the eastern region from Háva (2023). Fig. 4 indicates that *A. goliath* is currently known only from north Africa.

DISCUSSION

Anecdotal information suggests that Mulsant's collection was neglected and stored under poor conditions prior to being transferred to MNHN, Paris, in 1944. As a result, many of Mulsant's holotypes were lost, including *A. goliath*, hence the need to nominate a neotype. It is important to make every effort to ensure that the neotype is the same species as the holotype. Saulcy (Mulsant & Rey 1967) stated that the holotype came from Egypt and that the species was large (with a narrow body profile), differentiating it from all related species. In this study, we compared the specimen from NHML nominated to be the neotype with the only other large species foundclose to the Mediterranean, *A. corona*. *Anthrenus corona* is only known from Turkey (despite Háva's (2023) claim that it is found extensively across southern Europe) and is a broad, species with a rounded profile (Holloway 2021) which does not conform with Saulcy's description. The neotype conforms with Saulcy's description and the point of origin of the holotype. Furthermore, it fits with an image claimed to be *A. goliath* in Kadej et al. (2007). We are confident that the neotypeis the same species as the holotype originally described by Saulcy (Mulsant and Rey 1867).

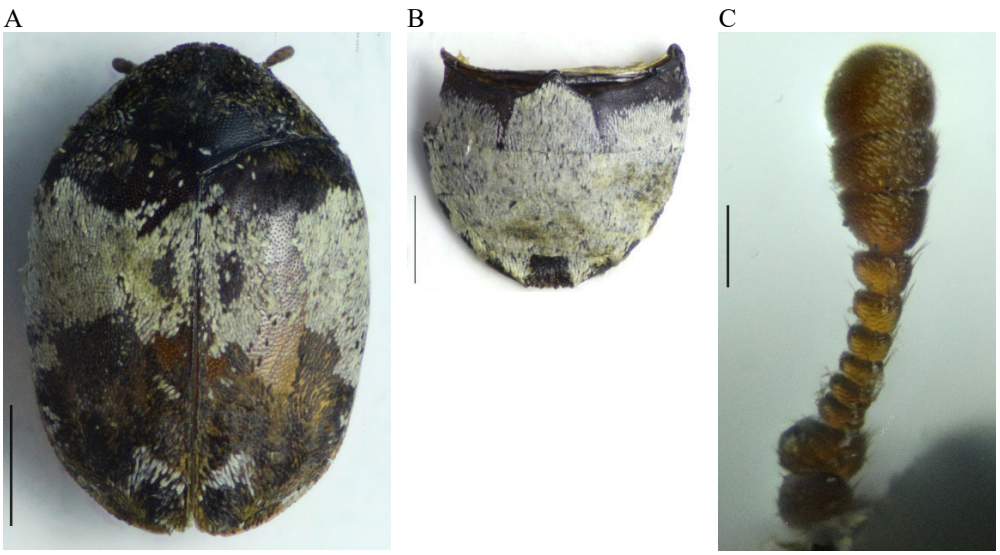

Fig. 3. Female *Anthrenus goliath* Saulcy in Mulsant & Rey, 1867, A: habitus dorsal aspect (scale bar = 1 mm), B: sternites (scale bar = 1 mm), C: antenna (scale bar = 100 µm)

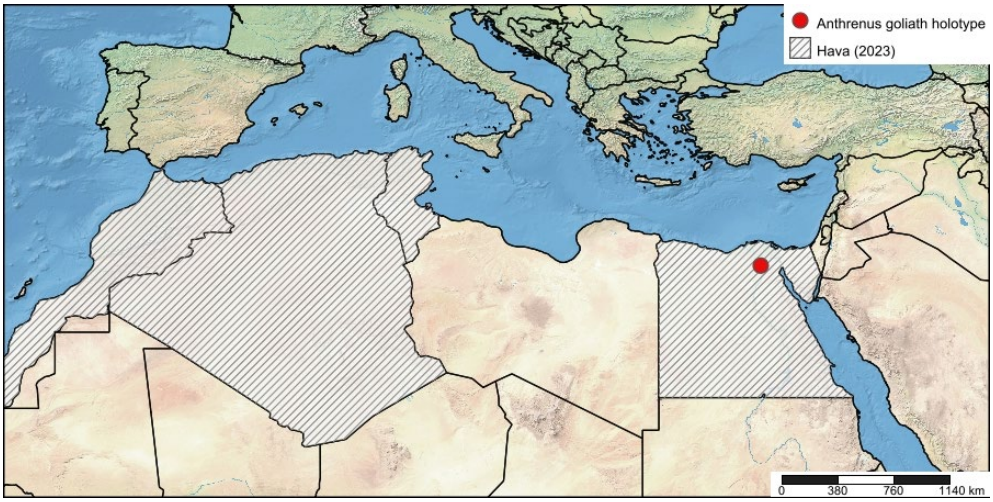

Fig. 4. Known distribution of *Anthrenus goliath* Saulcy in Mulsant & Rey, 1867. Red dot: neotype, hatched areas: countries claimed to hold *A. goliath* in the World Catalogue (Háva 2023)

In addition to the neotype, a single female was also found in NHML. Externally, the male and female are very similar with the possible exception of the antennal club. The antennal clubs of both sexes are very slim, but the male antenna (Fig. 1C) is asymmetric, and the female antenna (Fig. 3C) is almost symmetrical. This might reflect phenotypic variation in antennal club structure, but it could also indicate sexual differentiation. This warrants further investigation as more specimens of *A. goliath* become available.

Háva (2015) states that *A. goliath* has a wide distribution from eastern Europe and across southern Europe, into north Africa. This error has only recently been rectified in the online version of the World Catalogue (Háva 2023). It is not clear how Háva (2023) concluded that *A. goliath* is distributed across north Africa as there are no substantiated records to work with. Nevertheless, the point data in Fig. 4 agrees with part of Háva's (2023) distribution. As is the case with many faunistic studies on *Anthrenus*, claims made without associated dissection should be considered with caution. Only one recent study has linked habitus colour pattern with aedeagal structure in (western European) *A. pimpinellae* complex species (Holloway & Cañada Luna 2022), although this study did not include *A. goliath*.

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REFERENCES

Háva J. 2015. World Catalogue of Insects. Volume 13. Dermestidae (Coleoptera). Leiden/Boston: Brill, xxvi + 419 pp.

Háva J. 2023. Dermestidae World (Coleoptera). *World Dermestidae | Dermestidae world (Coleoptera) (wz.cz)* [Accessed 31 July 2023].

Hermand M-E.C., Holloway G.J. 2020. Profile of a species: *Attagenus rufiventris* Pic (Coleoptera: Dermestidae). *Israel J. of Entomol. 50: 93-102. http://doi.org/10.5281/zenodo.4322567*

Herrmann A. 2023. Dermestidae (Coleoptera) of the World. *Dermestidae (Coleoptera) - Homepage of Andreas Herrmann. [Accessed 27 July 2023]*

Holloway G.J. 2019. *Anthrenus* (s. str.) *amandae* (Coleoptera: Dermestidae): a new species from Mallorca, Spain. *Zootaxa.4543(4): 595-599. http://doi.org/10.11646/zootaxa.4543.4.9*

Holloway G.J. 2020. *Anthrenus* (s. str.) *chikatunovi* (Coleoptera: Dermestidae): A new species from southern France. *Israel J. Entomol.50: 69-75.*

Holloway G.J. 2021. *Anthrenus* (s. str.) *corona* (Coleoptera, Dermestidae, Anthrenini): a new species in the *A. pimpinellae* Fabricius, 1775 complex from Turkey. *Zootaxa. 4991 (3): 555-560. https://doi.org/10.11646/zootaxa.4991.3.7*

Holloway G.J., Bakaloudis D.E. 2020. A comparative morphological study of *Anthrenus pimpinellae pimpinellae* and *Anthrenus amandae* (Coleoptera: Dermestidae). Coleopt. Bull. 74 (2): 315-321. https://doi.org/10.1649/0010-065X-74.2.315

Holloway G.J., Bakaloudis D.E., Barclay M.V.L., Cañada Luna I., Foster C.W., Kadej M. & Paxton R.J. 2020. Revision of taxonomic status of *Anthrenus pimpinellae isabellinus* (Coleoptera: Dermestidae). *Eur. J. Entomol. 117: 481-489. https://doi.org/10.14411/eje. 2020.051*

Holloway G.J., Cañada Luna I. 2022 A morphometric analysis of *Anthrenus munroi* Hinton, 1943, and a key for citizen scientists to the Western European species in the *Anthrenus pimpinellae* complex (Coleoptera: Dermestidae). *Ent. Mon. Mag. 158 (2): 289-298.*

Holloway G.J., Maclure C.J., Foster C.W. (in press) Palaearctic distributions of *Anthrenus pimpinellae* (Fabricius, 1775) and *Anthrenus isabellinus* Küster, 1848. *Ent. Mon. Mag.*

Kadej M., Háva J., Kalík V. 2007. Review of the *Anthrenus pimpinellae* species group from Palaearctic region (Coleoptera: Dermestidae: Anthrenini). *Genus.18 (4): 721-50.*

Kadej M., Háva J. 2011. Three new species of *Anthrenus pimpinellae* species group from Palaearctic Region (Coleoptera: Dermestidae: Megatominae: Anthrenini). *Studies and Reports, Taxonomical Series.7: 241-248.*

Mulsant E., Rey C. 1867. Histoire Naturelle des Coléopteres de France. Tribu des Scuticolles. Paris: F. Savy, (1867) [reprint from *Annales de la Société Linnéenne de Lyon (N. S.) 15: 1-188, 3 pls.*].

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