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A journal of world insect systematics

INSECTA MUNDI

1092

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Date of issue: December 20, 2024

Center for Systematic Entomology, Inc., Gainesville, FL

Holloway GJ, Herrmann A. 2024. New synonym of *Attagenus tigrinus* (Fabricius, 1792) (Coleoptera: Dermestidae: Attageninae). Insecta Mundi 1092: 1–7.

Published on December 20, 2024 by
Center for Systematic Entomology, Inc.
P.O. Box 141874
Gainesville, FL 32614-1874 USA
http://centerforsystematicentomology.org/

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Electronic copies (online ISSN 1942-1354) in PDF format

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Abstract. The *Attagenus bifasciatus* species complex (Coleoptera: Dermestidae: Attageninae) surrounds the Mediterranean and extends into Asia. Several species are recognised but all of them are very similar to each other, and brief, old descriptions do not help to distinguish among them. Here the holotype *A. tigrinus* (Fabricius) and a syntype series of *A. bifasciatus rossii* Ganglbauer (subsequently raised to *A. rossii*) all collected from Italy were dissected to facilitate genital examination. From this genitalic study, *Attagenus rossii* is placed as a **new synonym** of *A. tigrinus*.

Key words. *Attagenus bifasciatus*, *Attagenus rossii*, *Attagenus tigrinus,* aedeagus, median lobe, sternite IX, bursa copulatrix, sclerites, dissection.

ZooBank registration. urn:lsid:zoobank.org:pub:2A2AE7B0-AEC4-4626-A3CA-D13129EAB99E

Introduction

The Dermestidae currently number in excess of 1900 species (Háva 2024) but the rate at which new species are being found suggests that many more remain undescribed (Háva 2024). Species complexes (Harbach 2012; Adams et al. 2014) offer rich sources of species discovery, for example the Palaearctic *Anthrenus pimpinellae* (Fabricius, 1775) complex (see Holloway et al. 2023; Holloway 2024; Holloway and Herrmann 2024, and references therein). Of course, the reason why so many new discoveries are made is that species within complexes are difficult to differentiate from each other. Another complex containing several very similar species is the *Attagenus bifasciatus* Olivier, 1790 complex from the Mediterranean and Middle East. At least six species have been claimed to belong to this complex: *A. bifasciatus*, *A. chakouri* Pic, 1907, *A. pulcher* Faldermann, 1835, *A. rossii* Ganglbauer, 1904, *A. simonis* Reitter, 1881, and *A. tigrinus* (Fabricius, 1792). The descriptions of most of these are short and inadequate, failing to focus on features that genuinely differentiate species (although see Háva et al. 2007; Zhantiev 2009). There is a need for some of these species to be described in more detail to facilitate our understanding of this difficult complex of species.

The purpose of the current study was to begin this process by redescribing two of the species listed above: *A. tigrinus* and *A. rossii*. Fabricius' (1792: 229) short description of *A. tigrinus* is as follows (translated from Latin):

'An oblong tomentose thorax dotted with black, elytra grey: with four brown spots, found in Italy (Schlanbusch). Black body. Thorax grey tomentose with several black dots. Elytra tomentose, dark grey with four large brown spots, the first at the bases with 2nd and 3rd opposite each other in the middle, 4th at the tip itself.'

Ganglbauer (1904: 26) goes a little further when describing *Attagenus bifasciatus* (translated from German):

'Oblong, usually narrower and more elongate in the male sex than in the female, black, the antennae with reddish-yellow flagellum, the legs brown with reddish tarsi or quite brown-red. The head and pronotum are yellowish-grey or whitish-grey and more or less black-spotted hairy, the elytra with black or brownish-black ground hairs and on a reddish-yellow or red ground with two jagged, yellowish-grey hairy transverse bands covering the ground coloration and often also with an equally hairy spot at the tip or with one at the base next to the shield, the underside

grey hairy. In the typical form on the wing coverts only two jagged, yellowish-grey hairy transverse bands, of which the anterior is jagged towards the shoulder bump and towards the shield to the front and about backwards in the inner third, while the posterior transverse band is usually interrupted by the suture. In var. simoni there is also a spot at the tip of the wing coverts, in var. rossii (bifasciatus Rossi) besides this spot also a yellowish-grey hairy basal spot next to the shield. With the ♂, the feeler club is almost twice as long as the previous one. The first two members are triangular with edged tip and protruding inner apical corner, the terminal limb as long as both taken together, bulged out on the inside. Long. 3.3-4.5 mm. Mediterranean Sea area. '

Neither Fabricius (1792) nor Ganglbauer (1904) produced any illustrations to aid identification.

Many modern studies on Dermestidae have demonstrated the absolute necessity of dissection to expose the genitalia to be certain of the species under study (e.g., Holloway et al. 2020; Ślipiński et al. 2023; Holloway and Herrmann 2024). During the 18th to early 20th century, dissection was rarely deployed. Having dissected out the genitalia of *A. tigrinus* and *A. rossii* in the current study, it was evident that the type specimens of the two species were identical, *A. rossii* is a junior synonym of *A. tigrinus*.

Materials and Methods

The holotype of *A. tigrinus* was obtained for study from the Zoological Museum of Kiel University, Kiel, Germany (ZMUC) and all four *A. rossii* syntypes were obtained from Humboldt-Universität [Zoologisches Museum], Museum für Naturkunde, Berlin, Germany (ZMUB). Other museums housing materials cited are: Muséum National d´Histoire Naturelle, Paris, France (MNHN); Museo di Zoologia dell Universita, Catania, Italy (MZUC); and Naturhistorisches Museum, Wien, Austria (NHMW).

One syntype of *A. rossii* was very fragile and excluded from the examination. All other 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. For the single *A. rossii* male, the aedeagus and sternite IX were extracted and the aedeagus placed into a 5% KOH solution for cleaning prior to inspection and imaging. All the rest were females which were similarly dissected to inspect the sclerites within the bursa copulatrices. Habitus images were captured at ×20 magnification using a Canon EOS 2000D camera mounted on the BMSL microscope. Images of aedeagi, male sternite IX, bursal sclerites were captured at ×100 magnification using a Canon EOS 1300D camera mounted on a Brunel monocular SP28 microscope. After dissection, for each specimen all body parts were mounted on a 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 8.2.2 focus-stacking software. 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
- Median lobe length (ML): from posterior tip to tip of one anterior stirrup.
- Sternite IX length (SL): distance from the tip of one anterior horn to the tip of the posterior lobe.

Scale bars were added using ImageJ 1.53M (Schneider et al. 2012).

Taxonomy

Genus *Attagenus* Latreille, 1802

Attagenus tigrinus (Fabricius, 1792) (type locality Italy, leg Schlanbusch, deposited in ZMUC, type label Fig. 1)

Synonyms

- *Dermestes tigrinus* Fabricius, 1792 [ZMUC]
- *Dermestes bifasciatus* Rossi, 1794 [ZMUB]
- *Attagenus poecilus* Germar, 1839 [ZMUB]
- *Attagenus bifasciatus* var. *decoloratus* Mulsant and Rey, 1868 [MNHN]
- *Megatoma tigrina* Reitter, 1887
- *Megatoma bifasciata* Reitter, 1887
- *Attagenus maltensis* Pic, 1894 [MNHN]
- *Attagenus rossii* Ganglbauer, 1904, **syn. nov.**, type locality Italy [NHMW].
- *Attagenus bifasciatus* ab. *hybridus* Ragusa, 1926 [MZUC]

Redescription, external characteristics (Fig. 2). Habitus holotype female (BL = 3.56 mm, BW = 2.00 mm, Fig. 2A). Integument head and pronotum dark brown, covered in yellow and brown setae. Brown setae concentrated on pronotal disc. Elytral integument mid to reddish brown, covered in yellow and brown setae. Dense yellow setae concentrated in two fasciae, one pre-medial, the other pre-apical. Extension of yellow setae on posterior margin of pre-medial fascia extends down towards pre-apical fascia, and extension of yellow setae on pre-apical fascia reaches up towards pre-medial fascia. The extensions do not quite meet. Spot of yellow setae on midpoint of basal margin of each elytron. Small spot of yellow setae on elytral apices. Rest of elytra covered in sparse brown setae through which brown integument can be seen easily.

Antenna with 11 antennomeres (Fig. 2B) with club consisting of three large, brown, loosely connected, hirsute antennomeres. Terminal antennomere narrows from a rounded base to a rounded tip and is marginally longer than the 9th and 10th antennomeres combined. Ninth and 10th antennomeres broader than long, 9th antennomere longer than 10th. First antennomere rounded, brown, all other antennomeres pale yellow. Second antennomere rounded, 3rd–5th antennomeres elongate, 6th to 8th antennomeres transverse.

Figure 1. *Attagenus tigrinus* holotype, labels.

Figure 2. *Attagenus tigrinus* holotype,female. **A)** Habitus, dorsal aspect (scale bar = 1 mm). **B)** Antenna (scale bar = 100 μm). **C)** Sclerite in bursa copulatrix (scale bar = 100 μm).

Description, internal characteristics (Fig. 2). Bursa copulatrix with two large, pale brown, paddle-shaped sclerites on inner ventral surface (one shown in Fig. 2C [NB fracture where stem joins paddle]). Paddles posterior to stem and wider than long. Stem, anterior margin of paddle, and tip of paddle with distinct spines. Posterior margin of paddle evenly rounded. Paddle longer than stem.

Attagenus rossii Ganglbauer, 1904, **new synonym** (type locality Italy, leg Johann Friedrich Schüppel, deposited in ZMUB, type label Fig. 3). Syntype series, three females, one male.

Material examined, two females (Fig. 4) and one male (Fig. 5). Female (Fig. 4A) BL = 3.27 mm, BW = 1.91 mm, Female (Fig. 4D) BL = 4.01 mm, BW = 2.15 mm, male (Fig. 5A) BL = 3.7 mm, BW = 1.72 mm). The above

Figure 3. *Attagenus rossii* syntype, labels.

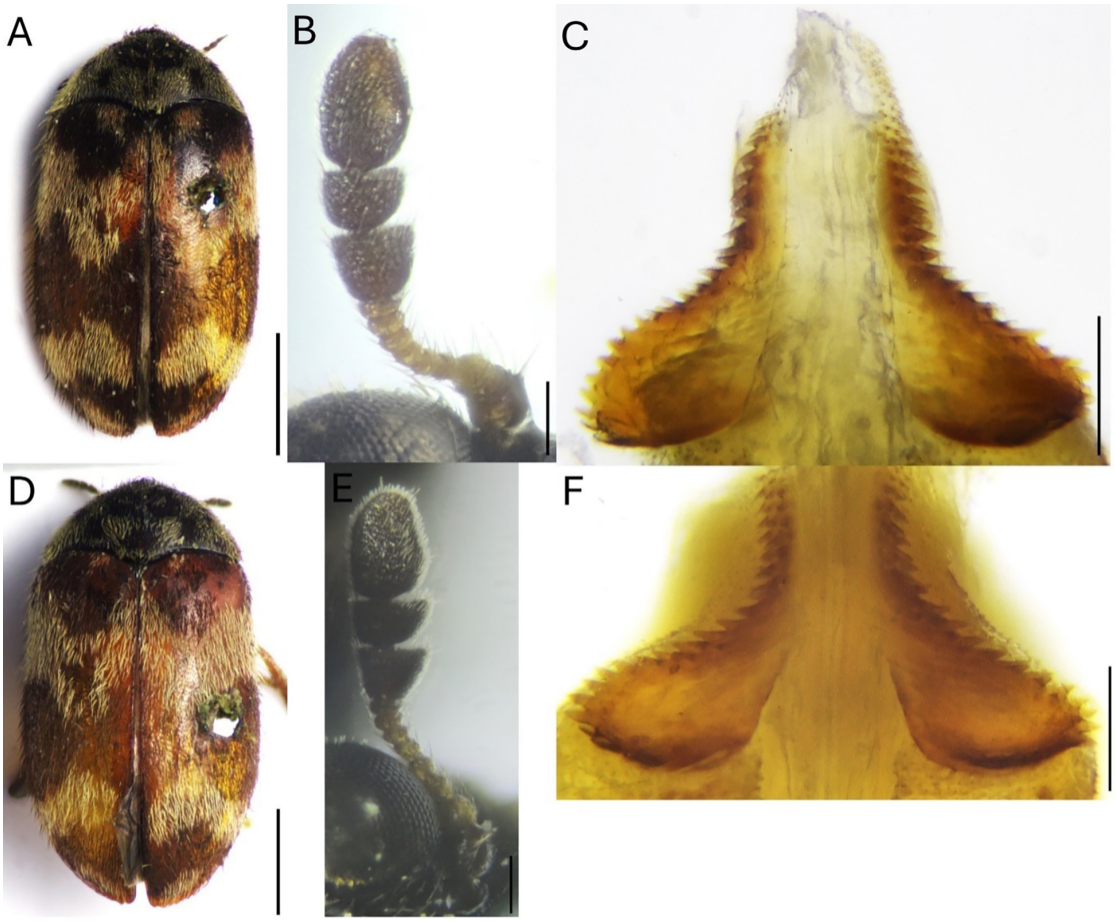

Figure 4. *Attagenus rossii* syntypes, female. **A, D)** Habitus, dorsal aspect (scale bars = 1 mm). **B, E)** Antenna (scale bars = 100 µm). **C, F)** Sclerites in bursa copulatrix (scale bars = 100 µm).

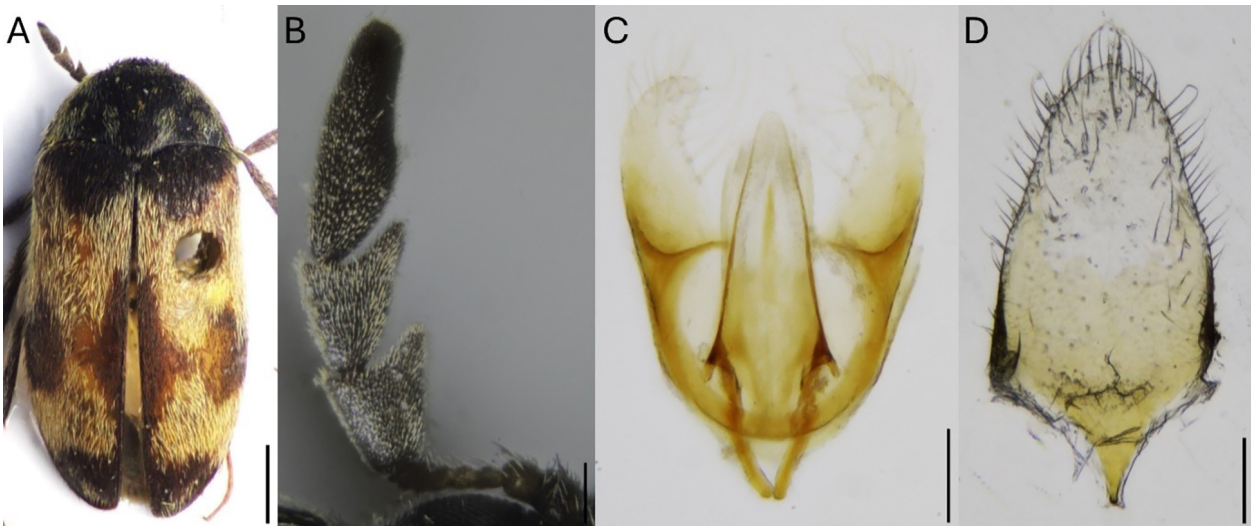

Figure 5. *Attagenus rossii* syntype, male. **A)** Habitus dorsal aspect (scale bar = 1 mm). **B)** Antenna (scale bar = 100 µm). **C)** Aedeagus (scale bar = 100 µm). **D)** Sternite IX (scale bar = 100 µm).

redescription provided for *A. tigrinus* (Fig. 2A) fits the specimens shown in Fig. 4A and Fig. 4D well. Across all three females (*A. tigrinus* and *A. rossii* x 2) there is very little variation in extent of yellow setae on elytra and pronota, and all three have spots of yellow setae on the elytral bases and apices. The antennae in Fig. 4B and 4E are identical to *A. tigrinus* (Fig. 2B) in terms of color and shape.

The sclerites in the bursa copulatrices (Fig. 4C and 4F) are like *A. tigrinus* (Fig. 2C) having broad rounded paddles with rounded posterior margins and distinct spines.

The male specimen (Fig. 5A) has broader elytral fasciae consisting of yellow setae with only a faint spot of yellow setae at the elytral apices, and no trace of a yellow spot at the elytral bases. The pattern of yellow setae across the pronotum is like the females (Fig. 2A, 4A, 4D). The antenna with 11 antennomeres (Fig. 5B) has a club consisting of three elongated, angular antennomeres that is much longer than the female antennal clubs.

The aedeagus (Fig. 5C) consists of a hard, broad-based median lobe with almost straight margins that converge to a narrow, rounded tip. Attached to the ventral surface of the median lobe is a large, broad pad of soft material (visible in Fig. 5C). The tip of the median lobe extends beyond this pad. The parameres are soft, especially the pale, hirsute apices.

Sternite IX (Fig. 5D) attached to the aedeagus by a single narrow point. Margins diverge rapidly from the attachment point to form a broad base. From the widest point, the margins are sinuate and converge to a rounded (slightly pointed) posterior apex. Margins from about halfway up carry many long setae, which are slightly longer and denser around the apex.

Discussion

It has been suspected for a long time that *A. bifasciatus* is a complex of species with overlapping distributions around the Mediterranean and into Asia (Ganglbauer 1904; Háva 2024). It is likely that many of these species are very similar, at least externally, rendering the brief, early descriptions entirely inadequate. As far as we know, the current study is the first to compare *A. bifasciatus* type specimens using genital dissection as a technique. This study has highlighted two things: two supposed species within the *A. bifasciatus* complex are synonymous, and the absolute necessity to dissect in all future studies of *A. bifasciatus* to be certain of the species in question. Two other studies have dissected *A. bifasciatus* specimens, Háva et al. (2007) raised a neotype specimen for nominate *A. bifasciatus* (although the images and illustrations are not clear), and Zhantiev (2009) dissected and illustrated *A. pulcher*. The many faunistic studies reporting on the whereabouts of the various *A. bifasciatus* species in the absence of dissection cannot be considered reliable. Consequently, we know very little about the distributions of the various *A. bifasciatus* complex species, except that *A. tigrinus* occurs in Italy.

Acknowledgments

We are very grateful to Professor Michael Kuhlmann (Zoological Museum of Kiel University, Germany) and Bernd Jaeger (Museum für Naturkunde, Berlin, Germany) for sending us the type specimens of *Attagenus tigrinus* and *Attagenus rossii*, respectively, for study.

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Received September 3, 2024; accepted October 9, 2024.
Review editor Michael L. Ferro.