

New synonym of *Anthrenus flavidulus* Reitter (Coleoptera: Dermestidae: Megatominae) from Iran

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ABSTRACT

The species *Anthrenus flavidulus* Reitter, 1889 is redescribed and *A. farsicus* Kadej & Háva, 2011, is synonymised under the former, based on a thorough comparison of the colour patterns and structures of the antennae, aedeagi and sternites IX of the two species. Thus, the number of valid species belonging to the Palaearctic *Anthrenus pimpinellae* complex has been reduced to 26.

KEYWORDS: Carpet beetles, skin beetles, Dermestidae, *Anthrenus pimpinellae* complex, new synonymy, taxonomy, Middle East, Palaearctic.

INTRODUCTION

The Palaearctic *Anthrenus pimpinellae* (Fabricius, 1775) complex contains many species that differ externally in only minor details (Holloway & Cañada Luna 2022). To differentiate these species, it is necessary to resort to dissection and inspection of the male genitalia and associated structures such as sternite IX (Kadej *et al.* 2007). We have been working for several years to clarify the taxonomy of the complex resulting in the discovery of several new species (Holloway 2019, 2020, 2021, 2024; Holloway & Herrmann 2024; Holloway *et al.* 2024), as well as in the resolution of taxonomic inaccuracies (Holloway & Bakaloudis 2020; Holloway *et al.* 2020). A systematic approach has been taken, sequentially studying each species or issue in depth to be certain of accuracy, and to ensure that all works stand up to scrutiny. The current state is that 27 species have been described belonging to the complex. The authors are confident of the validity of most of them, but issues still surround the authenticity of some of these species and in cases where insufficient information has been provided, detailed work needs to be carried out to iron out uncertainties. Here we consider one of these uncertainties. Kadej & Háva (2011) described three new species, viz. *A. farsicus* Kadej & Háva, 2011, *A. kafkai* Kadej & Háva, 2011, and *A. smetanai* Kadej & Háva, 2011. Evidence is provided in the current study to support the position of *A. farsicus* as a junior synonym of *A. flavidulus* Reitter, 1889.

MATERIALS AND METHODS

One specimen of *Anthrenus flavidulus* from Andreas Herrmann's Entomology Collection was studied. The specimen was macerated in 2% aqueous solution of

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 were captured at 20× magnification using a Canon EOS 2000D camera mounted on the BMSL microscope. Images of aedeagi and sternite IX were captured at 200× magnification using a Canon EOS 1300D camera mounted on a Brunel monocular SP28 microscope. After dissection, all body parts were mounted on card. Antennae were teased out and images were taken at 200× magnification through the SP28 microscope. All images were fed through Helicon Focus Pro version 8.0 focus-stacking software. The following measurements were taken using DsCap version 3.90: BL – body length from anterior margin of pronotum to posterior tip of elytra, BW – maximum body width (measured across both elytra), AL – antennal club length, AW – antennal club width across terminal segment, PL – paramere length, ML – median lobe length from tip of median lobe to end of anterior stirrups, SL – sternite IX length from tip of posterior lobe to tip of anterior horn.

The distribution map was constructed using SimpleMappr (Shorthouse 2010) with data from Háva (2023) and Kadej & Háva (2011).

Material deposited in the following collections: AHEC – Andreas Herrmann Entomology Collection, Stade, Germany; HNHN – Hungarian Natural History Museum, Budapest, Hungary; JHAC – Jiri Háva, Private Entomological Collection and Laboratory, Únětice u Prahy, Prague-West, Czech Republic.

TAXONOMY

Genus *Anthrenus* Geoffroy, 1762

Anthrenus flavidulus Reitter, 1889

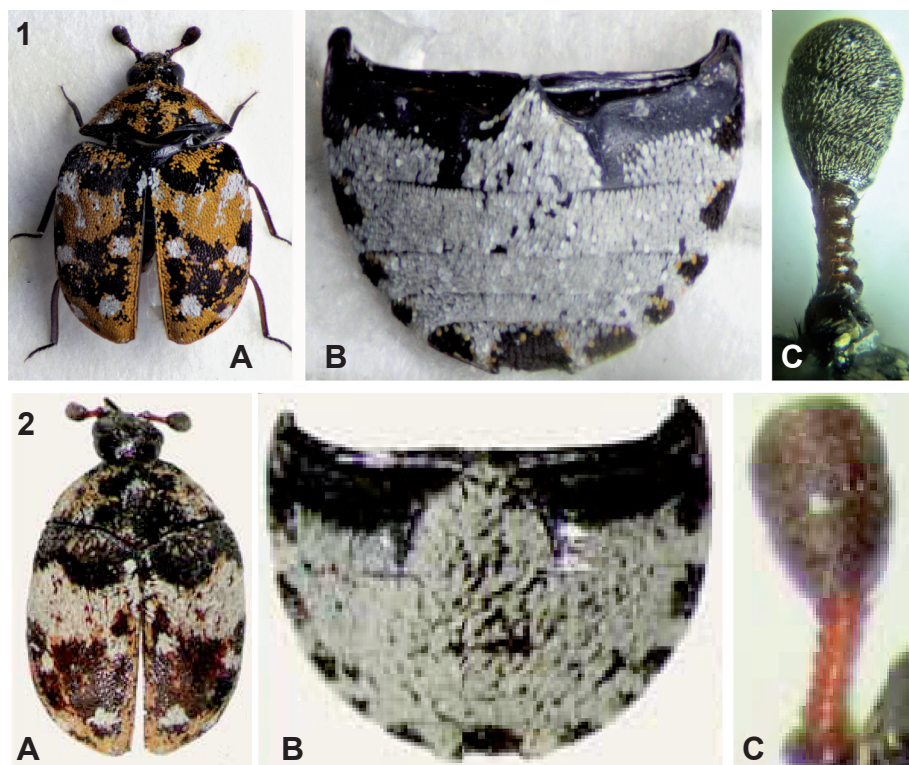
(Figs 1–4)

Anthrenus pimpinellae var. *flavidulus* Reitter, 1889: 23 (type locality: “Caucasus, Araxesthal [Arax valley]”; HNHN).

Anthrenus miniatulus Reitter, 1899 (HNHN).

Anthrenus farsicus Kadej & Háva, 2011 (type locality: Iran, Tehran-Darakesh; JHAC; urn:lsid:zoobank.org:act:2E736E6E-DA80-4F0B-B339-AA1FF04AC7C4), **n. syn.**

Description: Body oval (Fig. 1A), BL = 2.8 mm, BW = 2.11 mm. Ocellus small, amber-coloured, located in central part of head just below line joining tops of eyes. Lower half of inner margin of each eye emarginated. Integument on head, thorax and basal part of elytra dark brown. Dorsal surface covered with black, orange and white scales. White scales on elytra occurring in trans-elytral fascia that becomes progressively narrower from lateral margin on each elytron towards elytral suture, where fasciae on each elytron sweep upwards towards small dark scutellar shield. Four circular white spots of scales on each elytron, two just below each elytral fascia, one sub-sutural, one slightly lower sub-marginal and two towards elytral



Figs 1, 2. *Anthrenus flavidulus* Reitter, 1889, habitus (A), ventrites (B) and antenna (C): (1) specimen from Wadi Araba/Tafila, Jordan; (2) holotype of *Anthrenus farsicus* Kadej & Háva, 2011 (from Kadej & Háva 2011).

apex, one sub-sutural sub-apical and one slightly lower smaller marginal spot. Orange scales widely distributed across each elytron, across elytral basal margin, down elytral suture and around elytral apices. Orange scales also penetrating white fascia as series of parallel fingers from posterior margin of fascia. Scattering of orange scales between fascia and elytral apices. White and orange scales set in background of black scales.

Pronotum covered in black, orange and white scales. Three spots of white scales arranged in triangle, two on basal margin but inside outer corners, and third just inside middle of anterior margin. Central white spot set in horizontal band of black scales. Orange scales from one outer corner, around anterior margin and down to other outer corner. Scattering on black and orange scales across rest of pronotum.

Ventrites (Fig. 1B) covered with white scales. Diverging postcoxal lines on ventrite 1 free from covering of white scales. Spots of black scales at margins of ventrite 1 not bordered by white scales on anterior edge. Spots of black scales on anterior part of margins of ventrites 2–4 become progressively smaller. Ventrite 5 with large



Figs 3, 4. *Anthrenus flavidulus* Reitter, 1889, aedeagus (A) and sternite IX (B): (3) specimen from Wadi Araba/Tafila, Jordan; (4) holotype of *Anthrenus farsicus* Kadej & Háva, 2011 (from Kadej & Háva 2011).

terminal spot of black scales and two large lateral spots of black scales. Spots of black scales dotted with occasional orange scale, largely along anterior margin.

Eleven-segmented antenna (Fig. 1C) with well-defined 3-segmented dark-coloured club (AL = 230 μ m, AW = 179 μ m). Antennal club tear-drop shaped, asymmetric, widths of antennomeres becoming progressively greater towards terminal segment. Antennomere 10 longer on dorsal margin than ventral margin. Antennal club hirsute, covered in short, pale yellowish hairs. Antennomeres 1 and 2 black, antennomere 3 bicolored red and black, antennomeres 4–8 red.

Aedeagus (Fig. 3A) (PL = 366 μ m) rectangular, outer margins of parameres parallel to each other. Parameres expand from about $\frac{1}{3}$ up to form broad, parallel-sided paddles that curve in towards each other at posterior tip. Surface of each paramere covered in short stubble, except for patches of longer setae below paramere tips inside inner margins. Tips of parameres pale contrasting with otherwise uniform pale brown coloration.

Median lobe (Fig. 3A) (ML = 419 μ m) narrows from base before expanding slightly towards midway and then narrowing again towards tip which falls just short of paramere tips. Tip of median lobe slightly, but clearly, expanded. Surface of median lobe covered with scattered short stubble. Median lobe terminates at anterior end with two inwardly curved stirrups. Each stirrup ends in well-defined kink.

Sternite IX (Fig. 3B) (SL = 471 μ m) with posterior lobe evenly rounded. Margins around posterior lobe pale, carrying several spikey setae. Setae continue down margin for about half length of posterior lobe. Margins of posterior lobe narrow to produce neck before expanding to bases of two anterior pointing horns (NB: one

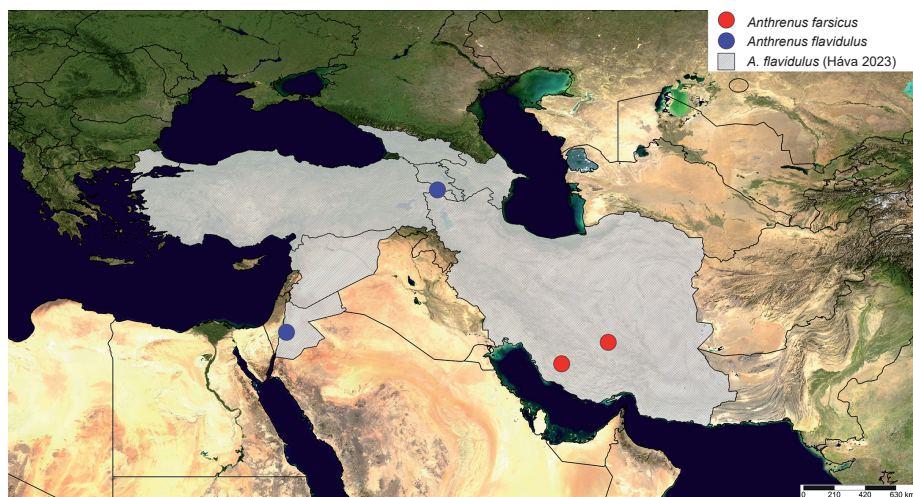


Fig. 5. Distribution of *Anthrenus flavidulus* (according to Háva 2023), collection points of the holotype and the examined specimen of *A. flavidulus*, and collection points of *Anthrenus farsicus* (Kadej & Háva 2011; Háva *et al.* 2015).

horn folded over in studied specimen). Horns hook inwards towards each other at tip. Inner margin of each horn at base with small, rounded flap.

Material examined: **Jordan:** Wadi Araba/Tafila, 30.471°N 35.176°E, leg. G. Sama, “*Anthrenus flavidulus* Reitter, 1889, det. J. Háva (xii 2002)” (1♂, AHEC).

Distribution: Armenia, “Caucasus”, Turkey, Iran, Jordan, Syria (Kadej & Háva 2011; Háva 2023) (Fig. 5).

DISCUSSION

Kadej and Háva (2011: 243) indicated two key features that separated their new species *A. farsicus* from *A. munroi* Hinton, 1943:

“Dorsal patterns. In *A. farsicus* subbasal band of white scales with brown scales on its margins...

Aedeagus. In *A. farsicus* parameres with sharpened apices, inner margin of parameres under the apex with slightly indentation, then the inner margin runs straight down...”

In the original description of *A. flavidulus*, Reitter (1889) stated that ‘yellow ochre’ scales run into the band of white trans-elytral scales. Kadej and Herrmann (2011) showed images of *A. flavidulus* holotype and its junior synonym *A. miniatulus*, demonstrating how the yellow ochre scales penetrating the band vary in colour from yellow ochre through to orange (Fig. 1A), as well as to brown (Kadej & Háva 2011). The degree of coverage of the white scales by coloured scales varies according to Reitter (1889), Kadej & Háva (2011) and Kadej & Herrmann (2011).

The diagnostic paramere features highlighted for *A. farsicus* by Kadej and Háva (2011) fit perfectly those in the *A. flavidulus* specimens studied by Kadej and Háva (2011) and herein (Fig. 3A) and *A. miniatulus* (Kadej & Herrmann 2011).

Other features linking *A. farsicus* with *A. flavidulus* include the distribution of spots of white scales on the elytra, distribution of pale spots and setae on the parameres, the shape of the median lobe, the kinked termini of the stirrups at the anterior end of the median lobe, the shape of sternite IX, and the flaps on the inside of the anterior horns on sternite IX.

Based on this analysis, we conclude that *A. farsicus* is a junior synonym of *A. flavidulus*. The difference in the colour pattern (Figs 1A and 2A) can be seen as variability in the extent of orange-brown scales. The colour pattern variability is found in other *Anthrenus* species, such as *A. isabellinus* Küster, 1848 (Holloway *et al.* 2022) and *A. delicatus* Kiesenwetter, 1851 (*A. d. delicatus* and *A. d. armstrongi* Mroczkowski, 1952) (Herrmann 2023). However, the similarities in the structures and patterning of the ventrites (Figs 1B and 2B), antennal club (Figs 1C and 2C), aedeagus (Figs 3A and 4A) and sternite IX (Figs 3B and 4B) are clear. *Anthrenus flavidulus* is the only *A. pimpinellae*-complex species with kinked termini of the stirrups at the anterior end of the median lobe, a feature also noted for *A. farsicus*. The present study reduces the number of species known within the Palearctic *A. pimpinellae* complex to 26 (Appendix 1, p. 130).

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APPENDIX 1. Species belonging to the Palearctic *Anthrenus pimpinellae* complex.

1. *Anthrenus almatyensis* Háva, 2018
2. *Anthrenus amandae* Holloway, 2019
3. *Anthrenus angustefasciatus* Ganglbauer 1904
4. *Anthrenus bakaloudisi* Holloway, Thanasoulis & Herrmann, 2023
5. *Anthrenus chikatunovi* Holloway, 2020
6. *Anthrenus corona* Holloway, 2021
7. *Anthrenus delicatus* Kiesenwetter, 1851
8. *Anthrenus flavidulus* Reitter, 1889
9. *Anthrenus goliath* Saulcy in Mulsant & Rey, 1868
10. *Anthrenus hoberlandti* Kadej, Háva & Kalík, 2007
11. *Anthrenus indicus* Kadej, Háva & Kalík, 2007
12. *Anthrenus isabellinus* Küster, 1848
13. *Anthrenus karkai* Kadej & Háva, 2011
14. *Anthrenus latefasciatus* Reitter, 1892
15. *Anthrenus mesopotamicus* Háva, 2001
16. *Anthrenus mroczkowskii* Kalík, 1954
17. *Anthrenus muehlei* Holloway & Herrmann, 2023
18. *Anthrenus munroi* Hinton, 1943
19. *Anthrenus nipponensis* Kalík & Ohbayashi, 1985
20. *Anthrenus oceanicus* Fauvel, 1903
21. *Anthrenus pfefferi* Kalík, 1954
22. *Anthrenus pimpinellae* (Fabricius, 1775)
23. *Anthrenus quernerii* Holloway, 2024
24. *Anthrenus similis* Kadej, Háva & Kalík, 2007
25. *Anthrenus smetanai* Kadej & Háva, 2011
26. *Anthrenus warchalowskii* Kadej, Háva & Kalík, 2007