# *Differentiation of Anthrenus fuscus from Anthrenocerus australis (Coleoptera; Dermestidae)*

# Differentiation of *Anthrenus fuscus* from *Anthrenocerus australis* (Coleoptera; Dermestidae)

Graham J. Holloway[1*], Pascal Querner[2] and David Pinniger[3]

*[1*] Cole Museum of Zoology, School of Biological Sciences, The University of Reading, Reading, UK*

*[2] Natural History Museum Vienna, Burgring 7, 1010 Vienna, Austria*

*[3] 83 Westwood Green, Cookham, UK*

**Email for correspondence: g.holloway@reading.ac.uk*

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**Abstract**

Accurate identification of pest species is the first line of defence for Museum IPM managers. Here we illustrate how to differentiate between two species that are on occasions found in museums and historic houses: *Anthrenus fuscus* and *Anthrenocerus australis*. The species can easily be differentiated with a microscope on the basis of antennal structure, or the presence of scales or hairs on the dorsum.

**Keywords:** IPM, pest management, museum, historic houses, identification

## Introduction

It has long been argued that one of the most important aspects of integrated pest management (IPM) in museums is the correct identification of the pest species (Pinniger, 2015; Querner, 2015; Holloway and Querner, 2025). Different species of beetles often have very different modes of life meaning that they might enter the building via different routes, shelter in different places and eat different things. Certain species of Dermestidae are commonly found in museums, such as *Anthrenus* Geoffroy, 1762 (Halstead, 1975; Pinniger and Lauder, 2018; Holloway and Pinniger, 2020). Even though they are closely related, among species variations in lifestyle are still evident. *Anthrenus* species are said to be dependent on keratin-based substances, such as hair and feathers (Querner, 2015), or dried insects (Pinniger and Lauder, 2018) as larvae. However, keratins appear in different forms, notably α-keratin (mammalian hair and skin), or β-keratin (feathers), and even this relatively small difference influences developmental performance with some species of *Anthrenus* entirely dependent on, for example feathers, and unable to breed on other substrates (Holloway et al, 2025). Surprisingly perhaps, even though Dermestidae are some of the most feared pests within museums, and some work has been carried out into the feeding and developmental performance of some species on different foodstuffs (e.g., Hinton, 1945; Woodroffe and Southgate, 1954; Armes, 1990, 1991), we still have an incomplete understanding of the threat posed by these species (Pinniger 2010, 2013).

The first stage en route to understanding the threats posed by pest species is correct identification (Pinniger, 2015; Querner, 2015). There are some good sources of information

facilitating the differentiation of species (e.g., Peacock, 1993, Pinniger and Lauder, 2018, Thompson Webb, 2025), but some species still require greater attention to detail to identify them because they are externally similar (Holloway and Querner, 2025). One such identification conundrum is the separation of *A. fuscus* Olivier, 1789 (the mill carpet beetle) from *Anthrenocerus australis* Hope, 1943 (the Australian carpet beetle). The purpose of the current study is to provide images and morphological descriptions of these two species to help museum IPM managers with the important job of species identification.

## Methods

Sticky traps set in museums and historic houses across Austria in 2022 were examined for coleopteran pests. The traps contained a number of species, including *A. fuscus* and *An. australis*. Beetles were lifted from the sticky trap glue using ethyl acetate (to make the glue fluid) and specimens were then dropped into dry cleaning fluid (k2r ®: methyl acetate and acetone) to remove any remaining surface glue. Insects were mounted on card using water-soluble PVA glue, and the antennae were teased out for imaging.

Habitus images were captured at ×20 magnification using a Canon EOS 2000d camera mounted on the BMSL microscope. Images of antennae were captured at ×100 magnification using a Canon EOS 1300d camera mounted on a Brunel monocular sp28 microscope. All images were fed through Helicon focus pro version 8.2.2 focus-stacking software. Scale bars were added using ImageJ 1.53m (Schneider *et al*., 2012).

## Results

*Anthrenus fuscus*

Figure 1 shows a range of images of *A. fuscus*. The overall appearance of males (Figs. 1A and 1B) is darker than females (Figs. 1D and 1E). Both sexes are covered in triangular scales (NB the scales can be easily rubbed off) and have transverse oblongs of white scales at the lower corners of the pronotum, slightly neater in males as the anterior edge of each oblong often bleeds into some yellow scales in females. Otherwise, the pronotum is covered in dark brown scales with a scattering of


*Fig. 1:* Anthrenus fuscus. *A: male habitus (scale bar = 1 mm), B: male habitus (scale bar = 1 mm), C: male antenna (scale bar = 100 µm), D: female habitus (scale bar = 1 mm), E: female habitus (scale bar = 1 mm), F: female antenna (scale bar = 100 µm).*

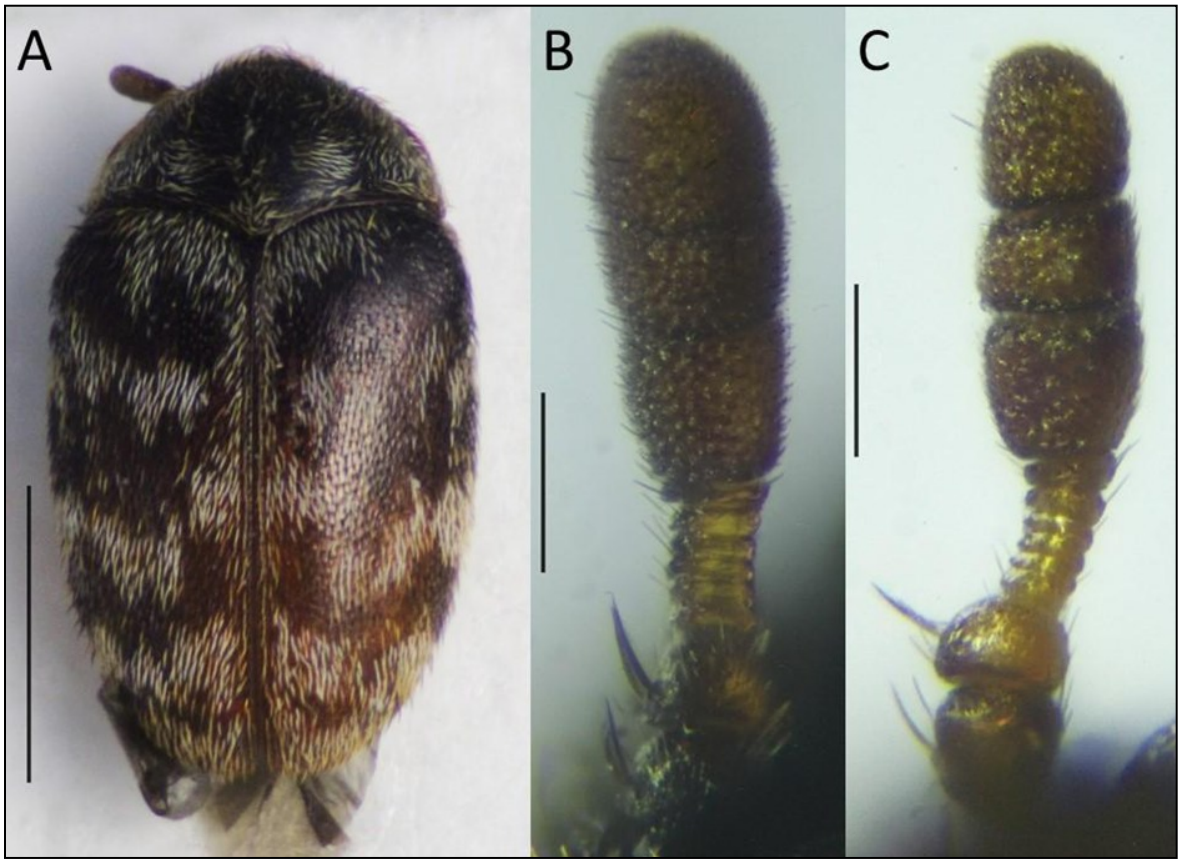


*Fig. 2:* Anthrenocerus australis. *A: male habitus (scale bar = 1 mm), B: male antenna (scale bar = 100 μm), C: female antenna (scale bar = 100 μm).*

yellow scales. The elytra are covered in dark brown scales with three bands of yellow scales, one sub-basal, one sub-medial and the last pre-apical. The bands are broader and more obvious in females than males. The beetles are small measuring 2-3.4 mm (Herrmann, 2023). The 5-segmented antennae are long (male ~ 600 μm, female ~ 480 μm), reddish throughout, and slim with more of an expansion than a club (shaped like a baseball bat).

*Anthrenocerus australis*

Images and a description of this species were presented by Holloway and Querner (2025),but for convenience are repeated here. Figure 2A shows an image of male *An. australis*. The sexes are similar in appearance, small and convex. The pronotum is dark brown and the elytra are dark brown basally, usually a lighter reddish brown in the apical half. The elytra have three bands of white hairs (rather than scales), sub-basal, sub-median, and sub-apical. The bands curve posteriad, particularly the sub-basal and sub-median bands. There are also patches of white hairs on the elytral base and apex (few elytral basal and apical scales in *A. fuscus*), the outer corners of the pronotum (but not forming neat transverse oblongs as in *A. fuscus*) and on the pronotum anterior to the scutellum. Body length 2 – 3.4 mm (Herrmann, 2023), is very similar to *A. fuscus*. The 11-segmented male antennae (Figure 2B) have a well-defined, 3-segmented brown cylindrical club that contrasts with the yellow of the basal eight segments. The antenna is about 0.45 mm long with the club accounting for about 0.25 mm of the total length. The female antenna is similar to the male.

## Discussion

The ability to accurately identify pest species is the first line of defence in the IPM manager's armoury, and identification can only be achieved if a range of good identification aids are available (see for example Peacock, 1993, Pinniger and Lauder, 2018, Thompson Webb, 2025). Here we focus on the possible confusion of two species, *Anthrenus fuscus* and *Anthrenocerus australis*. With a good microscope, it should be relatively easy to differentiate between the species using the features presented here. If antennae are exposed, it is straight forward: *A. fuscus* has slim baseball

shaped antennae and *An. australis* has clubbed antennae. *Anthrenus museorum* (the museum beetle), another brown species with golden scales (like *A. fuscus*), has an eight segmented antenna with a two segmented antennal club (Holloway and Pinniger, 2020). Quite often, though, the antennae are not exposed and difficult to see. Many Dermestidae have grooves, fossae, along the front edge of the pronotum into which the antennae can be withdrawn, including *A. fuscus*. If the antennae are not visible, identification can be indicated by establishing whether the beetle has hairs or scales. The caveat is that other species also have scales or hairs. The major museum pest, *A. verbasci* (the varied carpet beetle), also has scales although the colour patterning is very different from *A. fuscus* (Holloway and Pinniger, 2020). *Anthrenus museorum* as mentioned above resembles *A. fuscus* and also has scales (Holloway and Pinniger, 2020). *Trogoderma glabrum* (the glabrous cabinet beetle) is also dark with bands of white hairs. Separating *T. glabrum* from *An. australis* is considered elsewhere (Holloway and Querner, 2025). *Trogoderma angustum* Solier, 1849 (the Stockholm or Berlin beetle) also has white bands of scales across the elytra and is found in some natural science museum settings (Thompson Webb, 2025). The identification of *T. angustum* is reviewed in detail by Holloway and Sparks (2023).

Differentiating among museum pest beetles and arriving at an accurate identification is important in IPM, but it can be difficult without magnification and lead to misidentification. Accurate identification would indicate whether a beetle was actually a pest species or not, might indicate potential feeding preferences, and facilitate the application of appropriate management strategies. The feeding preferences of several species, including *An. australis*, are not well-known. Further research is required in this area.

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