

Palaeartic distributions of *Anthrenus pimpinellae* (Fabricius) and *Anthrenus isabellinus* Küster (Coleoptera: Dermestidae)

BY GRAHAM J. HOLLOWAY, CALUM J. MACLURE &
CHRISTOPHER W. FOSTER

GJH*, CJM, CWF: *Cole Museum of Zoology, School of Biological Sciences, HLS Building, The University of Reading, Whiteknights, Reading RG6 6EX, U.K.;*

GJH: *email: g.j.holloway@reading.ac.uk;* CJM: *email: c.j.maclure@pgr.reading.ac.uk;*

CWF: *email: c.w.foster@reading.ac.uk*

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ORCID ID: GJH: <https://orcid.org/0000-0003-0495-0313>; CWF: <https://orcid.org/0000-0002-7635-6797>

ABSTRACT

Distributions of *Anthrenus pimpinellae* (Fabricius, 1775) and *A. isabellinus* Küster, 1848, are presented using data from verifiable online images, posted by citizen scientists. *Anthrenus pimpinellae* is distributed from north-western Europe into eastern and south-eastern Europe, and just into eastern Asia. *Anthrenus isabellinus* in Europe (and north Africa) is largely distributed across regions around the Mediterranean Sea. The species distributions overlap in south-eastern Europe, but do not overlap in western Europe and northern Africa. Until recently, the taxonomy of these two species was confused – consequently our knowledge of their distributions poor. *Anthrenus pimpinellae* is still considered by some authorities to be cosmopolitan; the current study shows that this is probably not the case.

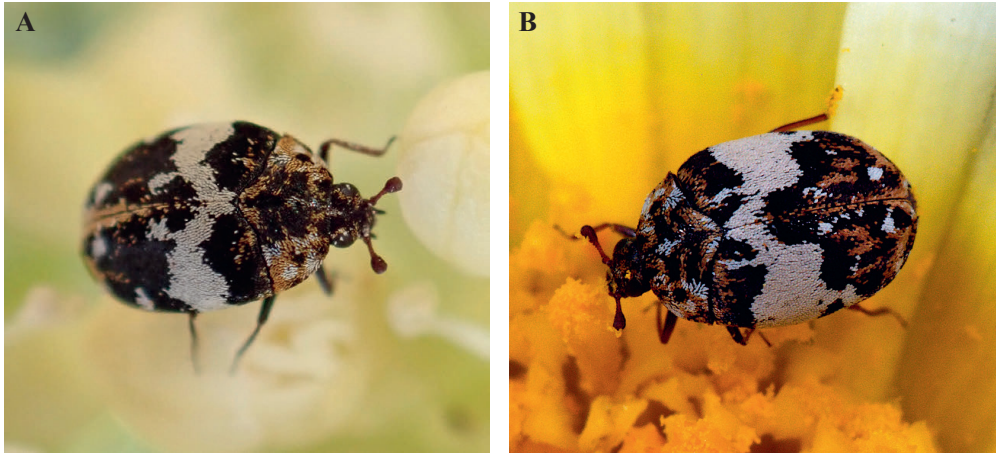
Keywords: Megatominae, Anthrenini, taxonomy, citizen science, Europe

INTRODUCTION

Dermestidae Latreille, 1804, numbers over 1800 species globally (Háva 2023). *Anthrenus* Geoffroy, 1762, forms a large polytypic genus in the family numbering 284 species, a number that is increasing as more species are described (Háva 2023). The Palaeartic *Anthrenus* (*Anthrenus*) *pimpinellae* (Fabricius, 1775) complex numbers about 24 species. Nearly all the species in this complex share a similar colour pattern with a white trans-elytral fascia on a largely black background and a scattering of orange/brown scales and white spots. Throughout the nineteenth and into the twentieth century, approximately eight species within the complex had been named. Most specimens possessing this colour pattern were still deemed to be a variant or subspecies of *A. pimpinellae*. Since the middle of the twentieth century, a further 16 species have been described, mostly during the last 20 years (Hinton 1943; Kalik & Ohbayashi 1985; Háva 2001, 2003, 2018; Kadej, Háva & Kalik 2007; Kadej & Háva 2011; Háva 2018; Holloway 2019, 2020, 2021).

The main approach used to species identification is dissection and comparison of male genitalia. This can be a slow process and many authors have preferred to identify their specimens from habitus coloration and antennal structure (see Háva 2023 – and references therein). The consequence has been a poor understanding of

* *corresponding author.*



Photos: A: Jean-Paul Boerekamps; B: Aurearamon

Fig. 1. — Examples of citizen science images of *Anthrenus* spp. on iNaturalist (2023): A, *A. pimpinellae*; B, *A. isabellinus*. Note: *A. isabellinus* differs from *A. pimpinellae* by having a broader body profile, a broader white fascia, more orange scales behind the white fascia, lateral white spots strongly joined to the posterior edge of the white fascia.

the species within the complex and a belief that species of the *Anthrenus pimpinellae*-complex are difficult to differentiate from each other. Museum collections labelled as *A. pimpinellae* are often a mixture of a variety of species (Holloway, unpub. data). An example of this is the confusion between *A. pimpinellae* and *A. isabellinus* Küster, 1848. Küster (1848) originally described *A. isabellinus*, but quickly the species was declared a subspecies of *A. pimpinellae* (Schaum 1862). Later, *A. pimpinellae* var. *dorsatus* Mulsant & Rey, 1868, was described (Mulsant & Rey 1868). *Anthrenus dorsatus* was subsequently raised to full species status (Háva 2003). It was considered to have a range restricted to some parts of North Africa and Malta (Háva 2015). Holloway, Foster & Callaghan (2019) and Holloway & Bakaloudis (2019) encountered *A. dorsatus* specimens from Mallorca and Greece, respectively, indicating that *A. dorsatus* was more widely distributed than previously thought. Holloway *et al.* (2020) examined *A. pimpinellae pimpinellae* and *A. pimpinellae isabellinus* establishing that they were clearly separate and valid species (*A. pimpinellae* and *A. isabellinus*, respectively), and that *A. dorsatus* was a synonym of *A. isabellinus*.

As a consequence of this clarification it became clear that we did not know the true distributions of the two species since they had been confused for so long. Hoebeke, Wheeler & Beal (1985) reported *A. pimpinellae pimpinellae* from the United States (USA). Later, Hoebeke & Wheeler (1990) recorded *A. pimpinellae isabellinus* from the USA. At that time, no work had been carried out to separate the two species. Holloway, Bakaloudis & Foster (2021) showed that there was no evidence of *A. pimpinellae* in the USA and that the North American species was in fact *A. isabellinus*. Despite a lack of evidence, Háva & Herrmann (2021) continued to maintain that *A. pimpinellae* exists in the USA, but now in addition to *A. isabellinus*. Meanwhile, *A. pimpinellae* continues to be described as ‘cosmopolitan’ (Háva 2023). This reported distribution appears to be based on numerous faunistic

publications where *Anthrenus* species are reported but have not been identified by dissection.

During an examination of *A. pimpinellae* held in the Natural History Museum, London (NHML), Holloway (unpub. data) noted that all specimens of this taxon were from Europe with none from further afield. The purpose of the current study, following on from this observation, was to establish the current global distributions of *A. pimpinellae* and *A. isabellinus*. Field entomology has developed since the advent of smart phones enabling high-quality images to be taken and uploaded easily onto citizen science platforms, such as iNaturalist (2023). Species from the *A. pimpinellae*-complex are attractively patterned and can often be found on flowers; as a consequence, images of species within this complex are often uploaded. Most of the images of *A. pimpinellae*-complex species on iNaturalist are of sufficient quality to be easily verified, making data from this platform suitable for the current study. Figs 1A & B show examples of images of *A. pimpinellae* and *A. isabellinus*, respectively [from iNaturalist].

MATERIALS AND METHODS

The iNaturalist database was searched separately for images under the terms '*Anthrenus pimpinellae*' and '*Anthrenus isabellinus*', with a focus on non-USA records (for *A. isabellinus*). Each image was inspected to confirm identification before it was included in the current study using Holloway & Cañada Luna (2022). Only images provided from these two search terms were included in the analysis. Images of *A. isabellinus* appearing against the search term '*Anthrenus pimpinellae*' were transferred to the *A. isabellinus* database, and vice versa. All other species appearing under these search terms were disregarded. Location data on verified images were lifted and transferred to a dedicated database. The location data were plotted using SimpleMappr (Shorthouse 2010).

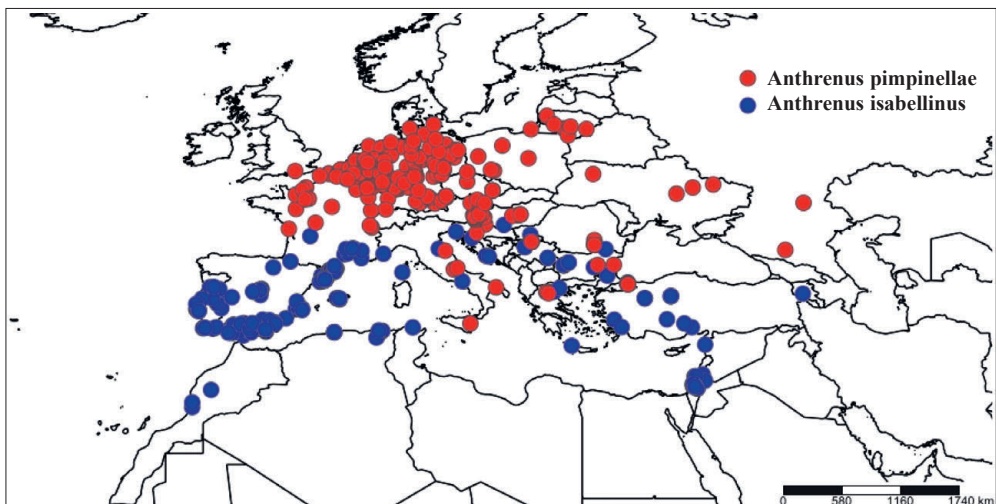


Fig. 2. — Global distribution of *Anthrenus pimpinellae* (red dots) and Palaeartic distribution of *Anthrenus isabellinus* (blue dots) (Note: *A. isabellinus* is also established in eastern USA, which is not covered here).

RESULTS

Totals of 232 verified records of *A. pimpinellae* and 214 verified (European) records of *A. isabellinus* were found. The distributions of *A. pimpinellae* and *A. isabellinus* in Europe are shown in Fig. 2. *Anthrenus isabellinus* is also found in eastern USA, but no images of *A. pimpinellae* had been submitted by citizen scientists from anywhere in the world beyond that shown in Fig. 2. *Anthrenus isabellinus* is distributed in almost all regions bordering the Mediterranean, both in southern Europe and north Africa, the exception being Libya and Egypt. Only one record of *A. isabellinus* occurs substantially away from the Mediterranean – in Armenia, although this record is relatively close to the Black and Caspian Seas. *Anthrenus pimpinellae* is found in northwest Europe from mid-France north into the Low Countries and Germany. It is also found further east beyond Poland and the Baltic States into Romania, Hungary, Ukraine and southern Russia. *Anthrenus pimpinellae* also occurs further south into Italy, Croatia, Greece, and just into northern Turkey. In western Europe there is a clean separation between *A. pimpinellae* (north from mid France) and *A. isabellinus* (south from mid France). From Italy eastwards, *A. pimpinellae* can be found mixed with *A. isabellinus*, but the distribution of *A. isabellinus* never moves far north (or south in north Africa) away from the Mediterranean.

DISCUSSION

Much is made here of the importance of *Anthrenus* identification by dissection. The next step is to translate identification by dissection into reliable external characters. Little attention has been made in this regard so far, although Kadej (2011) produced a habitus key for USA species of *Anthrenus* based on the dissection work carried out by Beal (1998). Holloway & Cañada Luna (2022) considered that citizen scientists have a role to play in helping us to understand the activities of Dermestidae under field conditions, and that their efforts need to be encouraged and facilitated. Holloway & Cañada Luna (2022) used species identified definitively by dissection to develop a habitus-image based key to help citizen scientists differentiate *A. pimpinellae*-complex species by habitus colour pattern alone. Most species can be identified reliably given good images. The value of the efforts of citizen scientists is clearly demonstrated in the current study.

Our knowledge of the distributions of most of the Dermestidae spp. is limited and largely reliant on Háva (2023). The World Catalogue (Háva 2023) represents an extraordinary achievement, but the distribution records therein largely rely on undissected specimens from very many faunistic studies (see references in Háva 2023). Given the problems that some workers have had differentiating among *Anthrenus pimpinellae*-complex species (e.g., Hoebeke, Wheeler & Beal (1985); Hoebeke & Wheeler (1990); Kadej, Háva & Kalik (2007); Háva & Herrmann (2021)), the distribution data provided cannot be considered definitive. For example, *A. pimpinellae* is considered cosmopolitan by Háva (2023) and the current study demonstrates that this is most probably not the case. In fact, *A. pimpinellae* has a relatively restricted distribution across Europe, excluding southern France and the Iberian Peninsula, extending east to Ukraine and the Caucasus. There are also records from southern Sweden on GBIF (2023), which are most probably *A. pimpinellae* since it appears there are currently no other *A. pimpinellae*-complex species in that region. There is no evidence of *A. pimpinellae* occurring anywhere in the world, beyond the distribution shown in Fig. 2.

There is an intriguing record from the UK. *Anthrenus pimpinellae* was removed from the UK list recently (Holloway, Foster & Barclay 2018), so this single record might reflect a north-westerly movement of the species, perhaps driven by climatic change. It has been suggested that another species, *A. angustefasciatus* Ganglbauer, 1904, might have moved into the UK following climatic changes (Foster & Holloway 2015). More records are required to consolidate the status of *A. pimpinellae* (and *A. angustefasciatus*) in the UK.

Faunistic studies form the basis for *Anthrenus* country species lists, but where data from dissected individuals contradict habitus-based identification, evidence from dissected individuals should be followed. Holloway, Bakaloudis & Foster (2021) found no evidence for *A. pimpinellae* in the USA contrary to Hoebeke, Wheeler & Beal (1985) [note: Holloway, Bakaloudis & Foster (2021) refer to *A. dorsatus* in the USA, which is synonymous with *A. isabellinus*]. The USA checklist of Dermestidae (Háva & Herrmann 2021) is probably incorrect in that it still contains *A. pimpinellae* (but it *does* also contain *A. isabellinus*). Likewise, the checklist of Dermestidae in Spain (Holloway, Cañada Luna & Kadej 2019) is also probably incorrect as it too contains *A. pimpinellae*. This list was largely derived from published faunistic studies. Country species lists are of interest, but a simple list assigned to a country can hide detail. For example, both *A. pimpinellae* and *A. isabellinus* appear on the French checklist, but the distribution data (Fig. 2) show that only *A. pimpinellae* appears in northern France and only *A. isabellinus* occurs in southern France. The fact that non-overlapping distributions have been demonstrated in western Europe, but not eastern Europe raises interesting questions about the ecological factors influencing the distributions of *A. pimpinellae* and *A. isabellinus* – questions that could not be asked without good distribution data.

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