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Research Article

Citizen science reveals the establishment of the invasive container breeder *Clogmia albipunctata* in Sweden and Denmark (Diptera: Psychodidae)

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Abstract

Clogmia albipunctata (Williston, 1893) is a moth fly (Diptera: Psychodidae) which occurs in synanthropic habitats in tropical and subtropical climates all over the world, particularly drains and kitchen sinks which has earned it the moniker "drain fly". Since the 1990s, however, its range has expanded rapidly northwards into temperate climates and it now occurs as far North as Karelia (Russia) and Finland. As it occurs together with humans and can be detected easily from photographs it is a species whose invasion can be tracked easily; inspection of Norwegian, Swedish and Danish nature photography web sites www.artsobservasjoner.no, www.artportalen.se and www.naturbasen.dk reveal its established presence in Denmark and Sweden, whereas no records hitherto have been presented from Norway. The records are all from large metropolitan areas, except one Danish record which is on the Southern border with Germany where the species has been established for a much longer time. The oldest Swedish images are from 2016 and the first Danish specimens appear in 2018. It remains unknown to which degree *C. albipunctata* poses a risk to native biodiversity, but records from Slovakia in 2012 revealed that it can breed in habitats used by native species also in temperate Europe.

Key words: Moth flies, container habitats, synanthropy, myiasis, amateur naturalists

Introduction

Clogmia albipunctata (Williston, 1893) is a widespread moth fly (Diptera, Psychodidae) whose range has expanded significantly over the last few decades. Its English common name "drain fly" suggests its association with drains and sewage systems. However, it is found in many habitats where its larvae feed on decaying matter. Its origin is most likely within a clade which primarily develops in rotholes in trees (Vaillant 1972, 1989; Jaume Schinkel et al. 2022) but its habits as a generalist container breeder have been recognized ever since its first description in 1893.

The geographic origin of *Clogmia albipunctata* is not known. The first description from Cuba (Williston 1893) was shortly thereafter followed by the description of a synonym *Pericoma meridionalis* Eaton, 1894 from

Table 1. Timeline of invasion for *Clogmia albipunctata* (Williston, 1893) in Europe.

Year	Event	Reference
1893	Original description from Cuba	Williston (1893)
1894	Synonym described from Tanzania	Eaton (1894)
1920	First European record, Barcelona, Spain	Tonnoir (1920)
1958	Outdoor breeding record from southern France	Mirouse (1958)
1971	Occurring between 40°S and 42°N	Vaillant (1972)
1992	First record from Germany	Werner (1997)
1995	Outdoor breeding record from Rijeka, Croatia	Kvifte et al. (2013)
2006	Records from the Netherlands and Belgium	Boumans (2009), Boumans et al. (2009)
2011	Outdoor breeding record from Slovakia. First records from Czech Republic	Ježek et al. (2012)
2014	Petrozavodsk, Russian Karelia – 61°N	Humala and Polevoi (2015)
2015	Finland	Salmela et al. (2019)
2016	Great Britain, First photos from Sweden	Sivell and Irwin (2016), this study
2018	First photos from Denmark	This study

Tanzania (Eaton 1894). An origin in the old world tropics is nevertheless plausible given that the other described species of *Clogmia s.str.* are from either Africa or Southeast Asia (Ježek 2004, but see also Kvifte 2012 for a different circumscription of the genus).

The first records of *Clogmia albipunctata* from Europe were by Tonnoir (1920) from Barcelona. Further European records were erroneously described as new species by Abreu (1930), from the Canary Islands, and Mirouse (1958), from France. Vaillant (1972) listed its distribution as between 40°S and 42°N, but the range expansion continued over the following decades (Table 1). With recent records from Finland (Salmela et al. 2019), Karelia (Humala and Polevoi 2015) and Great Britain (Sivell and Irwin 2016) the species now appears to have established itself in urban areas even quite far North in Europe.

Amateur naturalists in Scandinavia produce large amounts of biodiversity records every year, often documented with very precise photographs. The Swedish *Artportalen* alone has more than 10 000 active users (as of 2021) who provide more than 4 million records per year, both of identified and unidentified species. We can therefore expect *Artportalen* and similar tools developed for biodiversity recording in other Scandinavian countries to be a straightforward tool for monitoring biological invasions, particularly for conspicuous synanthropic species such as *C. albipunctata.* With the adults being easily recognized by their ovoid brownish grey wings with dark smudges on the basis of wing veins R_{2+3} and M_{1+2}, and the light spots along the wing edge (Figure 1), *C. albipunctata* is among very few Psychodidae species that can be reliably identified from photographs. The present study builds on the work of Boumans (2009) and later Oboňa et al. (2021) in systematically reviewing photo libraries gathered through citizen science to map the occurrence of this invasive species in Scandinavia.

Materials and methods

Three public community science natural observation sites were surveyed: www.artsobservasjoner.no (for Norway) and www.artportalen.se (for Sweden)

Figure 1. *Clogmia albipunctata* (Williston, 1893) from Germany, 2016. Photo by the author.

were surveyed by using the search phrase "Psychodidae" including all underlying taxa. Only records with images were considered. These images were then examined and identified as either *C. albipunctata* or discarded from the data set. No images were doubtful identifications. For Denmark, the gallery view in www.naturbasen.dk was examined for *C. albipunctata* for all Psychodidae at https://www.naturbasen.dk/billeder/familie/494/sommerfuglemyg. Georeferences for all records were exported (for artsobservasjoner and artportalen) or extrapolated from the map view in naturbasen. The records were then mapped in R using the package rworldmap (South 2011).

Results

The search for "Psychodidae" in the Swedish database yielded 243 images of 188 records, of which 31 images of 20 records could be positively identified as *C. albipunctata.* Nine of the 19 records were misidentified as *Psychoda alternata* Say, 1824 and one was misidentified as *Psychoda albipennis* Zetterstedt, 1850; of those that were identified only as "Psychodidae" one was tentatively identified as *C. albipunctata* by the photographer in the comment field (Bertil Johansson, https://artportalen.se/Image/1932008).

The Danish records contained 278 images of an unknown number of records, of which 19 images of 17 records were *C. albipunctata.* Four of the records were correctly identified to species. Most records were from the greater Copenhagen area, but one is also from Sønderborg, a small town of some 27 000 inhabitants not far from the German border. None of the 126 Norwegian Psychodidae images were *C. albipunctata.*

Figure 2. Records of *Clogmia albipunctata* (Williston, 1893) from Scandinavia. Created using *rworldmap* (South 2011).

All records in the databases were georeferenced and are summarized in Figure 2. Full references are given in Supplementary material Table S1.

Discussion

The herein presented records reveal the established presence of *C. albipunctata* in urban areas in Scandinavia, despite the majority of observations in the citizen science portals being from exurban environments. The "habitats" in which *Clogmia* occur in Scandinavia are primarily from anthropogenic habitats such as bathrooms, kitchens, garbage dumps, hospitals and veterinary hospitals (as in Boumans et al. 2009). However, a single record is from a light trap and it can not be ruled out that the species also spreads via "natural" habitats. Ježek et al. (2012) for instance recorded *C. albipunctata* as breeding in a water-filled cavity in an oak tree outdoors in Central Europe. Kvifte et al. (2013) expressed concern that *C. albipunctata* might outcompete other psychodids associated with these habitats, but this concern may be inflated since these native species still appear to occur with regularity in these habitats when they are specifically targeted by collectors (Oboňa and Ježek 2012a; Jaume Schinkel et al. 2022). Furthermore, at least larvae of *C. albipunctata* are unable to survive winter temperatures at 4 °C for longer than 48 hours and will therefore probably rely exclusively on anthropogenic habitats for overwintering (Oboňa and Baranová 2022).

Dispersal of *C. albipunctata* likely happens mostly through trade and other long-range transport, particularly of garbage and smaller water-filled containers such as tires. Oboňa and Ježek (2012b) collected large numbers of the species from a bus terminal building and suggested that transport was a major factor in *C. albipunctata's* spread in Europe, citing as evidence that a single fertilized female can lay from 200 to 300 eggs. This, combined with the species' robust and sturdy habits in the larval stage and the short

life cycle of about a month (Vaillant 1971), suggests that even chance transport events can lead to *C. albipunctata*'s rapid colonization of new habitat. Management of the invasion is therefore likely to prove difficult, as the rates of human trade and transport are likely to remain high also in the coming decades. Even if individual occurrences can be eliminated through chemical or biological control, it seems unlikely that *C. albipunctata* can be eradicated from a wider geographical area once established.

The invasion of *C. albipunctata* is not only biologically interesting, but can also be a public health concern. Several cases have shown *C. albipunctata* to be a pest species, particularly under poor hygienic conditions. The medical literature regularly publish cases in which *C. albipunctata* larvae infest living tissues in humans, including nasopharyngeal, urogenital and intestinal tissues (e.g. Mohammed and Smith 1976; Tu et al. 2007; El-Badry et al. 2014). Ježek et al. (2012) suggested that the risk of myiasis in Europe would be low due to mostly good hygienic conditions, but Faulde and Spiesberger (2013) showed that the species also in Germany can be a potential mechanical vector for pathogenic bacteria in hospitals. Efficient monitoring is therefore crucial and as demonstrated in the present study, photographs and citizen science are highly efficient and cost effective tools for this.

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Supplementary material

The following supplementary material is available for this article:

Table S1. Citizen Science records of *Clogmia albipunctata* from Sweden and Denmark.

This material is available as part of online article from:
http://www.reabic.net/journals/mbi/2023/Supplements/MBI_2023_Kvifte_SupplementaryMaterial.xlsx