

Recent and old records of the rare myrmecophilous beetle *Haeterius ferrugineus* (Olivier 1789) in Belgium, Luxembourg and North-East of France

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Haeterius ferrugineus (Olivier 1789) is a rarely observed histerid beetle which lives permanently in ant nests. We provide the first records of this species in Flanders, the northern part of Belgium, and give an overview of the scattered records for this species in Belgium, Grand-Duché of Luxembourg and the border region in the North of France gathered over the past 150 years.

Key words: Histeridae, ant guests, *Formica*, myrmecophile, commensalism, parasitism, recent records

Haeterius ferrugineus (Olivier 1789) est un coléoptère histéride rarement observé qui réside dans des fourmilières. Nous fournissons les premières observations de cette espèce en Flandre, et présentons un aperçu de toutes les observations de cette espèce en Belgique, dans le Grand-Duché de Luxembourg et dans la région frontalière du Nord de la France, au cours des 150 dernières années.

Mots-clés : Histeridae, *Formica*, myrmécophile, commensal, parasite, observations récentes.

INTRODUCTION

A remarkably number of beetle species strictly lives inside ant nests (Parker, 2016; Parmentier *et al.*, 2020; Hölldobler & Kwapich, 2022). Most of these myrmecophilous species are only occasionally recorded and the distribution and biology of many of them remains obscure. The Histeridae (clown or hister beetles) is a large family of beetles living in a wide variety of habitats encompassing dead wood, dung, nests of vertebrates and nests of social insects (Helava *et al.*, 1985). The latter strategy is especially well developed in the Haeteriinae subfamily, where all members are associated with ants or termites. Like other histerids they are characterized by a convex and robust body with short retractable appendages (Parker, 2016). The heavily

sclerotized, protective morphology helps to survive in ant nests. In addition, some of these Haeteriines resort to specialized strategies, such as chemical deception and appeasement of the host (Lenoir *et al.*, 2012; Parmentier *et al.*, 2017). The Haeteriinae subfamily has its biggest radiation of myrmecophiles in the neotropics. This is especially the case for species associated with army ants (Helava *et al.*, 1985) where some spectacular representatives evolved (von Beeren & Tishechkin, 2017). In Europe, four genera of Haeteriine beetles can be found: *Satrapes*, *Sternocoelis*, *Eretmotus*, and *Haeterius*. Among these, *Haeterius ferrugineus* is the sole species belonging to the *Haeterius* genus. It has the broadest distribution of all European Haeteriines, but records are sparse and scattered (Wasmann, 1894; Donisthorpe, 1927; Vallenduuk, 1987; Secq & Secq, 1996; Hlaváč & Lackner, 1998; Lapeva-Gjonova, 2013; Cuesta Segura & García García, 2014; Benisch, 2023; GBIF Secretariat, 2023).

Haeterius ferrugineus is a small (1.3-2.0 mm) reddish brown histerid with relatively long and flattened legs. It has sparse erect pale setae on the pronotum and elytra (**Figure 1**). This beetle has been the centre of fascination for entomologists for a long time. Pioneering entomologists Charles Janet and Erich Wasmann were the first to make detailed observations on its biology and were able to keep individuals for four years in laboratory nests (Janet, 1897; Wasmann, 1905). They observed that this beetle reaches a high level of integration into the colony. They rarely incite aggression, but if they do so, they resort to feigning dead. They are frequently licked by the ants which suggests that they have exocrine glands that appease the ants. They climb on the pupae and larvae and they are carried around by the ants (Wasmann, 1905) (**Figure 1**).

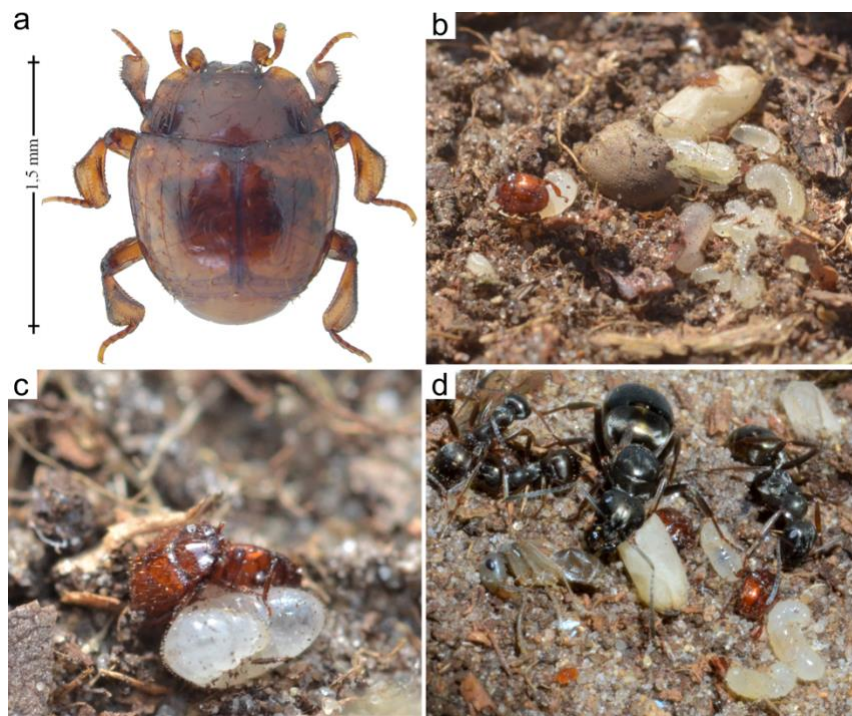


Figure 1: Photos of *Haeterius ferrugineus* (Olivier 1789) and its interaction with the ant brood and host. a) Detail photo of a prepared specimen (© David Ignace). b) Individual crawling on the *F. fusca* host brood, note the rove mite on the ant pupa. c) Two individuals on a *F. fusca* larva. The erect setae on the beetle elytra are visible. d) Two individuals among ant brood and the *F. fusca* host: three workers and a queen (© Thomas Parmentier).

Another peculiar behavior is the waving with the forelegs. It is assumed that this behavior draws the ant's attraction and may even lead to mouth-to-mouth food exchange. But probably they mainly scavenge on dead ants and prey and occasionally feed on ant brood (Hölldobler & Kwapich, 2022). They have been reported in nests of a large number of ant species (Wheeler, 1908; Parmentier *et al.*, 2020), but their preferred hosts appear to be *Formica* ants (Wasmann, 1894; Wheeler, 1908).

MATERIAL & METHODS

We compiled different unpublished records of this beetle in Belgium, Grand-Duché of Luxembourg and the North-East of France. Historical records were retrieved from RBINS collection voucher specimens and specimens from private collections (Jean-Yves Baugnée, Roger Cammaerts and David Ignace). The most recent records of *H. ferrugineus* were made during a detailed field study on the distribution and host preference of myrmecophiles in heathland patches south-west of Bruges, Belgium. In this study we collected myrmecophiles in a standardized way by sieving one liter of nest material from 193 ant nests, belonging to 16 ant species.

Table 1: Overview of the records of *Haeterius ferrugineus* (Olivier 1789) in Belgium, Luxembourg and North-East of France. Every row represents a record made in a distinct host nest. Every record is mapped in **Figure 2** with the number code (NR) of the first column. Records 5, 12 and 15 were previously published.

NR	Date	Location	Country	individuals	host ant	Collector/collection/reference
1	October 1876	Noville-sur-Mehaigne	Belgium	2	Unknown	Collection Jacobs
2	17/05/1880	Marloie	Belgium	1	Unknown	Collection de Borre
3	05/05/1910	Beez	Belgium	1	<i>Formica fusca</i>	Jean Bondroit (in collection F. Guillaume)
4	19/04/1943	Virton St Mard	Belgium	1	<i>Formica fusca</i>	Narcisse Leleup
5	23/08/1960	Torgny (dehors de la réserve)	Belgium	1	<i>Lasius flavus</i>	Clément Segers (Segers C, 1960, 1962)
6	24/06/1961	Torgny	Belgium		<i>Lasius flavus?</i>	Emile Derenne
7	25/04/1992	Foïsches	France	1	<i>Lasius alienus</i> ,	Roger Cammaerts
8	22/04/1992	Juvigny-sur-Loison	France	1	<i>Formica cunicularia</i>	Roger Cammaerts
9	09/04/1992	Minière du Heydt, Rédange	France	1	<i>Formica fusca</i>	Roger Cammaerts
10	30/05/1993	Boirs: carrière de tuffeau	Belgium	1	<i>Lasius niger</i>	Roger Cammaerts
11	03/04/1999	Esch-sur-Alzette, lieu-dit Galgebierg-Burgronn	GD Luxembourg	1	<i>Formica fusca</i>	Roger Cammaerts
12	05/04/1999	Carrière de Vance, Arlon	Belgium	1	Unknown	Maurice Delwaide & Yves Thieren (Delwaide & Thieren, 2010)
13	27/04/1999	Kayl-Rumelange, Holleschbiereg, lieu-dit Leiffrächen	GD Luxembourg	2	<i>Formica cunicularia</i>	Roger Cammaerts
14	23/03/2005	Champalle (Yvoir)	Belgium	1	<i>Formica fusca</i>	Jean-Yves Baugnée
15	11/09/2005	Carrière de Vance, Arlon	Belgium	3	<i>Formica fusca</i> et <i>Lasius</i> sp	Maurice Delwaide & Yves Thieren (Delwaide & Thieren, 2010)
16	16/04/2010	Sovimont/Floreffe	Belgium	2	<i>Formica fusca</i>	David Ignace
17	24/03/2011	Sablère de Champ'taine, Chaumont-Gistoux	Belgium	2	<i>Formica fusca</i>	Jean-Yves Baugnée
18	12/05/2017	Kayl	GD Luxembourg	1	<i>Formica fusca</i>	David Ignace
19	11/08/2017	Esch-sur-Alzette	GD Luxembourg	1	<i>Formica cunicularia</i>	David Ignace
20	22/05/2023	Brugge	Belgium	1	<i>Formica fusca</i>	Thomas Parmentier
21	22/05/2023	Brugge	Belgium	1	<i>Formica fusca</i>	Thomas Parmentier

22	22/05/2023 + 16/06/2023	Brugge	Belgium	12	<i>Formica fusca</i>	Thomas Parmentier
23	17/07/2023	Brugge	Belgium	1	<i>Formica fusca</i>	Thomas Parmentier
24	29/09/2023	Brugge	Belgium	1	<i>Formica sanguinea</i>	Thomas Parmentier

RESULTS

We compiled 23 records for *H. ferrugineus* in Belgium, Luxembourg and North-East of France of which three were previously published. An overview of the records and the number of individuals per nest are given in **Table 1**. Most records were concentrated in the south of Belgium and the border region of Grand-Duché of Luxembourg and France (**Figure 2**). Beetles were typically found with *F. fusca* or the related *F. cunicularia* (subgenus *Serviformica*). Our most recent records were found in four *F. fusca* nests and one *F. sanguinea* nest in heathland patches around Bruges in the north of Belgium. Interestingly, the beetle here was found in 4 of 36 sampled *F. fusca* nests and 1 of the 25 sampled *F. sanguinea* nests but was not recorded in the one liter samples of the nests of co-occurring ant species, such as *F. polyctena* ($N = 21$), *F. rufa* ($N = 2$), *Lasius fuliginosus* ($N = 8$), *L. niger* ($N = 28$), *L. platythorax* ($N = 11$), *L. flavus* ($N = 26$), *Myrmica* species ($N = 31$) and *Tetramorium* ($N = 4$) species.

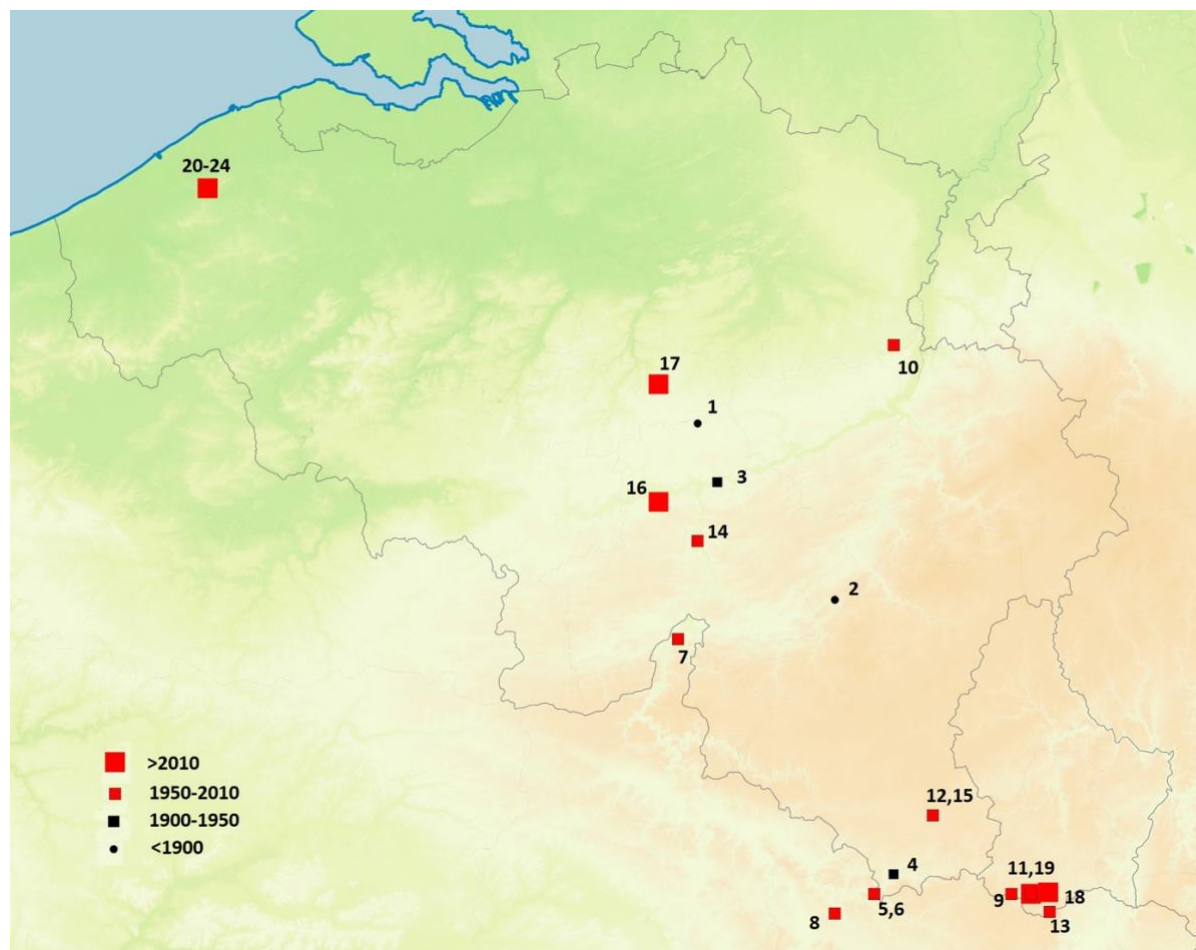


Figure 2: Map with records of *Haeterius ferrugineus* (Olivier 1789) in Belgium and nearby countries near the Belgian border. Numbers refer to localities mentioned in **Table 1**.

DISCUSSION

The beetle *Haeterius* is a small myrmecophilous beetle that is hard to find in North-West Europe. Our records show that it was typically found in *Formica fusca* or related *Serviformica* nests (Wasmann, 1894, 1905; Wheeler, 1908). The association of *Haeterius* beetles with other ant species may be either accidental or a consequence of social parasitism occurring within *Serviformica* nests. In particular, colonies of *F. fusca* and *F. cunicularia* are often targeted and taken over by red wood ants (*Formica rufa* group). This makes it easy for *Haeterius* beetles to associate with the new nest residents. Additionally, the brood of *Serviformica* nests is frequently raided by slave-making ants like *F. sanguinea* and *Polyergus*. It has been observed that the beetles exhibit a fascinating hitchhiking behavior, where they cling onto the raided pupae and are carried and transferred into the slavemaker ant nests (Hönle, 2022).

Most records in Belgium, but also in other European countries, typically mention one or two beetle specimen per nest (Donisthorpe, 1927; Vallenduuk, 1987; Lapeva-Gjonova, 2013). These records are mainly conducted by lifting stones and observing some specimen at the surface of the nest residing under the stone. During our last survey, we collected an exceptional number of 12 specimen in a single *F. fusca* nest. For this nest, we excavated a significant portion (approximately 5 liters) and spread the material onto large trays. We added a moist plate made of plaster in the middle of the trays. The ants instinctively collected their brood and sought refuge beneath the moist plaster. Interestingly, beetles were consistently attracted to these brood piles and were readily observed amidst the ant offspring under the plaster. Whenever we lifted the plaster, the ants carried their brood to safety, with the beetles frequently hitching rides on the transported brood (Wasmann, 1905).

We believe that this beetle is much more abundant than currently recorded. However, its cryptic biology deep inside the brood chambers of ant nests coupled with its small size result in it being overlooked. A more thorough investigation of its distribution, behavior, and host associations would undoubtedly provide valuable insights into the ecology of this fascinating beetle.

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