

First record of the louse fly *Icosta minor* (Diptera: Hippoboscidae) in Austria, including information on the host choice and entire distribution of the species

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Abstract. The first record of the polyphagous louse fly *Icosta minor* (Bigot in Thomson, 1858) in Austria has been reported. Worldwide, a total of 112 host specimens were documented. A compilation of all previously published host data has also been carried out, comprising 42 bird species, with passerine birds identified as the most frequent hosts. The mean of host size was 20.02 cm [95% CI: 17.53 – 23.19]. According to the current state of knowledge, southern Africa is considered to be the primary habitat of the species, while findings from other regions are rare and are probably associated with migratory birds.

Key words: *Icosta minor*, Hippoboscidae, hosts, distribution, Africa, Asia, Europe, Austria.

Introduction

Louse flies (Diptera: Hippoboscidae) are blood-sucking parasites that infest either mammals or birds, with a differing degree of host specificity that varies from species to species. They are distributed throughout the world, with most species found in tropical and subtropical regions (Büttiker 1994). Worldwide, the family comprises only 204 species.

Icosta minor was initially described by Bigot (1858) as *Olfersia minor*, on the basis of a specimen from Gabon. With a wing length of only 3.5–4 mm (Büttiker 1994), it is a relatively small louse fly that primarily parasitizes passerine birds, while it can be found less frequently on species from other bird orders (Maa 1969). Nevertheless, the species is polyphagous, and the choice of host species is therefore quite random. Southern Africa is the primary habitat of the *Icosta minor*, though it has also been documented sporadically in the Mediterranean Basin by findings in Croatia, Israel, Italy, Malta and Turkey (Bear & Freidberg 1995, Maa 1964, 1969, Schembri 1979, Sychra et al. 2020, Theodor 1975, Theodor & Oldroyd 1964, Trilar & Krčmar 2005), on the Atlantic coast in the south of Portugal, in Tenerife and on the Souss flood plain in Morocco (Beaucournu et al. 1985, Baez 1978, Maa 1969, Tomás et al. 2021) as well as some more distant regions of central Asia (Doszhanov 1975, Grunin 1988). In very rare cases, *Icosta minor* has been introduced into more northerly regions of Europe by migratory birds. Such observations have only been made in Great Britain, the north-western part of Russia and in Slovakia, with the most recent find occurring about 47 years ago (June 1974, Slovakia) (Chalupský & Macháček 1977, Corbet 1956a, Grunin 1988, Thompson 1974).

The present report describes a current record of *Icosta minor* in Europe and provides an overview of the host choice and the distribution of this species.

Material and methods

Since 1994, standardized scientific bird captures have been carried out at the settling ponds of a former sugar factory near Hohenau (WGS84 coordinates 48.583333°N, 16.908056°E) in eastern Austria (Tiefenbach et al. 2009). In 2020, researchers at the Hohenau-

Ringelsdorf Biological Station and the University of Applied Sciences Dresden began a collaboration in which the aim was the systematic documentation of louse flies. Louse flies were collected following bird capture (leg. B. Paces), stored in twist vials filled with 70 % alcohol and sent to Dresden. To identify the louse fly species, we used a stereo binocular SMZ 745T (Nikon) microscope, a VHX-5000 (Keyence) digital microscope and literature data from Büttiker (1994). For determination of the preferred host size, a compilation was made of all publications providing host numbers and species of *Icosta minor*, and their length data were taken from Bauer et al. (2005), Hoyo et al. (1997, 2005, 2006a, b, 2008, 2009, 2010, 2011), Svensson et al. (2017) and Zimmerman (1999) (Table 1). Microsoft Excel® (version 2016, Microsoft Corporation, Redmond, WA, USA) was used for data collection, processing and to create the graph. For the groups formed according to region, 95% confidence intervals (CI) were calculated by using the bootstrapping method (n=1000, IBM SPSS statistics program vers. 25, SPSS Inc., Chicago, IL, USA) for the host size.

Results

A male of *Icosta minor* (Fig. 1) was collected on August 10, 2020, during the bird banding season in Hohenau (Austria). This finding is new to Austrian fauna and the fifth overall in Europe outside the Mediterranean Basin. No host species could be specified. By now, within all of the published data, there has been a documentation of 112 specimens from Africa, Asia and Europe, with 34 house and Spanish sparrows reported in Kazakhstan alone (Table 2, special study sites according to references see Fig. 2). The vast majority of all records are historical data older than 43 years.

Host species are mentioned in a total of 101 of the records. These comprise 42 bird species, of which 36 belong to Passeriformes, three to Cuculiformes, one to Accipitriformes and a further one to Gruiformes (Tab. 2). In one case, it could not be ascertained whether *Cyanomitra alinae* (Jackson, 1904) or *Batis diops* (Jackson, 1905) had been the host. Other birds were either not identified more precisely or were referred to as a 'sparrow' or 'finch' or with the genus name only. Borrett (1969) found *Icosta minor* on a passerine species, which was later recognized to be a species complex. According to the current state of knowledge, these are mainly small to medium-sized birds with a body length between about 10 cm and

Table 1. Size of bird species of *Icosta minor* hosts.

Bird species	Size (cm)	Resource
<i>Acrocephalus arundinaceus</i> (Linnaeus, 1758)	19	Bauer et al. (2005)
<i>Anaplectes rubriceps</i> (Sundevall, 1850)	15	Hoyo et al. (2010)
<i>Anthus trivialis</i> (Linnaeus, 1758)	15	Bauer et al. (2005)
<i>Argya squamiceps</i> (Cretzschmar, 1827)	26–29	Hoyo et al. (2006b)
<i>Bradypterus grandis</i> Ogilvie-Grant, 1917	19	Hoyo et al. (2006a)
<i>Centropus burchellii</i> Swainson, 1838	36–42	Hoyo et al. (1997)
<i>Centropus superciliosus</i> Hemprich & Ehrenberg, 1829	36–42	Hoyo et al. (1997)
<i>Centropus toulou</i> (Stadius Müller, 1776)	40–46	Hoyo et al. (1997)
<i>Cercotrichas leucophrys</i> (Vieillot, 1817)	14–16,5	Zimmerman (1999)
<i>Cinnyris talatala</i> (Smith, 1836)	12	Hoyo et al. (2008)
<i>Circus pyrgargus</i> (Linnaeus, 1758)	39–50	Svensson et al. (2017)
<i>Crex crex</i> (Linnaeus, 1758)	25	Bauer et al. (2005)
<i>Erithacus rubecula</i> (Linnaeus, 1758)	13,5–14	Bauer et al. (2005)
<i>Estrilda atricapilla</i> J. Verreaux & E. Verreaux, 1851	10,5	Hoyo et al. (2010)
<i>Euplectes capensis</i> (Linnaeus, 1766)	5	Hoyo et al. (2011)
<i>Euplectes orix</i> (Linnaeus, 1758)	12–14	Hoyo et al. (2011)
<i>Lagonosticta senegala</i> (Linnaeus, 1766)	9,5–11	Hoyo et al. (2010)
<i>Lanius excubitor</i> Linnaeus, 1758	25	Hoyo et al. (2008)
<i>Lanius excubitoroides</i> Prévost & Des Murs, 1847	25	Hoyo et al. (2008)
<i>Lanius senator</i> (Linnaeus, 1758)	19	Hoyo et al. (2008)
<i>Linaria cannabina</i> (Linnaeus, 1758)	13–14 cm	Bauer et al. (2005)
<i>Macronyx croceus</i> (Vieillot, 1816)	20–22	Hoyo et al. (2009)
<i>Melittophagus pusillus</i> Stadius Müller, 1776	15–17	Hoyo et al. (2006a)
<i>Oenanthe familiaris</i> (Wilkes, 1817)	14–15	Hoyo et al. (2006a)
<i>Oriolus larvatus</i> Lichtenstein, 1823	20–21,5	Hoyo et al. (2008)
<i>Oriolus monacha</i> (Gmelin, 1789)	24	Hoyo et al. (2008)
<i>Passer domesticus</i> (Linnaeus, 1758)	14–16	Bauer et al. (2005)
<i>Passer hispaniolensis</i> (Temminck, 1820)	15	Bauer et al. (2005)
<i>Passer montanus</i> (Linnaeus, 1758)	14	Bauer et al. (2005)
<i>Phyllastrephus terrestris</i> Swainson, 1837	22	Hoyo et al. (2005)
<i>Pica pica</i> (Linnaeus, 1758)	51	Bauer et al. (2005)
<i>Ploceus capensis</i> (Linnaeus, 1766)	18	Hoyo et al. (2010)
<i>Ploceus cucullatus</i> (Stadius Müller, 1776)	15–18	Hoyo et al. (2010)
<i>Ploceus intermedius</i> Rüppell, 1845	13	Hoyo et al. (2010)
<i>Ploceus subaureus</i> Smith, 1839	15	Hoyo et al. (2010)
<i>Pycnonotus tricolor</i> (Hartlaub, 1862)	18	Hoyo et al. (2005)
<i>Sylvia borin</i> (Boddaert, 1783)	13–14	Bauer et al. (2005)
<i>Sylvia melanocephala</i> (Gmelin, 1789)	13–14	Svensson et al. (2017)
<i>Tchagra australis</i> (Smith, 1836)	15	Hoyo et al. (2009)
<i>Tchagra senegalus</i> (Linnaeus, 1766)	19–22	Hoyo et al. (2009)
<i>Turdus libonyana</i> (Smith, 1836)	21–23	Hoyo et al. (2005)
<i>Vidua macroura</i> (Pallas, 1764)	12,5–13	Hoyo et al. (2010)

Figure 1. *Icosta minor*, male, Hohenau (Austria) (Scale bar: 1000 μ m).

Table 2. Survey of *Icosta minor* records, number and host species (n = number, * data more than 40 years old, ** no date specification *** det. "*Anthus novaeseelandiae*" (Borrett 1969), probably *Anthus cinnamomeus* (Rueppell, 1840)).

Country/region	n	Host species	Source
Palaeartic region			
Accipitriformes			
Kazakhstan	1	<i>Circus pyrgus</i>	Doszhanov (1975)
Gruiformes			
Great Britain	1	<i>Crex crex</i>	Thompson (1974)*
Passeriformes			
Croatia	1	<i>Sylvia borin</i>	Trilar & Krčmar (2005)
Great Britain/Fair Isle	1	<i>Anthus trivialis</i>	Corbet (1956a)*
Israel	1	<i>Argya squamiceps</i>	Theodor (1975)*
	1	<i>Lanius senator</i>	Theodor & Oldroyd (1964)*
	1	<i>Passer domesticus</i>	Bear & Freidberg (1995)
Kazakhstan	1	<i>Linaria cannabina</i>	Doszhanov (1975)*
	34	<i>Passer domesticus / hispaniolensis</i>	
Malta	1	<i>Erithacus rubecula</i>	Schembri (1979)*
	1	<i>Passer hispaniolensis</i>	
	1	<i>Sylvia melanocephala</i>	
Morocco	1	<i>Lanius excubitor</i>	Beaucournu et al. (1985)**
	1	<i>Tchagra senegalus</i>	Maa (1969)*
Portugal	1	<i>Erithacus rubecula</i>	Tomás et al. (2021)
Russia/Kaliningrad	1	<i>Anthus trivialis</i>	Grunin (1988)*
Slovakia	1	<i>Passer montanus</i>	Chalupský & Macháček (1977)*
Spain/Tenerife	1	<i>Lanius excubitor</i>	Baez (1978)*
	1	<i>Passer hispaniolensis</i>	
Turkey	1	<i>Pica pica</i>	Maa (1969)*
Host species unknown			
Austria	1		this paper
Italy	1		Maa (1969)*
Morocco	1		Maa (1969)*
Turkey	1		Speiser (1904)*
Russia/east of Ural	1		Matyukhin et al. (2017)*
Afrotropic region			
Cuculiformes			
Madagascar	1	<i>Centropus toulou</i>	Maa (1964)*
Mozambique	1	<i>Centropus burchellii</i>	Maa (1969)*
Uganda	4	<i>Centropus superciliosus</i>	Maa (1969)*
Passeriformes			
Canary Islands	1	<i>Lanius excubitor</i>	Baez (1978)*
	1	<i>Passer hispaniolensis</i>	Baez (1978)*
Congo	1	<i>Vidua macroura</i>	Maa (1969)*
Gabon	1	<i>Bradypterus grandis</i>	Maa (1964)*
	1	<i>Estrilda atricapilla</i>	
Ruanda	1	<i>Euplectes orix</i>	Maa (1969)*
Senegal	1	<i>Melittophagus pusillus</i> Statius	Maa (1969)*
Sambia	1	<i>Tchagra senegalus</i>	Maa (1964)*
Simbabwe	1	<i>Acrocephalus arundinaceus</i>	Borrett (1969)*
South Africa	2	<i>Anaplectes rubriceps</i>	Sychra et al. (2020)
	1	<i>Cercotrichas leucophrys</i>	
	1	<i>Cinnyris talatala</i>	
	2	<i>Euplectes capensis</i>	
	1	<i>Oenanthe familiaris</i>	
	1	<i>Oriolus larvatus</i>	
	1	<i>Oriolus monacha</i>	Maa (1969)*
	1	<i>Passer domesticus</i>	Sychra et al. (2020)
	1	<i>Phyllastrephus terrestris</i>	
	1	<i>Ploceus capensis</i>	Maa (1969)*
	1	<i>Ploceus cucullatus</i>	Sychra et al. (2020)

Continued on the next page

Table 2. (continued).

Country/region	n	Host species	Source
	1	<i>Ploceus intermedius</i>	
	1	<i>Ploceus subaureus</i>	
	1	<i>Pycnonotus tricolor</i>	
	1	<i>Tchagra australis</i>	
	3	<i>Turdus libonyana</i>	Maa (1969)*
Sudan	1	<i>Passer domesticus</i>	Maa (1969)*
Tansania	1	<i>Tchagra senegalus</i>	Maa (1969)*
Uganda	2	<i>Lagonosticta senegala</i>	Maa (1969)*
	2	<i>Lanius excubitoroides</i>	
	1	<i>Macronyx croceus</i>	
	1	<i>Turdus libonyana</i>	Sychra et al. (2020)
Host species unknown			
Congo	1	<i>Cyanomitra alinae</i> or <i>Batis diops</i>	Maa (1969)*
	1	<i>Anthus</i> sp.	Maa (1964)*
	1	No advice	
Ethiopia	1	No advice	Maa (1969)*
Gabon	1	No advice	Bigot (1858)*
	1	<i>Estrilda</i> sp.	Maa (1964)*
Kenya	1	Finch (Fringillidae)	Maa (1969)*
	1	No advice	
Malawi	1	Passeriformes	Maa (1969)*
Simbabwe	1	<i>Anthus spec.</i> ***	Borrett (1969)*
South Africa	1	No advice	Speiser (1902)*
Total	112		

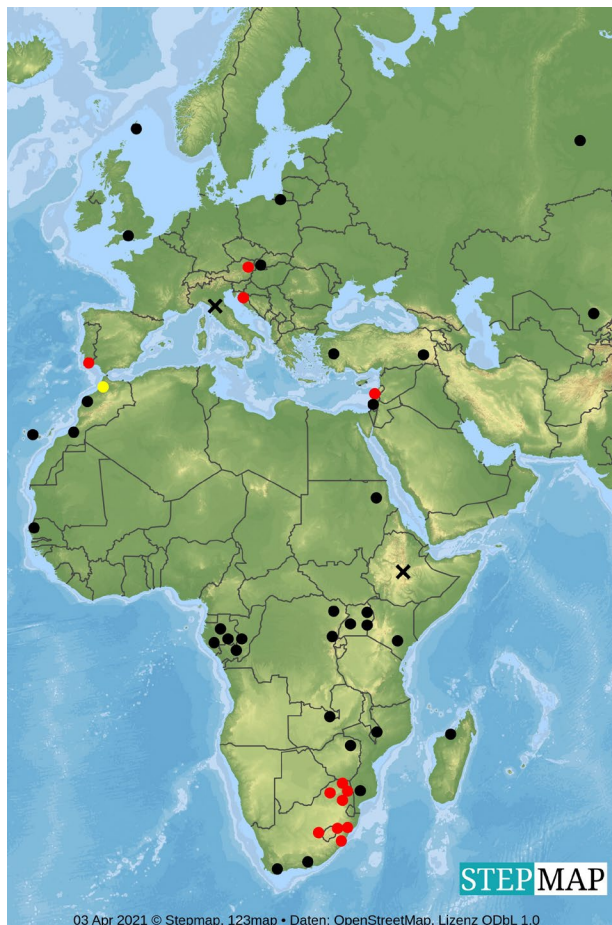


Figure 2. Map of *Icosta minor* records in Africa, Asia and Europe (red dots – records after 1995, black dots – records before 1978, yellow dot – no date specification, black cross – no special study site mentioned within the country).

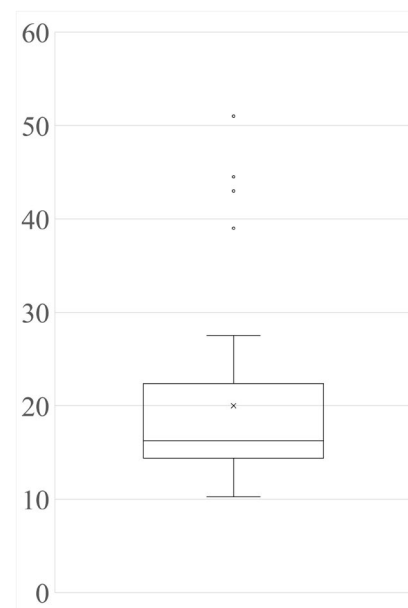


Figure 3. Distribution of hosts sizes of *Icosta minor* (ordinate axis measurement in cm).

25 cm, with 50% of the existing data being less than or equal to a median of 16.25 cm. The mean of all data is 20.02 cm [95% CI: 17.53 – 23.19] (Fig. 3). The outliers seen in Figure 3 belong to three species of cuckoo, a common magpie and a Montagu’s harrier. Findings were recorded in every month of the year, with the exception of January and March.

Discussion

If the overall documentation of *Icosta minor* is considered as a whole, two main points stand out. Most of the finds come from the southern regions of Africa. In the case of South Africa, Sychra et al. (2020) even suggest that *Icosta minor* and *Ornithoica turdi* (Latreille, 1812) are the two most common louse-fly species found on small passerines. The northernmost records in this region and in West Africa are from Sudan, Ethiopia and Senegal, respectively (Maa 1964, 1969). The northern frontier of the Afrotropic region runs approximately along this line and there is a lack of findings from the adjoining portions of northern Africa. There, the louse fly fauna may be markedly less well studied. In any case, the southernmost reports come only from the countries bordering the Mediterranean Sea and the directly adjacent areas of Morocco, the Canaries and Portugal (Baez 1978, Bear & Freidberg 1995, Beaucournu et al. 1985, Maa 1969, Schembri 1979, Thomas et al. 2021, Trilar & Krčmar 2005). These findings, together with the few records from the more northern and north-eastern areas of Europe (Chalupský & Macháček 1977, Corbet 1956a, Doszhanov 1975, Matyukhin 2017, Thompson 1974), including the first report from Austria described here, suggest that, rather than these being the main habitats of the flies, they are transported by migrating birds along the main western and eastern migration routes and to their summer grounds (Berthold 2007). In this context, it cannot be ruled out that the record from Senegal (Maa 1969) must already be added to this category and that the boundary of the species' actual habitat must be shifted to the more southern regions. Maa's (1964, 1969) statement that the species is distributed over the Afrotropic region and the Mediterranean basin should be specified in this context pending more current scientific findings.

Among the currently known records, the large number of finds in Kazakhstan between 1967 and 1972 (37 specimens, 34 from house and Spanish sparrows alone, Doszhanov 1975), the record of a specimen in 1909 from the Ural Mountains (Matyukhin 2017) and from Fair Isle (Corbet 1956a) stand out, as they are located at a greater distance than the other findings. In all of these cases, the authors describe a causal relation between the findings and aviary migration. Doszhanov's (1975) assumption that *Icosta minor*'s habitat might extend into the Indian region because it is the wintering grounds of *Passer hispaniolensis* has not yet been confirmed. Other than the findings of the species in Kazakhstan during the time period mentioned above, reports of the species outside the southern half of Africa have remained only rare exceptions in recent decades. Further and more detailed examination of louse fly fauna, especially in the countries of Asia Minor, would be helpful in monitoring this phenomenon.

Maa (1969) had additionally already reported that the hosts consisted mainly of passerines and only rarely other bird species. This finding is supported by the more recent data (in particular Sychra et al. 2020, who also found an example of co-occurrence of *Icosta minor* with the louse fly *Ornithoica turdi* (Latreille, 1812) each on one host: *Turdus libonyana* and *Anaplectes rubriceps*). Furthermore, some non-specified passerines were mentioned (e.g. 'sparrow', 'finch', (Maa 1969)). Borrett (1969) reported on an *Icosta minor* spec-

imen from Zimbabwe and identified the host as *Anthus novaeseelandiae* (Gmelin, 1789), which was later discovered to be a species complex (Tyler 2020). *Anthus novaeseelandiae* is the name of an Australian bird, whereas the true name of the host from Zimbabwe is most likely *Anthus cinnamomeus* (Rueppell, 1840) which, nevertheless, is a member of the passerine order.

The spectrum of hosts among small to medium-sized birds is very unspecific and ranges primarily from small (about 10 cm body size) to medium-sized passerine birds (25 cm), with an mean of 20.02 cm. In the southern part of Africa, only cuckoo species have been identified as larger hosts, and they may come into contact with the louse flies carried by passerine birds due to their breeding parasitism. Three more species of other suborders and even larger hosts (*Circus pyrrargus*, *Pica pica*) have been found only in the Palaearctic (Doszhanov 1975, Maa 1969, Thompson 1974). Since birds such as the house sparrow and the magpie, which are not primarily known as migratory birds, were also detected as hosts in this region, an interspecific exchange of louse flies from a migrating bird to a local bird is conceivable. At a minimum, this phenomenon of host changing has already been documented by Corbet (1956b) in the case of the likewise polyphagous louse fly *Ornithomya fringillina* (Curtis, 1836). It is expected that due to the polyphagous nature of *Icosta minor*, further studies will lead to the identification of additional host species.

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