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Use of the Helgoland Bird Trap in Kabli (Estonia) to investigate seasonal migration of Diptera (Syrphidae, Muscidae, Calliphoridae and Polleniidae)

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Abstract

On 3 September 2018 Diptera (Syrphidae, Muscidae, Calliphoridae and Polleniidae) were collected in a huge Helgoland bird trap in Kabli (Estonia). The material is identified, the migratory character of the collected species is investigated and the suitability of this kind of trap to study migrating Diptera is discussed. Three species of Muscidae, three species of Calliphoridae and one species of Polleniidae are reported from Estonia for the first time.

Keywords: *Calliphora vicina*, *Calliphora vomitoria*, *Lucilia caesar*, new records, *Mesembrina meridiana*, migratory species, *Phaonia subventa*, *Polietes lardarius*, *Pollenia pediculata*

Samenvatting

Op 3 september 2018 werden in de reusachtige Helgoland vogelval in Kabli (Estland) Diptera (Syrphidae, Muscidae, Calliphoridae and Polleniidae) verzameld. Het materiaal werd geïdentificeerd. Het migratie karakter van de verzamelde soorten en de bruikbaarheid van dit soort val om migrerende Diptera te bestuderen worden besproken. Drie soorten Muscidae, drie soorten Calliphoridae en één soort Polleniidae worden voor het eerst gerapporteerd uit Estland.

Résumé

Le 3 septembre 2018, des diptères (Syrphidae, Muscidae, Calliphoridae et Polleniidae) ont été collectés dans un énorme Helgoland-type piège à oiseaux à Kabli (Estonie). Le matériel a été identifié, le caractère migratoire des espèces collectées est étudié et la possibilité d'utiliser ce type de piège pour étudier les diptères migrateurs est discutée. Trois espèces de Muscidae, trois espèces de Calliphoridae et une espèce de Polleniidae sont signalées pour la première fois d'Estonie.

Fig. 1. Helgoland-type mesh net trap in Kabli (Estonia).

Fig. 2. Final part of the trap with wooden tunnel and collecting box.

Introduction

Seasonal bird migration is a well-known and widespread phenomenon. In autumn many bird species migrate from their breeding areas to their wintering grounds. Kabli, which is situated on the southwest coast of Estonia, has a long tradition of catching and ringing birds to study their migratory habits. Each autumn, a huge Helgoland-type mesh net trap is set up (mouth height 17 m, mouth width 51 m, total length 73 m) (Fig. 1). The net narrows from the mouth towards the end of the trap, and at the end of the trap there is a short wooden tunnel followed by an interchangeable box (Fig. 2). It is situated in the dunes with its mouth oriented towards the north. In recent years migrating bats, dragonflies and butterflies were also studied.

I visited the Kabli bird trap on 3 September 2018 and also noticed Diptera in the trap which, being a dipterist, excited me and stimulated me to take a closer look.

Material and methods

On 3 September 2018, after some bird migration in the early morning, hardly any birds were entering the trap. The first Diptera appeared near the end of the trap, but unfortunately, just like most dragonflies and butterflies, they were not entering the final wooden tunnel and the interchangeable collecting box. I received permission from the local coordinator to enter the trap near its end. There, using a hand net, I caught as many Diptera as possible before they escaped through the 1 cm wide meshes of the trap. I started a little after 10:00 and continued until 18:00. Collected specimens were separated per hour. For identification VAN VEEN (2004) was used for Syrphidae (Hoverflies), GREGOR *et al.* (2016) for Muscidae and ROGNES (1991) for Calliphoridae and Polleniidae.

Results

A total of 118 specimens and 24 species were collected. They belong to four different Diptera families: Syrphidae, Muscidae, Calliphoridae and Polleniidae. Table 1 gives a list of the collected species and their numbers.

Three of the Muscidae species (*Mesembrina meridiana*, *Phaonia subventa* and *Polietes lardarius*) are reported from Estonia for the first time (confirmed by ADRIAN PONT, pers. comm., X.2020), though they are all three widely distributed in Europe.

The Catalogue of Palaearctic Diptera (SCHUMANN, 1986) mentions that *Calliphora vicina* and *Calliphora vomitoria* occur in all parts of Europe and the former Soviet Union, and that *Lucilia caesar* occurs in all parts of the Palaearctic Region. *Pollenia pediculata* is not included in this catalogue. According to ROGNES (1991) the three Calliphoridae species (*Calliphora vicina, Calliphora vomitoria* and *Lucilia caesar*) and the Polleniidae species (*Pollenia pediculata*) occur in the former Soviet Union. According to Fauna Europea (ROGNES, 2020) the four species are all widely distributed in Europe but not yet recorded in Estonia. Estonia is also not on the distribution list of *Pollenia pediculata* in the recent world Polleniidae checklist (GISONDI *et al.*, 2020). As I couldn't find any published records for the three Calliphoridae and the Polleniidae species from Estonia, I assume they are here reported from Estonia for the first time.

Amongst the collected Syrphidae there are no species new to Estonia (KUZNETZOV, 1993).

Table 1 also gives the recorded number per hour and per sex for all collected species. The total number of specimens collected per hour is shown in Fig. 3. In the morning hardly any specimens were collected, whilst the highest numbers were obtained in the period 17:00–18:00. It should be noted that during the last 20 minutes there were hardly any more Diptera. I therefore stopped collecting at 18:00.

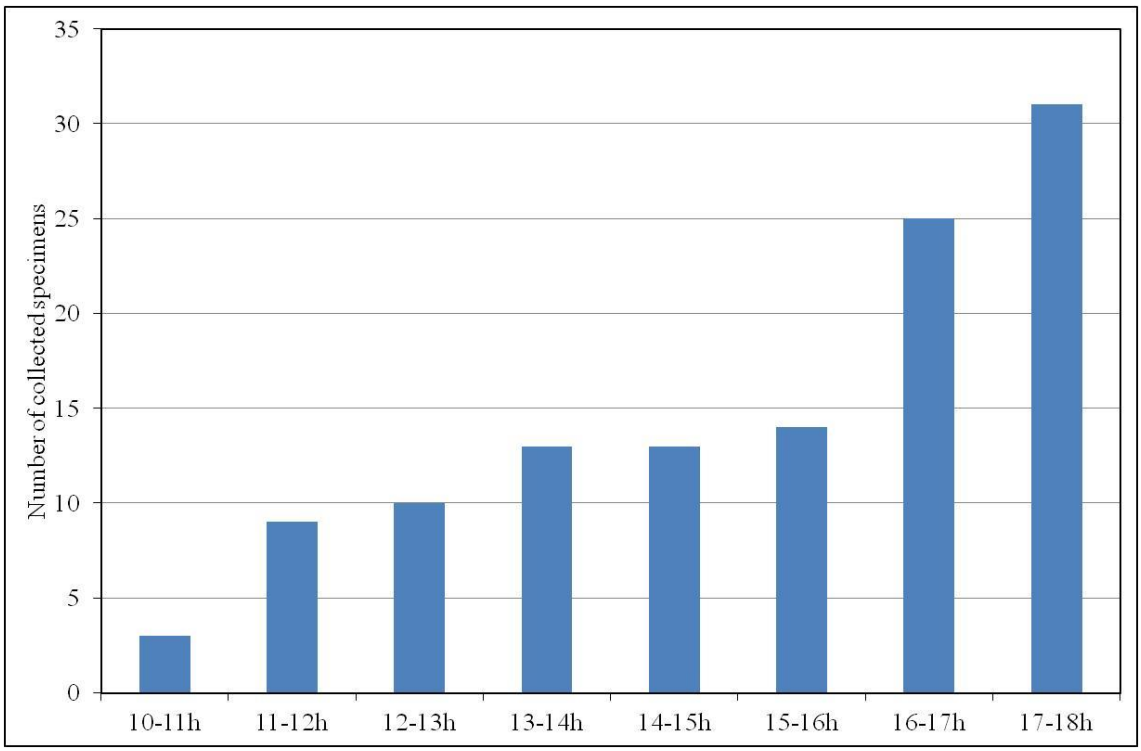

Fig. 3. Number of collected specimens per hour. Since during the last 20 minutes of the collection there were hardly any flies, the collection was stopped at 18:00.

Table 1. Collected species and numbers per hour and per sex.

	10:00 - 11:00		**11:00 - 12:00**		**12:00 - 13:00**		**13:00 - 14:00**		**14:00 - 15:00**		**15:00 - 16:00**		**16:00 - 17:00**		**17:00 - 18:00**		**Total per species and per sex**	
Family / Species	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
Syrphidae																		
Didea alneti																1	0	1
Didea intermedia											1	1	1	1			2	2
Episyrphus balteatus			1	1	1	1	1	1	2	1	2	1	1	1	2	1	10	7
Eristalis pertinax					1	1											1	1
Eristalis tenax			1	1	1	1	1	1	1	1	4	1	5	1	10	1	23	7
Helophilus pendulus			1	1			1	1							2	1	4	3
Leucozona glaucia														1			0	1
Scaeva pyrastri													1	1			1	1
Scaeva selenitica					1	1	1	1		1		1		1	1	1	3	6
Sericomyia silentis								1									0	1
Syrphus ribesii								1		1				1		1	0	4
Syrphus torvus			1	1						1	1	1		1		1	2	5
Syrphus vitripennis						1		1		1			1	1	1	1	2	5
Xanthandrus comtus													2	1			2	1
Muscidae																		
Helina impuncta										1							0	1
Helina reversio										1							0	1
Mesembrina meridiana				1													0	1
Musca autumnalis													2	1	1	1	3	2
Phaonia subventa																1	0	1
Polietes lardarius										1		1				1	0	3
Calliphoridae																		
Calliphora vicina	1	1															1	1
Calliphora vomitoria		1				1		1						1			0	4
Lucilia caesar								1		1							0	2
Polleniidae																		
Pollenia pediculata															2	1	2	1
Total per hour and per sex	**1**	**2**	**4**	**5**	**4**	**6**	**4**	**9**	**3**	**10**	**8**	**6**	**13**	**12**	**19**	**12**	**56**	**62**

Discussion

Syrphidae

Several species of Syrphidae are known to be seasonal migrants. Northward migration in spring and at the beginning of summer is rarely noticed as such, but the resulting influxes cannot be missed (ROTHERAY, 2010). On the contrary, southward migration at the end of summer is more frequently observed, mainly in years with a large number of migrating Syrphidae.

Hoverfly migration at Kabli was to be expected. Migrating Syrphidae like to follow the coast and prefer to fly along the lee or sheltered sides of sea walls and sand dunes, especially when there is a headwind. With a tailwind they fly higher to take advantage of the wind. Sometimes Syrphidae also travel over the sea and they have been recorded on ships, oil rigs and at lighthouses (REEMER *et al*., 2009, ROTHERAY, 2010). Additionally, some passes in the Alps and the Pyrenees are renowned for the large number of Syrphidae passing through at the end of summer (LACK & LACK, 1951; SNOW & ROSS, 1952; GRAY *et al.* 1953; AUBERT *et al*., 1976). In the Alps, AUBERT & GOELDLIN DE TIEFENAU (1981) marked and recovered marked individuals more than 100 km away, flying through mountain passes.

Syrphidae almost exclusively migrate on warm unclouded days with little wind (GRAY *et al*., 1953; REEMER *et al*., 2009). On 3 September 2018, when I was in Kabli, the weather gradually changed from cloudy and cool in the morning to pleasantly sunny in the second half of the afternoon. At the nearby weather station "Häädemeeste" the wind direction was varying between N and NE. At 12:00 it was 19°C and the wind speed was 3.1 (max. 4.1) m/s. As it was only sunny in the second half of the afternoon, for most of the day the weather was not ideal for insect migration. Moreover, due to the tailwind migrating insects were likely flying high. The weather will at least partly be responsible for the low number of collected specimens. Moreover, it was not surprising that in the morning hardly any specimens were recorded and that the numbers increased during the day. The highest number was obtained in the period 17:00–18:00.

Most hoverfly species that were recorded in Kabli (*Episyrphus balteatus, Eristalis pertinax, Eristalis tenax, Helophilus pendulus, Scaeva pyrastri, Scaeva selenitica, Syrphus ribesii, Syrphus torvus* and *Syrphus vitripennis)* are reported to be migratory (AUBERT *et al*., 1976; AUBERT & GOELDLIN DE TIEFENAU, 1981; GATTER & SCHMID, 1990). Remarkably, one of the best-known migratory species, *Eupeodes corollae,* was not recorded in Kabli. According to ROTHERAY & GILBERT (2011), *Didea alneti* is a vagrant species which visits the British Isles on an irregular basis and *Xanthandrus comtus* is a migrant on the continent. For *Didea intermedia, Leucozona glaucia* and *Sericomyia silentis*, no information on migration was found. The species that migrate can differ between regions/locations (REEMER *et al*., 2009).

Muscidae

According to MCALISTER (2017) stable flies *Stomoxys calcitrans* can travel long distances (up to 40 km a day). Both sexes are haematophagous and feed mainly on large mammals. They have a voracious appetite, feeding two to three times a day, forcing them regularly to travel to satiate themselves.

Very little information about seasonal migration of Muscidae was found. In the Alps, AUBERT & GOELDLIN DE TIEFENAU (1981) marked flies at the mountain pass 'Col de Bretolet' (Switzerland) and at the mountain pass 'Col de la Gozèle' (France), which is about 3 km southwest of 'Col de Bretolet'. Besides marked Syrphidae, they also recaptured two species of marked Muscidae: four *Muscina prolapsa* and one *Polietes lardarius*. Also, in the Alps, Wotton & Menz caught many migrating Muscidae and Calliphoridae in addition to Syrphidae (KARL WOTTON & MYLES MENZ, pers. comm., IX.2020).

Calliphoridae and Polleniidae

MCALISTER (2017) states that some Calliphoridae are very mobile. They are able to detect dead bodies from considerable distances (sometimes more than 16 km) and subsequently travel to those bodies. I could find very little information in the literature about seasonal migration by Calliphoridae. In the Alps, AUBERT & GOELDLIN DE TIEFENAU (1981) marked flies at the

mountain passes 'Col de Bretolet' and 'Col de Cou' (Switzerland) from which they recaptured four Syrphidae and one Calliphoridae (*Calliphora vicina*) at the mountain pass 'Col du Glandon' (France), which is about 111 km further to the southwest. *Calliphora vicina* is one of the Calliphoridae species that was collected in Kabli. As already mentioned above, KARL WOTTON & MILES MENZ (pers. comm., IX.2020) have stated that, at least in the Alps, many Calliphoridae migrate through mountain passes.

Helgoland-type trap

The trap in Kabli is huge, 17 m high and 51 m wide at the mouth, which offers interesting opportunities for studying migrating insects. But the trap also has some disadvantages. As the meshes of the net are 1 cm wide, many flies escape through the meshes. Covering at least the last part of the trap with a net with finer meshes would probably resolve this difficulty. In addition, it is unfortunate that the flies do not enter the short wooden tunnel and the interchangeable box at the end of the trap, and so they remain in the trap where they have to be caught with a hand net. This is very labour intensive and probably unfeasible at moments when there are very high numbers of migrating flies. As flies normally search for a way out by flying upwards towards the light, this could probably be solved by making near the end of the trap one part of the net higher, i.e. creating some kind of cylinder on top. At the top of this cylinder, an interchangable collecting jar with alcohol could be attached.

More data are needed to obtain an idea of the numbers and to assess their seasonal pattern and responses to weather conditions. More research is also needed to find out which species are migratory in Kabli and which species are local. Diptera can enter the trap through the mouth but also through the 1 cm wide meshes of the net which increases the change of trapping local, non migrating Diptera.

Fig. 4. Location of large bird traps along the Baltic coast.

As there are more large bird traps along the Baltic coast (see Fig. 4), one could think of a mark-recapture experiment. As, in the Alps, marked Diptera were recaptured at more than 100 km from the location where they are marked, it seems realistic to recapture Diptera also along the Baltic coast. Taking into account their geographical location, especially the traps in Pape (Latvia), Ventės Ragas (Lithuania), Fringilla (Kaliningrad Oblast, Russia) and Mierzeja Wiślana (Poland) seem suitable. Local non-migratory species or specimens can be recaptured in the trap where they are marked. Though large amounts of Diptera need to be marked to have a chance to recapture some (AUBERT & GOELDLIN DE TIEFENAU, 1981) and there is still the technical problem of the meshes which are currently too wide.

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