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The Sphaeroceridae and Lonchopteridae (Diptera) fauna of a heathland ecosystem (the nature reserve "Groot Schietveld")

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Abstract

In the scope of a larger study of the insect fauna of the heathland "Groot Schietveld", Brecht, Belgium, we carried out a survey of the Sphaeroceridae and Lonchopteridae fauna (Diptera). From April till December 1995, different heathland vegetations were sampled with white and yellow water traps at ground surface level. In all, 29 Sphaeroceridae and two Lonchopteridae species were found. Minilimosina splendens *is recorded for the first time for the Belgian fauna.*

Samenvatting

In het kader van een grotere studie over de insecten van het heidegebied "Groot Schietveld" te Brecht, werd een onderzoek uitgevoerd naar de Sphaeroceridae en Lonchopteridae fauna (Diptera). Van april tot december 1995 werden de vliegen verzameld in verschillende heidevegetaties door middel van witte en gele watervallen op grondniveau. In totaal werden 29 Spaeroceridae en twee Lonchopteridae soorten gevonden. Minilimosina splendens *wordt voor de eerste maal gemeld voor de Belgische fauna.*

Introduction

Heathlands are characterized by large open areas and acidic, nutrient poor, sandy soils. These characteristics oppose particular demands to the inhabiting fauna and flora (Stubbs & Fry, 1991). As a consequence, many heathland species are specialised in one or more ways, and their occurrence is closely linked to the habitat. During the last decades, heathland has become an increasingly endangered habitat in Europe. Heathland fragmentation, disappearance and deterioration has made that several of these specialised species became rare and ultimately even appeared on the red list of one or more countries.

In the scope of a larger study on the faunal composition of a large heathland, the natural area "Groot Schietveld", Brecht, Belgium, a survey of two soil dwelling Diptera families, Sphaeroceridae and Lonchopteridae, was carried out.

Sphaeroceridae, or lesser dung flies, consists of very common to rather rare, small to very small flies. The mode of life of sphaerocerid flies is generally saprophagous. The larvae develop in a wide range of decaying organic matter such as dung (mainly from mammals), carcasses of animals, refuse heaps, grass cuttings, etc... (PITKIN, 1988). Although they prefer humid conditions, Sphaeroceridae can be found in practically all kinds of habitat. Lonchopteridae are small flies with typically narrow pointed wings. They commonly occur in damp places with thick leaf carpets, where the larvae live among decaying vegetable matter (SMITH, 1969).

Material and Methods

The study area, was situated in the nature reserve "Groot Schietveld" on the municipal territory of Brecht, Belgium. This area (2500 ha) mainly consists of a large open heathland surrounded by different types of woods.

Two study sites were selected. The first is a dune slope ($\pm$500m^2) oriented to the south (UTM: FS 11 91). The top of the dune consists of large open fragments of bare sand, surrounded by a dense *Calluna vulgaris* vegetation on a dry soil. Lower, at the side of the dune, the vegetation passed into *Erica tetralix*. At the bottom, the dune is bound by a fen. The soil was very wet (inundated during winter) with a practically monotypic *Molinia caerulea* vegetation. In each vegetation strip (n=5), one sample plot was selected.

The second study site was an open area ($\pm$ 18200m^2) surrounded by mixed woods (UTM: FS 11 90). The vegetation had a mosaic structure. The basic matrix consists of a mixed *Molinia-Erica* vegetation. In this matrix, more or less isolated patches of other vegetation types were scattered. The following sample plots were selected (n=6): one dominated by *Erica tetralix*, a monotypic *Molinia caerulea* vegetation, a plot situated in an *Erica tetralix* vegetation covered by *Myrica gale* and one plot a the border of a fen. Additional plots were situated in the mixed *Molinia-Erica* matrix, and one in the mixed wood. This last plot was chosen as a kind of outlier to compare with the two heathland sites and will as such be analysed separately.

At each sampling plot we used one white and one yellow plastic water trap (diameter 19cm, depth 6.5cm). They were filled with a 0.04% formalin solution. A few drops of a colourless and odourless detergent were added to reduce surface tension. The top of the trap was at ground surface level. The traps were installed at the centre of the sample plots to reduce edge effects. From 29 April till 23 December 1995, the traps were emptied at fortnightly intervals. At the laboratory, the captured insects were transferred to a 75% alcohol solution. The flies are stored in the first author's collection at the University of Antwerp (RUCA). Later they will be deposited at the Royal Belgian Institute for Natural Sciences, Brussels.

Results & Discussion

The family Sphaeroceridae was represented by 2262 individuals belonging to two subfamilies (Limosininae and Copromyzinae) and 29 species (Tab. 1). From the family Lonchopteridae 69 specimen from 2 species were collected. One species, *Minilimosina splendens*, was recorded for the first time for the Belgian fauna (GOSSERIES *et al.*, 1991). *Opalimosina collini* is only recorded for the second time since it was added to the Belgian list (VEN & DE BRUYN, 1992).

Minilimosina splendens is an uncommon European species (PITKIN, 1988). It was formerly recorded from Great Britain, Germany, Poland, Czechia, Hungary and the 'North European territory' of the former USSR (PAPP, 1984). According to ROHÁČEK (1983) this species lives in damp woods. *M. splendes* was found on decayed fungi, deer excrements and were swept from vegetation (PITKIN, 1988). We captured two males at the wood site.

The most abundant species in this study were *Minilimosina vitripennis* (1322 specimen) and *Spelobia ochripes* (702 specimen). Both species together accounted for 89.5% of the total catch. 17 of the 31 species yielded less than ten individuals. From nine species, even only one single specimen was caught. This is a common situation in natural ecosystems where only few species are represented by many individuals while a majority are represented by only few specimen (KREBS, 1989).

Most species were captured at the mosaic (22 sp.) and wood site (21 sp.) (Tab. 1). Only 15 species were trapped at the dune site. Respectively twice as many, and 8 times more, unique species (i.e. only captured in one sample site) were found at the wood site (8 sp.) compared to the mosaic (4 sp.) and the dune sites (1 sp.). If we take the sample effort in consideration by calculating the average number of species per plot, we find 21 species/plot at the wood site, and only 7.1$\pm$3.7 and 10.6$\pm$1.1 species/plot at the mosaic and dune site. The heathland plots with the highest species number are the *Erica*-plot (12 sp.) at the dune site and the *Myrica*-plot (12 sp.) at the mosaic site.

It is clear that the wood plot carries substantially more species than the different heathland plots. A possible explanation can lie in the much higher amount of organic detritus because Sphaeroceridae and Lonchopteridae largely dependent on the presence of decaying organic matter for their larval development. In the wood plot, the litter layer was about 15cm while in the heathland plots, this layer never exceeded 8cm. Moreover, the composition was also more diverse and consisted of decaying *Molinia* grass leaves (the dominant herb) mixed with leaves of *Quercus robur*, *Betula pendula*, *Frangula alnus* and *Pinus sylvestris*. At the other plot, there were no trees and the herb layer was strongly dominated by a single plant species (*Calluna vulgaris*, *Erica tetralix* or *Molinia caerulea*).

Table 1. List of species (and number individuals) collected during this study at three different sites in a heathland. The species marked with * is new to the Belgian fauna.

Species	# ind.	Dune	Mosaic	Wood
SPHAEROCERIDAE				
Copromyzinae				
Copromyza stercoraria (MEIGEN)	2	•	•	
Crumomyia roserii (RONDANI)	1			•
Lotophila atra (MEIGEN)	22	•	•	
Limosininae				
Apteromyia claviventris (STROBL)	2			•
Coproica acutangula (ZETTERSTEDT)	6		•	
Coproica ferruginata (STENHAMMAR)	1	•		
Coproica lugubris (HALIDAY)	1			•
Kimosina sp.	4	•	•	
Leptocera fontinalis (FALLÉN)	9	•	•	•
Leptocera nigra OLIVIER	43	•	•	•
* *Minilimosina splendens* (DUDA)	2			•
Minilimosina vitripennis (ZETTERSTEDT)	1322	•	•	•
Opacifrons coxata (STENHAMMAR)	29	•	•	•
Opacifrons humida (HALIDAY)	11		•	•
Opalimosina collini (RICHARDS)	1		•	
Opalimosina liliputana (RONDANI)	1			•
Opalimosina mirabilis (COLLIN)	2		•	•
Paralimosina fucata (RONDANI)	1			•
Pteremis fenestralis (FALLÉN)	16	•	•	
Pullimosina pullula (ZETTERSTEDT)	10	•	•	•
Puncticorpus cribratum (VILLENEUVE)	14		•	•
Spelobia clunipes (MEIGEN)	16	•	•	•
Spelobia nana (RONDANI)	14	•	•	•
Spelobia ochripes (MEIGEN)	702	•	•	•
Spelobia palmata (RICHARDS)	1			•
Spelobia parapusio (DAHL)	22			•
Spelobia pseudosetaria (DUDA)	1		•	
Spelobia rufilabris (STENHAMMAR)	5		•	•
Telomerina flavipes (MEIGEN)	1		•	
LONCHOPTERIDAE				
Lonchoptera furcata FALLÉN	41	•	•	
Lonchoptera lutea PANZER	28	•	•	•
Number of species		15	22	21
Number of unique species		1	4	8
Mean number species / sample plot (mean±SD)		7.1±3.7	10.6±1.1	21

Ten sphaerocerid and one lonchopterid species were specifically caught at one or both heathland sites, and not at the wood. The biology of these species will be treated more in detail.

Copromyza stercoraria is regularly found in nests and burrows of mice (HACKMAN, 1963). We found this species at the *Erica*-plot of the dune site and the matrix-plot of the mosaic site.

According to ROHÁČEK (1989), *Lotophila atra* possesses a coprophagous life style. Adults are regularly found on excrements of various mammals. They are also regularly reported to be attracted by carcasses, rotting fungi and decaying vegetation. So, seemingly this species is rather polysaprophagous. At the dune site, it was captured at the *Calluna* zone, at the transition zone between *Calluna* and *Erica*, and at the *Molinia* zone at the bottom. At the mosaic site *L.atra* was found at the *Erica* and the *Molinia* plot.

Coproica acutangula and *C. ferruginata* are both coprophagous species, living in dung from larger mammals such as sheep, pigs and horses (ROHÁČEK, 1987; PITKIN, 1988). *C. acutangula* has also been recorded from rotting plant material (FLORÉN, 1989) and dry litter (PAPP & ROHÁČEK, 1987). Both *Coproica* species were solely caught at *Erica* plots; *C. acutangula* at the mosaic site, *C. ferruginata* at the dune site.

The four specimen (2♂♂, 2♀♀) of *Kimosina* sp. were very close to *K. longiseta* (Dahl), a rare species (ROHÁČEK, 1983; PITKIN, 1988) which was formerly found under mown sedges, in grass (RICHARDS, 1930), and in clumps *M. caerulea* (PITKIN, 1988). At the moment we do not know the life habit of the present species. We found it at the *Erica* and *Molinia* plots of the dune site, and at the *Myrica* plot at the mosaic site.

Opalimosina collini is again a coprophagous species which, in all probability, develops in excrements from large mammals (LAURENCE, 1955; PAPP, 1985). It was only collected at the *Molinia* plot of the mosaic site.

Pteremis fenestralis is a soil dwelling species which is very common in humid meadows and woods (ROHÁČEK, 1984). It lives primarily under decaying herbaceous material, but can also be found in nests and runs of small mammals (RICHARDS, 1930; HACKMAN, 1963). The habitat where we found *P. fenestralis* was variable. We trapped it at the *Calluna* zone, the transition zone between the *Calluna* and *Erica* zones on the dune slope, and at the matrix, the *Molinia*, and the *Myrica* plot of the mosaic site. It is surprising that the supposed wood inhabiting *P. fenestralis* was only collected in the heathland sites, and not in the wood.

Spelobia pseudosetaria is commonly found on and under decaying vegetation, but also on rabbit droppings (ROHÁČEK, 1983). This species was only caught at the *Myrica* plot of the mosaic site.

The last sphaerocerid species, *Telomerina flavipes* is a very common species with a preference for dark places and has a chiefly necrophagous life cycle (ROHÁČEK, 1983; PAPP & ROHÁČEK, 1987). This species is also

able to complete development on excrements and decaying fungi. It was only found in the traps at the site of the fen at the mosaic site.

Finally, the lonchopterid, *Lonchoptera furcata*, is normally found in damp places with a thick humus layer (SMITH, 1969). It was caught in high numbers at the *Molina* plots (both dune and mosaic site). *L. furcata* was also found in the traps in the *Calluna-Erica* transition zone (dune) and the matrix, *Erica* and *Myrica* plots of the mosaic site.

The most abundant species which occurred solely at the heathland plots are *Lonchoptera furcata* (n=41), *Lotophila atra* (n=22) and *Pteremis fenestralis* (n=16). All three species are polysaprophagous or are more or less specialised on decaying vegetational matter. These three species also had the broadest habitat distribution and were found in practically all plots covered by a vegetation. The mode of life of the majority of the other species is closely tied to the presence of mammals. They are primarily coprophagous in mammal excrements. Other feed on carcasses, or live in their nests. At the "Groot Schietveld" common mammals are roe deer, fox, rabbits and severel rodent species (most common: harvest mouse, wood mouse, common vole, bank vole). Practically all fly species were found at the humid *Molinia* and *Erica* dominated plots. None were found at the drier *Calluna* vegetations.

Finally we have to mention that heathland habitats, or at least those sampled during the present study, apparently do not harbour typical heathland species. All species captured were previously already reported form other habitat types such as humid meadows, gardens or woods (e.g. LAURENCE, 1955; PITKIN, 1986; VEN & DE BRUYN, 1992). Probably, the availability of the essential resources (e.g. decaying vegetable matter or fungi, animal excrements or corpses, ...) is more important than the type of habitat.

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