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Lesser dung flies (Sphaeroceridae) of the Belgian fauna: little known nutrient recyclers

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Introduction

The family Sphaeroceridae, or lesser dung flies, consists of very common to rare, small to very small flies (PITKIN 1988). They can easily be distinguished from other families by the distinctly widened and shortened first tarsomere of the hind legs. Most species are darkly coloured and possess fully developed wings. In some species wings are reduced or can even be absent. The third antennal segment is usually spherical with a long, sideways oriented arista.

The family Sphaeroceridae 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, PAPP 1992, BUCK 1997, PAPP *et al.* 1997). Although they prefer humid conditions, Sphaeroceridae can be found in practically all kinds of habitats. They are even found in caves, cellars and mine galleries or burrows and nests of mammals, birds or insects (HACKMAN 1967, MUNARI 1991). Some species are synanthropic and are known to cause some annoyance of different degrees (FREDEEN & TAYLOR 1964).

Identification keys can be found in DUDA (1932-1933) and PITKIN (1988). However, to be able to identify all Belgian species, it is necessary to consult additional papers as there are several recent generic revisions (e.g. ROHÁEK & MARSHALL 1982, 1985 & 1988, ROHÁČEK & PAPP 1988) which are not included in those keys.

World-wide more than 700 sphaerocerid species have been described (PITKIN 1988). Some are cosmopolitic. In the Palearctic region, more than 330 species have been found until now. For Belgium, the first major contributions on the family were written by VANSCHUYTBROECK (1942, 1943). LERUTH (1939) treated many forms that live in our caves. In 1991, GOSSERIES *et al.* compiled a checklist of the Belgian Sphaeroceridae. Later, more species were added to the list by VEN & DE BRUYN (1992) and DE BRUYN *et al.* (1997). At the moment, 104 species have been reported for Belgium.

Habitat specificity and indicator species

In recent decades, the conservation of insects has received increasing attention, not only because they are worth conserving, but also because some insect groups have been shown to be particularly good bio-indicators which react very quickly to environmental alterations. However, the basic knowledge on habitat specificity, necessary to construct such a predictive system, is still scarce, and in most groups even absent (LOBRY DE BRUYN 1997, VAN STRAALEN & VERHOEF 1997).

Sphaerocerid flies are tightly linked to the soil. This can probably be attributed to the feeding habit and the restricted locomotory behaviour of the studied species. Sphaeroceridae run and skip on the soil surface in the vegetation or in the litter (PITKIN 1988). Many species only fly infrequently, despite being fully winged. Some species are even brachypterous. Moreover, the flies are strongly bound to sites where the appropriate breeding substrate (e.g. decaying organic matter) is present (PITKIN 1986, BUCK 1997).

Earlier studies already pointed out that presence of the members of the family is influenced by factors as temperature, humidity and pH (HAFEZ 1939, EGGLISHAW 1960). A recent study on the habitat specificity of sphaerocerid flies in a heathland ecosystem (DE BRUYN *et al.* 2001) showed that species diversity could increase 7-fold when the soil gets wetter and contains more organic matter. Also the community composition changed under the influence of the soil parameters. The similarity based on species presence/absence reduced to 14 % within the same macrohabitat. Another study in a Poplar forest further showed that also phosphate and nitrogen play a role in structuring the species composition (ENGELEN 1998). A discriminant analysis further grouped the three traps of each sampling plot close together while the different plots of the forest, although they grew on the same soil, and consisted of the same trees, were clearly separated. The latter indicates that Sphaeroceridae indeed might be excellent indicators for environmental conditions.

Both studies further showed that the distribution of plant and fly species are both affected by soil conditions, but, no correlations were found between plant species richness and the fly diversity indices. The fly fauna is not merely a reflection of the vegetation. They clearly react to different aspects of the environment. The latter supports the findings of PRENDERGAST *et al.* (1993) that species-rich areas frequently do not generally coincide for different taxa.

Our study shows that the investigated fly communities clearly respond to microhabitat differences in the soil parameters. Additionally, the lack of a spatial structure in the species composition, even on the restricted spatial scale, points to a reduced mobility (high site fidelity) of the species. The combination of these factors makes them promising indicators for soil health and as tool for monitoring environmental changes. However, more basic research is needed to elucidate the strength of the relationship between the environmental factors and the fly communities.

Trapping

In the past, the knowledge concerning the biology of Sphaeroceridae was largely based on occasional observations by capturing Sphaeroceridae on or nearby a substrate where one could expect Sphaeroceridae. Some authors (ROHÁČEK 1983, PITKIN 1988, FLORÉN 1989), however, already noticed that some sphaerocerid species could be collected in fair numbers by using traps. However, no thorough analyses were carried out to compare different trapping methods.

In the scope of a faunistical and ecological study on the Belgian Sphaeroceridae fauna (VEN & DE BRUYN 1992), we examined which trapping methods would be the most suitable for collecting sphaerocerid flies. Therefore, interception traps, e.g. a Malaise trap (TOWNES 1972), pitfall traps (SOUTHWOOD 1978), and attraction traps (coloured traps: red, green, yellow, blue and white) (FINCH & SKINNER 1974, DE BRUYN 1986) were tested.

Most species were caught in the Malaise trap. The highest number of individuals was found in the red coloured traps. For species number, all coloured traps gave approximately the same result. The feeding and breeding sites (dung and animal burrows) of the species caught in the Malaise trap are usually scarce and widely spread in their habitat. To find the resources, the flies have to search actively. This indicates that species primarily caught in Malaise traps are active and mobile species which move long distances to search for oviposition sites. This was also already observed in other insect families (DE BRUYN *et al.* 1992). Although Malaise traps might be very effective for inventarisation work for larger sites, they are too indiscriminate for local indicator research. The coloured water traps are more effective for this purpose as their action range is confined to a few metres.

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