[Pollen in the [digestive] tract of hoverflies (Syrphidae)]

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Introduction

In the preference of hoverflies for certain plant species, attention is mainly paid to the type of flowers, but not to the crop pollen that the hoverflies have absorbed (eg Raslett, 1989; De Buck, 1990; Ssymank, 2001) with the exception of publications by Van der Goot & Grabrandt (1970), Haslett (1983, 1989) and De Buck (1986). As soon as the pollen grains enter a hoverfly gut, they are germinated with the aid of the incorporated sugars and subsequently enzymes break open the inner cell wall and make the nutrients of the pollen grain available for digestion (Haslett 1983). The firm and non-degradable exine (the outer cell wall of pollen grains) is not damaged: the structure and size of the exine makes it possible to examine the eaten pollen grains in the tract. This research starts with the analysis of the consumption pattern of hoverflies to obtain a more complete picture of their ecology.

Study material & methods

Male *Syrphus ribesii* were caught from spring to autumn in an area with thickets / grassland vegetation in Roofddorp (1x1 kilometre grid square 108-480) (Ernst 2002). In the autumn of 2004, the pollen grains of some other hoverflies from the same square present in the intestine were examined. At this time, many flowering Common hogweed (*Heracleum sphondylium*) and buttercup (*Ranunculus acris*) were present.

Only *Rhingia campestris* comes from a ruderal terrain in square 106-484. All hoverflies studied belong to polyphagous hoverflies on the basis of their flower visits (De Buck, 1990). During the catch, the flower on which the hoverfly sat and ate and the flowering plant species were noted in the area. *Eumerus strigatus* could only be caught sitting on leaves. Of the plant species present, some inflorescences (flowers) per species were collected in a separate box to facilitate the determination of the pollen grains. In addition, Andrew's (1984) pollen determination tables and photos available on the Internet (www.kv.geo.uu.selpollen: www.botany.unibe.ch) were consulted. After killing the caught hoverflies, the abdomen was first wiped with a brush to minimize pollen contamination from the outside. The abdomen is cut off from the body and opened with a razor blade, the contents of the tract are shaved in a drop of water and subsequently examined under a microscope (12 x 25 or 12 x 40) for the type of pollen grain. One hundred pollen grains per hoverfly were counted for standardization.

Results & Discussion

Table 1 shows that pollen from other plant species and with large differences in dominance in the gut of Syrphus ribesii was present in each month. The diversity of non-dominant pollen was greatest in June and July.

[**Table 1**. The diet of male *Syrphus ribesi* between April and October 2004 in the area of the Amolduspark. 100 pollen grains were counted per hoverfly.]

[**Table 2**. The type of pollen per plant species in the intestine of a series of hoverflies in the Haarlemmermeer in the autumn of 2004. Of each hoverfly, 100 pollen grains in the gut were counted. Syrphids from two locations were investigated in the square 108-480: HH Heimanshof. BP = Forest path]

[**Table 3**. The concentration (mmol kg-1 dry pollen) of nitrogen (N), phosphate (P). potassium (K) and sulfur (S) in pollen that is a food source for hoverflies (recalculated after Stanley & Linskens

1974).]

The unidentifiable pollen types may have come from flower visits in gardens. The composite pollen (Asteraceae, off grid) may be of Daisies (*Bellis perennis*) which have a very variable diameter in the research area, but here too it cannot be excluded that *S. ribesii* had eaten pollen from plant species from neighbouring gardens. With the exception of pollen from *Crepis biennis* and Common hogweed, the other pollen grains that were eaten in July come from plants mentioned as unvisited plant species by De Buck (1990).

In the autumn, large differences in the pollen species consumed were noted (Table 2). For example, the intestinal contents of *Rhingia campestris* consisted only of pollen grains of Rapeseed (*Brassica napus*).

Syrphus vitripennis ate only from blackberry (*Rubus fruticosus*) and *Episyrphus balteatus* from Hawkweed (*Hieracium umbellatum*), although many more flowering plant species were present in the week of 15 to 21 September 2005. In the intestine of a female of *Eumerus strigatus*, there was pollen from seven plant species not found in De Buck (1990). Pollen of buttercup was not found in any of the hoverfly species, although the plant bloomed throughout the study period.

In addition to the availability of pollen in the environment, the food quality of the pollen can also play a role in polyphagous hoverflies. It is known that pollen from cruciferous, umbelliferous and rose family plants is high in nitrogen (protein) as opposed to pollen from composite family plants (Table 3).

Conclusion

Apparently, polyphagous hoverflies have a greater preference for pollen from a particular plant than can be deduced from flower visits. Therefore, much research is still needed to measure the choice of plant species and the effectiveness of flower visits of hoverflies.