Pollen supply and feeding preferences of syrphids in shrub/herb vegetation boundary by feces analysis

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The role of pollen in a syrphid's metabolism

- Maturing of sex organs
- Protein supply for basic metabolism
- Exine of the pollen is indigestible
- Digestion of the interior of the pollen grain only after pollen germination in the gut and enzymatic break-down of the intine

Scope of feces analysis

- Diurnal diversity of flower visits by the same individuum
- Seasonal diversity of flower visits by the same species
- Differential exploitation of flowers by syrphid species in a small geographic area
- Time for pollen passage through the gut
- Efficiency of pollen digestion

- Methods
- (1) Analysis of pollen types in feces hand-collected syrphids kept in plastic bottles with transparent walls up to defecation.
- At feces removal, measurement of the size of the feces
- Dispersal and homogenization of feces in water on microscope slides.
- Microscopic analysis of three-time 100 pollen grains using a grid of 73 or 29 µm (Golding & Edmunds, 2003)
- (2) Feeding experiment
- Keeping syrphids for three hours for defecation. Then addition of inflorescences with morphologically contrasting pollen types for one hour. Each feces was removed immediately and analyzed.
- (3) Pollen digestion (Haslett, 1983) as % ingested pollen

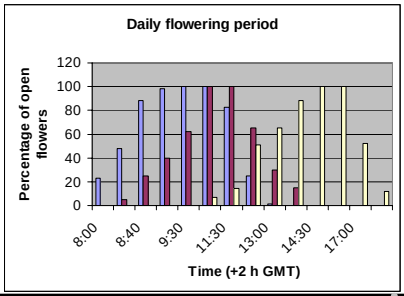
Feces size and form

Surfaces vary from 0.070 mm² in small species (*Melanostoma*) up to 16 to 20 mm² in large species (*Volucella zonaria).*
Forms are round, worm-like and patches.

From left to right feces of: *Syrphus ribesii*, *Episyrphus balteatus* with pollen of *Chenopodium album*, *Episyrphus balteatus* with pollen of *Ligustrum vulgare*, *Melanostoma scalare*, *Sphaerophoria scripta*

Species-specific opening and closing time of flowers

Flowers of *Lapsana communis* (blue) open and close earlier than those of *Cichorium intybus* (red) and *Crepis biennis (*yellow*).* Consequence for syrphids: switching to other food sources during a day.



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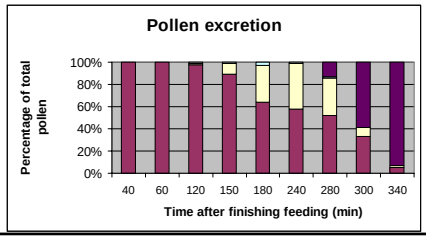
Open and closed flowers of *Cichorium intybus*

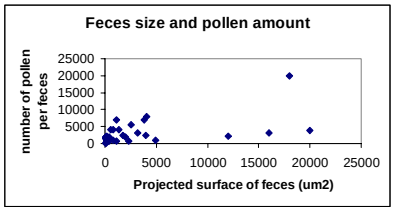
- Residence time of pollen in *Episyrphus balteatus*

When collected from inflorescences of *Heracleum sphondylium* the syrphids had consumed pollen of *Plantago lanceolata* (red) and *Heracleum sphondylium* (yellow) which stopped after sampling. Between 110 to 180 min flowers of *Rubus fruticosus* (blue) were offered for pollen consumption. Residence time of pollen can be more than 6 hours.



- Relationship between feces size and the number of pollen grains per feces

There is a highly significant correlation ($P<0.001$): y (number)=1300+0.72 x (surface)



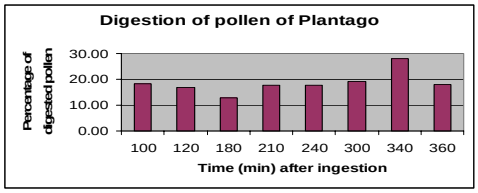
Species-specific pollen consumption in the same environment

- Only *Epistrophe eligans* and *Neoscia podagrica* ingested pollen of the tree *Prunus avium*, all other syrphids took pollen from herbs

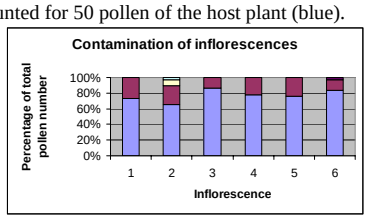
	Bras-sica	*Tussi-lago*	*Tara-xacum*	*Bellis*	*Prunus avium*
Ch. pagana	87	0	13	0	0
E. arbustorum	0	100	0	0	0
E. lineata	66	0	31	3	0
H.pendulus	0	85	14	1	0
N. podagrica	0	0	0	0	100
E. eligans	0	0	0	0	100

Digestion of *Plantago lanceolata* by *Episyrphe balteatus*

- Only less than 30% of the ingested pollen of *Plantago lanceolata* is digested during six hours after ingestion.



- Not all pollen types found in feces of the syrphids were the result of visits to different plant species, but were due to contamination of inflorescences by wind-dispersed or insect-transported pollen. Six inflorescences of *Cichorium intybus* were sampled just at closing time (noon) and per inflorescence 10 stigmata were pooled to one sample and counted for 50 pollen of the host plant (blue).



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Conclusion

- During the day, species taking pollen from flowers with a daily opening and closing rhythm have to move to other pollen suppliers.
- During the season, pollen of a high diversity of plant species are used without specific preferences.
- Not all pollen ingested are digested.
- Due to contamination of inflorescence by foreign pollen, low percentage of pollen types in feces do not indicate visit of syrphids to different plant species.

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