

Some species of the genera *Melanostoma*, *Platycheirus* and *Pyrophaena* (Diptera, Syrphidae) and their relation to flowers

by

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Present state of knowledge

In the literature many records of flowers visited by Syrphidae are to be found. All these records are, however, inconclusive because the writers omitted to observe whether the fly landed accidentally on that flower, whether it took up honey or took up pollen and if these observations are made one is unable to determine what the amount of honey or pollen is taken up in relation with feeding on other species or types of flowers. For honey-feeding we know no exact solution how to determine the amount of honey ingested on different species of flowers, but for feeding with pollen pollen-analysis of the contents of the alimentary tract will give exact figures about the different quantities of pollen taken up on different types or species of flowers. Along these lines we only refer to two publications written earlier on this matter.

The publication by GRINFELD gives a survey of research in 14 species of 11 genera of Syrphidae. GRINFELD investigated the contents of crop and intestine, especially of the crop. He found an amount of pollen in the crop, where it was stored and in small portions transported to the intestine as he actually saw in a freshly dissected fly in a physiological salt solution. The pollen is digested, because digestive saps enter the pollen grains through the pores. The excreted pollen has the normal shape, but is more transparent, because the contents have disappeared. GRINFELD also showed the presence of sugars in the crop. In *Syrphus* spec. there were 3 mg dry pollen in the crop, in *Volucella pellucens* L. 6 mg. This amount was compared with the 15 mg dry pollen on the two fully filled hind legs of a honey bee and 42 mg dry pollen on the hind legs of *Bombus lucorum* ♂, a bumble-bee. So the amount of pollen in Syrphidae is considerable, taking into account the proportions of a hover fly (*Volucella pellucens* is comparable to a honey bee, *Syrphus* is considerably smaller). However, GRINFELD did not make any pollen-analysis of the contents of the alimentary tract.

In contrast to GRINFELD, SCHNEIDER actually analyzed the pollen-contents of the crop in the females of *Scaeva* (*Lasiopticus*) *pyrastris* L., caught in early spring. He did not rule out the possibility that rare pollen grains, which were apparently ingested in the autumn of the year before, could still be found in spring-time. SCHNEIDER found many types of pollen grains in *Scaeva*. His conclusion is that *Scaeva* uses practically all possibilities offered by flowers accessible to flies, often changes the feeding-habits as to the species of flower and has a minor tendency to visit one species of flower preferably, in contrast to the honey bee. In a diagram SCHNEIDER showed he found in *Scaeva* 20 different types of pollen in only two days: 13 and 15.III. In his publication of 1969, SCHNEIDER summarized his results in *Scaeva* and made a statement concerning all Syrphidae: "Hover flies do not confine themselves to a specific kind of flower". This may be true for pollen-feeding of the majority of Syrphid-species, visiting insect-flowers, but in this publica-



Explanations of the figures in the diagrams:

1 Gramineae, 2 *Plantago lanceolata*, 3 Chenopodiaceae, 4 Cyperaceae, 5 Cruciferae, 6 *Anemone*-type, 7 *Aster*-type, 8 Compositae liguliflorae, 9 Rosaceae, 10 Rosaceae-type, 11 *Veronica*-type, 12 *Stellaria*-type, 13 *Ranunculus*-type, 14 *Achillea*-type, 15 *Cerastium*-type, 16 *Allium*-type, 17 *Gladiolus*-type (cultivated), 18 *Papaver*-type, 19 Umbelliferae, 20 *Urtica*, 21 *Cirsium*-type, 22 *Melandrium*-type, 23 *Polygonum*-type, 24 cf. *Alchemilla*-type, 25 *Calluna*, 26 *Hypericum*-type, 27 *Convolvulus arvensis*, 28 *Solanum nigrum*, 29 *Glechoma*-type, 30 *Salix*, 31 Indeterminatae.

tion it will be demonstrated that several *Platycheirus*-species have a clearly restricted range in pollen-feeding. Moreover we call to the attention of the readers *Peleco-cera tricincta* Mg., which in Holland visits nearly exclusively *Hieracium* (field observations, VAN DER GOOT only once found it on *Calluna*) and *Chamaesyrphus lusitanicus* Mik, which feeds exclusively on *Calluna*, at least in Holland. In the field VAN DER GOOT never found this species on another species of flower. These observations ought, however, be confirmed by pollen-analysis, as stated in the opening words of this discussion on the present state of knowledge.

Own observations

When catching Syrphid flies the first author often saw several *Platycheirus*- and *Melanostoma*-species, visiting the flowers of Gramineae and these same fly-species frequented the flowers of *Plantago lanceolata*. In 1952 VAN DER GOOT found in the Noordoostpolder several hundreds of *Platycheirus*- and *Melanostoma*-specimens killed by a fungus, sitting on the flowers of Gramineae and *Plantago lanceolata*. Both these plants are notably anemophilous and are generally considered not to attract any insect. Their pollen is of the usual anemophilous type and their flowers have no coloured petals. Yet some Syrphid-species appear to be specialized on the flowers of these plants. They apparently search for quite a different type of flower as compared with a normal flower-visiting insect. Perhaps the coloured anthers (often violet in Gramineae and white in *Plantago lanceolata*) of these so-called anemophilous flowers act as an attractant. If this is really so should be proved by further research.

In order to prove the correctness of the field observations this study has been made. Pollen-analytical investigations of the alimentary tract were done in the Hugo de Vries laboratory at Amsterdam by Mrs. GRABANDT, the insect-material came from the collection of the first author and was identified by him.

We tried to prove, by pollen-analysis of the alimentary tract, which flowers were visited by a specimen. In the genera *Melanostoma* and *Platycheirus* two types of flies were studied: those (according to field observations) which visited the normal insect-type of flower and those which visited the anemophilous flowers. As a result of the investigations there appeared some species, which sometimes visited insect-flowers, but also frequented Gramineae and *Plantago lanceolata*.

Method

The flies were softened by immersion during 10 minutes in 10% KOH at approximately 90° C. The whole alimentary tract was then dissected. The pollen was pressed out of the tract and mounted in a microscopical slide. The pollen-slides were counted under 400× enlargement. In pollen-rich samples the whole slide was inspected and then percentages were made by counting along five lines in a homogenous part of the slide. Such slides are represented in the diagrams. In slides with few pollen all grains were counted. In the tables these absolute numbers are followed by a full stop, while these slides are not represented in the diagrams. Each slide represents the total alimentary tract contents of a separate fly.

When making a pollen slide the pollen grains were coloured with saffranin dissolved in alcohol in order to facilitate observation of details of the pollen grains.

Results

1. Visitors of anemophilous flowers.

A. *Platycheirus clypeatus* Mg.

Slide no:	Locality	Date	Gr	Pl	Ran
17	Bussum	4-8-1967	4.	6.	
14	Alkmaar	6-8-1967		100	
15	ibid.	ibid.	100		
16	ibid.	ibid.	37	63	
18	ibid.	ibid.	0,01	99,99	
19	ibid.	ibid.	1.	21.	1.
50	Bussum	ibid.	40	60	
51	ibid.	ibid.		100	
52	ibid.	ibid.		36.	

B. *Platycheirus fulviventris* Macq.

Slide no:	Locality	Date	Gr	Pl
1	Alkmaar	25-6-1967	100	
2	ibid.	ibid.		100
3	ibid.	ibid.	33	67
4	ibid.	ibid.		100
5	ibid.	ibid.		100
6	ibid.	ibid.		100
49	ibid.	6-8-1967		100

C. *Platycheirus scambus* Staeg.

Slide no:	Locality	Date	Gr	Pl	Umb
7	Alkmaar	25-6-1967		100	
8	ibid.	ibid.		100	
28	ibid.	6-8-1967		100	
41	ibid.	ibid.	1.	3.	
42	ibid.	ibid.		100	
43	ibid.	ibid.		100	
44	ibid.	ibid.	4	96	2.
45	ibid.	ibid.		100	
46	ibid.	ibid.		100	
53	ibid.	ibid.	-	-	-
54	ibid.	ibid.		100	
55	ibid.	ibid.		100	
59	ibid.	ibid.		100	

D. *Platycheirus angustatus* Zett.

Slide no:	Locality	Date	Gr	Pl	Chen	Cruc
9	Alkmaar	25-6-1967	75	25		
69	Ottersum	17-8-1960	4,1	87,6	3,6	4,6
70	ibid.	ibid.	18	80		2
71	ibid.	ibid.	7	13	80	
72	Overasselt	24-8-1960	100			

2. Visitors of anemophilous flowers, which also frequent insect-flowers

A. *Melanostoma mellinum* L.

Slide no:	Locality	Date	Gr	Pl	Ach	Co	Conv	Cruc	Cyp	Ran	Sol	Ros	Umb
58	Bunderbos	30-4-1966								100			
67	Alkmaar	3-5-1950	15	32	1	14							38
57	ibid.	8-5-1952		11.						19.			31.
68	ibid.	10-5-1950	60,5	38		1,5							
66	ibid.	ibid.		100									
11	Bussum	4-8-1967	10	90									
13	ibid.	ibid.					45,4				54,6		
20	Alkmaar	6-8-1967		62				38					
29	ibid.	ibid.		76					24				
30	ibid.	ibid.		100									
31	ibid.	ibid.		94		2,5				3,5			
32	ibid.	ibid.		1.									
33	ibid.	ibid.		100									
34	ibid.	ibid.		100									
35	ibid.	ibid.	0,3	5,7				93,3				0,7	
36	ibid.	ibid.		100									
37	ibid.	ibid.		100									
38	ibid.	ibid.		100									
39	ibid.	ibid.		100									
40	ibid.	ibid.		100									
12	Bussum	ibid.	4,5	1,5							94		

B. *Melanostoma scalare* Fabr.

Slide. no:	Locality	Date	Gr	Pl	All	As	Gl	Ran	Sa	Ver	Stt	Umb
90	Heiloo	11-5-1952			0,1	0,2	6,5		0,2	53,6	0,1	39,3
92	ibid.	18-5-1952		77				3.		17		6
97	ibid.	ibid.	21	0,1				0,1		72		6,8
98	Bunderbos	16-8-1966					1,7					98,3
91	Heiloo	23-8-1951		99,99								0,01

Not included in the tables is the sex of the fly. It has not been noted in the material of 1967, but we know it of older material. All females, known to us, had fully filled crops, but among the males there is an example of a specimen with only some pollen grains (*Melanostoma mellinum* L., slide 57). Theoretically females ingest more pollen as they need it for the full development of the ovaries.

Discussion of the results

Concluding from the tables and diagrams it must be stated there is a considerable variation in the pollen-spectra from different flies of the same species from the same locality and date. For example all slides of *Platycyberus albimanus* Fabr. are from the same locality and of the same date, but the flower-visits, as they appear from the high percentages, are varying (56 *Stellaria*, 61 Rosaceae, 62 *Stellaria*, 63 *Aster* and *Stellaria*, 64 *Aster* and Cruciferae, 65 Rosaceae and *Stellaria*). The same applies to *Pyrophana granditarsa* Först., Alkmaar, 6.VIII.1967 (21 Ranunculus; 23

3. Visitors of insect-flowers, which only occasionally visit anemophilous flowers, thus normal flower-visiting insects.

A. *Platycheirus albimanus* Fabr.

Slide no.	Locality	Date	An	As	Co	Cruc	Ros	Ver	St
56	Bunderbos	4-5-1967	1,7	5,4	7,6	85,3			
61	ibid.	ibid.	9,2		90,8				
62	ibid.	ibid.	2			98			
63	ibid.	ibid.	3,5	63,5	5	1,5	26,5		
64	ibid.	ibid.	56	1,2	35	4,8	3		
65	ibid.	ibid.		6	64	30			

B. *Platycheirus manicatus* Mg.

Slide no.	Locality	Date	Ach	As	Cer	Chen	Co	Cruc	Ran
84	Mook	16-8-1960	1	9	15		30		45
85	ibid.	21-8-1960				1.		100	
86	Ottersum	22-8-1960	0,2	7,3	3,5	88,9	0,1		

C. *Platycheirus pellatus* Mg.

Slide no.	Locality	Date	Ach	All	Cer	Co	Cyp	Ep	Glad	Pap	Pl	Ran	Ros	Umb	Urt
78	Bunderbos	29-5-1966	0,5	69,5	30										1.
79	ibid.	4-6-1965	4		30					2,5	63,5				
80	Marknesse	3-8-1952				15	4					13	68		
47	Alkmaar	6-8-1967					1.					77			23
48	ibid.	ibid.								100					

Explanation of the abbreviations used in the tables: Ach *Achillea*-type, ?Alch cf. *Alchemilla*-type, All *Allium*-type, An *Anemone*-type, As *Aster*-type, Cal *Calluna*, Cer *Cerastium*-type, Chen *Chenopodiaceae*, Cirs *Cirsium*-type, Co *Compositae liguliflorae*, Conv *Convolvulus arvensis*, Cruc *Cruciferae*, Cyp *Cyperaceae*, Ep *Epipactis*, Gl *Glechoma*-type, Glad *Gladiolus*-type (cultivated), Gr. *Gramineae*, Hyp *Hypericum*-type, Ind. *Indeterminatae*, Mel *Melandrium*-type, Pap *Papaver*-type, Pl *Plantago lanceolata*, Pol *Polygonum*-type, Ran *Ranunculus*-type, Ros *Rosaceae*, ?Ros cf. *Rosaceae*-type, Sa *Salix*, Sol *Solanum nigrum*, St *Stellaria holostea*, Sst *Stellaria*-type, Umb *Umbelliferae*, Urt *Urtica*, Ver. *Veronica*-type.

D. Platycheirus scutatus Mg.

Slide no:	Locality	Date	Ach	All	As	Chen	Cirs	Co	Cruc	Mel	Pol	Ran	Ros	?Ros	Ver	St	Umb	Stt	Ind
81	Bunderbos	4-5-1967		0,4				0,4		1,2			0,8		12,3	84,9			
87	ibid.	ibid.					11									89			
82	Heiloo	26-5-1953							23								76,5	0,5	
83	ibid.	10-6-1950						2	8,3		32	10,6			22,1		25		
88	ibid.	29-6-1957	1	6,3			43		9					39			0,4		1,3
89	Marknesse	3-8-1952	3	2,1	1,4	7,2	80,6			4,3			1,4						

E. Pyrophæna granditarsa Först.

Slide no:	Locality	Date	Gr	Pl	Ach	?Alch	As	Cal	Chen	Co	Cruc	Hyp	Mel	Pol	Ran	Ros	Stt	Umb	Ind
96	Kortenhoef	14-6-1950	1,6	0,3												96	0,6	0,9	0,6
10	Alkmaar	25-6-1967	46	18												36			
21	ibid.	6-8-1967														100			
22	ibid.	ibid.	1.								1.								
23	ibid.	ibid.			20,3		2									2,1	13,6	56	6
24	ibid.	ibid.	2.						1.										
25	ibid.	ibid.	3.																
26	ibid.	ibid.	1.																
27	ibid.	ibid.							2.										
94	Bunderbos	17-8-1966	2,3		2.	0,9	0,8		0,7				1.		95			1.	
95	ibid.	ibid.				11						89							1.
93	Hilversum	22-9-1956	6	1.		0,4	0,2	0,1	2,1	23,5		1,5			58			8,2	

Umbelliferae, *Achillea* and Rosaceae), *Melanostoma mellinum* L., Bussum, 4.VIII.1967 (11 *Plantago lanceolata*, Gramineae; 13 *Solanum nigrum*, *Convolvulus arvensis*), *Melanostoma scalare* Fabr., Heiloo, 18.V.1952 (92 *Plantago lanceolata* and *Veronica*, 97 *Veronica* and Gramineae). However, in the flies which prefer anemophilous flowers these variations are nearly always restricted to either *Plantago lanceolata* or Gramineae. We refer here to the figures in the table on *Platycheirus lanceolatus* Staeg., Alkmaar, 6.VIII.1967, to *Platycheirus clypeatus* Mg. from the same locality and date and to *Platycheirus fulviventris* Macq., Alkmaar, 25.VI.1967. In these cases one could suppose there were no other flowers present. This, however, was not so as appears from the next table where some insect-flower visiting species and some anemophilous flower visiting species are compared, alle from the same date and locality:

Alkmaar, 6-8-1967														
Total number of slides	Species	Gr	Pl	Ran	Urt	Pap	Umb	Cruc	Ach	As	Ros	Co	Cyp	Ind
4	<i>Pl. clypeatus</i>	137	263											
1	<i>Pl. fulviventris</i>		100											
9	<i>Pl. scambus</i>	4	896											
2	<i>Pl. peltatus</i>				77	23	100							
2	<i>Pyr. granditarsa</i>				102			56		20	2	14		6
12	<i>M. mellinum</i>	0,3	1038	3,5				131				0,7	2,5	24

In this table only specimens with fully filled crops were included, so the figures are percentages. We conclude that three species are restricted for pollen-feeding to *Plantago lanceolata* and Gramineae, whereas three other very related species feed pollen on at least eleven other species of plants (there could have been, for example, more than one species of Umbelliferae). The specimens of all fly-species were collected over a distance of at most fifty yards, so the plants present were easily accessible to all specimens in the area.

Thus it has been demonstrated that there are some *Platycheirus*-species which clearly prefer *Plantago lanceolata* and Gramineae for pollen-feeding, even if other flowers are present. As these plants do not contain honey, as far as we know, it remains to be seen where these species obtain honey or substitutes of honey.

It would be interesting if in another region elsewhere in Europe, Asia or America this research could be duplicated, because regional differences cannot be excluded. This is possible, because the *Platycheirus*-species, which prefer anemophilous flowers have a Nearctic-Palaeartic dispersal, except for *Platycheirus fulviventris* Macq., and specimens standing in collections can be used for research, even if they have been collected years ago.

We already stipulated that research is needed to demonstrate what characteristics of an anemophilous flower act as an attractant to these Syrphid flies. It would also be interesting to know if pollination occurred as a result of the repeated visits to *Plantago lanceolata* and Gramineae. But these aspects were outside the scope of our investigations.

Summary

Pollen-analysis of the alimentary tract of some Syrphid flies was carried out in order to establish if some species really prefer anemophilous flowers. *Platycbeirus scambus* Staeg., *Plat. clypeatus* Mg., *Plat. fulviventris* Macq. and *Plat. angustatus* Zett. were shown to prefer Gramineae and *Plantago lanceolata* for pollen-feeding. If and where these species obtain honey or substitutes of honey remains unknown.

Samenvatting

Pollenanalytisch onderzoek werd uitgevoerd in het darmkanaal van enkele zweefvliegen om vast te stellen of sommige soorten werkelijk de voorkeur gaven aan windbloemen. Van *Platycbeirus scambus* Staeg., *Plat. clypeatus* Mg., *Plat. fulviventris* Macq. en *Plat. angustatus* Zett. werd aangetoond, dat ze grassen en Langbladige Weegbree prefereerden voor hun stuifmeelvoeding. Of en waar deze soorten honing of vervangingsmiddelen daarvan (bladluizenhoning) verkrijgen blijft nog onbekend.

References

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Tuxen, S. L., *Taxonomist's Glossary of Genitalia in Insects*. Tweede vermeerderde druk, 1970. 359 pagina's, 248 figuren. Uitg. Munkgaard, Kopenhagen. Prijs geb. DKr. 100.

Op het Internationaal entomologisch Congres te Amsterdam in 1959 stelde de Deense entomoloog TUXEN voor een „glossary”, een woordenboek dus, samen te stellen van de termen die gebruikt zijn of worden voor de talrijke onderdelen van de genitaliën van de insecten. De bouw ervan verschilt bij de diverse orden vaak aanzienlijk wat weer tot gevolg gehad heeft dat dezelfde term lang niet altijd dezelfde betekenis heeft. Trouwens bij dezelfde orde komt dit ook herhaaldelijk voor.

Geen wonder dus dat de poging van TUXEN om wat meer klaarheid op dit gebied te brengen met instemming begroet werd. En zo verscheen reeds in 1956 de eerste druk van het werk waarbij de auteur door niet minder dan 34 specialisten terzijde gestaan werd. Dat er veel vraag naar het boek was, blijkt wel uit het feit dat een tweede druk ervan nodig was, die bovendien nog uitgebreider werd dan de eerste.

De opzet is dezelfde gebleven. Eerst komt een algemeen gedeelte waarin genitaliën van elke orde door een specialiste ervan uitvoerig behandeld worden. Hierbij behoren ook de talrijke figuren. Dit deel neemt pag. 21—213 in beslag. Daarna volgt de eigenlijke lijst van termen, alfabetisch gerangschikt met opgave van de orde waarbij die term werd geïntroduceerd, door wie en wanneer.

Het spreekt vanzelf dat geen enkele morfologisch of taxonomisch werkende entomoloog het boek kan missen. Het is verheugend dat tot TUXEN's medewerkers twee van onze leden behoren, nl. de heren F. G. A. M. SMIT en Dr. A. DIAKONOFF. — LPK.