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ANTHECOLOGICAL RELATIONS BETWEEN REPUTEDLY ANEMOPHILOUS FLOWERS AND SYRPHID FLIES

IV. A NOTE ON THE ANTHECOLOGY OF SCIRPUS MARITIMUS L.

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SUMMARY

Scirpus maritimus L. (= *Bulboschoenus maritimus* (L.) Palla) is regularly visited by a number of syrphid flies including *Lejops vittata* (Mg.). Crop and gut contents analyses revealed that some of these flies feed for some time (almost) exclusively on the pollen of the Sea Club-Rush, but there is as yet no conclusive evidence that *Lejops* (or any other syrphid for that matter) is an effective pollinator of this plant species.

1. INTRODUCTION

In 1976 WAITZBAUER published an account of his observations of insects visiting the male inflorescences of *Typha angustifolia* L. in the Neusiedler See in Austria. The most interesting record was the frequency of occurrence of the hover fly *Lejops vittata* (Mg.), a species of apparently often very local distribution in Western Europe. This provoked our curiosity in connection with our current research project concerning possible relations between anemophilous taxa and anthophilous insects (see, *e.g.*, STELLEMAN 1980).

Upon our request Mr. V. S. van der Goot (Amsterdam) kindly supplied the information that as far as he could ascertain *Lejops* is very rare (or at least of very limited, local distribution) in The Netherland (according to a recent survey by A. Barendregt – private communication – there are in fact records from only about ten localities since 1950). As far as known, in The Netherlands it usually prefers habitats near brackish water; this agrees with Waitzbauer's record from the brackish Neusiedler See. In The Netherlands this species has apparently once or twice been caught on *Phragmites*, but was more recently recorded from *Scirpus maritimus* L. (but so far not from *Typha*), enough reason to verify its occurrence on the Sea Club-Rush. In June 1979, two of us (Leereveld and Meeuse) visited a number of places along the coast of the Province of Friesland from where *Lejops* had been reported and looked for other suitable sites. In two localities it was found in fairly large numbers on patches of *Scirpus maritimus*, which plant also appears to be regularly visited by other hover flies (compare *table 1*; a few clearly incidental visitors have not been taken into account). Details about the method and mode of recording employed will be published in a forthcoming paper (LEEREVELD 1981). The same sites were re-visited by all three of us and although

Table 1. Crop and gut contents of syrphid flies caught and seen feeding on *Scirpus* (1971–1979).

Species		Pollen recovered from crop and gut			
		Plantago lanceolata type	Gramineae	Cyperaceae	Other types
Lejops vittata (Mg.)					
specimens	Friesland				
PCL 13	1971	–	–	100% (*Scirpus maritimus*)	
PCL 16	1979	–	–	100% (*S. mar.*)	
PCL 24	1979	–	–	100% (*S. mar.*)	
PCL 44	1979	–	–	100% (*S. mar.*)	
PCL 23	1979	–	–	67% (not *S. mar.*!)	33% Cruciferae
PCL 15	1979	–	3*	49*	42* dicotyledonous
PCL 14	1970	–	12*	2*	3* dicotyledonous 1* indeterm.
Platycheirus fulviventris (Macq.)					
PCL 17	1979	–	–	100% (*S. mar.*)	
P. scambus (Stager)					
PCL 21	1979	77%	3%	20% (*S. mar.*)	
P. clypeatus (Mg.)					
PCL 22	1979	–	–	100% (*S. mar.*)	
Tropidia scita (Harris)					
PCL 19	1979	–	–	5% (*S. mar.*)	95% dicotyl.
PCL 26	1979	–	–	2% (*S. mar.*)	98% dicotyl.
PCL 25	1979	–	–	–	100% dicotyl.
Anasimyia lineata (F.) (= *Eurinomyia*)					
PCL 20	1979	–	–	64*	29* dicotyl.
PCL 28	1979	–	–	–	100% dicotyl.
PCL 29	1979	–	–	–	100% dicotyl.

N.B. Numbers marked with an asterisk indicate the actual numbers of grains recorded, not percentages.

the weather was unfavourable, our findings confirmed those of 1979 completely; the analyses are shown in *table 2* (the method employed was the same but since the results are consistent, to save time only 100 grains were counted to determine the percentages).

A third locality: Heiloo, near Alkmaar (prov. of North Holland) was repeatedly visited. Fairly extensive stands of *Scirpus maritimus* were growing there along the edge of fresh-water ditches. *Lejops* was not found there, but several other visitors were recorded (see *table 3*). It is clear that although *Tropidia scita* and *Anasimyia lineata* were repeatedly caught on *Scirpus* and apparently fed on

it, these species have a mixed diet and consume mostly dicotyledonous pollen. *Lejops* and the *Platycheirus* species feeding and caught on *Scirpus maritimus* are much more specialised in this respect. This might be expected of the *Platycheirus* species in question (compare LEEREVELD 1980) but not of *Lejops*, if one considers its close affinity to the genus *Helophilus* whose members, although polylectic, decidedly prefer entomophilous plants with showy flowers (mostly dicotyledonous ones) rather than anemophilous taxa.

2. FIELD OBSERVATIONS

In the two Friesland localities patches of *Scirpus maritimus* were kept under continual surveillance for several hours. *Lejops* was seen actively consuming *Scirpus* pollen, manipulating the anthers with the front legs, from at least 8.30–9.00 hrs. in the morning onward (both in 1979 on sunny days with some haze and in 1980 when the weather was decidedly inclement), and at least till noon. *Platycheirus fulviventris*, as might be expected (STELLEMAN & MEEUSE 1976), was already active when we arrived at the sites by about 8.00 hrs, whereas most of the other syrphids became active at about the same time as *Lejops* (*e.g.*, *Tropidia scita*). *Anasimyia lineata* has not been seen feeding on other plants species in the area, but, since our attention was focussed on the stands of *Scirpus*, this may be deceptive. The dietary study (*table 1*) at least indicates that *Tropidia* is a casual rather than a habitual visitor. According to experienced dipterologists *Tropidia* is normally found on dicots (often on Rosaceae such as *Crataegus*) and had not previously been recorded from *Scirpus*; when we revisited the Friesland localities in 1980 we paid special attention to this species and caught it repeatedly feeding on *Ranunculus repens* and on *Taraxacum* (compare *table 2*). It apparently also visists *Typha* (see *plate III, fig. 4 and 5*). In view of the available evidence this species can hardly be of importance as a potential pollinator of the Sea Club-Rush. The presence of *Anasimyia lineata* was not so unexpected because this species has repeatedly been recorded (also by ourselves) from other nominal anemophiles such as grasses and *Plantago lanceolata.*

3. SEM AND DIETARY STUDIES (by Stelleman and by Leereveld respectively)

Specimens of *Lejops* caught without very special precautions (see STELLEMAN 1978) carried very few cyperaceous pollen grains (see *plate I, figs. 1, 2*), but pollen of other species was sometimes also present. Apparently this syrphid is a potential pollen vector. Whether it pollinates *Scirpus maritimus* to an appreciable extent remains to be seen. This will be investigated in the near future. The analysis of the gut contents (LEEREVELD 1980) of specimens of *Lejops* caught on *Scirpus* clearly indicates that it sometimes feeds exclusively on this sedge for some time. The longer they move about on the inflorescences the greater the chance of contamination with pollen and the greater the possibility of the flies actually becoming pollen vectors. Judging by their diet, the same holds for some other species caught on Sea Club-Rush: *Platycheirus fulviventris* and the other

Table 2. Crop and gut contents of syrphid flies caught and/or seen feeding on *Scirpus* and on *Typha* (1980) in Friesland.

Species	Pollen recovered from crop and gut			
	Plantago lanceolata type	Gramineae	*Scirpus maritimus*	Other types and remarks
Lejops vittata				
PCL 81	–	–	97%	X (either other Cyperacea or a Juncacea, to be studied): 3%
PCL 82	–	–	100%	
PCL 83	–	–	95%	5% X; + dicotyl.
PCL 84	–	–	95%	5 % X
PCL 92	–	–	80%	20% X
PCL 98	–	–	99%	1% X
PCL 99	–	–	100%	+ *Carex* type; + grass
Platycheirus clypeatus				
PCL 87	–	34%	63%	3% X + dicotyl.
PCL 89	–	–	81%	19% X
PCL 93	–	+	100%	+ X + dicotyl.
PCL 97	–	–	89%	11% X
P. scambus				
PCL 88	–	1%	84%	15% X
PCL 91	–	–	93%	7% X
PCL 94	–	3%	91%	6% X
P. manicatus PCL 90	–	–	–	100% dicotyl. (*Ranunculus*?)
P. immarginatus				
PCL 95	–	3%	67%	16% *Carex* type; 12% other Cyperacea; 2% X
Casual visitors (caught on *Scirpus maritimus*):				
Sphaerophoria rueppelli				
PDL 96	–	–	–	100% dicot.
Helophilus trivittatus				
PCL 85, PCL 86	–	–	–	100% dicot.
Eristalinus aeneus				
PCL 100, PCL 1	–	–	–	100% dicot.
Tropidia scita				
PDL	–	–	–	100% dicot.
PDL 3	–	–	–	100% dicot.; + Cyperaceae
PDL 4	–	–	+	100% dicot.

species of this genus (see *plate II, fig. 3*), and perhaps *Anasimyia lineata* and *Parhelophilus versicolor* (caught on *Typha*, but containing an appreciable quantity of pollen of *Scirpus maritimus* in its digestive tract), but not for *Tropidia scita*; see also *table 3*, and *plate III*.

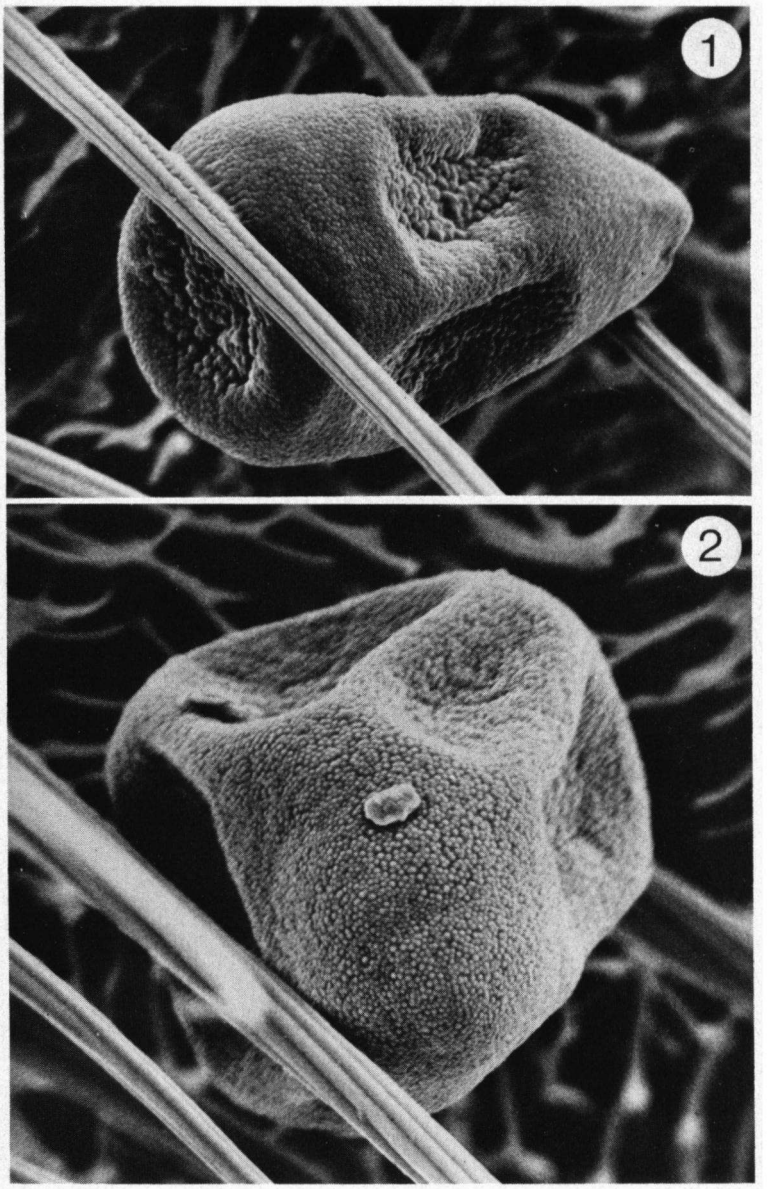


Plate I. Scanning photomicrographs.
Fig. 1. Part of thorax of *Lejops vittata* near a front leg, × 1500: pollen grain of *Scirpus maritimus* caught between palynophilous hairs (specimen caught 20 June, 1979, Zwarte Haan, Friesland).
Fig. 2. Part of femur of a front leg of *Lejops vittata*,× 2200: pollen grain of *Scirpus maritimus* attached to body (partly by palynophilous hairs). Same specimen as the one in *fig. 1*.

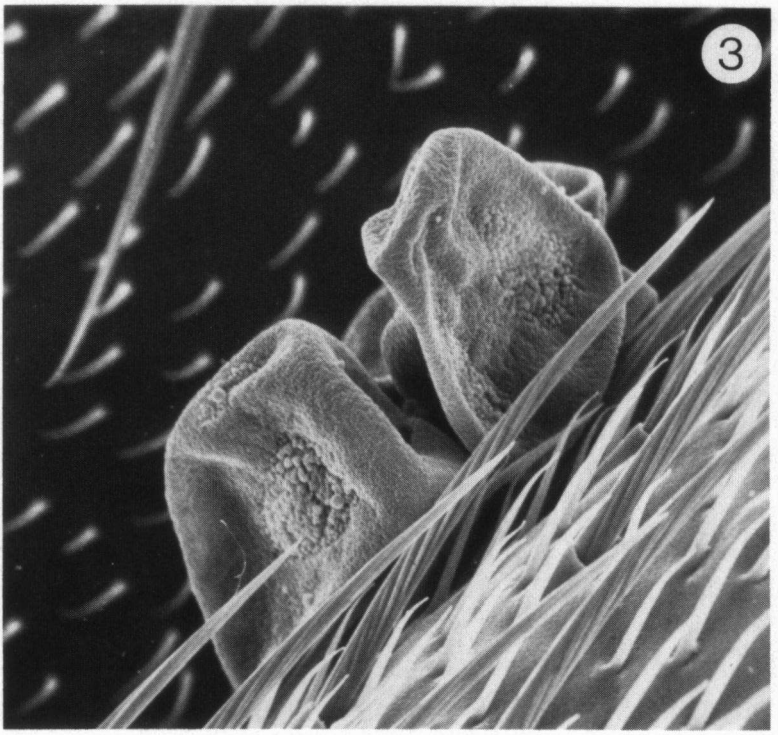


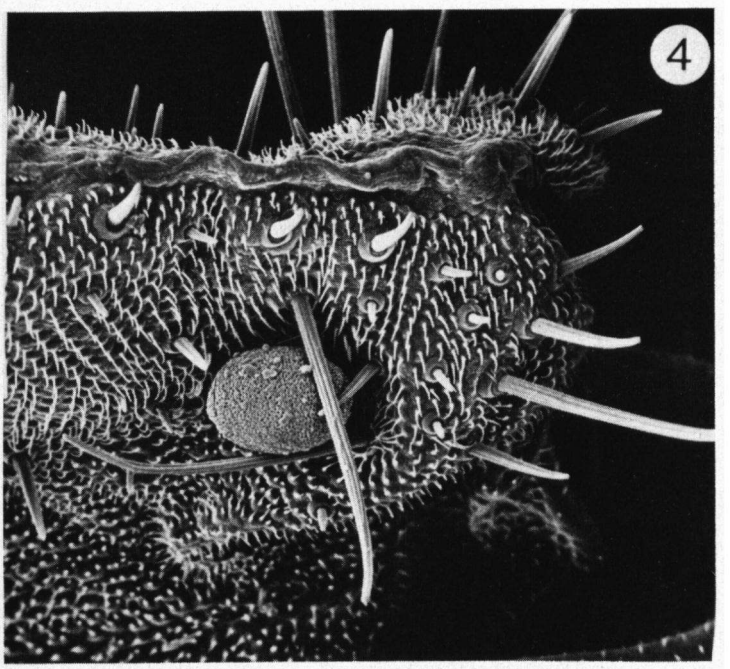
Plate II, fig. 3. Scanning photomicrograph of part of tibia, right middle leg of a *Platycheirus* species (most probably *P. scambus*), × 1200: group of pollen grains of *Scirpus maritimus* attached to body, partly by palynophilous pubescence (specimen from Oosterbierum, Friesland, 19 June, 1979).

4. DISCUSSION

The frequent visiting of *Scirpus maritimus* by pollen-consuming hover-flies may mean that some biotic transfer of its pollen takes place. The efficacy of such a transfer does not only depend on the activity of the insect, on its mobility and on the adhesive power of the pollen alone, but also on the possible incidence in monoclinous anemophiles of self-incompatibility and/or some other mechanism precluding auto- and geitonogamy (such as protogyny, etc.).

Patches of the Sea Club-Rush are most probably often clones formed by the development of underground runners so that in case of self-incompatibility

Plate III. Scanning photomicrographs.
Fig. 4. Proboscis of *Tropidia scita* with attached pollen grain of *Typha*, ×540. Specimen caught on *Scirpus maritimus*, but it had apparently visited *Typha* elswhere (no *Typha* was growing in the immediate vicinity of the site with *Scirpus*). Oosterbierum (Friesland), 19 June, 1979.
Fig. 5. Enlargement of the pollen grain, × 2160. See text: *Tropidia* is apparently only a casual visitor of *S. maritimus* and of *Typha*.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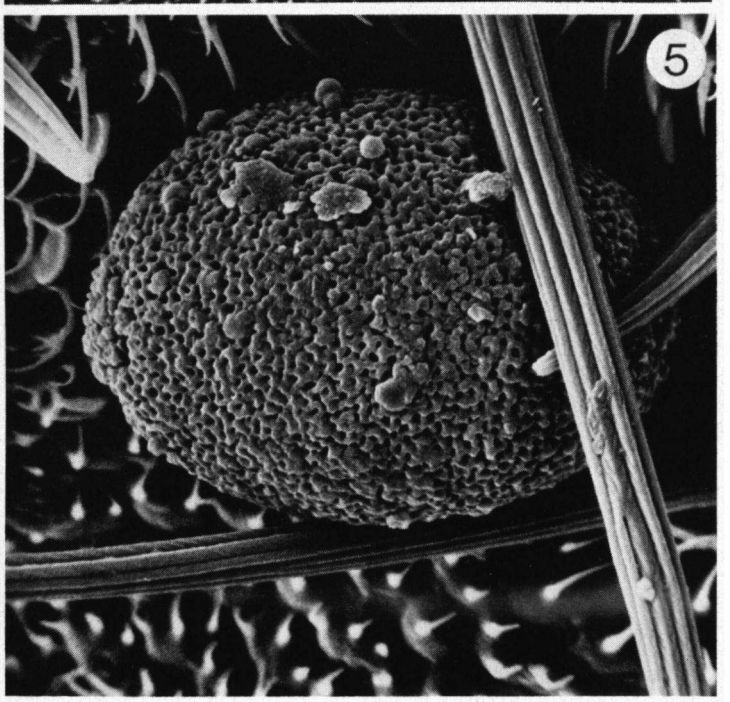
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Table 3. Crop and gut contents of syrphid flies caught and/or seen feeding on *Scirpus* and on *Typha* (1980), Heiloo.

Species	Pollen recovered from crop and gut			
	Plantago lanceolata type	Gramineae	*Scirpus maritimus*	Other types and remarks
Platycheirus fulviventris				
PDL 12	–	1%	95%	4% X
P. scambus				
PDL 10	–	–	98%	2% X
PDL 11	–	–	96%	4% X
PDL 13 (caught on *Eleocharis palustris*)	–	–	26%	74% *Eleocharis palustris*
Casual or regular visitors:				
Dryomyza flaveola				
PDL 9	–	5%	–	one specimen (not analysed) seen feeding on *S. maritimus*
Parhelophilus versicolor (caught on *Typha angustifolia*):				
PDL 5	–	–	1%	99% prob. *Typha*, + dicot.
casual visitor:				
Helophilus trivittatus				
PDL 6	–	–	+	100% dicotyl, + prob. *Typha*
PDL 7	–	–	–	100% dicotyl

geitonogamy is ineffective. As far as can be ascertained there is no record of self-incompatibility in *Scirpus*, and one must certainly establish the presence or absence of such a device before the efficacy of the regular pollen consumers as biotic pollen vectors can be assessed. The protogyny reported in many Cyperaceae, including *S. maritimus*, by various workers (a compilation was given by KNUTH 1899: 528) would enhance the chances of cross-pollination, but this would also favour wind-pollination if pollen-gathering insects are not very mobile and do not readily leave a patch of *S. maritimus* for another one. For the time being the role of syrphid flies as pollinators of *Scirpus maritimus* seems to be limited, but additional information will be required before a more definite conclusion can be drawn.

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