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Flower visitors to *Saxifraga hirculus* in Switzerland and Denmark, a comparative study

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Abstract

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A list is given of 76 species of insects visiting *Saxifraga hirculus* at its only occurrence in Switzerland, Col du Marchairuz. Based on the number of flower visits, 4 species were the dominant visitors: *Sphaerophoria scripta* (Diptera: Syrphidae); *Sepsis cynipsea* (Diptera: Sepsidae); *Neomyia viridescens* (Diptera: Muscidae); *Bellardia vulgaris* (Diptera: Calliphoridae). The visitors to the population of *S. hirculus* at Col du Marchairuz are compared with the visitors to the Danish population of *S. hirculus* at Rosborg. The two populations share only two visiting insects, *Melanostoma mellinum* and *Sphaerophoria menthastris* (Diptera: Syrphidae).

Key words: *Saxifraga hirculus*, flower visitors, Switzerland, Denmark.

Introduction

Flat and bowl-shaped actinomorphic flowers as are found in e.g. the genus *Saxifraga* are known to be visited by a wide array of insects. Flies and beetles are among the most frequent visitors to such unspecialized flowers (Baker and Hurd 1968).

The pollination of individual populations of plants with unspecialized flowers may on the other hand depend on a restricted number of insect species varying between seasons (Olesen and Warncke 1989) and sites. However, detailed information about such variations is unknown.

Taxonomic differentiation in *Saxifraga hirculus* L. was studied by Hedberg (1992). Distribution maps of this circumpolar arctic-boreal species indicate that its recent distribution outside the northern territories is highly fragmented (Hedberg 1992).

In this study, we give a description of the insect fauna visiting *Saxifraga hirculus* in an alpine wetland at Col du Marchairuz, the southernmost European population of this plant and its only population in Switzerland.

The objective of this study was (1) to show the qualitative and quantitative composition of the insect fauna visiting the flowers of *S. hirculus* at Col du Marchairuz, and (2) to compare the visitor fauna at Col du Marchairuz with the known visitor fauna of *S. hirculus* at Rosborg, Denmark (Olesen and Warncke 1989).

Material and methods

Study site and population

From 27 July to 5 August 1992 studies were conducted on the *Saxifraga hirculus* population in western Switzerland by the second author of this paper in a NE-SW expanding valley 1 km W of Col du Marchairuz (46°33'N, 60°14'E) at 1326 m above sea level: a wetland overlaying and surrounded by dolomitic calcareous rocks of the Upper Jura.

A detailed description of the history of the vegetation for the region is given by Wegmüller (1966). Average mean temperatures for January and July are approx. -2°C and 12°C . Annual precipitation amounts to 1631 mm (Wegmüller 1966). The valley is subject to grazing by cows throughout the summer.

Weather conditions were sunny during the observation period. Temperatures increased from 23°C on the first day to more than 25°C the following days, and wind was modest during all observation days except for the first day with no wind and the second day with strong winds. It only rained once, on August 1st.

During the summer, a ramet of *S. hirculus* consists of an inclined rhizome with up to 5 runners. A minority of the ramets produce a flowering shoot. A flowering shoot consists of a stem of 10–30 cm seldom having more than one terminal flower and one lateral flower, the latter being often poorly developed or aborted. The flowers are protandrous with distinct staminate and pistillate phases. Duration of these phases depends on insect visitation and pollination. For a further description of the floral phenology and biology see Olesen and Warncke (1989).

In the lowlands of Denmark, *S. hirculus* is confined to a restricted number of spring areas as described by Warncke (1980).

The total number of flowers in the population at Col du Marchairuz during the whole season was estimated to be at least 10000. Until July 27, when the field observations began, none of the flowers had reached the female phase, and none of the lateral flowers had opened yet.

The study area contained several co-blooming entomophilous species such as e.g. *Swertia perennis* L., *Gentianella campestris* L., *Gentiana lutea* L., *Parnassia palustris* L., *Lychnis flos-cuculi* L., *Epilobium palustre* L., *Euphrasia* spp., *Pinguicula* spp., *Ranunculus acris* L., *Lotus uliginosus* Schkuhr and *Dianthus superbus* L.

Flower visitors

Specimens of insects visiting the flowers of *S. hirculus* were caught with a net at different times of the day on every second day during the observation period.

Results and discussion

Four orders of insects visited the flowers of *S. hirculus* at Col du Marchairuz (Tab. 1). Diptera and Coleoptera were especially numerous. The most frequent visitors were Diptera: *Sphaerophoria scripta* 97 (Syrphidae in total 35.1%); *Sepsis cynipsea* 80 (Sepsidae in total 17.3%); *Neomyia viridescens* 32; *Spilogona dispar* 18 and *Neomyia cornicina* 11 (Muscidae in total 17.4%); *Bellardia vulgaris* 31 (Calliphoridae in total 7.2%).

Among 25 specimens of Hymenoptera (or in total 5.2%) the superfamily Apoidea was represented by 13 specimens, and Lepidoptera with 11 specimens only (or in total 2.3%).

The most frequently observed visitors to the large population of *S. hirculus* at Col du Marchairuz are plotted in Fig. 1. and compared with the visitors to the much smaller population at Rosborg. This population produced only 1525 flowers during the whole season from 9 July to 13 Aug. in 1984 (Olesen and Warncke 1989).

Numbers behind insect taxa in Fig. 1 refer to the most frequently observed species among these taxa. These species are briefly discussed in the following section.

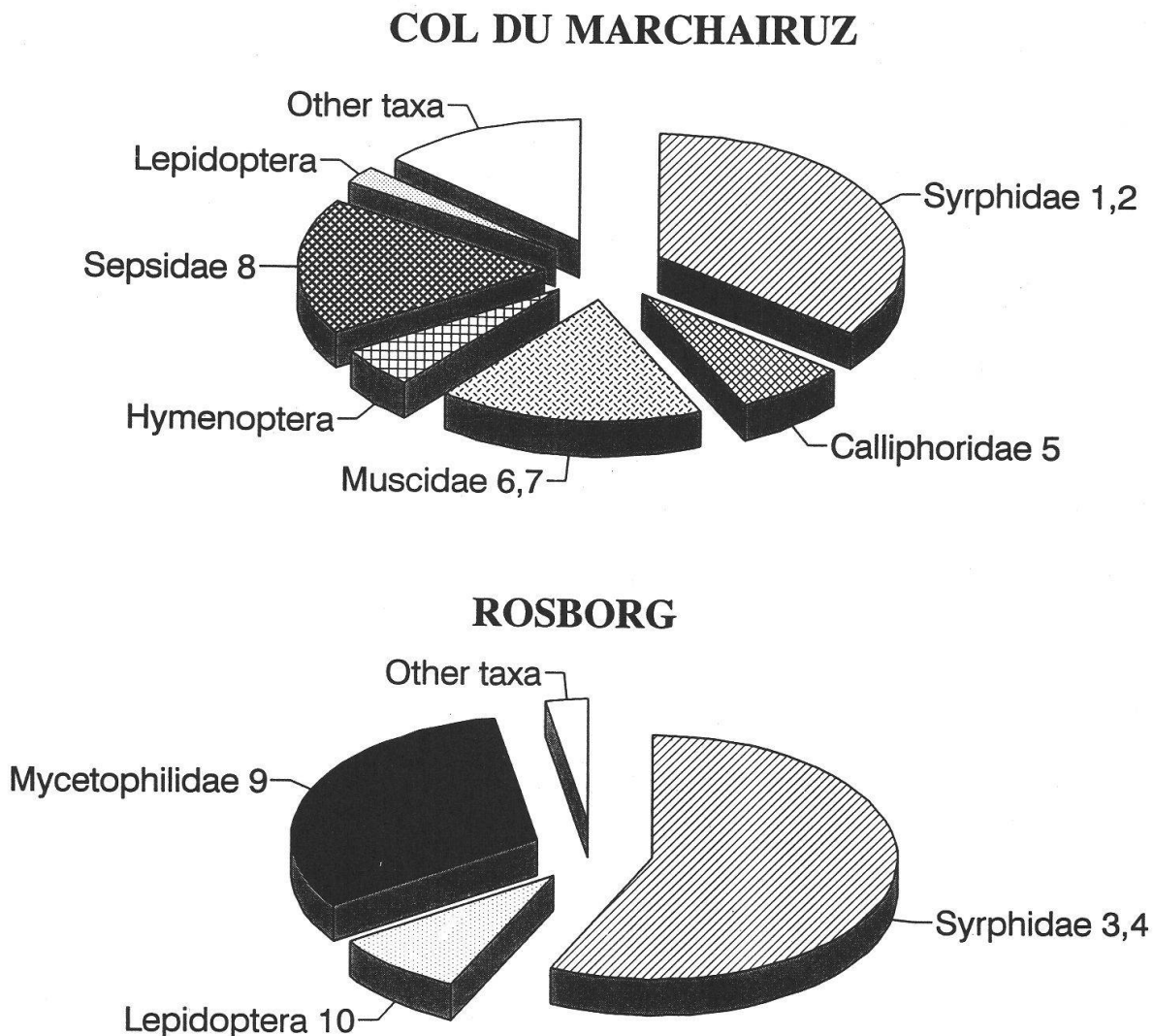


Fig. 1. Insects visiting *Saxifraga hirculus* at Col du Marchairuz, Switzerland, compared with visitors at Rosborg, Denmark. For further explanations see text.

Tab. 1. Flower visitors to *Saxifraga hirculus* at Col du Marchairuz, Switzerland 27 July–5 August 1992.

Species:	Remarks	N	Sex ratio of insects caught (δ/η)	Individuals observed	Species:	Remarks	N	Sex ratio of insects caught (δ/η)	Individuals observed
Coleoptera									
<i>Galeruca pomonae</i>	◆	2	2/	> 500	<i>Glaucoops hirsutus</i>	◆ △	2	/2	< 10
<i>Cyphon kongsbergensis</i>	◆ ●	1	1	> 1000					
<i>Otiorhynchus lugdunensis</i>	◆ △	1	1	> 10					
<i>Plateumaris consimilis</i>	◆	1	1	< 10	<i>Eriothrix rufomaculata</i>	◆	1	/1	< 10
<i>Plateumaris rustica</i>	◆	1	1	< 10	<i>Estheria bohemani</i>	◆	3	/3	< 10
					<i>Tachina magnicornis</i>	◆	1	/1	< 20
Diptera									
Anthomyiidae									
<i>Anthomyia liturata</i>	◆	1	1/	< 10	Tephritidae				
<i>Botanophila varicolor</i>	◆	1	1/	< 10	<i>Terellia serratulae</i>	◆	1	/1	< 10
<i>Hydrophoria lancifer</i>	◆	1	1/	< 10					
<i>Pegoplata aestiva</i>	◆ \$	6	4/2	> 100					
Calliphoridae									
<i>Bellardia vulgaris</i>	◆ \$	31	22/9	> 400					
<i>Pollenia amentaria</i>	◆	4	3/1	< 20					
Chloropidae									
<i>Chlorops</i> sp.	◆	1	1	< 10	Syrphidae				
<i>Meromyza</i> sp.	◆	1	1	< 10	<i>Cheilosia vernalis</i>	◆ \$	7	2/5	< 20
					<i>Eoseristalis interrupta</i>	◆	1	/1	< 20
					<i>Episyrphus balteatus</i>	◆	2	/2	< 20
					<i>Eristalis tenax</i>	◆	1	/1	< 20
					<i>Melanostoma mellinum</i>	◆	3	/3	< 20
					<i>Merodon</i> sp. ♀	◆ * △	3	/3	< 10
					<i>Metasyrphus corollae</i>	◆	3	/3	< 50
					<i>Neoascia</i> sp.	◆	1	1	< 10
					<i>Parasyrphus annulatus</i>	◆	1	/1	< 10
					<i>Platycheirus clypeatus</i>	◆ \$	11	3/8	< 50
					<i>Platycheirus cyaneus</i>	◆	3	2/1	< 20
					<i>Pyrophaena granditarsa</i>	◆	3	/3	< 20
Conopidae					<i>Scaeva pyrastris</i>	◆	2	/2	< 20
<i>Tecophora fulvipes</i>	◆	1	1/	< 10	<i>Sphaerophoria</i> sp. ♀	◆ * \$	16	/16	< 100
					<i>Sphaerophoria menthastri</i> ♂ \$		12	12/	
Dolichopodidae					<i>Sphaerophoria scripta</i> ♂ \$		97	89/8	> 1000
<i>Dolichopus longitarsus</i>	◆	2	1/1	< 10	<i>Sphaerophoria taeniata</i> ♂ \$		4	4/	

Muscidae		Hymenoptera	
Coenosia pedella	1	/1	<10
Drymeia brumalis	3	/3	<20
Drymeia hamata	8	2/6	>100
Graphomya minor	2	/2	<10
Hebecnema umbratica	1	/1	<10
Helina obscurata	1	1/	<10
Helina reversio	1	/1	<10
Hydrotaea albipuncta	1	/1	<10
Hydrotaea irritans	2	/1	<10
Musca autumnalis	1	/1	<10
Neomyia cornicina	11	5/6	<10
Neomyia viridescens	32	20/12	>500
Phaonia serva	1	/1	<10
Pseudocoenosia solitaria	1	/1	<10
Spilogona dispar	18	5/13	>400
Rhagionidae			
Rhagio tingarius	1	/1	<10
Sarcophagidae			
Discachaeta pumila	2	/2	<20
Sarcophaga sp. ♀	1	/1	<10
Sarcotachinella sinuata	2	1/1	<20
Scathophagidae			
Scathophaga stercoraria	2	/2	<10
Sciomyzidae			
Tetanocera fuscinervis	3	1/2	<10
Pherbellia cinerella	1	1	<10
Sepsidae			
Saltella sphondylii	4	4	>5000
Sepsis cynipsea	80	80	>5000
Sepsis orthocnemis	1	1	>5000
Ichneumonidae			
Diplazon sp.	4	4/	<20
Lissonota sp.	3	2/1	<20
Tenthredinidae			
Tenthredo schaefferi	2	2	<10
Nematus myosotidis	1	1	<10
Lepidoptera			
Nymphalidae			
Brenthis ino	4	4/	<20
Erebia pronoe vergy	1	1/	<10
Lycaenidae			
Cyaniris semiargus	2	/2	<10
Lysandra coridon	2	2/	<20
Gelechiidae			
Aristoliinae sp.	2	1/1	<20
Apoidea			
Andrena bicolor	1	/1	<50
Andrena coitana	1	/1	<20
Halictus rubicundus	3	/3	<50
Hyalaeus confusus	1	1/	<20
Lasioglossum fratellum	6	2/4	<20
Chalcididae sp.			
	1	1	<10
Eumenidae			
Odynerus spinipes	1	1/	<20

◆ Not observed in Denmark visiting *Saxifraga hirculus*.
 △ Not found in Denmark.
 ‡ Important visitors at Col du Marchairuz.

● Substitutes *Meligethes aeneus* at Rosborg in the Danish population.
 # Substitutes *Clossiana selene* at Rosborg in the Danish population.
 * Identification of females is uncertain. N = Collected specimens.

Syrphidae

(1) *Sphaerophoria scripta*. The dominant syrphid at Col du Marchairuz. In central Europe it is one of the obligate migrants. In Switzerland it flies from elevations of 300 m to 2700 m. Although common and widely distributed in Denmark (Torp 1984), it was not observed at Rosborg during the flowering period of *S. hirculus* in 1984. Suitable habitats of this species include fields, meadows and moors. The larva is aphidophagous.

(2) *Sphaerophoria menthastri* and *S. taeniata*. Both species were rather common at Col du Marchairuz. *S. menthastri* is common and distributed all over Denmark (Torp 1984), but was only observed with few individuals at Rosborg. *S. taeniata* is rare in Denmark (Torp 1984) and was not observed at Rosborg. The larvae are aphidophagous.

(3) *Eurimyia lineata*. The dominant syrphid at Rosborg. Common and widely distributed in Denmark (Torp 1984). Not observed at Col du Marchairuz. Habitats include moors and damp meadows often near ponds. The larva is saprophagous.

(4) *Neoascia tenur*. Common and widely distributed in Denmark (Torp 1984). Not observed at Col du Marchairuz. Habitats include borders of ponds, lakes, streams and drainage ditches, damp meadows and moors. The larva is saprophagous.

Calliphoridae

(5) *Bellardia vulgaris*. Rather common at Col du Marchairuz. Common and widespread in Europe. Not observed at Rosborg. The larva is an obligatory predator of earthworms.

Muscidae

(6) *Neomyia viridescens* and *Neomyia cornicina*. These shiny, metallic green Muscidae with a widespread distribution were rather common at Col du Marchairuz. *N. viridescens* is palaeartic and *N. cornicina* is cosmopolitan. *N. cornicina* is a species of the lowlands of Europe whereas *N. viridescens* is more common in the mountains. In Denmark, *N. viridescens* is seldom seen. Larvae of both species are coprophagous.

(7) *Spilogona dispar*. Rather common at Col du Marchairuz. Common and widespread in Middle- and Northern Europe. Belongs to a large genus of Muscidae, which strongly dominates in the subarctic-boreal part of the Holarctic. Not observed at Rosborg. Many species of this genus are important pollinators. The larva of *S. dispar* lives in wet soil, is carnivorous and feeds on other arthropods.

Sepsidae

(8) *Sepsis cynipsea*. Very common at Col du Marchairuz. Belongs to a common and widespread family in Middle- and Northern Europe represented with at least three species at Col du Marchairuz. The larva is coprophagous.

Mycetophilidae

(9) *Asindulum nigrum*. Common at Rosborg. Common and widespread elsewhere in Denmark. Only few individuals observed at Col du Marchairuz. The larva is saprophagous and is found in mushrooms. Not much is known about its biology.

Lepidoptera

(10) *Zygaena trifolii*. Common at Rosborg. Common and widespread in Denmark. Not seen at Col du Marchairuz. In Denmark this moth frequently visits also the flowers of *Lychnis flos-cuculi*. The caterpillar feeds on *Lotus corniculatus*, *L. uliginosus* and on other Leguminosae such as clover (*Trifolium repens*).

Visitors belonging to the order Hymenoptera were not observed at Rosborg.

In conclusion, this study shows 1) that the investigated Swiss population of *S. hirculus* shares only two species with the Danish population at Rosborg, namely the Diptera (Syrphidae): *Melanostoma mellinum* and *Sphaerophoria menthastris*; 2) the Swiss population as well as the Danish population of *Saxifraga hirculus* is visited by a large spectrum of insect species.

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