Habitat use by Syrphidae (Diptera) in the valley of the river Strom – Part 2: Comparison of wet grassland and its succession stages

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In 1999 research on hoverflies (Diptera, Syrphidae) was conducted in the "Stromtal", a river valley near Boitzenburg in NE Brandenburg (Germany). Catches from yellow and white water-dish traps installed on eight different sites, ranging from extensively used wet grassland to young black alder succession forest, revealed a rich local fauna with 99 species (4303 individuals recorded). The implications to nature conservation of major differences in species composition of the catches from areas disused for different lengths of time are discussed. A comparison is made with the results of Ssymank (2002), from nearby grid-mapping studies in the same river valley, adding 23 species to the local fauna.

Key words: wet meadows, alluvial forest, Hoverflies, nature conservation, Brandenburg.

Zusammenfassung

Im Stromtal bei Boitzenburg im Nordosten Brandenburgs wurden im Jahr 1999 vergleichende Untersuchungen auf acht Teilflächen von extensiv gepflegtem Feuchtgrünland über unterschiedlich alte Sukzessionsstadien bis zum Schwarzerlenwald mit gelben und weißen Farbschalen gemacht. Die Fauna der Schwebfliegen (Diptera, Syrphidae) erwies sich mit 99 Arten (4303 Nachweise) als artenreich. Unterschiede in der Artenzusammensetzung werden im Zusammenhang mit Alter und Pflege der Flächen unter Naturschutzaspekten diskutiert. Die Daten werden mit den Rasterkartierungen von Ssymank (2002) im gleichen Tal verglichen. Mit 23 neuen Arten gehören damit insgesamt 131 Schwebfliegenarten zur Lokalfauna des Stromtals.

1 Introduction

The Stromtal, in north-east Brandenburg (Germany, region Uckermark) is a typical, small river valley of the northern Baltic lowlands. Its slighly meandering river, together with the valley, is a nature conservation area with an interisting mosaic of habitats,

originating from former wet grassland that has been disused for different lengths of time. Thus the bottom of the valley has nowadays relics of wet grassland, Molinion-vegetation, large sedge beds (Magnocaricion), extensive reed beds (Phragmition australis), succession stages with *Salix cinerea*-scrub and relatively young alluvial black alder (*Alnus glutinosa*) forests. The wet grasslands of the valley bottom are usually not seasonally flooded, however the groundwater table is very high and a number of smaller flushes are present. In 1999 a research project was started to analyse habitat use by the local hoverfly (Diptera, Syrphidae) fauna. This project combined grid mapping in 1999 and 2000 (results published in Ssymank 2002) with a water-trap programme during the growing season of 1999. While the grid mapping aimed at a wider range of habitats within the river valley including the dry slopes, the present study with water traps focusses on comparing different succession stages, ranging from wet grassland of the Molinion and alkaline fens to reed beds with *Salix cinerea*-scrub to young black alder forests. Changes in the syrphid fauna following ecological succession processes are discussed in relation to nature conservation.

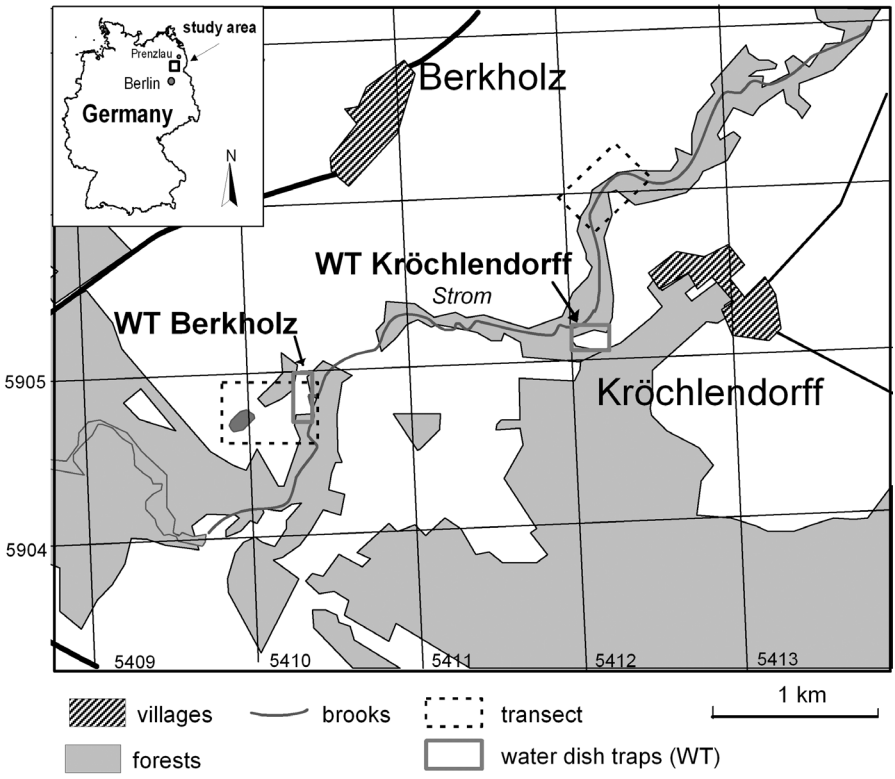

Fig. 1: Overview of the study area "Stromtal" indicating the location of sampling sites (Gauss-Krüger-coordinates, World Geodetic System 84, from Ssymank 2005).

2 Study area and methods

2.1 The study area

The study area has a subcontinental climate (approximately 650 mm annual rainfall, 8.4 ºC mean annual temperature) and forms part of the landscape "Uckermark", in north-east-Brandenburg (fig.1). The "Strom" is a slighly meandering river, carved about 20 m deep into the moraine, nowadays mostly running in the shade of black alder alluvial forests and alder carrs (Carici elongatae-Alnetum glutinosae and Stellario-Alnetum glutinosae). These young alder forests with helocrenes (groundwater-fed flushes) can have areas of white blooming flowers, like *Cardamine amara*, *Myosotis scorpioides* agg. and *Veronica beccabunga*, while more stagnant water is indicated by *Iris pseudacorus*. In the study area the valley bottom is largely covered by reed beds (Scirpo-Phragmitetum), or in some parts by tall sedge beds (Caricetum paniculatae, *Carex acutiformis*-stands). They form different succession stages in a mosaic with *Salix cinerea*-scrub (Salicion cinereae). Open, extensively used wet grassland of the Calthion and Molinion is rare, and is managed for nature conservation in the Berkholz valley section, where rare plants like *Succisa pratensis* and *Valeriana dioica* are present. More detailed descriptions can be found in Voigtländer (1991) and Ssymank (2002).

The river valley of the Strom was under regular grassland use (mowing and pasturage regime) until about 1950. At this time only a few scattered black alders were present along the river bank, but no forests existed. In the area of the "Kröchlendorffer meadow" in the 1940s agricultural improvement took place, involving artificial draining of springs. This drainage system is probably still partly effective today (written note from Hauke 2004). Until the 1970s the area was under a management regime of part mowing and part pasturage. Since that time the area has not been used for farming, and has only been mowed occasionally for nature conservation purposes, to prevent succession.

The area near Berkholz was used as cattle pasture until about 1985 when it was taken out of use (note from Hauke 2004). The natural succession is very slow on the valley bottom due to significant influence of rising ground water (springs) and peat formation in the wettest parts. Reed beds with *Phragmites australis* may form very persistent succession stages almost without invasion by shrubs or trees. Knowing the history of land use, the age of the studied black alder forest can be estimated to about 35-40 years near Kröchlendorff and to about 20-25 years near Berkholz.

2.2 Methods

In order to compare different stages of the wet grasslands in the valley bottom two different sections in the "Stromtal", one near Berkholz (about 400 m long and 200 m wide) and the other near Kröchlendorff (about 400 m long and 300 m wide), were chosen for installation of water traps. In each valley bottom section four localities with different habitats (biotopes) were selected, for installation at each locality of a set of

4 water traps, including three yellow and one white trap (20 cm in diameter, outside painted dark grey, inside yellow or white, details of construction and spectral qualities see Ssymank 2001). The traps were filled with water, to which detergent and 0.5 % formaldehyde were added for better conservation of the flies. The traps were run throughout the growing season in 1999 and emptied approximately every fortnight, starting on 14th of May and ending the 24th of September, when ground frost started to appear in the valley bottom. The traps were exposed at 0.5 m height in low vegetation of wet grassland (sites no. 4, 5 and 8), or at 1.1 m height in tall herb and reed vegetation. The location of water traps in relation to the alluvial forest and major vegetation types can be seen in figs 2a and 2b.

List of sites where traps were exposed in 1999

The last digit of the site-number (printed in bold) is used for indicating the sites in figs 2a and 2b.

Stromtal near Kröchlendorff:

No. 801_**1**: TK 274813, 53°16'20" N, 13°41'00"E, Reed bed (*Phragmites australis*) with helocrene, wet set aside, water traps yellow: A, B, C and white: W, 50 m NN, 1999.

No. 801_**2**: TK 274813, 53°16'20"N, 13°41'00" E, tall sedge bed (Magnocaricion), wet set aside close to the slope of the valley, water traps yellow: A, B, C and white: W, 50 m NN, 1999.

No. 801_**3**: TK 274813, 53°16'20" N, 13°41'00" E, Reed bed (*Phragmites australis*) intermingled with *Salix cinerea*-scrub (older set aside of wet grassland), water traps yellow: A, B, C and white: W, 50 m NN, 1999.

No. 801_**4**: TK 274813, 53°16'20" N, 13°41'00" E, Black alder alluvial forest on the banks of the river Strom (originating from a set aside of wet grassland, ca. 35-40 years old), water traps yellow: A, B, C and white: W, height of exposition 0.5 m, 50 m NN, 1999.

Stromtal near Berkholz:

Near Berkholz the water trap sampling was done in the same localities as the grid mapping of Ssymank (2002). In brackets behind the site number the corresponding grid-number is indicated.

No. 802_**5** (E2, E3): TK 274724, 53°16'10" N, 13°39'20" E, Molinion / alkaline fen (extensive mowing regime), water traps yellow: A, B, C and white: W, 48 m NN, 1999.

No. 802_**6** (E2): TK 274724, 53°16'10" N, 13°39'20" E, Reed bed (*Phragmites australis*) on the banks of the river Strom, water traps yellow: A, B, C and white: W, 48 m NN, 1999.

No. 802_**7** (E1): TK 274724, 53°16'10" N, 13°39'20" E, Reed bed with spring water influence: Phragmition/ Caricetum paniculatae, intermingled with *Salix cinerea*-scrub, water traps yellow: A, B, C and white: W, 48 m NN, 1999.

No. 802_**8** (E3, E4): TK 274724, 53°16'10" N, 13°39'20" E, Black alder alluvial forest near the river "Strom" (originating from a set aside of wet grassland, ca. 20-25 years old), water traps yellow: A, B, C and white: W (Prenzlau), 48 m NN, 1999.

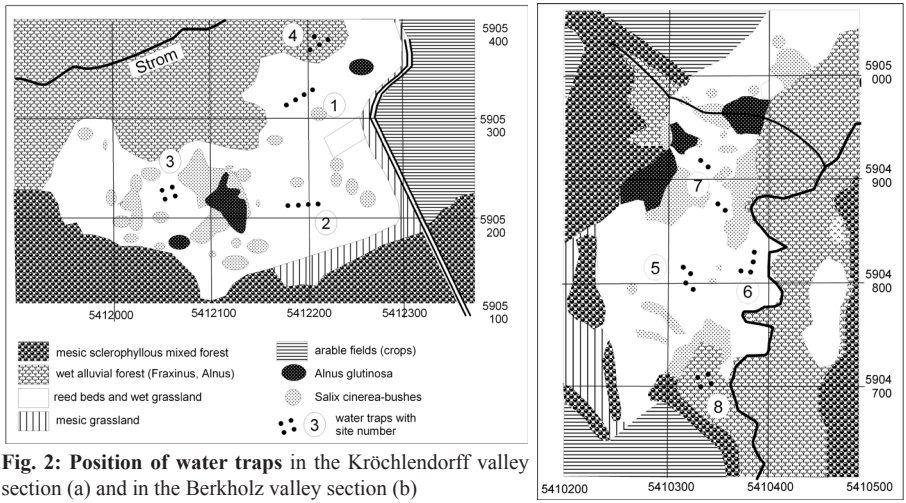

Fig. 2: Position of water traps in the Kröchlendorff valley section (a) and in the Berkholz valley section (b)

2.3 Determination and nomenclature

The nomenclature of hoverflies here follows that of the first German checklist (Ssymank et al. 1999) with its most recent amendments and corrections (Doczkal et al. 2002).

Critical specimens were checked and determined by Dieter Doczkal, Malsch, one *Chrysogaster virescens* with slighly differing characters by Claus Claussen, Flensburg. Interesting morphological abberrations were two individuals of male *Syrphus ribesii* with completely yellow hind femora and an intersex of *Chalcosyrphus nemorum* with completely black abdomen.

Red Databook references are taken from the national list (Ssymank et al. 1998) as no current Red Databook of Brandenburg exists for Syrphidae.

3 Results

3.1 Results from water traps

The water-trap sampling programme employed in the two valley sections involved 32 traps in 8 localities during the year 1999. This resulted in a total catch of 4,303 adult syrphids, belonging to 99 species (table 1). The species composition of the total catch had less than one third of the most abundant species *Episyrphus balteatus*, and 15% of it was specimens of *Chalcosyrphus nemorum*, reflecting the ideal situation for the

	Kröchlendorff				Berkholz				total catch			trap colours				
Locality No.:	1	2	3	4	5	6	7	8	Kr	Be	sum	w	y	y/3	LARV	RL_D
Anasimyia interpuncta (Harris, [1776])							9	2		11	11	1	10	3.3	3.1	V
Anasimyia lineata (Fabricius, 1787)	1				2	3			1	5	6		6	2.0	3.1	
Arctophila superbiens (Müller, 1776)	1		2		22	13	11		3	46	49		49	16.3	3.1	G
Baccha elongata (Fabricius, 1775) s.l.								1		1	1		1	0.3	2	
Chalcosyrphus nemorum (Fabricius, 1805)	149	22	168	35	30	79	143	10	374	262	636	80	556	185.3	3.2	
Cheilosia albipila Meigen, 1838							1			1	1		1	0.3	1	
Cheilosia albitarsis (Meigen, 1822)	11	3	9	3	2	2	5	3	26	12	38		38	12.7	1	
Cheilosia barbata Loew, 1857					1					1	1	1		0.0	1	
Cheilosia carbonaria Egger, 1860	1			2			2	2	3	4	7		7	2.3	1	
Cheilosia chlorus (Meigen, 1822)	3		2					1	5	1	6		6	2.0	1	
Cheilosia fraterna (Meigen, 1830)					1					1	1		1	0.3	1	
Cheilosia frontalis Loew, 1857	1								1		1		1	0.3	1	
Cheilosia impressa Loew in Schiner, 1857			1		1				1	1	2		2	0.7	1	
Cheilosia pagana (Meigen, 1822)			1			2	2		1	4	5	3	2	0.7	1	
Cheilosia pubera (Zetterstedt, 1838)	3	1		2	2	2	11	11	6	26	32	1	31	10.3	1	3
Cheilosia rufimana Becker, 1894					3	1	3	1		8	8		8	2.7	1	3
Cheilosia variabilis (Panzer, [1798])	1	1							2		2	1	1	0.3	1	
Cheilosia vernalis (Fallén, 1817)				1	1				1	1	2	1	1	0.3	1	
Chrysogaster cemiteriorum (Linnaeus, 1758)	1	1	2				1		4	1	5	1	4	1.3	3.1	3
Chrysogaster solstitialis (Fallén, 1817)	1		2				1		3	1	4		4	1.3	3.1	
Chrysogaster virescens Loew, 1854	5	2	3				1		10	1	10	8	3	1.0	3.1	G
Chrysotoxum bicinctum (Linnaeus, 1758)					2	1	3			6	6		6	2.0	2	
Chrysotoxum festivum (Linnaeus, 1758)			1		1	2	1		1	4	5	1	4	1.3	2	
Chrysotoxum vernale Loew, 1841			2						2		2	1	1	0.3	2	V
Chrysotoxum verralli Collin, 1940	8	2	4		2	2	3		14	7	21	1	20	6.7	2	V
Dasysyrphus albostriatus (Fallén, 1817)			1						1		1		1	0.3	2	
Dasysyrphus hilaris (Zetterstedt, 1843)	4		3	1					8		8		8	2.7	2	
Dasysyrphus spec. 1 (sensu Doczkal)							1			1	1		1	0.3	2	

Dasysyrphus tricinctus (Fallén, 1817)						2				2	2		2	0.7	2	
Dasysyrphus venustus (Meigen, 1822)	10	1	2	2			1	2	15	3	18		18	6.0	2	
Episyrphus balteatus (De Geer, 1776)	276	216	211	97	184	195	153	65	800	597	1397	239	1158	386.0	2	
Eristalinus sepulchralis (Linnaeus, 1758)	5	3	2		23	33	16		10	72	82	7	75	25.0	3.1	
Eristalis abusiva Collin, 1931	1		1		3				2	3	5	2	3	1.0	3.1	
Eristalis arbustorum (Linnaeus, 1758)	2	2	2		16	13	12		6	41	47	4	43	14.3	3.1	
Eristalis interrupta (Poda, 1761)	29		12		12	13	10		41	35	76	7	69	23.0	3.1	
Eristalis intricaria (Linnaeus, 1758)		1	1		7	16	6		2	29	31	1	30	10.0	3.1	
Eristalis lineata (Harris, 1776)	1	1	1			5	2		3	7	10	6	4	1.3	3.1	
Eristalis pertinax (Scopoli, 1763)	5	3	2		4	9	6	1	10	20	30	12	18	6.0	3.1	
Eristalis picea (Fallén, 1817)			1			1			1	1	2	2			3.1	
Eristalis tenax (Linnaeus, 1758)	4	2	2			5	1		8	6	14	6	8	2.7	3.1	
Eumerus strigatus (Fallén, 1817)			1			1	2		1	3	4	1	3	1.0	1	
Eupeodes corollae (Fabricius, 1794)	17	5	5		6	3	7		27	16	43	27	16	5.3	2	
Eupeodes goeldlini Mazánek, Láska & Bičík, 1999							1			1	1	1			2	
Eupeodes latifasciatus (Macquart, 1829)		1			1	4	2		1	7	8	2	6	2.0	2	
Eupeodes luniger (Meigen, 1822)			1						1		1	1			2	
Helophilus affinis Wahlberg, 1844					1	4	2	2		9	9	3	6	2.0	3.1	
Helophilus hybridus Loew, 1846		1			10	6	2		1	18	19	3	16	5.3	3.1	
Helophilus pendulus (Linnaeus, 1758)	61	40	55	6	117	196	96	41	162	450	612	189	423	141.0	3.1	
Helophilus trivittatus (Fabricius, 1805)	1		2		7	12	7		3	26	29	3	26	8.7	3.1	
Heringia heringi (Zetterstedt, 1843)	1								1		1		1	0.3	2	G
Lejogaster metallina (Fabricius, 1781)					1					1	1		1	0.3	3.1	V
Leucozona lucorum (Linnaeus, 1758)			1						1		1		1	0.3	2	
Melanogaster hirtella (Loew, 1843)	2	5	4		4	2			11	6	17	4	13	4.3	3.1	
Melanogaster nuda (Macquart, 1829)	25	4	22	5	13	32	66		56	111	167	1	166	55.3	3.1	
Melanogaster parumplicata (Loew, 1840)	4	3		1	1		1		8	2	10	1	9	3.0	1	G
Melanostoma mellinum (Linnaeus, 1758)	19	5	2	2	8	18	12	3	28	41	69	27	42	14.0	2	
Melanostoma scalare (Fabricius, 1794)	3		4	13		5	5	5	20	15	35	23	12	4.0	2	

Microdon devius (Linnaeus, 1761)			1						1		1		1	0.3	2	3
Microdon mutabilis (Linnaeus, 1758)/ *myrmicae* Schönrogge et al. 2002					1					1	1		1	0.3	2	3
Myathropa florea (Linnaeus, 1758)	1		2						3		3	1	2	0.7	3.2	
Neoascia meticulosa (Scopoli, 1763)	5	1		2	2		3	1	8	6	14	2	12	4.0	3.2	
Neoascia podagrica (Fabricius, 1775)	2		3				1		5	1	6	4	2	0.7	3.2	
Neoascia tenur (Harris, 1780)	8		6	5	2	5	8		19	15	34	6	28	9.3	3.2	
Neocnemodon sp. (female)			2						2		2		2	0.7	2	
Neocnemodon vitripennis (Meigen, 1822)			1			1			1	1	2	1	1	0.3	2	
Orthonevra brevicornis (Loew, 1843)	3				2			2	3	4	7	1	6	2.0	3.1	V
Orthonevra intermedia (Lundbeck, 1916)	1	1	2		3	6	10		4	19	23	5	18	6.0	3.1	2
Orthonevra nobilis (Fallén, 1817)			1			2			1	2	3		3	1.0	3.1	
Parasyrphus annulatus (Zetterstedt, 1838)								1		1	1		1	0.3	2	
Parhelophilus frutetorum (Fabricius, 1775)	4		2		1	1	5	1	6	8	14	1	13	4.3	3.1	V
Parhelophilus versicolor (Fabricius, 1794)	7		1		4	3	4		8	11	19	8	11	3.7	3.1	V
Pipiza lugubris (Fabricius, 1722)	1								1		1		1	0.3	2	
Pipiza quadrimaculata (Panzer, 1804)			1						1		1		1	0.3	2	
Platycheirus albimanus (Fabricius, 1781)	3			2			1	5	5	6	11	7	4	1.3	2	
Platycheirus clypeatus (Meigen, 1822)	1	2	1			5	1		4	6	10	3	7	2.3	2	
Platycheirus fulviventris (Macquart, 1829)		1	2		1	3	1		3	5	8	2	6	2.0	2	V
Platycheirus peltatus (Meigen, 1822)	11	4	14	3	1	8	10	1	32	20	52	35	17	5.7	2	
Pyrophaena granditarsa (Forster, 1771)						3				3	3		3	1.0	2	
Pyrophaena rosarum (Fabricius, 1787)	1		1			2	1		2	3	5		5	1.7	2	
Scaeva pyrastri (Linnaeus, 1758)			1		1				1	1	2		2	0.7	2	
Scaeva selenitica (Meigen, 1822)				1					1		1		1	0.3	2	
Sericomyia silentis (Harris, [1776])			1			2			1	2	3	2	1	0.3	3.2	
Sphaerophoria interrupta (Fabricius, 1805)	1		3		1	1	1		4	3	7	4	3	1.0	2	
Sphaerophoria scripta (Linnaeus, 1758)	17	11	9		5	13	3		37	21	58	20	38	12.7	2	
Sphaerophoria taeniata (Meigen, 1822)	2	1	2			2			5	2	7	3	4	1.3	2	
Sphegina elegans Schummel, 1843				1					1		1		1	0.3	3.2	

Syritta pipiens (Linnaeus, 1758)	4	1			2	1			**5**	**3**	**8**	2	6	2.0	3.2	
Syrphus ribesii (Linnaeus, 1758)	18	4	15	2	7	6	10	2	**39**	**25**	**64**	11	53	17.7	2	
Syrphus torvus Osten-Sacken, 1875	2	1	1		1		1		**4**	**2**	**6**	1	5	1.7	2	
Syrphus vitripennis Meigen, 1822	6	4	4	8	6	10	10		**22**	**26**	**48**	4	44	14.7	2	
Temnostoma apiforme (Fabricius, 1794)		2						1	**2**	**1**	**3**		3	1.0	3.2	3
Temnostoma bombylans (Fabricius, 1805)			1		1	1	1	1	**1**	**4**	**5**	1	4	1.3	3.2	
Triglyphus primus Loew, 1840			1			1	3		**1**	**4**	**5**		5	1.7	2	
Tropidia scita (Harris, 1780)	43	4	23		12	38	51	1	**70**	**102**	**172**	62	110	36.7	3.1	
Volucella bombylans var. *bombylans* (Linnaeus, 1758)	2								**2**		**2**	2			3.2	
Volucella pellucens (Linnaeus, 1758)						1				**1**	**1**	1			3.2	
Xanthandrus comtus (Harris, 1780)	1						1		**1**	**1**	**2**	1	1	0.3	2	
Xylota segnis (Linnaeus, 1758)	2	6	37	1	1	3	4		**46**	**8**	**54**	3	51	17.0	3.2	
Xylota sylvarum (Linnaeus, 1758)	2	6	6		1		1		**14**	**2**	**16**		16	5.3	3.2	
Xylota tarda Meigen, 1822		1	2						**3**		**3**	1	2	0.7	3.2	3
number of individuals	**804**	**375**	**681**	**195**	**543**	**800**	**739**	**166**	**2055**	**2248**	**4303**	**866**	**3437**	**1145.7**		
species number	**57**	**39**	**63**	**22**	**51**	**54**	**59**	**25**	**83**	**83**	**99**	**64**	**93**			

Table 1: Syrphidae recorded in each locality by water traps in 1999.
Total catch: Kr Kröchlendorff valley section, Be Berkholz valley section. – Trap colours: w white (1 trap), y yellow (all 3 traps), y/3 average reduced to one yellow trap per locality. – Larv: larval feeding type with 1 phytophagous, 2 zoophagous, 3.1 aquatic saprophagous, 3.2 terr. saprophagous.– RL_D: German Red Data Book category.

development of its larvae provided by the wet dead wood of the black alder forests. Another 14% of the catch was *Helophilus pendulus* with aquatic larvae, followed by *Tropidia scita* and *Melanogaster nuda* with about 4% each. The abundance of these species clearly reflects the wet habitats of the valley bottom, that were the main focus of this study. All other species had less than 2%. Rare species with less than 5 individuals (<0.1%) made up 39% (=39 species) of the species list.

3.2 Major differences between the Kröchlendorff and Berkholz valley sections

The number of syrphids caught in Kröchlendorff (48% of the total) and Berkholz (52% of the total) was similar. Also, the number of species recorded was the same, with 83 species in each valley section. However, when examined more closely, the species combinations observed differed greatly between the two valley sections. Species with a minimum of 8 records, and demonstrating a clear preference for one of the valley sections, comprised at least 75% of individuals recorded, as shown in table 2.

Valley section Kröchlendorff	%	n
Dasysyrphus hilaris (Zetterstedt, 1843)	100	8
Chrysogaster virescens Loew, 1854	90	10
Xylota sylvarum (Linnaeus, 1758)	88	16
Xylota segnis (Linnaeus, 1758)	85	54
Dasysyrphus venustus (Meigen, 1822)	83	18
Melanogaster parumplicata (Loew, 1840)	80	10
Valley section Berkholz	**%**	**n**
Anasimyia interpuncta (Harris, [1776])	100	11
Helophilus affinis Wahlberg, 1844	100	9
Cheilosia rufimana Becker, 1894	100	8
Helophilus hybridus Loew, 1846	95	19
Arctophila superbiens (Müller, 1776)	94	49
Eristalis intricaria (Linnaeus, 1758)	94	31
Helophilus trivittatus (Fabricius, 1805)	90	29
Eristalinus sepulchralis (Linnaeus, 1758)	88	82
Eupeodes latifasciatus (Macquart, 1829)	88	8
Eristalis arbustorum (Linnaeus, 1758)	87	47
Orthonevra intermedia (Lundbeck, 1916)	83	23
Cheilosia pubera (Zetterstedt, 1838)	81	32
Helophilus pendulus (Linnaeus, 1758)	74	612

Table 2: Hoverflies restricted to or clearly dominant in one valley section. – n total number of observations, % percent of observations with reference to the Berkholz section resp. Kröchlendorff section of the valley. Only species included with n > 8 observations.

In the Kröchlendorff section species like *Dasysyrphus venustus*, and xylosaprophagous species like *Xylota segnis* and *X. sylvarum* that indicate mesic conditions were dominant. The Berkholz section revealed a number of exclusive or dominant species like *Anasimyia interpuncta*, all four *Helophilus* species, *Eristalinus sepulchralis*, *Orthonevra intermedia*, *Eristalis intricaria* – all having aquatic, saprophagous larvae and clearly indicating wetter conditions in this part of the valley. These results are perfectly in line with the grid mapping results of Ssymank (2002) and they are also supported by an analysis of the larval feeding groups (fig. 3).

At 46.6 + 9.5% the percentage of aquatic, saprophagous syrphids (based on number of individuals) in the Berkholz section was more than double that in the Kröchlendorff section of the valley, with only 20.9 + 8.5%. Vice-versa the syrphids of the Kröchlendorff section were characterised by a much higher percentage of aphidophagous species (52.9%) and almost double the amount of terrestrial saprophagous species (23.6% versus 13.6%), including the xylophagous species of the genus *Xylota*. These high differences are astonishing, as in both cases only the valley bottom with the wettest habitats present and roughly similar vegetation types were compared.

This difference may be due to drainage of the Kröchlendorffer section of the valley carried out in historical times, probably reducing habitat availability for aquatic syrphid larvae. Soil changes for example, like damage to peat layers, may explain why Molinion-vegetation with transitions to bog vegetation are missing in the Kröchlendorff-section. Species like *Arctophila superbiens* and *Orthonevra intermedia*, preferring relatively nutrient-poor, water-logged soils, were therefore almost exclusively found in the Berkholz section of the Stromtal. Similar observations of large differences between the two valley sections were made by Ssymank (2005) concerning the soldier flies (Stratiomyidae), most of which have aquatic larvae and showed much greater abundance in the Berkholz section.

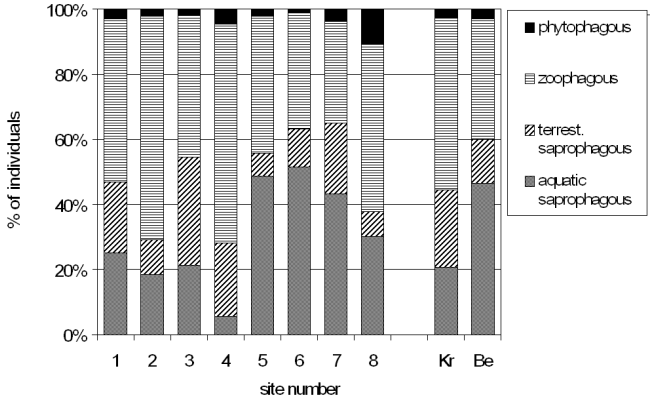

Fig. 3: Larval feeding types. – Site number and larval feeding type assigned to each species see Table 1: locality no. Kr Kröchlendorff section, Be Berkholz section of the valley.

3.3 Differences between sampling localities – different successional stages of wetlands

The localities in the study area represent different successional stages of wet grassland, due partly to differences in land use in the past and partly to how long they have been out of use for farming. Thus the most interesting question is, how the diversity and species composition of syrphid communities differ at localities that were subject to different farming regimes and that have been out of use for farming for different lengths of time. The Black alder forests studied (Stellario-Alnetum glutinosae with transgressions to Carici elongatae-Alnetum, sites No. 4 and 8) represent the oldest succession stages in the study area and were still under agricultural use as pastures and for mowing about 35-40 years ago (Site no. 4) or 20-25 years ago (site no. 8). These sites had relatively low abundances of Syrphidae with only 22-25 different species recorded. Many species observed in all other more or less open wet habitats investigated were missing in these young black alder forests (see constancy [1)] table, table 3) for example *Eristalinus sepulchralis* and *Tropidia scita* that are typical for wetlands, but also including species that inhabit a wider range of wet to dry habitats like *Eristalis arbustorum*, *Sphaerophoria scripta* or *Eupeodes corollae*. Thus the development of a forest canopy of black alders dramatically changes the species composition, while succession stages with even a large proportion of *Salix cinerea* and *Salix caprea*-scrub did not have this effect (site no. 3 for example). On closer examination it can be seen that the two black alder forests each have species groups absent from the other: *Xylota segnis*, *Neoascia tenur*, *Syrphus vitripennis* and *Melanogaster nuda* were only present on site number 4. Whether this is due to the different age stages, with probably *Xylota segnis* beginning to colonise young black alder forests after a period of more than 20-25 years only, or whether minor differences in hydrology play an important role can only be guessed at, without more extensive investigations. However, high numbers of *Chalcosyrphus nemorum* inhabit both forests and the larvae of this species use wet, decaying wood of *Alnus glutinosa* (egg-laying observed on fallen trees partly immersed in water).

Among the sites with open vegetation site No. 2 showed a very poor syrphid inventory, with only 39 species recorded, as compared with more than 50 species in all other open habitats. This is a pure sedge bed with low plant diversity close to the slope of the valley. This may explain why not only both *Parhelophilus*-species but also *Eristalis*

Table 3: Constancy of syrphid species given in classes.
Only species with more than 8 observations have been used for the analysis. Constancy classes (percent classes of the frequency with which a hoverfly species was recorded in the traps of each locality): + 0 – 25%, I 26 – 50 %, II 51 – 75%, III 76 – 100%. If the proportional representation of a species in a locality was over 40% (in relation to the total catch of this species), the cell in the table is shaded in grey.
Valley Section: Kr Kröchlendorff, Be Berkholz. Habitat Type: Ph/qu Phragmition (reedbed) with spring water, Mol Molinion, MC Magnocaricion (tall sedge beds), Sal Salicion cinereae (grey willow scrub intermingeld), Aln Black alder forests (*Alnus glutinosa*).

[1)] Constancy is the frequency with which a syrphid species is caught within one localitity or one habitat type in a number of traps, usually given as a percentage (constancy in percent c=n*100/m, with m number of traps in the habitat type, n number of traps which caught the species).

Locality No.:	1	5	7	6	3	2	4	8	Sum
Valley Section:	Kr	Be	Be	Be	Kr	Kr	Kr	Be	
Habitat Type:	Ph/qu	Mol	Ph/MC	Ph	Ph/Sal	MC	Aln	Aln	
Tropidia scita	III	III	III	III	III	I		+	172
Eristalinus sepulchralis	I	III	III	III	+	II			82
Sphaerophoria scripta	III	II	II	III	II	III			58
Eristalis arbustorum	I	III	III	II	I	+			47
Eupeodes corollae	II	III	I	+	II	II			43
Eristalis pertinax	II	I	II	II	+	I		+	30
Orthonevra intermedia	+	I	III	II	+	+			23
Chrysotoxum verralli	II	I	II	I	II	+			21
Melanogaster hirtella	I	I		+	II	I			17
Xylota sylvarum	I	+	+		I	I			16
Eristalis lineata	+		I	I	+	+			10
Chrysogaster virescens	+		+		+	+			10
Eristalis interrupta	III	II	III	III	III				76
Parhelophilus versicolor	III	II	I	I	+				19
Parhelophilus frutetorum	I	+	II	+	I			+	14
Arctophila superbiens	+	II	II	II	I				49
Helophilus hybridus		II	I	II		+			19
Eristalis intricaria		I	II	III	+	+			31
Helophilus trivittatus	+	III	II	III	+				29
Helophilus affinis		+	I	II				I	9
Neoascia meticulosa	III	I	I			+	I	+	14
Melanogaster parumplicata	II	+	+			+	+		10
Anasimyia interpuncta			II					+	11
Eristalis tenax	I		+	II	I	I			14
Platycheirus clypeatus	+		+	II	+	I			10
Melanogaster nuda	II	II	II	II	III	II	II		167
Xylota segnis	I	+	I	II	III	I	+		54
Syrphus vitripennis	II	II	III	II	III	II	III		48
Neoascia tenur	III	I	III	II	II		II		34
Episyrphus balteatus	III	III	III	III	III	III	III	III	1397
Chalcosyrphus nemorum	III	III	III	II	III	III	III	III	636
Helophilus pendulus	III	III	III	III	III	III	II	III	612
Melanostoma mellinum	III	II	II	III	+	I	I	I	69
Syrphus ribesii	III	II	III	II	III	I	+	+	64
Platycheirus peltatus	III	+	II	II	II	+	+	+	52
Cheilosia albitarsis	II	I	II	I	I	I	II	I	38
Melanostoma scalare	II		+	I	+		I	II	35
Cheilosia pubera	I	I	II	I		+	I	II	32
Dasysyrphus venustus	II		+		+	+	I	I	18
Platycheirus albimanus	I		+				I	I	11

interrupta were missing at this site, since there were almost no nectar-bearing flowers present throughout the growing season. The development of pure stands of Magnocaricion obviously reduced the syrphid species richness, without any characteristic species being restricted to this habitat type. These vegetation stages are also known botanically to be relatively persistent in successional series of wet grasslands.

According to the constancy table the three sites with open vegetation in the Berkholz valley section are well characterised by 5 different species, *Arctophila superbiens*, all *Helophilus species* and *Eristalis intricaria*. However, these three sites differed in presence (relative abundance) of both these species and other distinct species groups. Site number 5, the Molinion grassland in Berkholz, was characterised by the highest proportional representation of *Arctophila superbiens* and *Helophilus hybridus*, at over 40%, an observation shared with the habitat preferences recorded by grid mapping (Ssymank 2002). The mixed vegetation with Magnocaricion and reedbeds of *Phragmites australis* of site No. 7 was characterised by a high constancy of *Anasymia interpuncta*, and at the same time by the highest proportional representation of *Melanogaster nuda*, *Orthonevra intermedia* and *Anasimyia interpuncta*. The Reed beds of site no. 6 were characterised by a high proportional representation (compared to the other wet habitats investigated!) of *Platycheirus clypeatus* (*Phragmites* is probably the main larval microhabitat for this syrphid in the valley), *Helophilus trivittatus*, *H. affinis*, *Eristalis intricaria* and *Eristalinus sepulchralis*.

Within the Kröchlendorff section the two sites (no. 1 and 3) with mixed reed-beds and either helocrenes or some scrub invasion by *Salix cinerea*, proved to be quite species rich with, respectively, 58 and 63 species recorded. But they did not have such distinct species combinations as the Berkholz-sites. In the *Phragmites* stand with helocrenes of site no. 1 *Neoascia meticulosa* and *Melanogaster parumplicata* showed a high constancy, but the number of individuals recorded was low. In the reed bed with *Salix cinerea*-scrub (site no. 3) no site-specific constant species could be detected, but it is interesting to note that *Xylota segnis* displayed here its highest numbers, with 80% of the total catch of this species. However it is not clear whether *Xylota segnis* is mainly flying into this site (habitat use?) from breeding places in the adjacent black alder forest or whether it may breed also in the young and thin dead wood available from *Salix cinerea*.

3.4 Efficiency of trap-colour

As known from many other investigations a yellow colour is usually more effective in catching hoverflies, but white may yield some additional species. Thus three yellow traps and only one additional white trap were used per locality. In comparing the total catch per trap the yellow traps yielded on average 143 individuals as compared with 90 in the white traps (ca. 60% more in the yellow). Average species number per trap were comparable however, with 21 species per trap both in yellow and white traps. With the arrangement of traps used 93 species were collected in yellow traps and 64 in

white traps, reflecting of course the triple number of yellow traps. However, large differences were found in individual hoverfly species: a relatively large number of species clearly preferred the yellow traps and were collected only in small numbers or not at all in the white. Examples are *Arctophila superbiens*, *Cheilosia albitarsis*, *C. pubera*, *Dasysyrphus venustus*, *Eristalinus sepulchralis*, *Eristalis arbustorum*, *E. intricaria*, *E. interrupta*, *Syrphus vitripennis* and the genus *Xylota*. Species preferring white were few, such as *Chrysogaster virescens*, *Eristalis lineata*, *Platycheirus albimanus* and *P. peltatus*. The relative importance of the additional white traps, in providing a more complete inventory, can be seen from the number of exclusive species: 7 species were found exclusively in white traps, while with triple the number of traps, 37 species were exclusive to yellow.

4 Selected nature conservation aspects

The small section of the Stromtal investigated has, with at least 131 known species, a rich local fauna of almost 30% of the German fauna of syrphids. The large differences shown in the species collected from wet habitats on the valley bottom that exhibit only small differences in vegetation, indicates that the species diversity of Syrphidae depends on an existing mosaic of different succession stages, with a clear focus on keeping a significant area of the open habitats. Similar results were obtained for another group of Diptera, the soldierflies (Stratiomyidae, Ssymank 2005). The main focus should be laid upon keeping the hydrology untouched, especially in the wettest parts of the valley (Berkholz section in this study), as here most of the more specific and characteristic species were concentrated. Natural flooding in immediate vicinity of the river in combination with unpolluted groundwater springs and flushes are certainly outstanding features explaining the rich syrphid fauna (in the Berkholz section at least 5, in the Kröchlendorff section 3 flushes on the valley bottom). As the surrounding landscape is intensively used farmland with crops (corn and rapeseed), it can be assumed that most of the species recorded have their larval habitats in the valley, possibly with the exception of a few migrating species.

Endangered species from the German Red Data Book included 1 species of category "2 highly threatened": *Orthonevra intermedia*. There were in total 7 "threatened" (category 3) species: *Cheilosia rufimana*, *Cheilosia pubera*, *Chrysogaster cemiteriorum*, *Microdon devius*, *Microdon mutabilis* agg. (as no larvae were recorded this might be the recently described cryptic species *M. myrmicae* Schönrogge et al. 2002 [Schönrogge et al. 2002]), *Temnostoma apiforme* and *Xylota tarda*. Of categoy "G" (threatened, but degree of threat unknown) 4 species occurred: *Arctophila superbiens*, *Chrysogaster virescens*, *Heringia heringi* and *Melanogaster parumplicata*. Furthermore, 8 species listed in category "V" as possibly endangered, when further declining, were present. Red List-species from very wet habitats like *Microdon mutabilis/myrmicae* and *Orthonevra intermedia* occurred mainly in the Berkholz section, while species preferring drier

habitats like *Chrysogaster cemiteriorum* and *Microdon devius* were mainly present in the Kröchlendorff section of the valley.

The number of red-listed species, including those possibly endangered (V), was high only in the wet open habitats, ranging from 8-12 species (localities 1, 2, 3 and 5, 6, 7) and dropped to 6 species in locality 8 and only 2 species in locality 4. This means that the local conservation interest for endangered species of young alder succession forests is much lower than that of the open wet grassland and reed habitats. However, no investigations have been made so far in very old alluvial forests in the same region and it can be assumed that old black alder alluvial forests are species richer and may host a number of endangered xylophagous species.

5 Local fauna

It is interesting to compare the results from this study using water traps with the results of the grid mapping study of 1999-2000 (Ssymank 2002) that was carried out close by, in the same river valley (see fig. 1). With almost 8000 observations grid mapping produced 108 species over the whole habitat suite present in the valley, including the slopes with drier vegetation. This study focussed on the wet grassland and its succession stages on the valley bottom and resulted in 23 additional species, that were not recorded during grid mapping. This is partly due to the intensity of investigation adding rarer species like *Cheilosia albipila*, *Microdon mutabilis/myrmicae*, *M. devius*, *Triglyphus primus* or *Xanthandrus comtus*. Remarkable is also the first record of *Eupeodes goeldlini* (det. Doczkal) from northern Germany. However some species, like *Orthonevra intermedia*, *Parhelophilus versicolor* and *Xylota sylvarum*, were caught in considerable numbers in water traps but not observed directly at all. As the grid mapping took place in the same year this cannot be explained by fluctuations of the populations, but only by very localised occurrences of these species.

In total the local fauna of the Stromtal now comprises 133 known species of Syrphidae, based on these two investigations (table 4). This includes one unnamed species of the *Melanostoma mellinum*-complex and one unnamed *Dasysyrphus*. It can be assumed that the fauna of the Stromtal is still incompletely known and a number of rarer species may be expected.

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Table 4 (p. 182-184): Hoverfly records from Stromtal / Brandenburg. Kr = Kröchlendorff, Be = Berkholz

	water traps 1999 (Ssymank 2005)			transects 1999-2000 (Ssymank 2002)	
	Kr	Be	Σ	Kr	Be
Anasimyia interpuncta (Harris, [1776])		11	11	v	v
Anasimyia lineata (Fabricius, 1787)	1	5	6		v
Arctophila superbiens (Müller, 1776)	3	46	49	v	v
Baccha elongata (Fabricius, 1775)		1	1	v	v
Brachymyia berberina (Fabricius, 1805)					v
Brachyopa pilosa Collin, 1939					v
Chalcosyrphus nemorum (Fabricius, 1805)	374	262	636	v	v
Cheilosia albipila Meigen, 1838		1	1		
Cheilosia albitarsis (Meigen, 1822)	26	12	38	v	v
Cheilosia barbata Loew, 1857		1	1		
Cheilosia bergenstammi Becker, 1894				v	v
Cheilosia carbonaria Egger, 1860	3	4	7	v	v
Cheilosia chlorus (Meigen, 1822)	5	1	6	v	v
Cheilosia fraterna (Meigen, 1830)		1	1		v
Cheilosia frontalis Loew, 1857	1		1		
Cheilosia impressa Loew in Schiner, 1857	1	1	2	v	
Cheilosia pagana (Meigen, 1822)	1	4	5	v	v
Cheilosia proxima (Zetterstedt, 1843)				v	
Cheilosia pubera (Zetterstedt, 1838)	6	26	32	v	v
Cheilosia rufimana Becker, 1894		8	8	v	v
Cheilosia variabilis (Panzer, [1798])	2		2	v	v
Cheilosia vernalis (Fallén, 1817)	1	1	2	v	
Cheilosia vicina (Zetterstedt, 1849)				v	
Cheilosia vulpina (Meigen, 1822)				v	
Chrysogaster cemiteriorum (Linnaeus, 1758)	4	1	5	v	v
Chrysogaster solstitialis (Fallén, 1817)	3	1	4	v	v
Chrysogaster virescens Loew, 1854	10	1	10		
Chrysotoxum bicinctum (Linnaeus, 1758)		6	6		v
Chrysotoxum cautum (Harris, 1776)				v	v
Chrysotoxum festivum (Linnaeus, 1758) *)	1	4	5		
Chrysotoxum vernale Loew, 1841	2		2	v	
Chrysotoxum verralli Collin, 1940	14	7	21	v	v
Dasysyrphus albostriatus (Fallén, 1817)	1		1		
Dasysyrphus hilaris (Zetterstedt, 1843)	8		8		v
Dasysyrphus spec. 1 (sensu Doczkal) **)		1	1		
Dasysyrphus tricinctus (Fallén, 1817)		2	2		
Dasysyrphus venustus (Meigen, 1822)	15	3	18	v	v
Didea fasciata Macquart, 1834					v
Epistrophe eligans (Harris, 1780)				v	v
Epistrophe nitidicollis (Meigen, 1822)					v
Episyrphus balteatus (De Geer, 1776)	800	597	1397	v	v
Eristalinus sepulchralis (Linnaeus, 1758)	10	72	82		v
Eristalis abusiva Collin, 1931	2	3	5		v

Eristalis arbustorum (Linnaeus, 1758)	6	41	47	v	v
Eristalis interrupta (Poda, 1761)	41	35	76	v	v
Eristalis intricaria (Linnaeus, 1758)	2	29	31		v
Eristalis lineata (Harris, 1776)	3	7	10	v	v
Eristalis pertinax (Scopoli, 1763)	10	20	30	v	v
Eristalis picea (Fallén, 1817)	1	1	2		
Eristalis tenax (Linnaeus, 1758)	8	6	14	v	v
Eumerus strigatus (Fallén, 1817)	1	3	4	v	
Eupeodes corollae (Fabricius, 1794)	27	16	43	v	v
Eupeodes goeldlini Mazánek, Láska & Bičik, 1999		1	1		
Eupeodes latifasciatus (Macquart, 1829)	1	7	8	v	v
Eupeodes luniger (Meigen, 1822)	1		1	v	v
Eupeodes nitens (Zetterstedt, 1843)					v
Ferdinandea cuprea (Scopoli, 1763)					v
Helophilus affinis Wahlberg, 1844		9	9		v
Helophilus hybridus Loew, 1846	1	18	19	v	v
Helophilus pendulus (Linnaeus, 1758)	162	450	612	v	v
Helophilus trivittatus (Fabricius, 1805)	3	26	29		v
Heringia heringi (Zetterstedt, 1843)	1		1		v
Lejogaster metallina (Fabricius, 1781)		1	1	v	
Leucozona lucorum (Linnaeus, 1758)	1		1	v	v
Melanogaster hirtella (Loew, 1843)	11	6	17		
Melanogaster nuda (Macquart, 1829)	56	111	167	v	v
Melanogaster parumplicata (Loew, 1840)	8	2	10	v	
Melanostoma mellinum (Linnaeus, 1758)	28	41	69	v	v
Melanostoma mellinum agg. **)				v	
Melanostoma scalare (Fabricius, 1794)	20	15	35	v	v
Meligramma trianguliferа (Zetterstedt, 1843)				v	
Meliscaeva auricollis (Meigen, 1822)				v	v
Meliscaeva cinctella (Zetterstedt, 1843)				v	v
Microdon devius (Linnaeus, 1761)	1		1		
Microdon mutabilis (Linnaeus, 1758) / *myrmicae* Schönrogge et al. 2002		1	1		
Myathropa florea (Linnaeus, 1758)	3		3	v	v
Neoascia interrupta (Meigen, 1822)					v
Neoascia meticulosa (Scopoli, 1763)	8	6	14	v	v
Neoascia podagrica (Fabricius, 1775)	5	1	6	v	v
Neoascia tenur (Harris, 1780)	19	15	34	v	v
Neocnemodon vitripennis (Meigen, 1822)	3	1	5		
Orthonevra brevicornis (Loew, 1843)	3	4	7	v	v
Orthonevra intermedia (Lundbeck, 1916)	4	19	23		
Orthonevra nobilis (Fallén, 1817)	1	2	3		v
Paragus haemorrhous Meigen, 1822				v	
Paragus pecchiolii Rondani, 1857				v	v
Parasyrphus annulatus (Zetterstedt, 1838)		1	1		
Parhelophilus frutetorum (Fabricius, 1775)	6	8	14	v	
Parhelophilus versicolor (Fabricius, 1794)	8	11	19		

Pipiza lugubris (Fabricius, 1775)	1		1		
Pipiza noctiluca (Linnaeus, 1758)					v
Pipiza quadrimaculata (Panzer, 1804)	1		1		
Pipizella annulata (Macquart, 1829)				v	
Pipizella viduata (Linnaeus, 1758)				v	v
Platycheirus albimanus (Fabricius, 1781)	5	6	11	v	v
Platycheirus angustatus (Zetterstedt, 1843)				v	v
Platycheirus clypeatus (Meigen, 1822)	4	6	10	v	v
Platycheirus europaeus Goeldlin, Maibach & Speight, 1990				v	v
Platycheirus fulviventris (Macquart, 1829)	3	5	8	v	v
Platycheirus occultus Goeldlin, Maibach & Speight, 1990				v	v
Platycheirus peltatus (Meigen, 1822)	32	20	52		v
Platycheirus scutatus (Meigen, 1822)				v	
Pyrophaena granditarsa (Forster, 1771)		3	3		
Pyrophaena rosarum (Fabricius, 1787)	2	3	5		v
Rhingia campestris Meigen, 1822				v	v
Riponennsia splendens (Meigen, 1822)				v	
Scaeva pyrastri (Linnaeus, 1758)	1	1	2	v	
Scaeva selenitica (Meigen, 1822)	1		1	v	v
Sericomyia silentis (Harris, [1776])	1	2	3		v
Sphaerophoria interrupta (Fabricius, 1805)	4	3	7	v	v
Sphaerophoria scripta (Linnaeus, 1758)	37	21	58	v	v
Sphaerophoria taeniata (Meigen, 1822)	5	2	7	v	v
Sphegina clunipes (Fallén, 1816)				v	v
Sphegina elegans Schummel, 1843	1		1	v	v
Syritta pipiens (Linnaeus, 1758)	5	3	8	v	v
Syrphus ribesii (Linnaeus, 1758)	39	25	64	v	v
Syrphus torvus Osten-Sacken, 1875	4	2	6	v	v
Syrphus vitripennis Meigen, 1822	22	26	48	v	v
Temnostoma apiforme (Fabricius, 1794)	2	1	3	v	v
Temnostoma bombylans (Fabricius, 1805)	1	4	5	v	
Temnostoma meridionale Krivosheina & Mamaev, 1962					v
Triglyphus primus Loew, 1840	1	4	5		
Tropidia scita (Harris, 1780)	70	102	172	v	v
Volucella bombylans var. *bombylans* (Linnaeus, 1758)	2		2		v
Volucella pellucens (Linnaeus, 1758)		1	1		v
Xanthandrus comtus (Harris, 1780)	1	1	2		
Xanthogramma cf. *dives* (Rondani, 1875)					v
Xanthogramma citrofasciatum (De Geer, 1776)				v	
Xanthogramma pedissequum (Harris, 1776)				v	
Xylota segnis (Linnaeus, 1758)	46	8	54		v
Xylota sylvarum (Linnaeus, 1758)	14	2	16		
Xylota tarda Meigen, 1822	3		3		
IZ	2055	2248	4303		
AZ	84	83	99		
AZ, ganze Fläche	133				

*) former: *C. arcuatum* sensu Thompson et al. 1982, nec Linnaeus
**) including one undescribed species of *M. mellinum* agg. and one undescribed species of *Dasysyrphus*