Results of a Malaise trap sampling campaign at the Botanic Garden Jean Massart (Brussels-Capital Region, Belgium) *partim* Syrphidae (Diptera)

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Abstract

The Botanic Garden Jean Massart in Oudergem (Brussels-Capital Region, Belgium) is part of a unique area with meadows, seepage areas and ponds at the outskirts of the Sonian forest. A Malaise trap survey in 2015 and 2017 yielded 114 species of Syrphidae, with a good representation of saproxylic species and species of wet meadows and marshlands. Rarefaction indicates that the sampling is still far from complete, which is corroborated by existing data from the surrounding area where >175 hover fly species have been recorded, including a regionally unique mixture of saproxylic species (*Callicera*, *Mallota*, *Myolepta* and *Pocota* spp., etc.) not found in the present sampling, possibly because they are canopy species that are underrepresented in Malaise traps. In addition to forest species, a diverse assemblage of species of wet meadows and marshlands is found, indicative of its relatively good habitat quality. More (and scarcer) species of this ecological group are found at similar places in the Sonian forest indicating the importance of these ecosystems within the Brussels area. Overall, the Botanic Garden Jean Massart and its environs are a highly diverse area for syrphid flies, and because of its high floral abundance, probably constitutes an essential piece in the ecological network at the west side of the Sonian forest.

Keywords: biodiversity survey, saproxylic species, seepages

Introduction

Members of the hover flies (Syrphidae) are generally medium-sized, attractive flies with conspicuous colours mimicking bees or wasps. They are frequent flower visitors that make an important contribution to pollination and aphid control in crops and natural ecosystems (van Rijn & Smit, 2007; Inouye *et al.*, 2015). Recent studies have indicated strong declines of Syrphidae in North-western Europe (Doyle *et al.*, 2020; Hallmann *et al.*, 2021; Barendregt *et al*, 2022) and a recent Red List for the Flanders region in Belgium indicates that 44% is threatened to some extent or has gone extinct (Van de Meutter *et al*., 2021). Monitoring initiatives need to be launched with the aid of standard trapping methods to document the current trends of insects (https://wikis.ec.europa.eu/display/EUPKH/EU+Pollinator+monitoring+framework) to feed and evaluate conservation initiatives. Identifying hotspots of specific groups, such as Syrphidae, will be part of effective protection of our fauna.

In the present paper, the results on the Syrphidae collected during the Malaise trap survey conducted between 2015 and 2017 in the Botanic Garden Jean Massart are presented. The results will be discussed and put into context relative to available data for the area.

Material and methods

A description of the Botanic Garden Jean Massart, the sample sites, the sample methodology and sample processing is given in Grootaert *et al*. (2023).

A total of 63 samples containing Syrphidae were processed for this project. They came from two different Malaise traps in 2015 (MT1 & MT2) and four Malaise traps in 2017 (MT2, MT4, MT5, MT6). Syrphidae were identified using Bot & Van de Meutter (2019). Nomenclature also follows Bot & Van de Meutter (2019) except for *Cheilosia ruffipes* (Preyssler, 1793) that is used for *Cheilosia soror* (Zetterstedt, 1843). Species habitat affinity traits are taken from Speight, 2015. This publication presents species affinity scores (ranging 1-3) to different habitat types for all European hover flies. For this study we have only retained habitat affinities >1 as indicative of a strong habitat link. Species can have a strong habitat link to different habitats. For simplicity we have only retained the four overarching habitat groups [aquatic habitats, forest, cultural habitats and open habitats, for more details and background see Speight (2015)]. A sample-based species rarefaction curve was made using the specaccum function in Vegan (Oksanen *et al.*, 2018). The data of this study at the Botanic Garden Jean Massart are put into a larger context of the area using data of the Belgian Syrphidae database (BELSYRPHDAT) hosted by Frank Van de Meutter at INBO (Research Institute for Nature and Forest).

Results

Table 1 gives an overview of the species collected. A total of 2,271 specimens were examined, with 2,238 identified with absolute certainty. The specimens of uncertain identity are females of the genera *Eumerus*, *Neocnemodon*, *Pipizella* and *Platycheirus* that most likely belong to some species recorded with certainty (i.e. they are not extra species). A total of 114 different species were recognized. The rarefaction curve of all samples combined indicates that species richness still moderately increases and has not reached the asymptote of local α-diversity yet (Fig. 1).

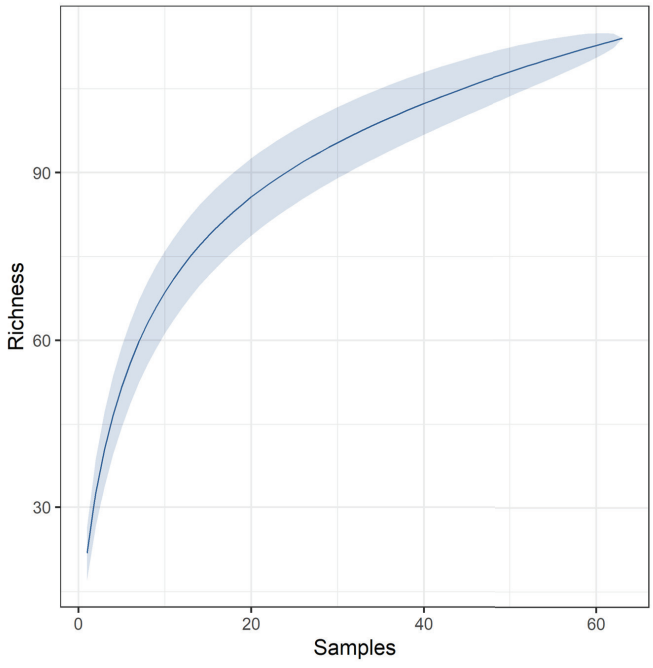

Fig. 1. Rarefaction curve of all samples in the Botanic Garden Jean Massart (combining years and different Malaise traps). Richness refers to species richness i.e. the number of species.

Table 1. List of species and numbers recorded for the different Malaise traps at the Botanic Garden Jean Massart, Oudergem, Brussels-Capital Region, Belgium.

Species	**MT1**	**MT2**	**MT3**	**MT5**	**MT6**	**Total**
Anasimyia contracta		2				2
Baccha elongata	12	12		2		26
Brachyopa pilosa	1	2			1	4
Brachyopa scutellaris	2	7				9
Brachypalpoides lentus	3					3
Brachypalpus laphriformis		2				2
Caliprobola speciosa	3	5		1		9
Ceriana conopsoides		1				1
Chalcosyrphus nemorum	13	68	1	3	11	96
Cheilosia albipila		1				1
Cheilosia albitarsis	23	57	5	61	4	150
Cheilosia chloris		1				1
Cheilosia himantopus		1				1
Cheilosia lasiopa	1	4				5
Cheilosia pagana	4	18		1		23
Cheilosia ruffipes		1				1
Cheilosia scutellata	5	5			1	11
Cheilosia semifasciata	1	3		2		6
Cheilosia uviformis	1	1				2
Cheilosia variabilis				1		1
Chrysogaster solstitialis	3	2		1	1	7
Chrysotoxum bicinctum		5				5
Criorhina asilica		5			1	6
Criorhina berberina	14	8				22
Criorhina ranunculi		2				2
Dasysyrphus albostriatus	2	5				7
Dasysyrphus tricinctus					1	1
Dasysyrphus venustus	1	4		2		7
Didea fasciata	2	3		1		6
Didea intermedia				1		1
Epistrophe eligans	11	7		3	1	22
Epistrophe flava	1					1
Epistrophe grossulariae	1					1
Epistrophe melanostoma	1	5				6
Epistrophe nitidicollis	2	8		2		12
Epistrophe olgae		2				2
Epistrophella euchroma		1				1
Episyrphus balteatus	23	119		10	7	159
Eristalinus sepulchralis		3				3
Eristalis nemorum	1	5				6
Eristalis pertinax	4	1		1	1	7
Eumerus funeralis		68	2		13	83
Eumerus ornatus		2				2

Species	MT1	MT2	MT3	MT5	MT6	Total
Eumerus sp.		2				2
Eumerus strigatus		3				3
Eupeodes bucculatus					2	2
Eupeodes corollae	8	14			2	24
Eupeodes latifasciatus	10	117		3	3	133
Eupeodes luniger	15	15		3	2	35
Fagisyrphus cinctus		11	1	12	11	35
Ferdinandea cuprea	83	27	1	15	1	127
Helophilus pendulus	14	21		2	3	40
Lejogaster metallina		1				1
Matsumyia berberina		7		4	2	13
Melangyna cincta	1					1
Melangyna lasiophthalma		1				1
Melanogaster hirtella	3	56	1	11	1	72
Melanogaster nuda	1	9		1	7	18
Melanostoma mellinum	9	160		12	1	182
Melanostoma scalare	20	66		18	4	108
Meligramma triangulifera	2	6				8
Meliscaeva auricollis		5		8	3	16
Merodon equestris	2	28		2	5	37
Myathropa florea	2	7				9
Neoascia interrupta		1				1
Neoascia meticulosa	1	7		2	1	11
Neoascia obliqua		1				1
Neoascia podagrica		4		1		5
Neocnemodon pubescens		1				1
Neocnemodon sp.		8				8
Neocnemodon vitripennis		1				1
Orthonevra brevicornis		3	1		1	5
Paragus haemorrhous	1	6				7
Paragus pecchiolii		9	1			10
Parasyrphus punctulatus	1	1	1	1		4
Parhelophilus frutetorum		3			5	8
Parhelophilus versicolor		1			1	2
Pipiza festiva		2				2
Pipiza luteitarsis		2				2
Pipiza noctiluca	1					1
Pipiza notata		1				1
Pipizella sp.	2	15				17
Pipizella viduata		18		3	3	24
Pipizella virens		3				3
Platycheirus albimanus	31	18	2	2	6	59
Platycheirus angustatus	4	12		2	1	19
Platycheirus clypeatus		5				5
Platycheirus europaeus	1	9				10

Species	MT1	MT2	MT3	MT5	MT6	Total
Platycheirus fulviventris	1	9		1	4	15
Platycheirus occultus	5	10		5		20
Platycheirus peltatus		2				2
Platycheirus scutatus	3	10	1	11	1	26
Platycheirus sp.	2	4				6
Pyrophaena rosarum		9		1	2	12
Rhingia campestris	4	1			1	6
Rhingia rostrata				1		1
Riponnensia splendens		2				2
Scaeva pyrastri		2				2
Scaeva selenitica		2		9	1	12
Sericomyia silentis	2	7			1	10
Sphaerophoria scripta		41		6	1	48
Sphaerophoria taeniata		1		4		5
Sphiximorpha subsessilis	1					1
Syritta pipiens	2					2
Syrphus nitidifrons		1				1
Syrphus ribesii	28	47	6	29	57	167
Syrphus torvus				1	7	8
Syrphus vitripennis	3	11	1	5	2	22
Temnostoma bombylans		8			1	9
Temnostoma vespiforme	6	7		1	5	19
Volucella bombylans	1	5		2	2	10
Volucella pellucens	3	4				7
Volucella zonaria					1	1
Xanthogramma pedissequum		6		1		7
Xanthogramma stackelbergi					1	1
Xylota segnis	8	6		3	10	27
Xylota sylvarum	4	16		2	2	24
Xylota xanthocnema		1				1
Total	420	1345	24	276	206	2271

The species *Cheilosia uviformis* Becker, 1894 is critically endangered while *Epistrophe flava* Doczkal & Schmid, 1994 (Fig. 2), *Eupeodes bucculatus* (Rondani, 1857) and *Lejogaster metallina* (Fabricius, 1781) (Fig. 3) are endangered according to the recent Flemish Red list (Van de Meutter *et al*., 2021).

The distribution of the recovered species over the different habitat groups is presented and compared to the Belgian situation in Table 2. Forest species are the dominant ecological group (55%) closely followed by species of open habitats (an aggregate of meadows, heathlands, marshes, etc.). Species of aquatic habitats and cultural habitats present nearly a quarter of all species. Compared to the full community of Belgian species, the Botanic Garden Jean Massart has very similar proportions of most habitat groups, except a clearly higher percentage of cultural species. Cultural species are species associated with agricultural land, park land, urban areas, brownfields, and alike.

Fig. 2. *Epistrophe flava* Doczkal & Schmid, 1994, an endangered species. © Rachel Poppe.

Fig. 3. *Lejogaster metallina* (Fabricius, 1781), an endangered species. © Floris Walraet.

Table 2. Percentage of species belonging to 4 habitat groups for the Botanic Garden Jean Massart and all Belgian species [only habitat affinities >1 are retained from Speight (2015)].

Habitat	Jardin Massart	Belgium
Aquatic habitats	23	24
Forest	55	56
Cultural habitats	25	13
Open habitats	54	50

Discussion

The Botanic Garden Jean Massart is part of a larger half-open park-like landscape around the "Rood Klooster" ("Rouge Cloître"), an old monastery with orchards, ponds and a park. The area is a geological depression with seepage areas that feed the ponds. This open landscape penetrates into the westside of the Sonian forest, one of the largest old-growth forests in Belgium. This area is famous for its high number of saproxyilic hover fly species (e.g. genera *Callicera*, *Mallota*, *Myolepta*, *Pocota*), some of which occur here in abundances nowhere else encountered in Belgium (e.g. *Callicera spinolae* Rondani, 1844 and *Mallota fuciformis* (Fabricius, 1794), Wakkie & Van de Meutter, in prep.). More than 175 species of hover flies have been recorded in an area of ca. 25ha neighbouring the Botanic Garden Jean Massart (data from the BELSYRPHDAT, database) and most of them probably also visit the Botanic Garden Jean Massart to feed. The Sonian forest has large closed stands of Beech and Oak of the same age class (some over 250 years old), in which little light can reach the forest floor and with little flowers in the understory. Its specialized fauna, which relies on pollen and nectar, ventures into forest margins and forest glades with flowers and blossoms to feed, such as the Rood Klooster and Botanic Garden Jean Massart. Many of these species remain high in the forest canopy for most of their lives, and when coming down to feed, also show a strong preference for flowers high above the ground (flowering trees and bushes, ivy, Reemer *et al*. (2009)). As such they may be found by experienced collectors, but rarely end up in Malaise traps. This may partly explain the moderate representation of these specialized forest species in the catches at the Botanic Garden Jean Massart. Further, this could also be a reason why species richness still increases fairly strongly with each extra sample, even after running 6 Malaise traps for a whole year (see rarefaction curve). Specific trap location may also play a role, as setting up a Malaise trap specifically for syrphid flies may differ somewhat from a more general approach. A Malaise trap campaign in the Hageland region yielded 112 species with 7 traps (pers. obs., unpublished document), in less diverse habitats compared to the Botanic Garden Jean Massart, but had similar richness and a higher percentage of saproxylic species, which may be due to more optimal trap location for syrphids in general and for attracting canopy species (under a flowering *Crataegus*, southeast oriented forest margins that are used for warming up, etc.).

Of high importance in a Flemish and Brussels context are the species from wet meadows and marshes (genera *Cheilosia*, *Lejogaster*, *Neoascia*, *Orthonevra*, *Platycheirus*, *Riponnensia*). *Cheilosia* is a genus of hover flies that tunnels plant tissue of specific genera or species (Speight, 2020). A good diversity of *Cheilosia* indicates good floral diversity and good management for larvae to develop. *Cheilosia himantopus* (Panzer, 1798) lives in leaf stems of *Petasites hybridus* and *C. uviformis* has been observed ovipositing on *Eupatorium cannabinum* (pers. comm. Leendert-Jan van der Ent). Whereas both these plants are not rare in our region, its associated species occur (very) locally within the range of the food plants (Van de Meutter,

Opdekamp & Maes, 2021) suggesting some additional requirements or dispersal limitation. The presence of base-rich seepages in the area is reflected in the presence of *Orthonevra brevicornis* (Loew, 1843), *Lejogaster metallina* (Fabricius, 1777) and especially *Riponnensia splendens* (Meigen, 1822), a species that largely lacks in water-rich the Netherlands, but is widespread in the Belgian silt region ("leemstreek"). Other seepage areas in the Sonian forest (mainly in Hoeilaart, a few km south of the Botanic Garden Jean Massart) also harbour the regionally very scarce *Sericomyia lappona* (Linnaeus, 1758) and *Chrysogaster virescens* Loew, 1854 (data from BELSYRPHDAT and waarnemingen.be), indicating the unique character of these seepage areas within broad-leaved forest, even if they are now largely surrounded by urban land. The high contribution of cultural species to the Botanic Garden Jean Massart hover fly fauna typically follows from the fact that it is a botanical garden with a large variety of traditional garden plants. Several are food for syrphid larvae, such as bulbs (e.g. *Narcissu*s, *Tulipa*) that are the food of *Eumerus* and *Merodon* or *Sedum telephium* of which the leaves are tunneled by *Cheilosia semifasciata* Becker, 1894 (Bot & Van de Meutter, 2019).

The Botanic Garden Jean Massart and its near environment within an open wedge within the Sonian forest is extremely rich in Syrphidae. Despite high human pressure bordering to the Brussels urbanized centre and high numbers of visitors to the area, the presence of senescent trees in the parks and the Sonian forest and of diverse biotic conditions on a small area (seepages, ponds, wet meadows, park land and botanical garden, dry heathlands on exposed sand, etc.) sets the stage for a diverse syrphid community. Areas with high floral diversity and mild human pressure such as found within the Botanic Garden Jean Massart are essential pieces of the ecological network found here.

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