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Agromyzidae (Diptera) of the nature reserve "Hobokense polder": faunistics and life-history aspects*

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Abstract

From May 1990 till January 1991 Agromyzidae were collected in the nature reserve "Hobokense Polder". The agromyzid flies were sampled with a malaise trap, coloured water traps and pitfall traps. Forty two agromyzid species were captured during this study. Twenty one species turned out to be new for the Belgian fauna. Life-history aspects such as host spectrum, phenology and sex ratio are discussed.

Samenvatting

Van mei 1990 tot en met januari 1991 werden Agromyzidae verzameld in het natuurreservaat "Hobokense Polder". Hierbij werd gebruik gemaakt van een malaise val, gekleurde watervallen en bodemvallen. Tweeënveertig soorten Agromyzidae werden tijdens deze studie gevangen. Eenentwintig soorten worden voor de eerste maal gemeld voor België. Aspecten van de levenswijze, zoals waardplantenspectrum, fenologie en sex ratio, worden besproken.

Introduction

The family Agromyzidae is, in respect to the number of species, the most diversified family of acalyptrate flies occurring in the Palaearctic region (von Tschirnhaus, 1994). The large number of described species and the large number of still undescribed species makes the identification

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of Agromyzidae difficult. This may be the reason why the Belgian agromyzid fauna is only poorly investigated. In the catalogue of the Diptera of Belgium only 88 species are mentioned for the Belgian fauna (De Bruyn & von Tschirnhaus, 1991). Compared to the agromyzid fauna of the surrounding countries (United Kingdom: 313, Spencer 1972; Netherlands: >150, Oosterbroek 1981; Germany: >320, Schumann 1992), this number is very low. The agromyzid records in the catalogue of the Diptera of Belgium are also based on some older publications (Meunier, 1911; van den Bruel, 1933, 1936, 1938; Collart, 1938, 1942, 1953; Ghesquière, 1947). Due to recent revisions of this family, the high number of newly described species and the recent use of the morphology of male genitalia, these older faunistical records are unreliable and must be verified.

Agromyzidae are phytophagous insects. The larvae of all agromyzids are internal feeders. Most are leaf miners, others mine or bore in stems, roots, flower heads, seeds or even the cambium of trees. The representatives of the genus *Hexomyza* induce galls on some few tree species (Spencer, 1976). Agromyzidae can be found on a broad range of plant species. Few species live on members of the Bryophyta, Equisetophyta and Polypodiophyta. Most larvae of Agromyzidae can be found mining representatives of the large group of Angiospermae. Spencer (1990) gives a survey of all known host plants of Agromyzidae. The hosts of only 50% of all described Agromyzidae are known (Spencer, 1990). Only recently von Tschirnhaus (1981, 1992, 1994) started to examine life-history aspects like voltinism, phenology, colour preference, and sex ratio.

In the scope of a faunistical and ecological study of the Belgian Agromyzidae, we investigated the agromyzid fauna of the nature reserve "Hobokense Polder". In this paper the faunistical results and life-history aspects (host spectrum, phenology, and sex ratio) of the captured agromyzid species are discussed.

Material and methods

The study was conducted in the nature reserve "Hobokense Polder", located in Hoboken (FS.97), Belgium. Different kinds of traps were placed in a humid, overgrown meadow (± 0.5 ha) in the centre of the reserve. The meadow is surrounded by a brushwood of willows and *Phragmites* stands. Several small and some larger ponds are located in the vicinity. The vegetation can be characterised as a transient between Agropyro-Rumicion crispi and Filipendulion. A detailed description of the vegetation is given in table 1. The identifications of the plant species were based on De Langhe *et al.* (1988).

To collect the flies, one malaise trap (type Townes, 1972), five coloured water traps and 6 pitfalls were used between 18.V.1990 and 11.I.1991. The water traps (green, blue, red, white and yellow), based on the Moericke-principle (Moericke, 1951), were composed of plastic semi-spherical bowls with a diameter of 23 cm and a height of 9 cm. As pitfall traps we used glass vials (Ø 6 cm, height 11 cm). All traps were filled with a 4% formaldehyde solution. A few drops of detergent were added to lower the surface tension. The traps were emptied at weekly intervals.

General identification keys were published by Hendel (1931-1936), Spencer (1972, 1976), and Nowakowski (1973). However, a reliable identification is only possibly when numerous additional publications are consulted.

Table 1. Vegetation occurring at the trapping site.

Amygdalaceae
Prunus serotina Ehrh.

Apiaceae
Daucus carota L.

Asteraceae
Cirsium arvense (L.) Scop.
Cirsium palustre (L.) Scop.
Cirsium vulgare (Savi) Ten.
Pulicaria dysenterica (L.) Bernh.
Senecio jacobaea L.
Solidago canadensis L.
Sonchus asper (L.) Hill

Boraginaceae
Symphytum officinale L.

Cyperaceae
Carex spp.

Fabaceae
Lotus corniculatus L.
Sarothamnus scoparius (L.)
Vicia cracca L.
Vicia sepium L.

Gentianaceae
Centaurium erythraea Rafn

Hypericaceae
Hypericum perforatum L.

Juncaceae
Juncus effusus L.
Juncus inflexus L.

Lamiaceae
Lycopus europaeus L.
Mentha aquatica L.

Malvaceae
Crataegus monogyna Jacq.

Onagraceae
Epilobium angustifolium L.

Orchidaceae
Epipactis helleborine (L.) Crantz

Poaceae
Arrhenatherum elatius (L.) B. ex J. et C. P.
Agrostis tenuis Sibth.
Holcus lanatus L.
Phalaris arundinacea L.
Phragmites australis (Cav.) Trin. ex St.

Polygonaceae
Rumex conglomeratus Murray
Rumex crispus L.

Primulaceae
Lysimachia vulgaris L.

Ranunculaceae
Ranunculus repens L.

Rosaceae
Rosa canina L.
Rubus sp.

Salicaceae
Salix sp.

Urticaceae
Urtica dioica L.

The identified Agromyzidae are stored in the collection of J. SCHEIRS at the University of Antwerp (RUCA). Later they will be deposited at the Royal Belgian Institute of Natural Sciences, Brussels.

Results and Discussion

Altogether, 42 agromyzid species were captured during this study. Twenty one species turned out to be new for the Belgian fauna. The high number of species recorded for the first time clearly illustrates our poor knowledge of the Belgian agromyzid fauna. All species are listed in table 2. They are discussed below together with life-history aspects such as phenological data, host plants and sex ratio. Host plant records were derived from SPENCER (1990) unless mentioned otherwise.

1. *Agromyza bromi*: The larvae of this species live on *Bromus* spp. Only one male was found in the malaise trap emptied on 24.VIII.1990.

2. *Agromyza graminicola*: A monophagous leaf miner of *Phragmites australis*. Only one female captured on 3.VIII.1990 in the malaise trap. SPENCER (1990) mentions that this species is not uncommon in eastern Europe but not known in the west. *A. graminicola* was previously recorded from Germany (eastern), Poland, Austria, Hungary (SPENCER, 1976) and Western Germany (VON TSCHIRNHAUS, 1981). The fact that several males of this species were collected in an other reserve in the vicinity of Antwerp (SCHEIRS *et al.*, in prep) proves that this species is present in the western part of Europe.

3. *Agromyza hendeli*: A monophagous leaf miner of *Phragmites australis*.

4. *Agromyza nigripes*: The larvae of this species can be found mining in different species of the tribe Aveneae (Poaceae). One specimen was captured by the green water trap. It was the only representative of the genus *Agromyza* trapped by a colour trap during this study.

5. *Agromyza phragmitidis*: This species is a monophagous leaf miner of *Phragmites australis*. Aspects of the ecology and life-history of this species are discussed in SCHEIRS (1992).

6. *Cerodontha angulata*: *C. angulata* lives on different *Carex* spp. and is widespread and common in Europe. Individuals were trapped with the malaise trap from 10.VIII.1990 till the end of September (21.IX.1990). The sex ratio of the individuals captured by the malaise trap is largely in favour of the females (8♂♂:18♀♀).

7. *Cerodontha atra*: Common in Europe, mining all kinds of Aveneae. *C. atra* was captured only with the malaise trap, from July (06.VII) till the beginning of September (07.IX). The sex ratio for the individuals captured with the malaise trap, was in favour of the females (4♂♂:16♀♀).

8. *Cerodontha atronitens*: VON TSCHIRNHAUS (1991) reared one female of this species from *Poa nemoralis* L. *C. atronitens* was the only representative of the subgenus *Xenophytomyza* we captured. VON TSCHIRNHAUS (1991) gives a survey of the flight periods of the species of the subgenus *Xenophytomyza*. All species of this subgenus are univoltine. For *C. atronitens* he mentions a flight period from 28.V till 28.VII. Our samples fit within this range.

9. *Cerodontha denticornis*: SPENCER (1976) lists this species as an oligophagous miner of leaf blade and leaf sheaths of various kinds of grass species. The only species of the genus *Cerodontha* that was attracted by the colour traps. *C. denticornis* can be captured by various types of colour traps as already stated by VON TSCHIRNHAUS (1981). This species was captured from the start of the trapping period (18.V.1990) till the beginning of November (09.XI.1990). Therefore, this species is with certainty a polyvoltine species with overlapping generations.

10. *Cerodontha fasciata*: The larvae have been reared from *Poa chaixii* VILL.

11. *Cerodontha flavocingulata*: The larvae mine different species of grasses of the subfamily of the Pooideae (Poaceae).

12. *Cerodontha fulvipes*: According to VON TSCHIRNHAUS (1992), the species has been reared from *Poa* spp. When identifying this species with the key of NOWAKOWSKI (1973: p. 45) one may encounter identification problems in couplet 12. In this couplet one must choose between *C. fulvipes* and *C. unguicornis* HENDEL. NOWAKOWSKI gives a number of characters but avoids a distinct difference between the two species, the different shape of the antennae. A figure of the antennae of both species is given by HENDEL (1931-1936). Similar species to be considered in identifying *C. fulvipes* are *C. kerzhneri* ZLOBIN, 1979, *C. caucasica* ZLOBIN, 1979, and *C. coxalis* MARTINEZ, 1987.

13. *Cerodontha muscina*: Miner of different grass species (Poaceae). The sex ratio of the individuals captured in a malaise trap seems always to be largely in favour of the females. In our study the sex ratio is 1♂:13♀♀, in VON TSCHIRNHAUS (1992) and (1994) the sex ratio is respectively 0♂:42♀♀ and 0♂:21♀♀. The species was captured with the malaise trap from the end of July (20.VII.1990) till the end of September (21.IX.1990). This flight period is much shorter compared to the flight period mentioned by VON TSCHIRNHAUS (1994). He captured the species with a malaise trap from 23.V till 12.IX and therefore concluded that the species must be polyvoltine.

14. *Cerodontha phragmitidis*: A monophagous miner of *Phragmites australis*. The eggs of this species are laid on the margin of the leaf. Each larva forms an individual mine near the margin and/or the tip of the leaf, quite different from two other miners of *Phragmites australis*, *Agromyza phragmitidis*, and *A. hendeli*, in which a common mine is formed between (pers. obs.). The larvae pupate inside the mine (pers. obs.).

Table 2. Species captured with malaise and colour traps at the "Hobokense Polder". The phenological records are mentioned for each species on a two week basis and from 21.IX.1990 on a 3-4 week basis. Species new to the Belgian fauna are printed in bold. In the last column the sex ratio is mentioned. Deviations from a 1♂:1♀ sex ratio were tested by a χ^2, goodness-of-fit test ($p<0.05$) when expected frequencies were larger or equal to 5, when smaller we used a binomial test (two-tailed, $P<0.05$)). Only the sex ratios of those species with more than 5 individuals captured in a given trap, were examined. Sex ratios that differ significantly from 1♂:1♀ are followed by ^{S} and when they do not differ significantly followed by ^{NS}.

Nr.	Taxon	Trap	# Ind.	01. VI	15. VI	29. VI	13. VII	27. VII	10. VIII	24. VIII	7. IX	21. IX	12. X	9. XI	07. XII	11. I	♂:♀
1.	***Agromyza bromi*** SPENCER, 1966	Mal.	1	.	.	.	.	.	.	1	.	.	.	.	.	.	1:0
2.	***Agromyza graminicola*** HENDEL, 1931	Mal.	1	.	.	.	.	.	1	.	.	.	.	.	.	.	0:1
3.	*Agromyza hendeli* GRIFFITHS, 1963	Mal.	13	1	.	.	.	6	2	1	3	.	.	.	.	.	3:10^{NS}
4.	*Agromyza nigripes* MEIGEN, 1830	Mal.	14	.	.	.	.	6	7	.	.	1	.	.	.	.	10:4^{NS}
		Green	1	.	1	.	.	.	.	.	.	.	.	.	.	.	1:0
5.	*Agromyza phragmitidis* HENDEL, 1922	Mal.	3	.	.	.	.	.	.	.	3	.	.	.	.	.	2:1
6.	***Cerodontha angulata*** (LOEW, 1869)	Mal.	26	.	.	.	.	.	.	10	14	2	.	.	.	.	8:18^{S}
7.	***Cerodontha atra*** (MEIGEN, 1830)	Mal.	20	.	.	.	1	9	4	1	5	.	.	.	.	.	4:16^{S}
8.	***Cerodontha atronitens*** (HENDEL, 1920)	Mal.	2	1	1	.	.	.	.	.	.	.	.	.	.	.	1:1
9.	*Cerodontha denticornis* (PANZER, 1806)	Mal.	19	1	.	2	.	3	4	.	4	1	3	1	.	.	11:8^{NS}
		White	6	.	1	1	1	.	.	.	.	.	3	.	.	.	3:3^{NS}
		Yellow	7	.	1	.	1	1	.	1	.	2	.	1	.	.	2:5^{NS}
		Green	9	1	.	.	2	.	.	.	.	.	3	3	.	.	6:3^{NS}
		Blue	5	.	1	.	1	.	.	1	1	.	.	1	.	.	4:1
		Red	2	.	.	1	1	.	.	.	.	.	.	.	.	.	1:1
10.	***Cerodontha fasciata*** (STROBL, 1880)	Mal.	2	.	.	.	.	1	.	.	1	.	.	.	.	.	1:1
11.	***Cerodontha flavocingulata*** (ST., 1909)	Mal.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	1:0
12.	*Cerodontha fulvipes* (MEIGEN, 1830)	Mal.	2	.	.	.	.	.	.	.	1	.	1	.	.	.	0:2
13.	***Cerodontha muscina*** (MEIGEN, 1830)	Mal.	14	.	.	.	.	3	1	1	2	7	.	.	.	.	1:13^{S}
14.	*Cerodontha phragmitidis* NOW., 1967	Mal.	4	.	.	.	.	3	.	.	1	.	.	.	.	.	1:3
15.	*Chromatomyia horticola* (GOUR., 1851)	Yellow	3	.	.	3	.	.	.	.	.	.	.	.	.	.	3:0
16.	*Chromatomyia milii* (KALTENB., 1864)	Mal.	6	.	.	1	.	3	2	.	.	.	.	.	.	.	1:5^{NS}
17.	*Chromatomyia nigra* (MEIGEN, 1830)	Mal.	3	1	.	.	2	.	.	.	.	.	.	.	.	.	0:3
		White	3	1	.	2	.	.	.	.	.	.	.	.	.	.	0:3
		Yellow	15	.	3	1	6	4	1	.	.	.	.	.	.	.	11:4^{NS}
		Green	1	.	.	1	.	.	.	.	.	.	.	.	.	.	1:0
		Blue	1	.	.	1	.	.	.	.	.	.	.	.	.	.	1:0
		Red	5	.	1	.	4	.	.	.	.	.	.	.	.	.	3:2
18.	***Hexomyza cecidogena*** (HERING, 1927)	Mal	1	1	.	.	.	.	.	.	.	.	.	.	.	.	1:0
19.	*Liriomyza bryoniae* (KALTENB., 1858)	Yellow	1	.	.	.	.	.	.	.	.	.	.	1	.	.	1:0
20.	*Liriomyza congesta* (BECKER, 1903)	Mal.	3	.	.	.	.	1	1	1	.	.	.	.	.	.	0:3
		White	1	.	.	.	.	.	.	.	.	.	1	.	.	.	1:0
21.	*Liriomyza eupatorii* (KALTENB., 1873)	Mal.	1	.	.	.	.	.	.	1	.	.	.	.	.	.	1:0
22.	*Liriomyza flaveola* (FALLÉN, 1823)	Mal.	11	.	.	.	.	4	3	.	2	2	.	.	.	.	2:9^{NS}
23.	***Liriomyza hampsteadensis*** SP., 1971	White	10	1	.	1	2	1	.	2	3	.	.	.	.	.	8:2^{NS}
		Blue	4	1	.	.	3	.	.	.	.	.	.	.	.	.	4:0
24.	*Liriomyza huidobrensis* (BL., 1926)	Yellow	2	.	.	.	.	.	.	.	.	.	.	2	.	.	2:0
25.	***Liriomyza phryne*** HENDEL, 1931	Mal.	13	.	.	.	.	6	3	2	1	1	.	.	.	.	3:10^{NS}
		Yellow	1	.	.	.	.	.	.	.	.	.	1	.	.	.	1:0

26. *Liriomyza pusio* (MEIGEN, 1830)	Mal.	28	3	.	.	.	11	2	4	7	1	4:24^{S}
	White	1	.	.	.	1	.	.	.	.	.	0:1
	Blue	1	.	.	.	.	.	.	.	.	1	0:1
27. ***Liriomyza soror*** HENDEL, 1931	Mal.	27	4	.	.	1	2	12	7	1	.	3:24^{S}
	White	13	.	.	.	4	.	1	8	.	.	8:5^{NS}
	Yellow	118	2	3	35	60	9	2	6	1	.	104:14^{S}
	Green	10	.	.	.	3	.	.	7	.	.	4:6^{NS}
	Blue	3	.	.	1	1	.	.	.	1	.	0:3
	Red	1	.	.	.	.	1	.	.	.	.	0:1
28. ***Liriomyza virgula*** FREY, 1946	Mal.	2	2	.	.	.	.	.	.	.	.	1:1
29. *Melanagromyza aeneoventris* (F., 1823)	Mal.	13	.	.	.	.	4	7	1	1	.	0:13^{S}
30. *Melanagromyza cunctans* (MEIGEN, 1830)	Mal.	42	.	.	.	.	.	8	9	17	8	14:28^{S}
	White	3	.	.	.	.	.	.	.	.	.	0:3
	Yellow	3	.	.	.	.	.	.	1	.	.	1:2
	Blue	1	.	.	.	.	.	.	1	.	.	1:0
31. ***Metopomyza flavonotata*** (HAL., 1831)	Mal.	2	2	.	.	.	.	.	.	.	.	2:0
32. ***Metopomyza xanthaspis*** (LOEW, 1858)	Mal.	2	.	.	.	.	2	.	.	.	.	1:1
33. ***Ophiomyia beckeri*** (HENDEL, 1923)	White	1	.	.	.	.	.	.	.	.	.	1:0
34. *Ophiomyia pulicaria* (MEIGEN, 1830)	Mal.	3	.	.	.	.	1	2	.	.	.	1:2
	Yellow	1	.	.	.	.	.	.	.	.	.	0:1
35. ***Phytoliriomyza arctica*** (LUNDB., 1901)	Mal.	2	.	.	.	.	.	.	1	.	1	1:1
36. ***Phytoliriomyza perpusilla*** (MG., 1830)	Mal.	1	.	.	.	.	.	.	1	.	.	1:0
37. ***Phytomyza cirsii*** HENDEL, 1923	Mal.	34	5	1	.	3	22	2	.	1	.	19:15^{NS}
38. *Phytomyza ranunculi* (SCHRANK, 1803)	Mal.	1	.	.	.	.	.	.	.	.	.	1:0
	Yellow	6	.	.	.	.	.	.	.	.	.	5:1^{NS}
	Red	2	.	.	.	.	.	.	.	.	.	2:0
39. *Phytomyza spinaciae* HENDEL, 1928	Mal.	10	4	1	.	.	2	2	1	.	.	3:7^{NS}
	Yellow	9	1	3	.	2	3	.	.	.	.	6:3^{NS}
40. ***Phytomyza tetrasticha*** HENDEL, 1927	Mal.	2	1	.	.	.	.	1	.	.	.	1:1
41. *Pseudonapomyza atra* (MEIGEN, 1830)	Mal.	21	.	.	.	.	2	4	6	8	1	13:8^{NS}
	White	1	.	.	.	.	1	.	.	.	.	1:0
	Yellow	3	.	.	.	2	.	.	.	1	.	3:0
	Green	3	.	.	2	.	.	.	1	.	.	1:2
42. ***Pseudonapomyza europaea*** SP., 1973	Mal.	21	.	.	.	.	2	6	7	6	.	17:4^{S}
	White	26	4	.	2	.	6	.	5	9	.	24:2^{S}
	Yellow	4	.	.	.	.	.	.	1	3	.	3:1
	Green	31	.	.	5	14	.	.	11	1	.	29:2^{S}
	Blue	28	1	.	3	4	4	1	1	11	3	27:1^{S}
	Red	1	.	.	.	.	.	.	.	1	.	0:1

15. *Chromatomyia horticola*: A polyphagous species. In Belgium, *Chr. horticola* was already reared from *Solanum nigrum* L., *Sonchus oleraceus* L., and *Impatiens parviflora* DE CANDOLLE (SCHEIRS *et al.*, 1993, 1994).

16. *Chromatomyia milii*: A leaf miner found on grasses of the following genera: *Holcus*, *Poa*, *Milium*, *Hordeum*, *Hierochloe*, and *Agrostis*. DE BRUYN (1990) gives a survey of the phenology of this species which seems to be polyvoltine (DE BRUYN, 1990; VON TSCHIRNHAUS, 1994).

17. *Chromatomyia nigra*: An oligophagous leaf miner of a broad range of Poaceae species, a survey of the host records is given by GRIFFITHS (1980). One individual was captured by a pitfall trap on 27.VII.1990.

18. *Hexomyza cecidogena*: This species is a gall maker on *Salix* spp. Only one male was captured on 01.VI.1990.

19. *Liriomyza bryoniae*: A polyphagous species. This species is difficult to separate from *L. strigata* (MEIGEN). According to SPENCER (1976) and VON TSCHIRNHAUS (1994), *L. strigata* has small dark tubercles on the distiphallus "head" while *L. bryoniae* has no such tubercles.

20. *Liriomyza congesta*: An oligophagous species mining in plants of the family Fabaceae. Four species of the Fabaceae are occurring at the trapping site (Table 1): *Lotus corniculatus*, *Sarothamnus scoparius*, *Vicia cracca*, and *Vicia sepium*. According to SPENCER (1990), *L. congesta* has already been reared from representatives of the genera *Vicia* and *Lotus* but not from *Sarothamnus*.

21. *Liriomyza eupatorii*: A miner of *Eupatorium* and *Galeopsis*. This species is very difficult to distinguish from *L. pusilla*. *L. eupatorii* has a lesser bluish shine of the mesonotum and is lighter than *L. pusilla*. In fact, only rearing records give certainty in identification. *L. eupatorii* is present in Belgium, confirmed by rearing from its host (SCHEIRS *et al.*, 1993).

22. *Liriomyza flaveola*: Miner of Poaceae, one of the most common species on grasses. This species was only captured with the malaise trap. Both our results and the results of VON TSCHIRNHAUS (1992) give an indication that there exist two flight periods. Our results mention a first flight period from 20.VII till 10.VIII and one from 31.VIII till 14.IX (captured with a malaise trap). VON TSCHIRNHAUS (1992) mentions a first flight period from 16.V till 8.VIII and a second one from 3.X till 14.XI (based on malaise trap records). In an other investigation (VON TSCHIRNHAUS, 1981) divided flight periods are not significant.

23. *Liriomyza hampsteadensis*: The colour preference and the host (*Achillea millefolium* L.) have been established by VON TSCHIRNHAUS (1981). In spite of the considerable number of individuals captured in the white (n = 10) and in the blue (n = 4) colour trap, this species did not enter the malaise trap.

24. *Liriomyza huidobrensis*: A highly polyphagous species, originally distributed from South to North America (SPENCER, 1973). *L. huidobrensis* was introduced in Europe, probably together with its host plants (DE CLERQ & CASTEELS, 1992; SÜSS & COLOMBO, 1992; TROUVE *et al.*, 1993). This species is a serious pest of crops (*Pisum*, *Solanum*, etc.) and ornamental plants (*Chrysanthemum*, *Aster*, etc.) (SPENCER, 1973). Records of natural habitats outside greenhouses in Europe are rare.

25. *Liriomyza phryne*: Known to live on grasses belonging to the Poeae and Triticeae. We captured this species with the malaise trap from the end of July (20.VII) till the end of September (21.IX). According to VON TSCHIRNHAUS (1994) this is a polyvoltine species.

26. *Liriomyza pusio*: The species has been reared as a leaf miner of *Arrhenatherum elatius* by SCHEIRS *et al.* (1993), other authors mention the same host (SPENCER, 1976). VON TSCHIRNHAUS (1994) cleared the status of this species and its differentiation from *L. graminivora* HERING. This species was trapped with the malaise trap at the end of May (18-25.V) and from the end of July (20.VII) till the end of September (14.IX) according to our results, and from May till October according to VON TSCHIRNHAUS (1994). *L. pusio* is probably polyvoltine (VON TSCHIRNHAUS, 1994). The sex ratio of the specimens captured in the malaise trap was in favour of the females (4♂♂:24♀♀).

27. *Liriomyza soror*: This species has been reared from *Carduus* spp. and *Cirsium* spp. *L. soror* was the most abundant species in our traps, 172 individuals were captured in total. Most of the individuals were attracted by the yellow water trap (n = 118). The sex ratio of the individuals caught in the malaise trap was in favour of the females (3♂♂:24♀♀), but the sex ratio of the individuals captured in the yellow colour trap was in favour of the males (104♂♂:14♀♀). More details about life-history aspects which vary according to the trapping method used will be discussed in a future paper.

28. *Liriomyza virgula*: Host not known. One male and female captured in the malaise trap on 1.VI.1990.

29. *Melanagromyza aeneoventris*: A stem miner of *Cirsium* and *Carduus* species. Significantly more females than males were captured in the malaise trap (0♂:13♀♀).

30. *Melanagromyza cunctans*: SPENCER (1976) gives an illustration of the stem galls which are induced by this species on *Lotus* spp. Large patches of *Lotus corniculatus* were present at the trapping site which explains the high number of individuals captured in the malaise trap (n = 42). The species was captured in the malaise trap from the end of July (27.VII) till the end of September (21.IX). An excess of females was captured in the malaise trap (14♂♂:28♀♀).

31. *Metopomyza flavonotata*: Host unknown. This species occurs in spring and the early summer and is probably univoltine (VON TSCHIRNHAUS, 1994). We captured two male individuals with the malaise trap from 18 till 25 May 1990. The key and revision made by VON TSCHIRNHAUS (1981) is essential for the identification of the species of this genus.

32. *Metopomyza xanthaspis*: A miner of different *Carex* spp.

33. *Ophiomyia beckeri*: According to SPENCER (1973), this species forms mines along the midrib of different species of Asteraceae.

34. *Ophiomyia pulicaria*: As *O. beckeri*, a miner of different Asteraceae species (SPENCER, 1973).

35. *Phytoliriomyza arctica*: The species has been found as a stem miner on species of the genera *Crepis*, *Lapsana*, *Sonchus* and *Solidago*.

36. *Phytoliriomyza perpusilla*: After the description of several closely related species the hosts were not confirmed again, probably the same as *P. arctica*.

37. *Phytomyza cirsii*: The adults have been reared from several *Cirsium* species and members of the genera *Cynara* and *Serratula*. According to the trapping results of the malaise trap, this species seems to be bivoltine with a peak in spring (end May (18.V) till begin June (08.VI)) and one in summer (end-June (29.VI) till mid-August (10.VIII)).

38. *Phytomyza ranunculi*: VON TSCHIRNHAUS (1994) mentions as hosts species of the genera: *Ranunculus*, *Ficaria*, and *Myosurus*. This species occurs in two generations. The first generation occurs in early spring (April, May). We missed this generation because we only started trapping at mid-May. The second generation is found in autumn (October, November) (VON TSCHIRNHAUS, 1994; SCHEIRS *et al.*, in prep). The individuals which we captured in autumn belonged to the pale form var. *flava*.

39. *Phytomyza spinaciae*: Reared from different species of the genera *Cirsium*, *Carduus*, *Cnicus*, and *Serratula*. Species were trapped in the malaise and the yellow water trap. The flight period of *P. spinaciae* (based only on malaise trap records) seems to have two peaks, one at the end of May (18.V) till the first half of June (08.VI) and a second at the end of July (20.VII) till the end of August (17.VIII). This flight period closely agrees with that of *P. cirsii* another miner of *Cirsium* spp. (see no. 37). Results of VON TSCHIRNHAUS (1994) don't confirm this result, he trapped individuals of this species with a malaise trap from the begin of July till the begin of August.

40. *Phytomyza tetrasticha*: Lives on *Mentha* spp. The only plant species of this genus present at the trapping site was *Mentha aquatica*.

41. *Pseudonapomyza atra*: According to ČERNÝ (1992) an oligophagous species that lives on different grass species (Poaceae). Till 1973 it was believed that only one representative of this genus, nl. *Pseudonapomyza atra*, occurred in Europe. Recent additions of new species to this genus (SPENCER, 1973; ČERNÝ, 1992; PAKALNIŠKIS, 1992; ZLOBIN, 1993a, b) pointed out that at least 16 species occur in Europe. So, identifications of European *Pseudonapomyza* species before 1973 are unreliable. We captured the species with the malaise trap from the end of July (20.VII.1990) till mid September (14.IX.1990). This species is considered to be polyvoltine (VON TSCHIRNHAUS, 1994).

42. *Pseudonapomyza europaea*: Host not known but probably grass species. In Western Europe, this species is frequently found together with *Pseudonapomyza atra*. *Ps. europaea* was caught in the malaise trap and all types of water traps. The species was also captured in a pitfall on 13.VII. 1990. During this study only two agromyzid species were found in a pitfall

(also *Chr. nigra*). This indicates that pitfall traps are very inefficient in capturing Agromyzidae. The flight period of *Ps. europaea* and *Ps. atra* are nearly the same when we look at the malaise trap records. The sex ratio of the individuals captured in the malaise trap (17♂♂:4♀♀) and the white (24♂♂:2♀♀), green (29♂♂:2♀♀), and blue (27♂♂:1♀) colour traps, was in favour of the males.

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References

ČERNÝ, M., 1992. - A revision of the Czechoslovak species of *Pseudonapomyza* HENDEL, with description of four new species (Diptera, Agromyzidae). *Acta ent. bohemoslovaca* 89: 451-465.

COLLART, A., 1938. - Contribution à l'étude des diptères de Belgique. (4e Note). *Bull. Annls Soc. ent. Belg.* 78: 363-373.

COLLART, A., 1942. - Diptères mineurs de Belgique. I. *Bull. Mus. r. Hist. nat. Belg.* 18 (4): 1-10.

COLLART, A., 1953. - *Phytomyza scolopendri* ROBINEAU-DESVOIDY (Diptera, Agromyzidae) noveau pour la faune de Belgique. *Bull. Annls Soc. r. ent. Belg.* 89: 237-238.

DE BRUYN, L., 1990. - Resource exploitation patterns in *Phytomyza milii* KALTENBACH, 1864 (Diptera, Agromyzidae), a leafminer on Poaceae. *Meded. Fac. Landbouwwet. Rijksuniv. Gent* 55 (2b): 511-517.

DE BRUYN, L. & VON TSCHIRNHAUS, M., 1991. - Agromyzidae. *In*: GROOTAERT, P., DE BRUYN, L. & DE MEYER, M. (Eds), *Catalogue of the Diptera of Belgium*, Studiedokument van het KBIN 70: 151-154.

DE CLERQ, R. & CASTEELS, H., 1992. - Occurrence and host plants of *Frankliniella occidentalis* and *Liriomyza huidobrensis* in Belgium. *Bull. OEPP/EPPO* 22: 363-366.

DE LANGHE, J. E., DELVOSALLE, L., DUVIGNEAUD, J., LAMBINON, J. & VANDEN BERGHEN, C., 1988. - *Flora van België, het Groothertogdom Luxemburg, Noord-Frankrijk en de aangrenzende gebieden.* Ceuterick, N.V., Leuven: 972 pp.

GHESQUIÈRE, J., 1947. - Communication. (*Phytomyza ilicis*). *Bull. Annls Soc. ent. Belg.*, 83: 212-213.

GRIFFITHS, G. C. D., 1980. - Studies on boreal Agromyzidae (Diptera). XIV. *Chromatomyia* miners on Monocotyledones. *Entomologica scand. suppl.* 13: 1-61.

HENDEL, F., 1931-1936. - 59. Agromyzidae. *In*: LINDNER, E. (Ed.), *Die Fliegen der Palaearktischen Region*, Schweizerbart'sche Verlagsbuchhandlung, Stuttgart 6 (2): 570 pp.

MEUNIER, F., 1911. - Contribution à la faune diptérologique des environs d'Anvers. *Annls Soc. Sc. Brux.* 32: 104-113.
MOERICKE, V., 1951. - Eine Farbfalle zur Kontrolle des Fluges von Blattläusen, insbesondere der Pfirsichblattlaus, *Myzodes persicae* (SULZ.). *NachrBl. dt. Pflanzenschutzdienst (Stuttgart)* 3: 23-24.
NOWAKOWSKI, J. T., 1973. - Monographie der europäischen Arten der Gattung *Cerodontha* Rond. (Diptera, Agromyzidae). *Annles zool. Warsz.* 31: 327 pp.
OOSTERBROEK, P., 1981. - De Europese Diptera: Determineertabel, biologie en literatuuroverzicht van de families van de muggen en vliegen. *Wet. Meded. K. ned. natuurh. Veren.* 148: 81 pp.
PAKALNIŠKIS, S., 1992. - Notes on Lithuanian Agromyzidae (Diptera) with the description of three species new to science. *In*: JONAITIS, V. (Ed.), *New and rare for Lithuania insect species. Records and descriptions of 1992.*, Institute of Ecology, Lithuanian Entomological Society, Vilnius: 47-55.
SCHEIRS, J., 1992. - *Een Ecologische Studie van op grassen (Poaceae) minerende Agromyzidae (Diptera): Agromyza phragmitidis, een monofage parasiet van riet (Phragmites australis).* M.Sc.-thesis, Antwerp: 53 pp.
SCHEIRS, J., DE BRUYN, L. & VERDYCK, P., 1993. - Leafminers (Diptera: Agromyzidae) of the Belgian fauna. *Bull. Annls Soc. r. belge Ent.* 129: 113-119.
SCHEIRS, J., DE BRUYN, L., VANDENBUSSCHE, D., VERDYCK, P. & JORDAENS, K., 1994. - Leafminers (Diptera; Agromyzidae) new to the Belgian fauna. *Bull. Annls Soc. r. belge Ent.* 130: 53-57.
SCHEIRS, J., DE BRUYN, L. & VON TSCHIRNHAUS, M., (in prep.) - The agromyzid fauna of the nature reserve "The kuifeend": faunistics and life-history aspects.
SCHUMANN, H., 1992. - Systematische Gliederung der Ordnung Diptera mit besonderer Berücksichtigung der in Deutschland vorkommenden Familien. *Dt. ent. Z., (N. F.)* 39 (1-3): 103-116.
SPENCER, K. A., 1972. - Diptera, Family Agromyzidae. *Handbk Ident. Br. Insects* 10 (5g): 136 pp.
SPENCER, K. A., 1973. - *Agromyzidae (Diptera) of economic importance.* Dr. W. Junk, The Hague: 418 pp.
SPENCER, K. A., 1976. - The Agromyzidae (Diptera) of Fennoscandia and Denmark. *Fauna ent. scand.* 5a & b: 606 pp.
SPENCER, K. A., 1990. - *Host specialization in the world Agromyzidae (Diptera).* Kluwer Academic Publishers, Dordrecht: 444 pp.
SÜSS, L. & COLOMBO, M., 1992. - L'agromizide neartico *Liriomyza huidobrensis* è arrivato anche in Italia. *Inftore agrario, Verona* 48(1): 65-67.
TROUVE, C., PHALIP, M. & MARTINEZ, M., 1993. - Situation en France de *Liriomyza huidobrensis* (BLANCHARD). In: *"Liriomyza"*. Colloque sur les mouches mineuses des plantes cultivées, Montpellier: 49-57.
TOWNES, H., 1972. - A light-weight malaise trap. *Ent. News* 83: 239-247.
VAN DEN BRUEL, W., 1933. - Contribution à l'étude des mouches de la chicorée-witloof, *Napomyza lateralis* FALL. et *Ophiomyia pinguis* FALL. (Agromyzides). *Bull. Inst. agron. Stns Rech. Gembloux,* 2 (1): 17-44.

VAN DEN BRUEL, W., 1936. - Notes complémentaires sur *Napomyza lateralis* FALL. *Bull. Annls Soc. ent. Belg.* 76: 441-455.
VAN DEN BRUEL, W., 1938. - Communication (*Napomyza lateralis* FALL. et *Ophiomyia pinguis* FALL.). *Bull. Annls Soc. ent. Belg.* 78: 119.
VON TSCHIRNHAUS, M., 1981. - Die Halm- und Minierfliegen im Grenzbereich Land-Meer der Nordsee. Eine ökologische Studie mit Beschreibung von zwei neuen Arten und neuen Fang- und Konservierungsmethoden (Diptera: Chloropidae et Agromyzidae). *Spixiana Suppl.* 6: 405 pp.
VON TSCHIRNHAUS, M., 1991. - New results on the ecology, morphology, and systematics of Agromyzidae (Diptera). - *In*: WEISMANN, L., ORSZÄGH, I. & PONT, A. C. (Eds), *Proceedings of the second international Congress of Dipterology*, VEDA, Bratislava, SPB Academic Publishing, The Hague: 285-313.
VON TSCHIRNHAUS, M., 1992. - Minier- und Halmfliegen (Agromyzidae, Chloropidae) und 52 weitere Familien (Diptera) aus Malaise-Fallen in Kiesgruben und einem Vorstadtgarten in Köln. *Decheniana Beih.* 31: 445-497.
VON TSCHIRNHAUS, M., 1994. - Minierfliegen (Diptera: Agromyzidae) aus Malaise-Fallen in spezifischen Pflanzengesellschaften: Ein Weinberg der Ahr-Eifel in Entwicklung zu einem Felsenbirnen-Gebüsch (*Cotoneastro-Amelanchieretum*). *Beitr. Landespflege Rheinland-Pfalz* 16 (1993): 481-534.
ZLOBIN, V. V., 1993a. - Notes on *Pseudonapomyza spicata* MALLOCH from Canary and Cape Verde Islands (Diptera: Agromyzidae). *Dipt. Res.* 4: 81-89.
ZLOBIN, V. V., 1993b. - The description of a new *Pseudonapomyza* species from Palaearctic region (Diptera: Agromyzidae). *Dipt. Res.* 4: 173-176.