

Succession of dance fly fauna (Diptera: Empidoidea: Empididae, Hybotidae, Microphoridae) in ancient forests and afforested former agricultural land: a case-study in the "Voerstreek" (Belgium, Flanders): faunistics and new species for the Belgian fauna

by Patrick GROOTAERT, Wouter DEKONINCK & Konjev DESENDER

Abstract

112 species of Empididae *sensu lato* were found in forests at the extreme eastern border of Flanders in a region known as the Voerstreek. Seven species are recorded for the first time in Flanders. Two species are also new records for the Belgian fauna: *Rhamphomyia (Pararhamphomyia) murina* Collin and *Rhamphomyia (Rhamphomyia) argentata* von Röder. Distribution of Red Data Book species is commented.

Four species supposed to be Extinct were observed; one species Critically endangered was recorded: *Rhamphomyia (Pararhamphomyia) marginata* (Fabricius); four species are Endangered (3.6%); four species are Vulnerable (3.6%); 35 species are Susceptible (31%), one Near threatened and seven are Data Deficient (6%). 49 species are Safe/low risk (43%). Only 43% of the species are safe and under low risks, so even when the Data Deficient species are not taken into account, still 51% of the species are more or less threatened.

Young forests of at least 20 years old show a higher species diversity than the old or very young forests. However, if we consider the true forest species, the reference forests (ancient) have more true forest species and the younger forests have less forest species. Forest plantations and spontaneous afforestations that are more than 20 years old, start to have a dance fly fauna resembling that of the old reference forests. Forests younger than 15 years old contain only generalist forest species. The plantation of 1989 in Altenbroek approaches strongly the fauna of the reference forest. Colonisation of the plantation proceeds more rapidly than in a spontaneous afforestation.

Key words: Diptera Empididae, succession, ancient forests, afforestation, faunistics

Introduction

In order to compare the differences in natural quality of spontaneous afforestation with artificial plantation of new forest, a study was set up in the Voeren region in the extreme east of Flanders (Belgium). The fauna of forest of various age, various origin and with a different grazing were compared to two ancient forests, the Altenbroek and Alserbos. These reference forests are known to be there unaltered since more than 225 years and are so-called Ferraris-forest since they are represented on the Ferraris-maps.

Since the "Voerstreek" is situated in the extreme east of Flanders, it has a Central European fauna in contrast to the mainly Atlantic fauna of Flanders. This explains the huge number of new or rare species that were found during this study.

Why dance flies?

In contrast to 'rare or uncommon' animal groups that are frequently used in site quality assessments, dance flies or empidid flies are common and widespread. Too often, only mammals, birds or butterflies are used in site quality assessment and they are not always representative for the area. On the contrary, dance flies are always present, even in small plots. During an annual cycle, up to 50 species can be observed in a particular biotope (station) (GROOTAERT *et al.*, 1988). Many species have a very tight microhabitat preference and hence they are good indicators for a specific habitat or environmental conditions. Of course, most species are very common and belong to the Red Data Book status (RDB): Safe/Low risk. But sometimes up to 30% of a species assembly are rare or threatened. The combination of total diversity, i.e. the total number of species, the number of specific species for a particular habitat or microhabitat (target species) and the amount of individuals of a species combined with the rarity factor (Red Data Book status) allows to make site quality assessments (POLLET & GROOTAERT, 1999).

Niche of the dance flies

The larvae of all empidids, as far as known, are carnivorous and are living in the soil or in decaying wood (xylobionts). A very important limiting factor for the occurrence of larvae in the soil is the water saturation. Apart from a few exceptions of species living in wells or streams, the larvae are not adapted to living in an aquatic environment. The adult flies are either obligate carnivorous or nectar feeders. The predators catch their prey either on a solid substrate (soil, surface of leaves or vertical walls), floating on a water surface or in flight. However, many species feed on nectar and hence might play an important role in pollination. Finally, there are species that have a combined feeding strategy. They are nectar feeders, but the male captures a prey to present to the female during mating. In early spring, flower visitors belonging to the genera *Empis* and *Rhamphomyia* are especially abundant. Probably, they play an important role in pollination. From June on, it are above all pre-

dators that are abundant and dominant. They are voracious and probably play a role in the population regulation of plant parasitic Diptera (leafminers and gallmidges). Dance flies constitute a food source for many insectivorous animals such as spiders and birds.

The occurrence of dance flies is above all determined by the structure of the habitat and landscape. In some surveys we showed that Empididae need different habitats to complete their lifecycle (DELETTRE *et al.*, 1992; 1998) e.g. the larvae of *Hilara* live in a particular soil type, the male collects prey on water surfaces while the female swarms in areas with a particular structure. Empididae also show a preference for habitats nonexposed to the sun, i.e. shaded locations with a high relative humidity. Consequently, forests are an environment that host many species.

Systematics of dance flies

Approximately 272 species occur in Flanders (360 in Belgium). They are grouped in the superfamily of the Empidoidea (CHVÁLA, 1975) comprising the families Empididae, Hybotidae, Microphoridae, Atelestidae and Dolichopodidae. In the present study, we envisage the former family of the Empididae *sensu lato* that groups the four families of the Empididae, Hybotidae, Microphoridae and Atelestidae (not found during this study). The Dolichopodidae or long-legged flies are dealt with in another paper. A Red Data Book of the dance flies in Flanders is available (GROOTAERT *et al.*, 2001).

Material and methods

The Voeren region has the oldest sites in Flanders where afforestation was planned and carried out on former agricultural land on loamy soils. In the neighbourhood of two forest relics (the Altenbroek and the Alserbos), relatively large areas have been designated for spontaneous afforestation or to be altered to forest by plantation of indigenous trees (VERSTRAETEN *et al.* 2001; DEKONINCK *et al.*, 2005). At present, these two forests consist of many small plots with different age, structure and history and are as such ideal to evaluate current on-going afforestation.

Dance flies were sampled in five sites of the Altenbroek forest and six sites of the Alserbos forest. The sampling stations situated on Fig. 1. Characteristics of all 11 sampling stations are given in Table 1, whereas details on soil and vegetation characteristics can be found in DEKONINCK *et al.* (2005). In each station (VOER01-VOER05 and VOER07-VOER12) 3 pitfalls (PT), 3 white water traps (WT) and one Malaise trap (MT) were installed. All pitfalls (glass jam jars, diameter of 9.5 cm) and white water traps (17x10 cm and 5 cm high) were installed in a row, spaced 3-5 m apart. A 3.5% formaldehyde solution was used for killing and fixation and some detergent was added to lower surface tension. Each Malaise trap collecting-vial was filled with a 75% alcohol solution. All traps were emptied 12 times from 02-IV-2003 until 08-X-2003.

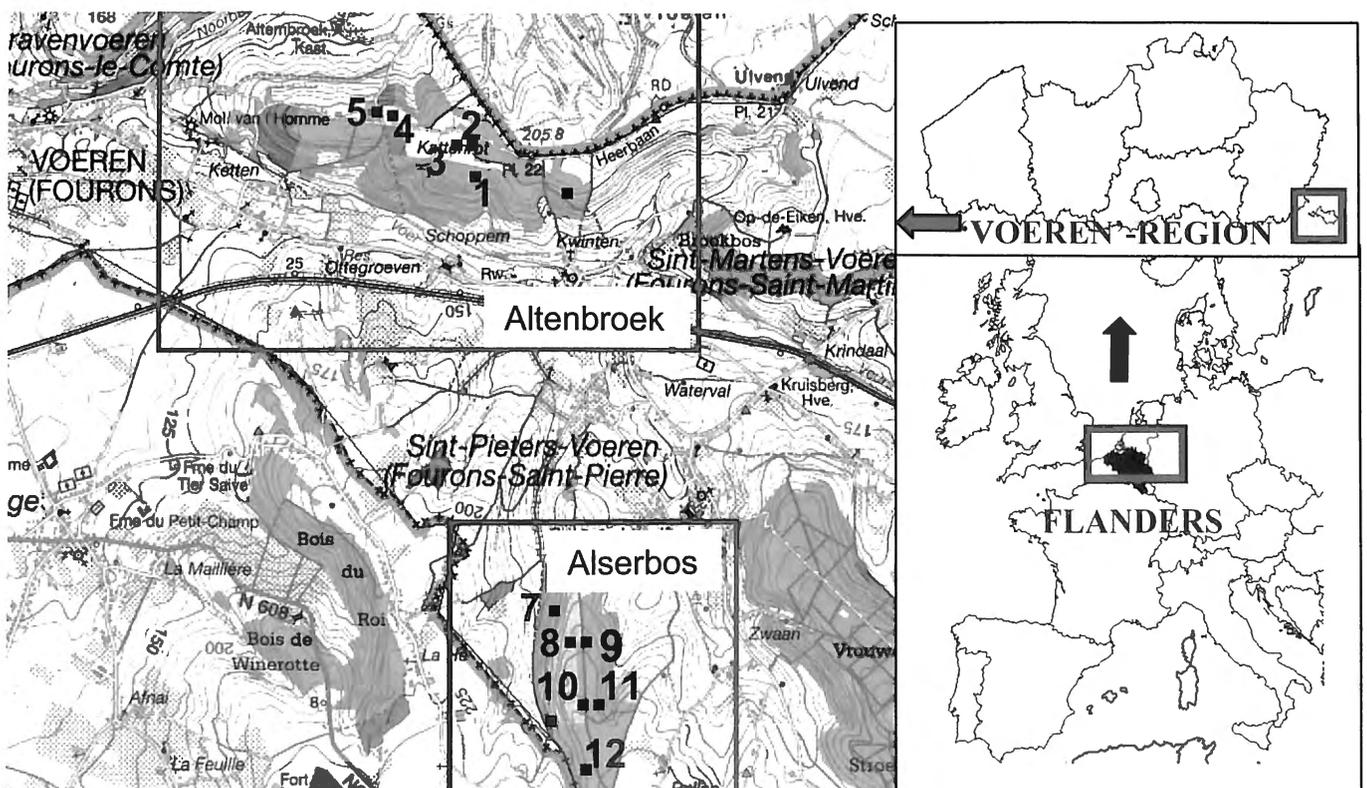


Fig. 1 — Sampling stations in “Voeren” region.

Table 1 — Code, history, description and age of the sampling sites.

Site code	Forest	History	Description of the site	Forested since
VOER01	Altenbroek	Ancient forest	Ancient oak-birch forest	<1775 de Ferraris
VOER02	Altenbroek	Arable field	Afforestation and low density grazing (Galloways), <i>Salix</i> sp. and birch.	1996
VOER03	Altenbroek	Grassland	Afforestation and low density grazing (Galloways), no shrubs or trees	1996
VOER04	Altenbroek	Arable field	Afforestation and intensive summer grazing, <i>Salix</i> sp. and birch	1996
VOER05	Altenbroek	Arable field	Plantation of <i>Quercus robur</i>	1989
VOER07	Alserbos	Ancient forest	Ancient oak-birch forest	<1775 de Ferraris
VOER08	Alserbos	Grassland	Afforestation of birch	1980
VOER09	Alserbos	Arable field	Afforestation of birch	1980
VOER10	Alserbos	Grassland	Plantation of <i>Prunus avium</i> with fragments of spontaneous <i>Calluna vulgaris</i>	1985-1990
VOER11	Alserbos	Arable field	Afforestation of birch	1980
VOER12	Alserbos	Grassland	Plantation of <i>Quercus robur</i>	1985-1990

Results faunistics

General results faunistics

9.639 individuals belonging to 112 species were collected and identified (Table 2). Most specimens were caught with the Malaise traps (5.397), followed by the white pan traps (4.153) and the pitfall traps (109). All data were combined in the final analyses.

The dance fly fauna of the Voerstreek is very special in comparison to the other regions in Flanders. The “Voerstreek” abuts the Central European Province of the Palaearctic Region whereas the rest of Flanders mainly hosts an Atlantic fauna with a few scattered Central European elements (relics). For the first time, a very intensive sampling campaign was performed in the Voerstreek, resulting in a total number of 112 species as to 272 species known from Flandres. 63 species of them have a Red Data Book status (see Table 2). Seven species are recorded for the first time in Flandres, 4 species were supposed to be “Extinct”, 1 species is “Critically endangered”, 4 species have the status “Endangered”, 4 species are “Vulnerable”, 35 species are “Susceptible”, 1 species is “Near Threatened” and 7 species are “Data Deficient”. Two species are recorded for the first time in Belgium. This large amount of Red Data Book species can be explained by the fact that many of these species are occurring on the edge of their distribution area and as a consequence they are rather rare in the remaining parts of Flanders. Another reason is that we are dealing with old forests which have an extraordinary fauna. Furthermore, the sampling was very intensive, in an area never sampled before in detail.

New species for Flanders

Seven species are recorded for the first time in Flanders. According to the criteria used in GROOTAERT *et al.*, 2001,

they can get at most the Red Data Book status of “Susceptible” or “Data deficient” since no records before the pivot year of 1980 are available. The trend criterion or percentage of decrease of the number of records after pivot date of 1980 is the first criterion for the Red Data Book. Their habitat not being threatened is a second criterion for not placing them in a threatened category.

– *Rhamphomyia (Pararhamphomyia) murina* COLLIN, 1926 – *New for Belgium and Flanders*

Material examined: Altenbroek, 1 male, 1-14.V.2003 (VOER02, MT).

Rh. murina was described by COLLIN from Scotland and later only recorded from the Czech Republic (CHVÁLA, 1989; 2004). This is apparently a very rare species with an Atlantic and Central European distribution. In the present study, the species was found in rather young spontaneous developing afforestation on arable land. It is probably not a forest species.

– *Rhamphomyia (Rhamphomyia) argentata* VON RÖDER, 1887 – *New for Belgium and Flanders*

Material examined: Alserbos, 1 female, 14-30.V.2003 (VOER08, PT).

This species is only known from Central Europe: Germany, Switzerland, Austria, Czech Republic and Hungary (CHVÁLA, 1989; 2004). It has been found in spontaneous forestation on grassland, aged 23 years. It is not known whether it is a true forest species.

– *Oedalea apicalis* LOEW, 1859 – *New for Flanders*

Material examined: Alserbos, 1 female, 30.V-14.VI.2003 (VOER09, MT); 1 female, 30.V-14.VI.2003 (VOER09, MT); Altenbroek, 1 female, 30.V-14.VI.2003 (VOER02, MT).

Previous records: Flanders: Wijnendale bos, 1 female, 14.VI.2000, M. POLLET; Beiaardbos, 1 female, 16.V.2000. These two records have not yet been published.

Table 2 — Continued.

Code	Species name	Red data book status	Altenbroek								Alserbos							Total
			VOER 01	VOER 02	VOER 03	VOER 04	VOER 05	VOER 07	VOER 08	VOER 09	VOER 10	VOER 11	VOER 12					
Plat ampe	<i>Platypalpus annulipes</i> (Meigen, 1822)	6. Safe\Low risk	1		1	5	21		2	3		3	13	48				
Plat aris	<i>Platypalpus aristatus</i> (Collin, 1926)	4. Susceptible	5	1	1	1	14		1	1		3	7	34				
Plat aroi	<i>Platypalpus articulatooides</i> (Frey, 1918)	6. Safe\Low risk	1			2								3				
Plat arus	<i>Platypalpus articulatus</i> Macquart, 1827	6. Safe\Low risk			1									1				
Plat aust	<i>Platypalpus australominutus</i> Grootaert, 1989	6. Safe\Low risk										1		1				
Plat calc	<i>Platypalpus calceatus</i> (Meigen, 1822)	6. Safe\Low risk		3	1	30	2	2	4	5	13	3	4	69				
Plat cili	<i>Platypalpus ciliaris</i> (Fallén, 1816)	6. Safe\Low risk	99		2	1	36		19	2	13	1	2	176				
Plat clar	<i>Platypalpus clarandus</i> (Collin, 1926)	6. Safe\Low risk										2		2				
Plat curs	<i>Platypalpus cursitans</i> (Fabricius, 1775)	6. Safe\Low risk		1										1				
Plat divi	<i>Platypalpus divivus</i> Walker, 1851	8. New for Flanders					2							2				
Plat exil	<i>Platypalpus exilis</i> (Meigen, 1822)	4. Susceptible	3				2		7	6	5		23	46				
Plat flav	<i>Platypalpus flavicornis</i> (Meigen, 1822)	4. Susceptible			1	2								3				
Plat infe	<i>Platypalpus infectus</i> (Collin, 1926)	4. Susceptible			4									4				
Plat loco	<i>Platypalpus longicornis</i> (Meigen, 1822)	6. Safe\Low risk	1			2			1	5	14	2	1	28				
Plat lose	<i>Platypalpus longiseta</i> (Zetterstedt, 1842)	6. Safe\Low risk	2		3	3	3		6	1	4		4	26				
Plat lute	<i>Platypalpus luteus</i> (Meigen, 1804)	4. Susceptible				1			1			1	2	5				
Plat minu	<i>Platypalpus minutus</i> (Meigen, 1804)	6. Safe\Low risk			1	2				2		2		7				
Plat nita	<i>Platypalpus nigratarsis</i> (Fallén, 1816)	6. Safe\Low risk								1				1				
Plat nive	<i>Platypalpus niveiseta</i> (Zetterstedt, 1842)	4. Susceptible				1								2				
Plat obsc	<i>Platypalpus obscurus</i> (von Roser, 1840)	8. New for Flanders		1										1				
Plat pall	<i>Platypalpus pallipes</i> (Fallén, 1815)	4. Susceptible		1		1	1							3				
Plat pave	<i>Platypalpus pallidiventris</i> (Meigen, 1822)	6. Safe\Low risk	3	30	7	23	2	2	5	9	10	7	8	109				
Plat pect	<i>Platypalpus pectoralis</i> (Fallén, 1815)	6. Safe\Low risk	87		1	1	5		4		1		1	100				
Plat poli	<i>Platypalpus politus</i> (Collin, 1926)	4. Susceptible				1								1				
Plat puli	<i>Platypalpus pulicarius</i> (Meigen, 1830)	7. Data deficient										1		1				
Plat rapi	<i>Platypalpus rapidus</i> (Meigen, 1822)	2. Endangered			1	12								13				
Plat stig	<i>Platypalpus stigma</i> (Collin, 1926)	7. Data deficient		1										1				
Plat verr	<i>Platypalpus verralli</i> (Collin, 1926)	3. Vulnerable										3		3				
Racl albo	<i>Rhamphomyia</i> (<i>Aclonempis</i>) <i>albohirta</i> Collin, 1926	7. Data deficient							1					1				

Racl long	Rhamphomyia (Aclonempis) longipes (Meigen, 1804)	2	5		25				1		2			35
Ramy eryt	Rhamphomyia (Amydroneura) erythrothalma Meigen, 1830	275	1	4	2		39	1	5	17	1	3	348	
Ramy gibb	Rhamphomyia (Amydroneura) gibba (Fallén, 1816)	6			2		1		1	3		1	14	
Rhol flav	Rhamphomyia (Holoclera) flava (Fallén, 1816)							2	4				6	
Rhol nigr	Rhamphomyia (Holoclera) nigripennis (Fabricius, 1794)	6	1	4			8	16	18				53	
Rhol umbr	Rhamphomyia (Holoclera) umbripennis Meigen, 1822	14	1	10						1			26	
Rmeg anom	Rhamphomyia (Megacyttarus) anomalipennis Meigen, 1822	1					1						2	
Rmeg cras	Rhamphomyia (Megacyttarus) crassirostris (Fallén, 1816)	11	5	1			58	38	23	22	76	6	240	
Rpar dent	Rhamphomyia (Pararhamphomyia) dentipes (Zetterstedt, 1842)			1					1			1	4	
Rpar marg	Rhamphomyia (Pararhamphomyia) marginata (Fabricius, 1787)	4		3	2					1			10	
Rpar muri	Rhamphomyia (Pararhamphomyia) murina Collin, 1926		1										1	
Rpar tars	Rhamphomyia (Pararhamphomyia) tarsata Meigen, 1822									2	2	4	9	
Rrha arge	Rhamphomyia (Rhamphomyia) argentata von Röder, 1887							1					1	
Rrha laev	Rhamphomyia (Rhamphomyia) laevipes (Fallén, 1816)											1	1	
Rrha sulc	Rhamphomyia (Rhamphomyia) sulcata (Meigen, 1804)	1	19	3	1	1	13	1	1	22	11	21	94	
Tadr aemu	Tachydromia aemula (Loew, 1864)				1	2						1	4	
Tadr annu	Tachydromia annulimana Meigen, 1822				1								1	
Tadr arro	Tachydromia arrogans (Linnaeus, 1761)					3							3	
Tadr umbr	Tachydromia umbrarum Haliday, 1833										1		1	
Tape nubi	Tachypeza nubila (Meigen, 1804)	6	1	1	1	3	2		4	1	1	1	21	
Tric elon	Trichina elongata Haliday, 1833	5				9	6	4	6	12	3	1	46	
Trim flav	Trichinomyia flavipes (Meigen, 1830)	25				13	20	2	1	14			75	
	total ind.	754	662	224	779	426	840	1374	1517	991	1044	1028	9639	
	no. species	48	42	34	55	58	46	45	52	51	35	45	112	
	no. forest species	18	9	3	9	17	16	12	17	15	12	12	29	

South Belgium: Virelles, 1 female, 14.VI.1986; 1 female, 16.VII.1986, N. MAGIS (MT in swamp in forest along Lac de Virelles).

This species is known from Great Britain, Germany and Poland (CHVÁLA & WAGNER, 1989), Denmark and Hungary (CHVÁLA, 2003). It is evident that this species is very rare but apparently it is widespread. It is a forest species and most probably a xylobiont.

– *Oropezella sphenoptera* (LOEW, 1873) – *New for Flanders*

Material examined: Alserbos, 1 female, 30.V-14.VI.2003 (VOER08, MT); 1 male, 30.V-14.VI.2003 (VOER09, MT); 1 male, 30.V-14.VI.2003 (VOER11, MT); 2 males, 1 female, 14-26.VI.2003 (VOER09, MT); 1 male, 1 female, 14-26.VI.2003 (VOER11, MT); 1 female, 26.VI-11.VII.2003 (VOER09, MT); 1 female, 26.VI-11.VII.2003 (VOER11, MT).

Previous records: South Belgium: Hockai, 1 individual, 9.VII.1947, M. BEQUAERT; Mirwart, 6 individuals, 6.VII.1943, R. TOLLET.

This species is present all over Europe, including the south and is perhaps less abundant in Northern Europe (CHVÁLA, 1983).

– *Platypalpus divisus* WALKER, 1851 – *New for Flanders*

Material examined: Altenbroek, 1 male, 30.V-14.VI.2003 (VOER05, WT); 1 female, 30.V-14.VI.2003 (VOER05, MT).

Previous records: South Belgium: Ottignies, 1 female, 16.V.1981; 1 male, 30.V.1981; 1 male, 22.VI.1981, P. DESSART (MT in garden); Vallée du Rabais, 1 male, 30.VI.1980, P. GROOTAERT.

This rare species is known from Great Britain, Czech Republic, Austria and Hungary (CHVÁLA & KOVALEV, 1989).

– *Platypalpus obscurus* (VON ROSER, 1840) – *New for Flanders*

Material examined: Altenbroek, 1 female, 26.VI-11.VII.2003 (VOER02, MT).

Previous records: South Belgium: Treignes, 1 female, 31.VIII.1984, KHO; Logne, 2 females, 21.VII.1989, R. DETRY; Torgny, 1 female, 10.VII.1948, M. Bequaert; Buzenol, 1 male, 28.VII.1981, P. GROOTAERT.

It appears to be a very rare species, previously only known from 5 individuals in South Belgium. It is widespread in Europe: Denmark, Italy, Switzerland, Spain, Hungary and Romania (CHVÁLA & KOVALEV, 1989).

P. obscurus does not occur in Northern Europe and is found in the southern and eastern parts of Europe.

– *Leptopeza borealis* ZETTERSTEDT, 1842 – *New for Flanders*

Material examined: Altenbroek, 1 male, 14-30.V.2003 (VOER05, MT); 1 male, 30.V-14.VI.2003 (VOER04, MT); 1 female, 30.V-14.VI.2003 (VOER05, MT).

Previous records: South Belgium: Mirwart, 1 female, 14.VI.1946, M. Bequaert; 1 female, 18.VI.1946, M. BEQUAERT; Hockai, 1 female, 28.VII.1946, A. COLLART;

1 female, 10.IX.1948, A. COLLART; 1 female, 1.VI.1949, A. COLLART; Ellezelles, 1 female, 24.V.1959, M. BEQUAERT; Chatillon, 1 female, 29.V.1981, JAC; Ottignies, 1 female, 24.VII.1982, P. DESSART; Sart, 1 female, 2.VI.1982, R. DETRY; Fairon, 1 female, 3.V.1983, R. DETRY.

This species is quite common in South Belgium and is widespread in Europe (CHVÁLA & KOVALEV, 1989).

Species previously considered as “Extinct”

The following four species were presumed to be extinct in Flanders (GROOTAERT *et al.*, 2002). All these species seem to occur on the limit of their distribution area (CHVÁLA & KOVALEV, 1989). Their Red List status has to be revised in the frame of the criteria: decline, rarity and the threat of their habitat. They probably will receive the status “Critically endangered”.

– *Empis (Leptempis) variegata* MEIGEN, 1804

Material examined: Altenbroek, 1 male, 14.V-30.V.2003 (VOER03, MT); 1 male, 6 females, 14.V-30.V.2003 (VOER04, MT).

Previous records: Flanders: Buizingen, 1 female, 13.V.1880, J. JACOBS.

South Belgium: Fleron, 1 female, 16.V.1894, COUCKE; Hamoir, 1 female, 18.V.1896, CANDÈZE; 1 female, 5.VI.1896; Hockaifagne, 1 female, 8.VI.1911, M. GOETGHEBUER; Dalheim, 1 male, 1 female, 23.V.1917, M. GOETGHEBUER; Aubel, 1 male, 1 female, 6.V.1934, M. BEQUAERT; Visé, 1 male, 1 female, 12.V.1946, A. COLLART; Le Mesnil, 1 female, 15.V.1947, A. COLLART; Borgoumont, 1 female, 19.V.1950, R. TOLLET; Spa, 1 male, 22.V.1976, SBA; Elsenborn, 2 males, 3 females, 7.VI.1981; Krinkelt, 3 males, 5 females, 20.V.1981, NMP; Rocherath, 1 male, 1 female, 26.V.1981; Vallée de la Jansbach, 1 male, 1 female, 1982.

E. variegata is a remarkable large *Empis* species with spotted wings. It has a Central European distribution (CHVÁLA, 2003). Most records in Belgium are quite old and almost all are from South Belgium and the “Hautes Fagnes” only. It is not astonishing that it is found in the Voeren region as this region abuts the Hautes Fagnes.

– *Empis (Pachymeria) femorata* FABRICIUS, 1798

Material examined: Altenbroek, 1 male, 1-14.V.2003 (VOER01, MT); 1 male, 1-14.V.2003 (VOER02, MT), 1 male, 14-30.V.2003, 1 female, 14-26.VI.2003 (VOER01, WT), 1 female, 14-26.VI.2003 (VOER02, MT); Alserbos, 3 females, 30.V-14.VI. 2003 (VOER07, WT), 1 female, 30.V-14.VI. 2003 (VOER10, MT), 1 female, 30.V-14.VI. 2003 (VOER10, WT), 1 male, (VOER11, MT), 1 male, 14-26.VI.2003 (VOER10, WT). Previous records: Flanders: Willebroek, 1 male, 1 female, VII.1878, J. JACOBS.

South Belgium: Beyne, 1 female, 31.V.1941, M. LECLEERCQ; Wanze, 41 males, 26 females, 30.V.1982; 4 males, 2 females, 6.VI.1982, 1 female 13.VI.1982,

R. DETRY (in MT); Lixhe, 1 male, 4.V.1938, M. BEQUAERT; Virelles, 1 female, 16.VII.1986, N. MAGIS.

E. femorata is a Central European species, not known from Scandinavia but it is found in Great Britain (common only in Southern England), Belgium, The Netherlands (the most northerly found populations) and the remaining parts of Central Europe. In the south its distribution area reaches to in France and Italy.

In South Belgium, the species is known from 4 populations: Wanze (1982), Beyne (1941), Lixhe (1938) and Virelles (1986). In Flanders, the population counts many tens of individuals. In Flanders, there is only one record of a female found in July 1878 in Willebroek. Probably, the species was once more common and Flanders makes part of its distribution area.

The species occurs in lowland forests, especially in mixed deciduous forest. The males form small swarms, flying stationary between pending branches at a height of 0.5 to 2 m while holding their prey. Females are found on *Anthriscus sylvestris* (cow parsley) and composite flowers. Flight time: mid of April till June (VAN DER GOOT, 1989).

– *Hilara primula* COLLIN, 1927

Material examined: Alserbos, 1 male, 14-26.VI.2003 (VOER10, MT).

Previous records: Flanders and Brussels: Elsene, 1 female, 10.V.1896, COUCKE; Wiekevorst, 5 females, 23.IV.1926, GAB; Mollem, 1 male, 1 female, 15.V.1901, GSE; Heusden, 1 male, 19.IV.1944, Jean Verbeke; Lo-Reninge, 1 male, 1 female, 4.V.1920, GSE; Munte, 1 male, 1 female, 17.IV.1937; Destelbergen, 1 male, 5 females, 17.IV.1912, M. GOETGHEBUER; St. Amandsberg, 2 males, 7.IV.1942, Jean VERBEKE; Waarschoot, 2 males, 1 female, 24.IV.1942; Heusden, 1 male, 26.IV.1945, Jean Verbeke; Hageven, 1 male, 26.IV.2000, P. GROOTAERT.

South Belgium: Visé, 3 males, 1 female, 30.V.1941, A. COLLART.

This species has been identified as *Hilara primula* but has to be re-examined. *H. primula* is a very early spring species; already found in April. The observation in the present survey is quite late and therefore questions its identification. Possibly, it concerns an unknown sister species. *H. primula* is probably more abundant than supposed to be but it is likely not recorded since there are less sampling campaigns in early spring.

H. primula is known from Great Britain, The Netherlands, Belgium, Denmark, France, Czech Republic and Hungary (CHVÁLA, 2003).

– *Platypalpus analis* (MEIGEN, 1830)

Material examined: Alserbos, 2 males, 25.VII-7.VIII.2003 (VOER12, PT).

Previous records: Flanders: St. Jan-in-Eremo, 1 male, 5.VII.1956, M. BEQUAERT; Nukerke, 3 females, 8.VII.1944, M. GOETGHEBUER; Oostakker, 1 female, 5.VII.1945, M. GOETGHEBUER; Merelbeke, 1 female, 9.VII.1944, M. GOETGHEBUER.

South Belgium: Genval, 1 female, 6.VII.1917, A. TONNOIR; Steinbach, 1 female, VII.1902, GUI; Buzenol, 2 females, 25.VIII.1981, P. GROOTAERT; Buzenol, 2 females, 11.VIII.1981, P. GROOTAERT; Logne, 1 female, 17.VII.1986, R. DETRY; Forge-Phillipe, 1 female, 25.VI.1981, P. GROOTAERT; Wanze, 1 female, 24.VI.1981, R. DETRY; Logne, 1 male, 2.VII.1986, J. BERTAUX; Logne, 1 male, 1 female, 2.VII.1989, R. DETRY.

Platypalpus analis is encountered in forests. In addition, it is known from Great Britain, France, The Netherlands, Denmark, Germany, Sweden, Italy, Czech Republic and Switzerland (CHVÁLA, 2003). Apparently, *P. analis* has an Atlantic and Central European distribution.

Critically endangered species

– *Rhamphomyia (Pararhamphomyia) marginata* (FABRICIUS, 1787)

Material examined: Altenbroek, 1 female, 17.IV-1.V.2003, (VOER01, MT); 3 females, 14-V.2003 (VOER05, MT); 2 males, 1 female, 14.IV-1.V.2003 (VOER01, MT); 1 female, 14-30.V.2003 (VOER04, MT); 1 female, 30.V-14.VI.2003 (VOER04, MT); Alserbos, 1 female, 14-30.V.2003 (VOER04, MT).

Previous records: Flanders: Meerdaal, 1 male, 20.IV.1999, L. DE BRUYN.

South Belgium: Buzenol, 2 females, 19.V.1981, P. GROOTAERT.

In the present survey, 10 specimens were encountered. This is a lot more than the amount yet present in the collections of the RBINS. This very remarkable species has broadened wings with a black edge. In flight, this fly resembles a moth and it has frequently been cited in this way. There are only 2 confirmed records from Belgium: one from Meerdaalwoud and the other from Buzenol in the most southern region of Belgium. *Rh. marginata* is widespread in Western Europe from Great Britain up to Hungary and Romania in the east; in the north in Scandinavia but it is not reported from Southern Europe (Spain and Italy).

Endangered species

– *Bicellaria nigra* (MEIGEN, 1824)

Material examined: Altenbroek, 1 female, 1-14.V.2003 (VOER01, MT)

This species is known from 5 localities in Flanders and 4 in South Belgium.

– *Hilara litorea* (FALLÉN, 1816)

Material examined: see Table 2.

There are 17 previous records from Flanders and 19 from South Belgium. In the present survey, the species is very abundant in Altenbroek and in Alserbos. Perhaps, its Red Data Book status has to be revised.

– *Hilara lurida* (FALLÉN, 1816)

Material examined: Altenbroek, 1 male, 14-26.VI.2003 (VOER01, WT); 1 male, 26.VI-11.VII.2003 (VOER05, WT); Alserbos, 1 female, 14-26.VI.2003 (VOER08, MT).

There are 22 previous records of this species in Flanders and 8 in South Belgium.

– *Platypalpus rapidus* (MEIGEN, 1822)

Material examined: Altenbroek, 1 female, 26.VI-11.VII.2003 (VOER04, MT); 1 female, 11-25.VII.2003 (VOER03, MT); 6 females, 11-25.VII.2003 (VOER04, MT); 3 females, 25.VII-7.VIII.2003 (VOER04, MT); 2 females, 7-22.VIII.2003 (VOER04, MT).

Previous records: Flanders: St. Truiden, 1 female, 26.VII.1985; 1 female, 2.VIII.1985, L. DE BRUYN; Destelbergen, 1 male, 29.VII.1934, A. COLLART.

Brussels: 1 male, 13.VI.1933, OSA.

South Belgium: 22 records in 10 localities.

It is not clear what kind of habitat *P. rapidus* frequents. In the present survey it has been found in a young afforestation. *P. rapidus* is a summer species and this is quite uncommon for *Platypalpus* that are either spring or autumn species.

Vulnerable species

– *Hilara fuscipes* (FABRICIUS, 1794)

Material examined: Altenbroek, 1 male, 1 female, 14-26.VI.2003 (VOER01, MT); 2 females, 26.VI-11.VII.2003 (VOER01, MT); 1 female (VOER01, BT); Alserbos, 1 male, 11-25.VII.2003 (VOER07, MT); 1 female (VOER09, MT).

There are 22 previous records from Flanders and 34 from South Belgium.

– *Hybos femoratus* (MÜLLER, 1776)

Material examined: Altenbroek, 1 female, 25.VII-7.VIII.2003 (VOER05, MT).

There are 206 previous records from Belgium (33 localities in Flanders).

Normally this is a very common species of forest margins. Nevertheless, there is only one record of this species. On the contrary, *Hybos culiciformis* was very abundant in both localities (Altenbroek and Alserbos), with a total amount of 102 individuals.

Hybos femoratus is widespread in Europe: from Scandinavia on to the most southern part of North Africa. It is very widespread in South Belgium and is found commonly in the Hautes Fagnes. In Flanders, it is known from 8 UTM squares in the period after 1979. Flight time: from June till September.

A decline of 82% is noted but as it occurs in more than 5% of the UTM squares, the species is assigned the status "Vulnerable". It is unknown why there is a decline of the *Hybos* species.

– *Platypalpus verralli* (COLLIN, 1926)

Material examined: Alserbos, 1 male, 2 females, 30.V-14.VI.2003 (VOER10, MT).

P. verralli is found in forest margins, especially in heathland.

Flight time: activity from mid May till mid of July. It is a characteristic species of heathlands and forest margins of heathlands.

Distribution in Europe: in Scandinavia it is present up to in the high North; it is quite common in Great Britain and less common in Central Europe; the species is absent in Southern Europe. In South Belgium it is known from 5 populations (10 records), particularly in the Hautes Fagnes. In Flanders, we have a total amount of 6 populations but after 1980 the species has only be found in 2 localities (Melle and Hove).

– *Rhamphomyia (Megacyttarus) crassirostris* (FALLÉN, 1816)

Material examined: 240 individuals (169 males, 71 females), present in all plots in Altenbroek and dominant in Alserbos.

This large species is active in early spring. Previously it was known from 3 localities in Flanders. Its Red Data Book status should be revised.

It is a very common species in Europe and very widespread.

Data deficient species

Seven species have the Red List status of "Data deficient". This status was been assigned to the following species since we judge that there is a lack of information on their distribution in Flanders or because their habitat was unknown (GROOTAERT *et al.*, 2002).

– *Platypalpus pulicarius* (MEIGEN, 1830)

Material examined: Alserbos, 1 female, 30.V-14.VI.2003 (VOER10, MT).

There are 12 records in Flanders however, limited to Oostende and Wijnendale bos. Furthermore, the species is widespread in South Belgium with 23 records in 13 localities, indicating that this species has a Central European distribution and that the populations occurring in Flanders are rather relics.

– *Platypalpus stigma* (COLLIN, 1926)

Material examined: Altenbroek, 1 male, 14-26.VI.2003 (VOER02, MT).

Platypalpus stigma was been described by COLLIN (1926) from Great Britain. Nevertheless, this species is rather rare in Western Europe. It is rather rare in Western Europe, but common in South and Southeast Europe, up to in Turkey (GROOTAERT, in litt.). There are additional records from Wijnendale bos, Gembloux and Virelles.

– *Rhamphomyia (Aclonempis) albohirta* COLLIN, 1926

Material examined: Alserbos, 1 male, 1-14.V.2003 (VOER07, MT).

Previous records: Flanders: Hoeilaart, 5 males, 2 females, 2.V.1997; 4 males, 15.V.1997, L. DE BRUYN; Wijnendale bos, 1 male, 25.V.1986, M. POLLET.

South Belgium: Virelles, 33 males, 27 females, 21.VI.1986, N. MAGIS.

– *Rhamphomyia (Holoclera) umbripennis* MEIGEN, 1822
 Material examined: Alserbos, 1 male, 14-30.V.2003 (VOER10, MT); Altenbroek, 1 male, 17.IV-1.V.2003 (VOER01, MT); 7 males, 1 female, 1-14.V.2003 (VOER01, MT); 4 males, 1 female (VOER05, MT); 4 males, 1 female, 14-30.V.2003 (VOER01, MT); 5 males (VOER05, MT); 1 female, 30.V-14.VI.2003 (VOER02; MT).

Previous records: Flanders: Mechelse Heide, 1 male, 27.V.1997, JGo; Rekem, 1 female, 22.V.1997.

South Belgium: Virelles, 2 males, 14.VI.1986, N. MAGIS.

– *Rhamphomyia (Megacyttarus) anomalipennis* MEIGEN, 1822

Material examined: Alserbos, 1 male, 14-30.V.2003 (VOER07, MT);

Altenbroek, 1 male, 14-30.V.2003 (VOER01, MT).

Previous records: Flanders: Wijnendale bos, 1 male, 9.V.1987; 1 male, 3.V.1987, 1 female, 17.V.1987, M. POLLET.

In Belgium, this remarkable species with its aberrant wing venation, was only known from Wijnendale bos.

– *Rhamphomyia (Pararhamphomyia) dentipes* (ZETTERSTEDT, 1842)

Material examined: Altenbroek, 1 male, 1-14.V.2003 (VOER05, MT); 1 female, 30.V-14.VI.2003 (VOER04, MT); Alserbos, 1 female, 14-26.VI.2003 (VOER09, MT); 1 female, (VOER12, MT).

Previous records: Flanders: St. Martens-Latem, 1 female, 16.V.1999; 5 females, 24.V.1999; 2 females, 30.V.1999; 1 female, 20.VI.1999, P. GROOTAERT.

South Belgium, 2 males, 1 female, Virelles, 21.VI.1986, N. MAGIS.

Rhamphomyia (Pararhamphomyia) dentipes was only recorded from 2 localities in Belgium: St. Martens-Latem and Virelles.

– *Rhamphomyia (Rhamphomyia) laevipes* (FALLÉN, 1816)

Material examined: Alserbos, 1 male, 1-14.V.2003 (VOER12, MT).

Previous records: Flanders: St. Martens-Latem, 1 female, 21.V.1999, P. GROOTAERT.

South Belgium, Rocherath, 1 female, 26.V.1981.

Results diversity

How do we have to interpret diversity?

Table 2 gives a summary of the abundance of the species in the various plots. The old reference forests had respectively 48 species in Altenbroek and 46 species in Alserbos. In the plantation in Altenbroek (VOER05) 58 species are found. The old spontaneous afforestation (VOER09) in Alserbos has 52 species and the old plantation in Alserbos (VOER10) counts 51 species. Briefly, young

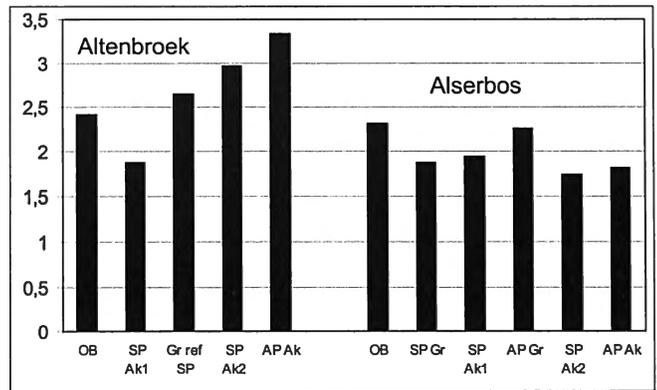


Fig. 2 — Shannon's diversity indexes per site with OB = ancient forest, SP = spontaneous afforestation, AP = plantation, Gr = former grassland and Ak = former arable land.

forests of at least 20 years old show a higher species diversity.

However, if we consider the true forest species, the reference forests have more true forest species and the younger forests have less forest species. Forest plantations and afforestations that are more than 20 years old, start to have a dance fly fauna resembling that of the old reference forests. Forests younger than 15 years old contain much less true forest species. The plantation of 1989 in Altenbroek (VOER05) approaches already more the fauna of the reference forest. Colonisation in the plantations proceeds more rapidly than in a spontaneous afforestation.

Shannon's diversity index H (Fig. 2)

Instead of considering the absolute figures, the SHANNON index is applied:

$$H = -\sum (P_i * \ln P_i)$$

with P_i the proportion of individuals of species i , i.e. the number of individuals of species i as to the number of individuals collected in a particular site (Fig. 3).

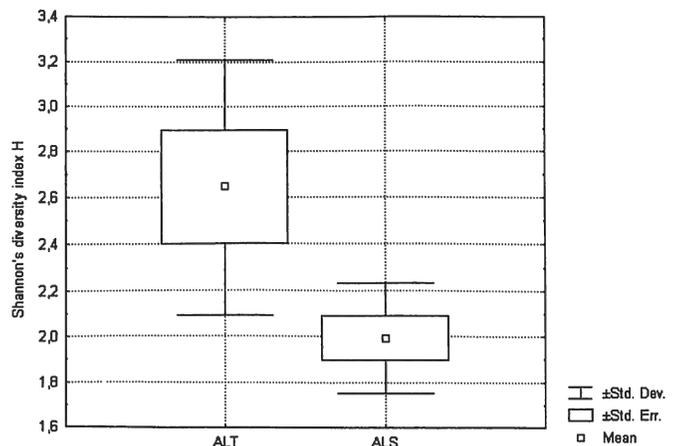


Fig. 3 — Categorized Box-Whisker plot (mean/SE/SD) of the average Shannon's diversity of the sites per forest complex (ALT = Altenbroek en ALS = Alserbos).

Table 3 — Abundance of *Platypalpus* species per site (codes see Table 2). True forest species are highlighted.

Species	Altenbroek					Alserbos						Total	Habitat
	VOER01	VOER02	VOER03	VOER04	VOER05	VOER07	VOER08	VOER09	VOER10	VOER11	VOER12		
<i>Platypalpus agilis</i>	2	10	11	15	6	5			8	2	1	60	eurytopic
<i>Platypalpus albiseta</i>							1					1	
<i>Platypalpus albicornis</i>							1	3				4	grassland
<i>Platypalpus analis</i>											2	2	forest
<i>Platypalpus annulipes</i>		1		5	21		2	3		3	13	48	edge
<i>Platypalpus aristatus</i>	5	1	1	1	14	1		1	3		7	34	edge
<i>Platypalpus articulatoides</i>	1			2								3	grassland
<i>Platypalpus articulatus</i>			1									1	grassland
<i>Platypalpus australominutus</i>									1			1	eurytopic
<i>Platypalpus calceatus</i>		3	1	30	2	4	4	5	13	3	4	69	eurytopic
<i>Platypalpus ciliaris</i>	99		2	1	36	19	2	13	1	1	2	176	forest
<i>Platypalpus clarandus</i>									2			2	edge
<i>Platypalpus cursitans</i>		1										1	edge
<i>Platypalpus divisus</i>					2							2	
<i>Platypalpus exilis</i>	3				2	7		6	5		23	46	forest
<i>Platypalpus flavicornis</i>			1	2								3	grassland
<i>Platypalpus infectus</i>			4									4	grassland
<i>Platypalpus longicornis</i>	1			2		1	5	14	2	2	1	28	eurytopic
<i>Platypalpus longiseta</i>	2		3	3	3		6	1	4		4	26	eurytopic
<i>Platypalpus luteus</i>				1		1			1	2		5	forest
<i>Platypalpus minutus</i>			1	2					2		2	7	eurytopic
<i>Platypalpus nigratarsis</i>								1				1	heathland
<i>Platypalpus niveiseta</i>				1	1							2	
<i>Platypalpus obscurus</i>		1										1	
<i>Platypalpus pallipes</i>		1		1	1							3	
<i>Platypalpus pallidiventris</i>	3	30	7	23	2	5	9	10	7	8	5	109	eurytopic
<i>Platypalpus pectoralis</i>	87		1	1	5	4		1			1	100	forest
<i>Platypalpus politus</i>				1								1	
<i>Platypalpus pulicarius</i>									1			1	
<i>Platypalpus rapidus</i>			1	12								13	
<i>Platypalpus stigma</i>		1										1	eurytopic
<i>Platypalpus verralli</i>									3			3	heathland
total ind.	203	49	34	103	95	47	30	58	53	21	65	758	
no. species	9	9	12	17	12	9	8	11	14	7	12	32	
no. forest species	3	0	2	3	3	4	1	3	3	2	4	5	
Ind/forest species	199	0	3	3	43	31	2	20	7	3	28		

Especially in Altenbroek forest, the diversity index is higher in younger forests than in the older forest. The differences are much less pronounced in the site of Alserbos.

The average diversity of both forests is distinctly higher in Altenbroek. As both reference sites have a more or less equal diversity, this difference is above all due to the higher diversities in the younger forest sites. In Alserbos, the general diversity is lower than in those sites of Altenbroek which have been recently taken out of agriculture. As the forest succession progresses (already more than 20 years in Alserbos), the diversity seems to decrease in comparison to the young sites in Altenbroek.

Possible reasons for this could be, the more forest succession continues, the more stable the fauna is and the smaller the chance that occasional species occurring temporarily in the site will increase diversity.

The genus Platypalpus

The ecology and habitat preference of the genus *Platypalpus* is well known and therefore it is interesting to examine how these species react to alterations. *Platypalpus* species are predators that forage mainly on horizontal substrates, i.e. on leaf of shrubs and trees, sometimes on tree-trunks and a few species hunt on the soil. Some

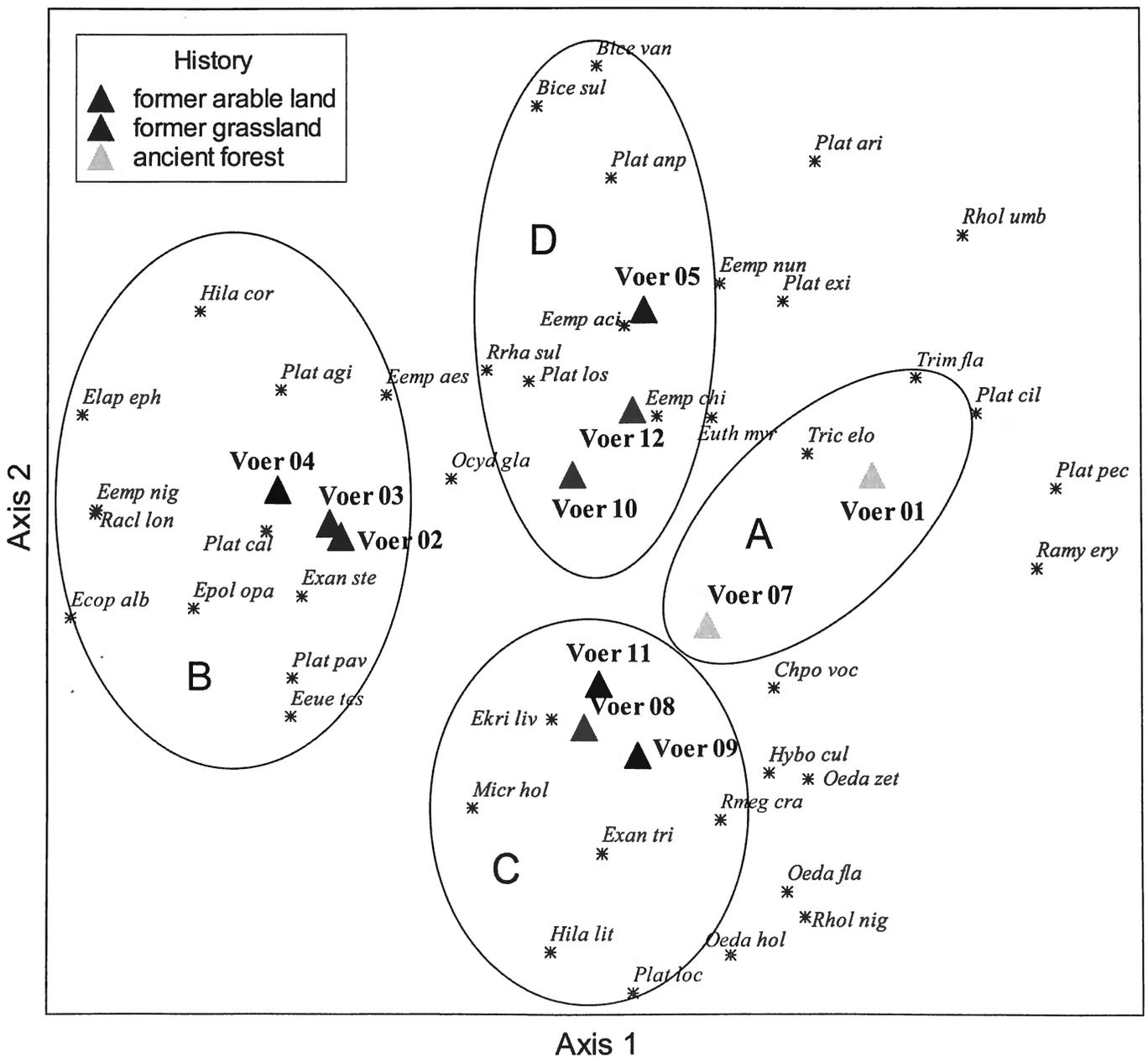


Fig. 4 — DCA diagrams (axis1 and 2) of all sites based on all collected data of dance fly communities, showing all sites ▲ and their history; species are represented by *. All species are abbreviated by the first four letters of the genus name and the first three of the species name.

smaller species such as *P. articulatus*, *P. articulatooides* and *P. maculatus*, are able to hunt of the leaves of grasses and they are mainly found in meadows. In general, forest margins and hedges are the preferable hunting fields for *Platypalpus*. These are spots that break the wind and that can be sunny. A lot of insects are flying along these forest margins and hedges and will take a rest in these areas. *Platypalpus* is sitting on leaves, waiting for a possible prey to land on it. Subsequently, it jumps on its prey, grips it with its thickened fore- and midlegs and pierces it in the neck region with its powerful snout. The prey consists of small insects such as flies and hymenopterans. Its prey can be as large as itself. There are a few typical forest species (highlighted in the Table 3) and most of them have a yellow body, the other species possess a black ground-color of the body.

In the present survey, 32 species of *Platypalpus* were found in the Voerstreek (Table 3). The number of true forest species is the highest in the oldest forests and there are more individuals per forest species as well. Typical forest species are *P. pectoralis*, *P. ciliaris*, *P. exilis*, *P. luteus* and *P. analis*. The first three are common species, while the last two species are rather rare. As the forests are younger, the diversity is increasing and this is due to the higher number of eurytopic species and grassland species. As a rule we can set that in old forests there are less species, but almost all species are true forest species. Moreover, this phenomenon was also observed when all dance fly data are analysed together.

Results community structure analysis

The dance fly communities and their characteristics were examined. This was done by applying a DCA with different overlays. Species of which less than 25 individuals were found, were excluded from the multivariate analyses. In that way, 42 species remained for the analyses. The eigenvalues of the axes were respectively $\lambda_{As1} = 0.46$; $\lambda_{As2} = 0.25$ and $\lambda_{As3} = 0.06$ (the last axis explained very few variation in the data set and was therefore excluded for further analyses). Figure 4 shows the DCA diagram (axis1-2).

The first axis seems to group the sites according to their forest age. From the left to the right, the forest age of the sites increases. The youngest forest site is seen at the utmost left part of the diagram (taken out of agriculture since 1996). Entirely to the right, the reference sites can be found (VOER01 and VOER07: ancient forest) with in the middle the sites where the forestation process takes place since 1980-1989.

The second axis seems to group the sites with a mid-young forest age according to the type of forest expansion. At the top of the diagram the plantations can be found and at the bottom the spontaneous forestations.

Although we have only used a restricted number of sampling units, it can be seen that the sites are distributed in four groups. Group A contains the two old forest sites. In these reference sites, mostly true forest species are found. The young forestations of Altenbroek, sites with

an open character, are clustered in group B. Grassland species and species common to forest margins are found here. The third group (C), is the one of the older spontaneous forestations (more than 20 years) in Alserbos. A number of forest species are found here and species of forest margins. Nevertheless, the fauna of these sites seems already to approach the one of the reference site (VOER07) of Alserbos. True forest species are already found here and the share of species of forest margins is quite obvious.

In conclusion, 4 types of dance fly fauna could be determined. Especially, the fauna of the young spontaneous forestations in Altenbroek is distinctly different from those of the reference sites. The dance fly fauna of the plantations are also distinctly different from the older spontaneous forestations but both show some kind of overlap with the fauna of the reference sites. The faunas appear to be above all dependent on the age of the forest succession, the type of forest expansion and are less dependent on the history, i.e. the starting circumstances arable land versus grassland.

General conclusion

Colonisation with typical forest species happens more rapid in plantations than in spontaneous forestation. Colonisation in plantations seems to take place in another way than in spontaneous forestation. The dominant species are different.

The average diversity of both forests is obviously higher in Altenbroek. The general diversity in Alserbos is lower than in the sites of Altenbroek recently taken out of agriculture. As the forest succession continues (already more than 20 years in Alserbos), the diversity seems to decrease in comparison to the younger sites in Altenbroek. Possible reasons could be that the longer forest succession progresses the more stable the fauna and the smaller the chance that occasional species occurring temporarily in the site will increase diversity.

Diversity is low in very young forestation, becomes high in forests with an age between 15 and 20 years old and diversity is lower in the old forests. The number of true forest species is the highest in the old forests. Forest which are 20 years old approach the species composition of old forests. The percentage of true forest species is much lower in younger forests. This applies also to the genus *Platypalpus*. The number of *Platypalpus* species increases as the forests are younger and this is due to the high number of eurytopic species and grassland species. As a rule we can state that: old forests have less species but they are almost exclusively true forest species.

Acknowledgments

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Patrick GROOTAERT, Wouter DEKONINCK
& Konjev DESENDER
Department of Entomology
Royal Belgian Institute of Natural Sciences
Vautierstraat 29, B-1000 Brussels
Belgium