

## Asilidae in restored heathland patches near Bruges: surprisingly species rich ! (Diptera)

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### Abstract

Asilidae were collected during 3 consecutive years in 4 restored heathland patches west of Bruges. In total 9 species were collected. The surprisingly rich Asilidae fauna found in these rather young heathlands in the northwest of Belgium is discussed and compared with other Asilidae communities elsewhere in Flanders. Comments are given on the different trapping methods used. White pan traps seem to be more efficient to collect many species of robberflies than yellow pan traps and pitfall traps. However also yellow pan traps can collect many specimens in absence of white pan traps.

**Keywords:** Asilidae, Bruges, restored heathland patches, restoration projects, *Erica cinerea*

### Samenvatting

Ten westen van Brugge werden roofvliegen ingezameld gedurende drie jaar in 4 recent gevormde heidegebieden. Negen verschillende soorten werden ingezameld. Deze verrassende rijkdom aan roofvliegen in die relatief jonge heidegebieden wordt besproken en vergeleken met die van andere roofvliegengemeenschappen in Vlaanderen. De verschillende gebruikte verzamelmethodes worden vergeleken. Witte vliegenvallen bleken meer efficiënt dan gele vliegenvallen en bodemvallen, maar in afwezigheid van witte vallen kunnen ook gele vliegenvallen heel wat roofvliegen inzamelen.

### Résumé

Trois années de collectes dans 4 sites de landes à bruyère en restauration à l'ouest de Bruges ont permis de récolter 9 espèces d'Asilidae. Cette richesse surprenante de la faune des asilides dans ces landes récentes est discutée et comparée avec les autres communautés d'asilides en Flandre. Les différentes méthodes de capture sont commentées. Les coupelles blanches semblent être plus efficaces que les jaunes ou les pièges à fosse. Cependant, en absence de coupelles blanches, les jaunes donnent un bon rendement.

### Introduction

Asilidae (robber flies) are predators of other, mainly flying insects and have an important impact in sites where they are abundant and therefore they are often considered as good bio-indicators for the

conservation of ecosystems (MCCRAVY, 2017). Robber flies are found on all continents except Antarctica and up till now about 7000 species have been described. The highest diversity can be found in semi-arid and arid habitats and tropical forests. From Belgium 50 species are known while in DR Congo 200 species have been listed (TOMASOVIC & BORTELS, 2015).

In Belgium robber flies species are essentially found in undisturbed areas and can be used as indicators for well managed semi-natural open and thermophile “natural” habitats. Nevertheless intensive inventories with different trap types to estimate their diversity in particular sites in Belgium, are rare. TOMASOVIC & DEKONINCK (2000) recorded 11 species in 6 sites, mainly heathland relicts, in East Flanders, near Gent. They also showed that sampling during a complete spring and summer with different trap types can give information on ecology and phenology of the recorded species and they concluded that the species composition could differ strongly between analogue sandy areas within the same region. In that study it was also suggested that robber flies are poor colonisers as they were lacking in recently cleared forests and potentially suitable new created inland dunes (TOMASOVIC & DEKONINCK, 2000). In 2002, BONTE *et al.* published on 13 species of Asilidae and their species composition in three Flemish heathland areas where nature restoration measurements were undertaken on former arable fields. They found that the differences that were observed in species composition could be attributed to landscape structure i.e. bare sand, tussocks or dwarf shrubs. In a contribution to the distribution and ecology of robber flies in the sandy regions of Flanders BONTE *et al.* (2002) focused on the paucity of the Flemish coastal dunes. In this paper a preliminary Red List status for 14 Flemish species was also suggested. Before TOMASOVIC (1998) already studied the evolution of the distribution of robber flies in Belgium and found that most of the species are declining in Belgium. Records of Asilids near Bruges are rare. BONTE *et al.* (2002) mentioned 4 species collected with hand catches in the Schobbbjakshoogte east of Bruges (*Dysmachus trigonus*, *Tolmerus atricapillus*, *Tolmerus cingulatus* and *Philonicus albiceps*). In the present study, we give the results of an inventory in newly created heathlands, in the west of Bruges, in Sint-Andries.

### Material and methods

A project to evaluate heathland restoration near Bruges using abundant insect families, was initiated in April 2014. During 3 consecutive years, heathland patches with a different surface, history and management were sampled with pitfalls (Table 1-2). Sampling with pitfall traps in 8 of these patches (3 heathlands, 8 sampling sites and in total 24 pitfalls) was started in 2014. In three of these heathlands (Rode dopheide Beisbroek, Chartreuzinnenheide, Zevenkerken) yellow and white pan trap were installed from April until September in 2015, besides 30 pitfall traps in five heathlands and 10 sites. In 2016, 9 yellow pan traps were used to sample flying insects in three heathland sites (Ter Heyde, Zevenkerken, Beisbroek) besides 30 pitfalls in four heathlands. From these samples, robber flies were sorted and identified.

Details on the sampling project are explained in DEKONINCK *et al.* (2015) and LOCK *et al.* (2017); an overview of all screened samples is given in table 1. The location of these 4 heathlands and their surface are delineated in figure 1. Figure 2 shows an example of a yellow pan trap in Zevenkerken. Most of the sampled sites are characterised by *Erica cinerea* and *Calluna vulgaris* as dominant plant species although in some recent heathland sites also high abundances of lichens and great surfaces of bare sand are important.

Table 1. Overview of the sampled heathlands patches, with the number and types of traps used during 3 consecutive sampling years 2014-2015-2016 (PF=pitfall trap, WPT=white pan trap; YPT=yellow pan trap).

Heathland	Sampling site	PF 2014	PF 2015	PF 2016	WPT 2015	YPT 2015	YPT 2016
Beisbroek	Former cornfield (restored since 2009) + heathland Diksmuidse Heirweg restoration started in 1977, age of heathland patches between 10 and 30 years old	9	15	12	2	3	3
Chartreuzinnenheide	New created heathland near Beisbroek. (restoration started in 2004; heathland since 2009)	6			2	3	
Zevenkerken	Rode dopheide reservaat (heathland since 1996)	6	6	6	2	3	3
Ter Heyde	Property Haspenslagh (heathland since 2012)			12			3

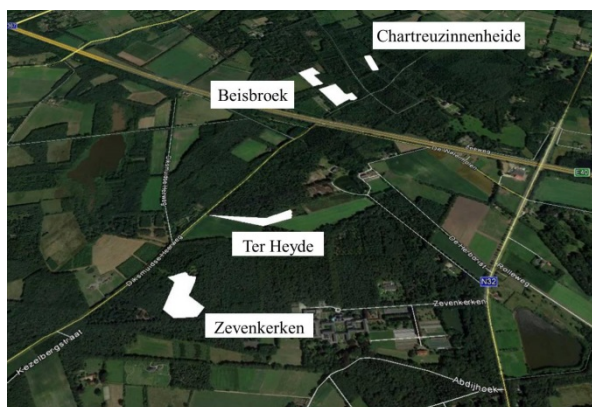


Fig. 1. Sampled heathlands west of Bruges, with north of the E40 highway: Beisbroek and Chartreuzinnenheide and south of the highway: Ter Heyde and Zevenkerken.



Fig. 2. Yellow pan trap in Zevenkerken.

## Results and discussion

### General Results

Nine species (Fig. 3a-i) and in total 287 specimens were collected. The two most abundant species were *Tolmerus atricapillus* (108 individuals) and *Dysmachus trigonus* (83 individuals), which represented together 66.5% of all collected individuals. The number of each species collected per site are given in Table 2.

Table 2. Overview of all collected Asilidae and their numbers per site. Beisbroek = heathland Diksmuidse Heirweg + heathland on former cornfield.

Species	Sites				
	Beisbroek	Chartreuzinnenheide	Ter Heyde	Zevenkerken	Total
<i>Dioctria atricapilla</i> Meigen, 1804			2		2
<i>Dioctria cothurnata</i> Meigen, 1820	2	3	3	7	15
<i>Dioctria hyalipennis</i> Meigen, 1803		1	1		2
<i>Dysmachus trigonus</i> (Meigen, 1804)	36	1	16	30	83
<i>Eutolmus rufibarbis</i> (Meigen, 1820)	4	4	2	7	17
<i>Lasiopogon cinctus</i> (Fabricius, 1781)	16	1		4	20
<i>Philonicus albiceps</i> (Meigen, 1820)	23	12			35
<i>Tolmerus atricapillus</i> (Fallén, 1804)	52	21	7	28	108
<i>Tolmerus cingulatus</i> (Fabricius, 1781)	3		1		4
<b>Total</b>	<b>136</b>	<b>43</b>	<b>32</b>	<b>76</b>	<b>287</b>
<b>Species</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>5</b>	<b>9</b>

Most of the species were more or less expected during the sampling. *Tolmerus cingulatus* is considered as a less common species in Belgium and was so far, very rare in the littoral region (VERLINDEN, 1982). *Eutolmus rufibarbis* was considered as a common species 100 years ago but its distribution seems to be decreasing in Belgium since then (TOMASOVIC, 1998). *Lasiopogon cinctus* was also considered as rare since 1910 (TOMASOVIC, 1998) and is absent in the coastal dunes (BONTE *et al.*, 2002) but was collected in high numbers in heathlands dominated by *Calluna vulgaris* in East Flanders in 1999 (TOMASOVIC & DEKONINCK, 2000). *Philonicus albiceps* and *Tolmerus cingulatus* can be found in regions dominated by sandy soils where vegetation is scarce, but also in “le haut massif ardennais” and the littoral region. In the coastal dunes *P. albiceps* is the most dominant robber fly (BONTE *et al.*, 2002).



Fig. 3a-f. a: *Dioctria atricapillus*; b: *Dioctria cothurnata*; c: *Dioctria hyalipennis*; d: *Dymachus trigonus*; e: *Eutolmus rufibarbis*; f: *Lasiopogon cinctus*.

#### *Trapping techniques*

The yellow traps (sampling in 2015 and 2016, in total 18 traps) collected 9 species (all asilids species recorded during the project) and 182 specimens in total. The white pan traps (sampling only in 2015, 6 traps) collected 33 specimens and five species in total. None of the *Dioctria* species as well as *Eutolmus rufibarbis* were collected with the white pan traps. 72 specimens belonging to 6 species were collected with pitfall traps (year round sampling of 21 in 2014, 21 in 2015 and 30 pitfall traps in 2016) and *Tolmerus cingulatus*, *Dioctria hyalipennis* and *Dioctria atricapilla* were not collected with pitfall traps. In general *Dioctria* species are only rarely collected with traps installed on the soil (TOMASOVIC, 1995) although they live in meadows and fallows where the vegetation height does not exceeds 60 cm.

For the four most abundant species the % of the total specimens collected by each type of trapping was calculated although the intensity of sampling and period was not the same for the 3 different trap types. For *Tolmerus atricapillus* 76.8% of the individuals were collected by yellow pan trap, white pan traps collected 15.7% and pitfall traps 7.4% of the individuals. *Dymachus trigonus* was collected most frequently with pitfall traps (44.6% of the individuals) and yellow pan traps (48.8% of the

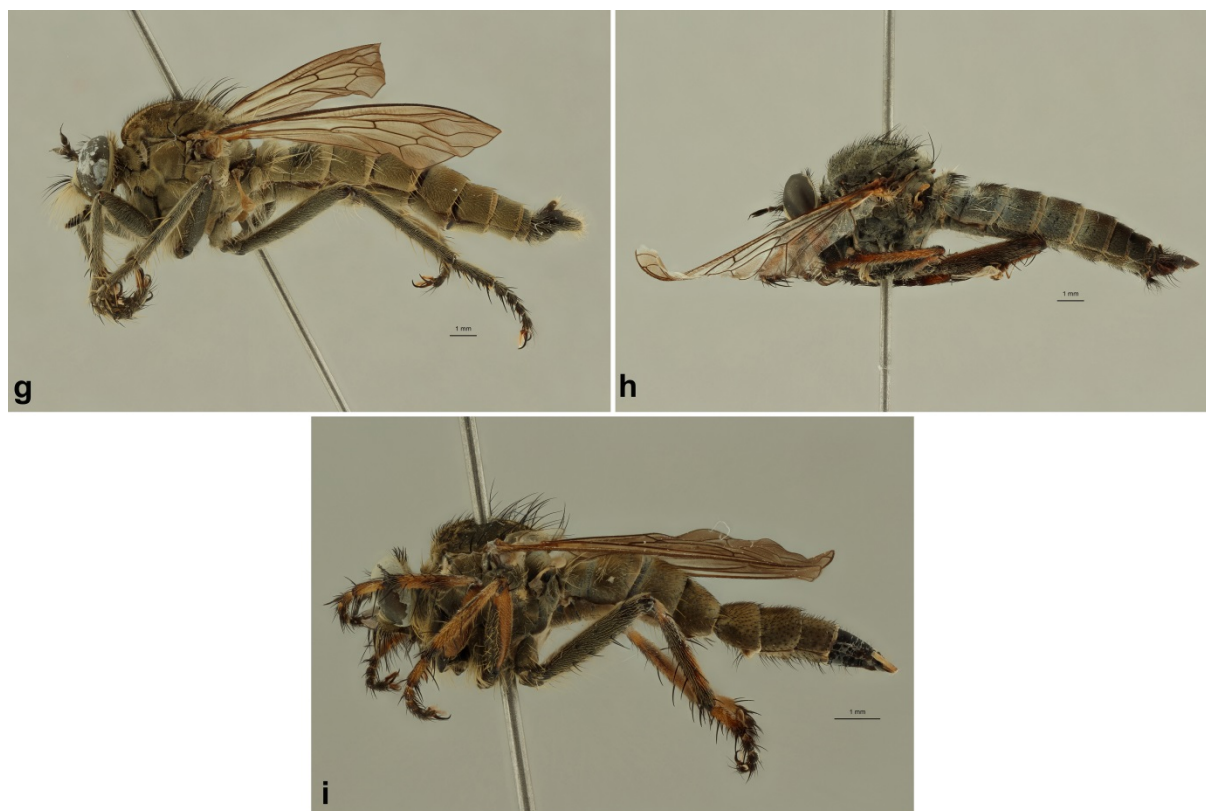


Fig. 3g-i. g: *Philonicus albiceps*; h: *Tolmerus atricapillus*; i: *Tolmerus cingulatus*.

individuals) and less with white pan traps (7.2% of the individuals). 42.8% of the individuals of *Philonicus albiceps* were collected with yellow pan traps, 34.2% of the individuals with pitfall traps and 22.9% with white pan traps. *Lasiopogon cinctus* was mainly collected with pitfall traps (61.9% of the individuals) followed by 33.3% of the individuals collected with yellow pan traps and only 5-4.8% collected with white pan traps.

During the study in East Flanders (TOMASOVIC & DEKONINCK, 2000) 64% of the specimens were collected with white pan traps, 23% with yellow pan traps and 13% with pitfall traps (Table 3a). To be able to compare the efficiency of the 3 different type of traps within this project as well as with the trapping in heathland relicts in East Flanders in 1999 (TOMASOVIC & DEKONINCK, 2000) the average number of specimens collected per operational trap for 1999 and 2015 respectively was calculated, the only years where the 3 different types of traps were used at the same sites (Table 3a and 3b). In total, 100 specimens were collected during 2015.

Table 3a. Asilidae species collected in the study of TOMASOVIC & DEKONINCK (2000) per trap type, with 780 Asilidae specimens collected in 1999 by Tomasovic & Dekoninck in heathland relicts in East Flanders.

Trap type	Number of traps	Total Asilidae collected	N specimens / trap
White pan trap	36	499 (64% of total)	13.87
Yellow pan trap	36	180 (23% of total)	4.98
Pitfall trap	60	101 (13% of total)	1.69

Table 3b. Asilidae species collected in 2015 per trap type in three heathlands near Bruges.

Trap type	Number of traps	Total Asilidae collected	N specimens / trap
White pan trap	6	33 (32,6% of total)	5,5
Yellow pan trap	9	38 (37,6% of total)	4,2
Pitfall trap	21	30 (29,7% of total)	1,4

In the heathlands sampled in 2015 near Bruges, yellow pan traps collected nearly the same average number of specimens than the white pan traps did, whereas in the heathlands near Ghent white pan traps collected 3 times more efficient robber flies than the yellow pan traps.

The average number of specimens per trap collected for each trapping type are presented in Table 4. One species was collected more efficiently with Pitfall traps: *Lasiopogon cinctus* whereas white pan traps were most efficient to collect *Dysmachus trigonus*, *Philonicus albiceps* and both *Tolmerus* species.

Table 4. Average number of specimens of robber flies per trap, collected in 2015 in 3 heathlands in the west of Bruges for each trapping type. The highest average per species are in bold.

Species	White Pan Trap	Yellow Pan Trap	Pitfall
<i>Dysmachus trigonus</i>	<b>1.00</b>	0.44	0.48
<i>Lasiopogon cinctus</i>	0.17	0.22	<b>0.48</b>
<i>Philonicus albiceps</i>	<b>1.33</b>	0.22	0.29
<i>Tolmerus atricapillus</i>	<b>2.83</b>	2.67	0.19
<i>Tolmerus cingulatus</i>	<b>0.17</b>	0.00	0.00
<i>Eutolmus rufibarbis</i>	0.00	<b>0.11</b>	0.00
<i>Dioctria cothurnata</i>	0.00	<b>0.11</b>	0.00

#### *Differences between restored heathland patches*

Ter Heyde: Although at Ter Heyde we only collected one year and only with yellow pan traps and pitfall traps, 32 specimens and 7 species were collected which is more than 3 sampling years at Zevenkerken (5 species). All 3 *Dioctria* species were collected at this site with *D. atricapilla* as unique species for that heathland. Ter Heyde is a small heathland fragment between forest and arable fields and a relative young heathland, restored in 2012 and 2014, when trees of *Pinus sylvestris* and *Pinus nigra* var. *corsicana* were removed, ponds were restored and sods were removed at some plots.

Chartreuzinnenheide: In this heathland Asilidae were sampled during two years with pan traps; however only a limited number of traps were installed. 7 species were found with *Philonicus albiceps* and *Tolmerus atricapillus* being the most abundant species. Compared to the other heathland patches only *Dysmachus trigonus* was collected in very low numbers. This rather recently (restoration started in 2004, heathland since 2009) heathland transformed woodland seems to harbour a rich robber fly community.

Beisbroek: This heathland is the most intensively sampled heathland and for some species a high number of robber flies specimens was found. This large heathland is a matrix of small heathland patches with a higher diverse history. The most intensively sampled patch was the former cornfield that was restored since 2009. The larger heathland patches that were sampled near the Diksmuidse Heirweg are older. In some patches restoration started in 1977 and the age of heathland patches in this zone varies between 10 and 30 years old. Notwithstanding the high intensity of sampling, the Asilidae diversity was not higher than in the other heathlands (7 species). We do need to mention that also an eighth species was recorded there: *Dioctria hyalipennis*, which was collected by an interception trap during the summer of 2016.

Zevenkerken: The sampling activity in this heathland was quite intense and spread over several years and more specimens were found than in Ter Heyde and Chartreuzinnenheide, but nevertheless only 5 species of Asilidae were collected. This can probably partially be explained by the fact that a large part of this heathland is a very recently restored site (removing of the top layer in the winter 2013-2014 of a highly eutrophic heathland/grassland, that originated for deforestation in 1996). TOMASOVIC & DEKONINCK (2000) already mentioned the poverty of Asilidae in such young dune and heathland vegetations in East Flanders.

## Conclusions

A surprisingly species rich Asilidae fauna was found in the sampled heathlands near Bruges. Nevertheless in none of these heathlands all nine species were found together. Compared with the

Asilidae fauna of some nearby heathland relicts in East Flanders some species are nevertheless still missing: i) *Antipalus varipes* which was a rare species before the sampling in 1999 (TOMASOVIC & DEKONINCK, 2000), was collected in 1999 in Moerbeke and Sint-Martens-Latem and was not recorded before a long-time in the Northwest of the country; ii) *Neoitamus cyanurus*, which is a species from open forests and more shrubby vegetations and iii) *Dioctria rufipes*. In the heathlands, near Bruges, one species, *Dioctria cothurnata*, was collected, which was lacking in the heathlands in East Flanders, although at [www.waarnemingen.be](http://www.waarnemingen.be) the species is also recorded from a heathland east from Bruges: Schobbejak, which is only a few km east of Bruges and further eastwards in Flanders (Ursel and Lembeekse bossen).

The most surprising result of this sampling was the high number of Asilidae collected with yellow pan traps in the absence of white pan traps in 2016. During previous sampling campaigns, white pan traps collected generally a higher number and diversity of Asilidae (TOMASOVIC & DEKONINCK, 2000). However it seems that 2015, the only year where white pan traps were used, was a less good year for Asilidae. In 2016, 9 yellow pan traps collected 144 robber flies (19 specimens per trap) as in 2015 this was only 4.2 specimens per trap. This suggests a great variability in Asilidae abundances per year.

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