

**A contribution to the distribution and ecology of Asilid flies
in the sandy regions of Flanders (Diptera Asilidae)
with a focus on the paucity in the Flemish coastal dunes**

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Summary

In this contribution we discuss the distribution and ecology of some Asilid flies, captured in sandy regions of Flanders, within the framework of some large invertebrate survey projects conducted at the Royal Belgian Institute of Natural Sciences and the University of Ghent. A total of 14 species were found, from which several are extremely rare: *Antipalus varipes*, *Asilus crabroniformis*, *Machimus arthriticus* and *Pamponerus germanicus*. Their distribution and ecology is discussed. We also propose a Red List status for the captured species.

Keywords : Asilidae, distribution, phenology, ecology, dunes.

Introduction

In our temperate regions, Asilid flies are in their adult life stage active predators, which catch their prey mainly during flight. Almost all our Belgian species are typical for undisturbed areas and can thus be used as bio-indicators in semi-natural open and thermophile habitats.

In Belgium, Asilid flies are mainly found in the Pleistocene sandy regions of inner-Flanders, the coastal dunes, and the area of Samber-Meuse in the South of the country. VERLINDEN (1982) could identify six large biogeographical districts, based on the collections at the Royal Belgian Institute of Natural sciences. TOMASOVIC (1998) summarised the distribution and the evolution of Asilid flies in Belgium and found that most of the species (probably with the exception of *Laphria flava* and *Neoitamus socius*) are declining in our region.

Although a basic knowledge is present on the distribution of Asilid flies in our country, almost no ecological or applied ecological research has been done till now. Only TOMASOVIC & DEKONINCK (2000) investigated the presence of Asilid flies in the inner dunes of Eastern Flanders in function of the ground use. They concluded that the species composition could differ strongly between analogue sandy areas within the same

region. Their results indicated that Asilid flies, despite of their well developed flying capacity, are poor colonisers since they were almost completely absent from recently cleared forests, but potentially suitable inner dunes. In a way they can be seen as the counter actors of Therevid flies from which is shown that they are typical pioneer species (GROOTAERT *et al.*, 2001).

In this contribution we give an overview of new records on the distribution of Asilid flies in sandy regions in Flanders. We especially focus on the paucity of the Asilid fauna in the Flemish coastal dunes and differences in their phenology. The ecology of some species is finally discussed.

Material and Methods

The data, presented here could be gathered within the framework of some large survey projects, coordinated at the Royal Belgian Institute of Natural Sciences, department Entomology and the University of Ghent, Lab of Animal Ecology. Parts of the results are already published by TOMASOVIC & DEKONINCK (2000). Additional data were obtained from inventory projects in Eastern Flanders (projects AMINAL-Eastern Flanders, evaluation of the invertebrate fauna of some humid inland dunes and on the road verges in Waasmunster – DEKONINCK & GROOTAERT,

Table 1. Overview of the sampled localities, the habitat characterisation, sampling methodology and sampling year.

Number	Locality	habitat	Sampling methodology	Year
1-7	De Panne	coastal dunes (grassland, marram dunes, grey dunes, dune slack)	white pitfalls	2000
8-9	De Panne	coastal dunes, grassland	white pitfalls	2000
10-11	Ghyvelde-Adinkerke	coastal dunes, grassland, grey dune	white pitfalls	1999
12-14	Ursel	grassland	white pantraps	2002
15-18	Heidebos, Moerbeke	heathland, grassland	white pantraps	2001
19	Serskamp	grassland	white pantraps	2001
20-21	Molsbergen, Lokeren	river dune, grey dunes	white pantraps	2002
22	Opgrimbie, Kikbeek	heathland	hand catches	2000
23-27	Hageven, Neerpelt	heathland	white pantraps	2001
28-31	Teut, Zonhoven	heathland	white pantraps	2001
32-37	Road verges E17, Waasmunster	heathland	white pantraps	2000
38	Schobbejakshoogte, Brugge	heathland, grey dune	hand catches	1995
39	Honegem-Reebroek	woodland	white pantraps	2002
40-42	Stroppers, Stekene	grassland	white pantraps	2002

Table 2. Total number of the captured species per locality.

Species	Locality	1-7	8-9	10-11	12-14	15-18	19	20-21	22	23-27	28-31	32-37	38	39	40-42	Number of localities	Total per species
		<i>Antipalus varipes</i> (Meig.)	0	0	0	0	12	0	0	0	0	0	0	4	0		
<i>Asilus crabroniformis</i> (L.)	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	1	6
<i>Dioctria atricapilla</i> Meig.	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1
<i>Dioctria cothurnata</i> Meig.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1
<i>Dioctria oelandica</i> L.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1
<i>Dysmachus trigonus</i> Meig.	22	8	61	1	39	0	5	1	87	36	23	2	0	0	0	11	285
<i>Eutolmus rufibarbis</i> (Meig.)	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	1	3
<i>Lasiopogon cinctus</i> (Fab.)	0	0	0	0	96	1	26	0	287	13	11	0	0	20	0	7	454
<i>Machimus athriticus</i> Zeller	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	1	5
<i>Machimus atricapillus</i> Fallén	1	0	1	6	330	0	1	0	11	25	5	2	0	10	0	7	392
<i>Machimus cingulatus</i> Fabr.	0	0	0	2	8	0	7	0	182	2	1	2	0	0	0	8	204
<i>Neoitamus cyanurus</i> (Leow.)	0	0	0	0	1	0	0	0	0	0	11	0	0	0	0	2	12
<i>Pamponerus germanicus</i> (L.)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1
<i>Philonicus albiceps</i> (Meig.)	78	0	12	0	57	0	62	0	56	8	0	2	1	3	0	9	279

2001), the coastal dunes (Project AMINAL-monitoring of dune management) and Limburg (VLINA-project-evaluation of Nature restoration on former arable fields). All animals were inventoried with white pan or pitfall traps. Additional data are included from net sampling in the Kikbeek-area in Limburg and the Schobbejakshoogte in Brugge (ZWAENEPOEL, pers. comm.). An overview of the sampled places and the sampling methodology is given in Table 1. The sites are visualised on Figure 1.

For the most common species (*Dysmachus trigonus*, *Lasiopogon cinctus*, *Machimus atrica-*

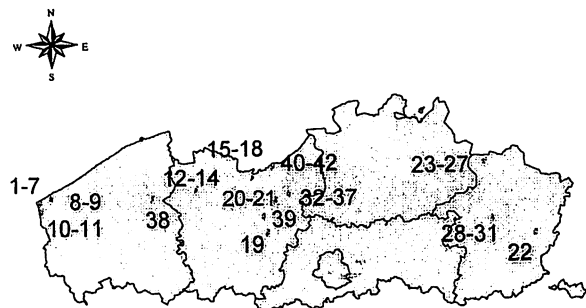


Fig. 1. Localisation of the different sampled areas.

pillus, *M. cingulatus* and *Philonicus albiceps*), we analysed habitat preference by non-linear regression of the species' abundance per plot (if sampled with three white pan-traps or five white pitfall traps, which had in total similar trapping surface) with the recorded habitat parameters 'distance to woodland, surface of bare sand and vegetation height'. We also calculated the sex-ratio mm/ff and compared it with an equal sex-ratio via χ^2 -tests.

Finally, we attempt to define the species' Red list status in Flanders, based on their known distribution, habitat preference and trend (TOMASOVIC, 1998)

Results

General results

A total of 1660 individuals were identified, belonging to 14 species (Table 2). *D. trigonus*, *L. cinctus*, *M. atricapillus*, *M. cingulatus* and *Philonicus albiceps* were both in abundance and number of localities the most common species. Rare captured species were *Asilus crabroniformis*, *Dioctria cothurnata*, *Dioctria oelandica*, *Machimus arthriticus* and *Pamponerus germanicus*.

Ecology and distribution

Antipalus varipes

A. varipes was only recorded in the inland dunes in Eastern Flanders, where well-developed heathland was present (Fig. 2). In Belgium, this species is very rare (TOMASOVIC, 1998). TOMASOVIC & DEKONICK (2000) found the species in Sint Martens Latem, Wetteren and Moerbeke. Our study reveals the presence of a population along the road verges of the E17 in Waas-



Fig. 2. The occurrence of *Antipalus varipes* in the sampled areas.

munster. The sex-ratio mm/ff was 0.18, indicating that especially females were caught. The species can be found during the months July and August (Fig. 3).

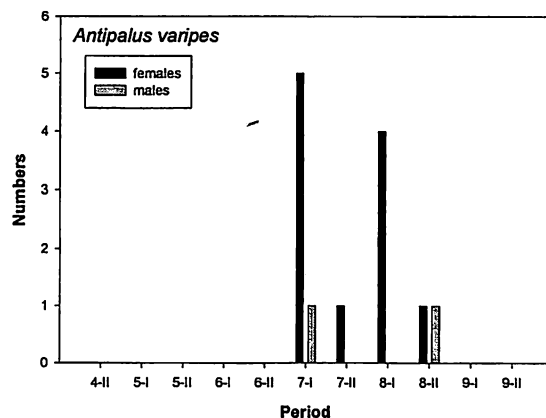


Fig. 3. Phenology of *Antipalus varipes* in Waasmunster (Road verges E17).

Asilus crabroniformis

This is the first documented record of this coprophytic species since 1963 (TOMASOVIC, 1998). During the recent sampling campaign, this species was only found in the Hageven-reserve, a nature reserve with large areas of short grass- and heathland, grazed by Galloway-cattle. A total of 5 females and 1 male were captured in these habitats, during July-September (Fig. 4).

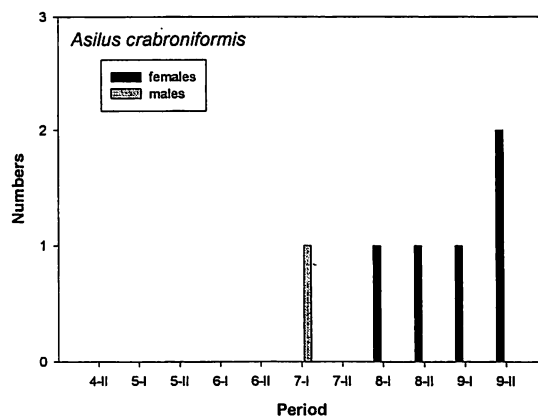


Fig. 4. Phenology of *Asilus crabroniformis* in Neerpelt (Hageven).

Dioctria atricapilla, *D. cothurnata* and *D. oelandica*

Only one individual of each species was caught during the different inventories. One male *D. atricapilla* was found in Moerbeke in the first half of July (Fig. 5). This is probably the only species which can be found in large numbers outside the sandy regions of Flanders and the

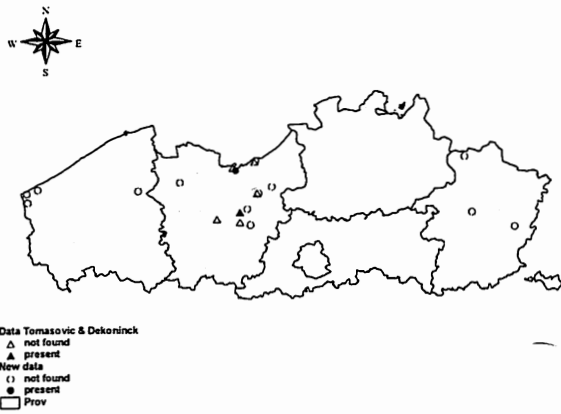


Fig. 5. The occurrence of *Dioctria atricapilla* in the sampled areas.

Netherlands (VAN VEEN, 1996). One male of *D. cothurnata* was found during the same period in the Hageven-reserve. These species are fairly common on sandy soils, but doesn't prefer typical oligotrophic vegetation (VAN DER GOOT, 1985; TOMASOVIC, 1998). They can both be found in woodlands, dense grasslands in both humid and dry situations (VAN VEEN, 1996). Because of their leaf-hunting behaviour, these species are probably difficult to survey with pantraps.

D. oelandica is the rarest species of the three (TOMASOVIC, 1998), for which the number of localities is strongly declining. A male was found in the first half of July in the Hageven. The species is typical for wooded heathland areas (VAN DER GOOT, 1985; VAN VEEN, 1996).

Dysmachus trigonus

This is probably the most common Asilid fly in Flanders, which can be found on open sandy grounds. In the coastal dunes, this species is also very common (Fig. 6)

Our analysis of the species' habitat preference indicates that the species doesn't has any preferences for height of the grass-vegetation or the amount of bare sand. The absence of the species in a recently optimised habitat in Uitbergen (TOMASOVIC & DEKONINK, 2000), indicates however that the species is a bad coloniser. The species can be found from the beginning of May till September. Interesting is that the species occurs a half a month later in the coastal dunes, in comparison with inland data (Fig. 7a,b & TOMASOVIC & DEKONICK, 2000). The peak in the phenology is also a month later in the coastal dunes, indicating a possible effect of lower temperatures during the spring and summer on

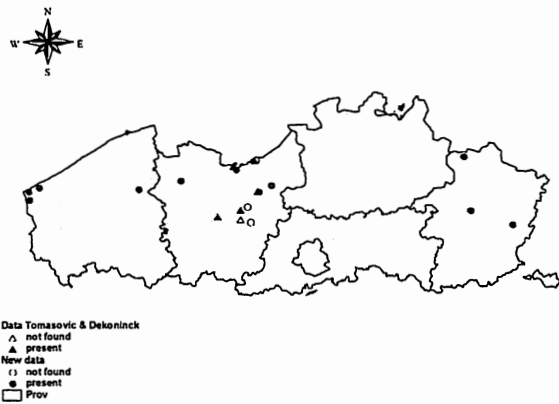


Fig. 6. The occurrence of *Dysmachus trigonus* in the sampled areas.

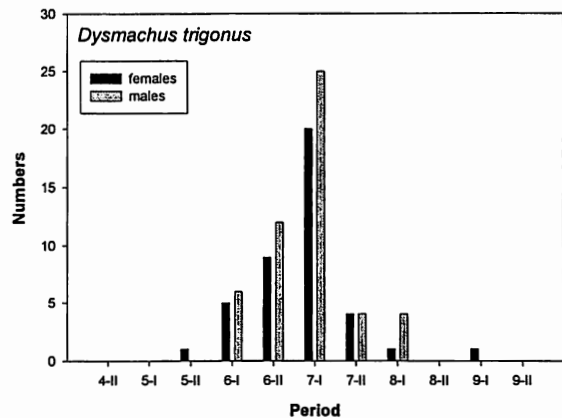


Fig. 7a. Phenology of *Dysmachus trigonus* in the Flemish coastal dunes.

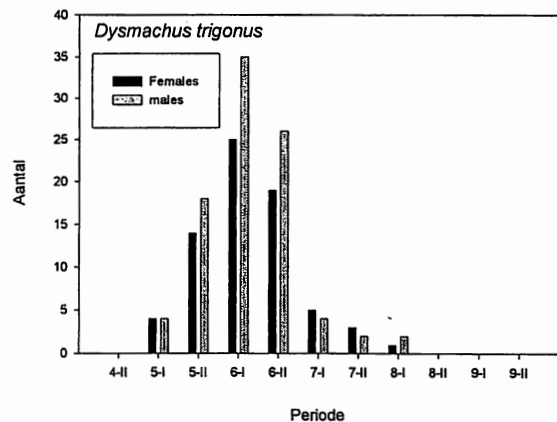


Fig. 7b. Phenology of *Dysmachus trigonus* in the inland dunes of Flanders.

the species' larval development. The sex-ratio mm/ff is 1.28 and not significantly different from one (χ^2 -test, $p > 0.05$).

Eutolmus rufibarbis

This species is also rare in our country and declining (TOMASOVIC, 1998). We only caught two males and one female in Neerpelt (Fig. 8) in the second half of June and the first half of July. TOMASOVIC & DEKONINCK (2000) found howe-

ver two populations in Eastern Flanders. The species is rare and appears to be bound to open sandy patches in heathland areas. VAN VEEN (1996) also mentions the species from forest edges on sandy soils.

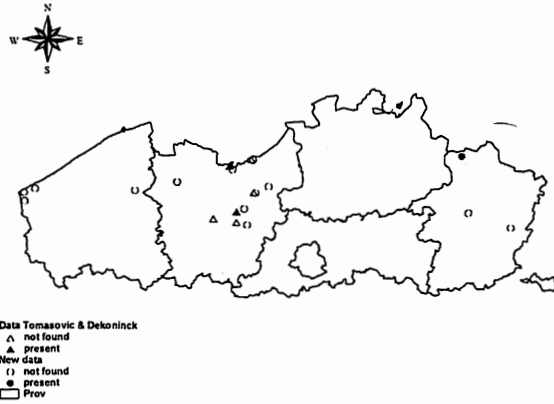


Fig. 8. The occurrence of *Eutolmus rufibarbis* in the sampled areas.

Lasiopogon cinctus

TOMASOVIC (1998) considered this species as rare in Belgium. Our surveys indicated that this species is however rather common in the investigated areas, but certainly absent in the Flemish coastal dunes (Fig. 9). The sex ratio was 1.52 and significantly different from one (χ^2 -test, $p < 0.05$), indicating that more males were caught. *L. cinctus* is active during the spring period (Fig. 10). The species is typical for forest edges in sandy regions, since it reacts significantly to the distant to the forest edge (Fig. 11) and to the amount of bare sand (Fig. 12).

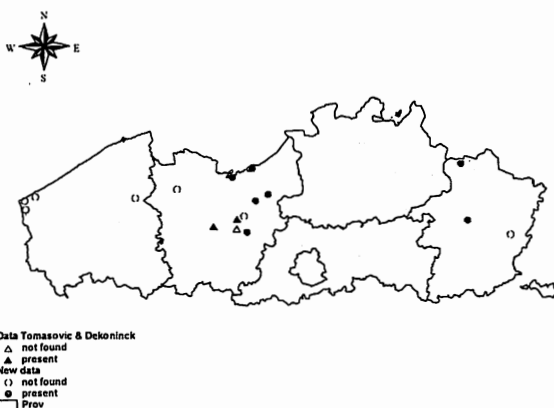


Fig. 9. The occurrence of *Lasiopogon cinctus* in the sampled areas.

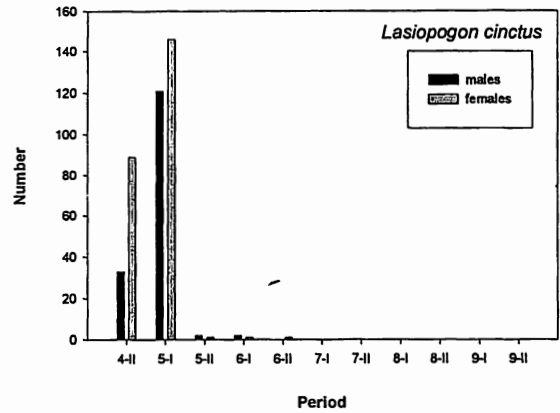


Fig. 10. The phenology of *Lasiopogon cinctus* in the inland dunes of Flanders.

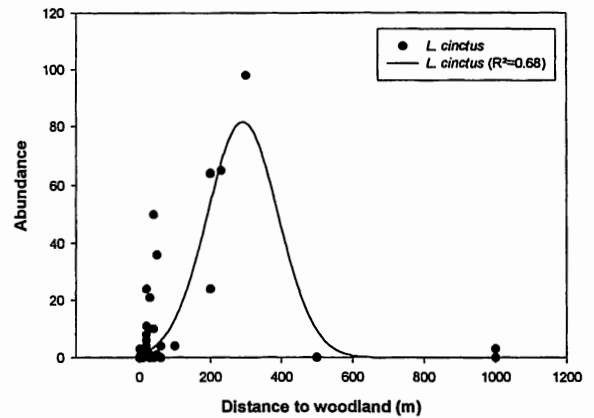


Fig. 11. The abundance of *L. cinctus* in function of the distance to woodland.

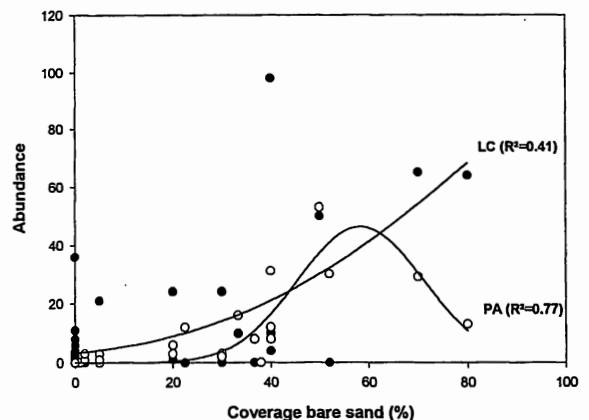


Fig. 12. The abundance of *L. cinctus* (LC) and *P. albiceps* (PA) in function of coverage of bare sand.

Machimus arthriticus

This species has never been found in Flanders. Only three records are known from Belgium: two from the 19th century (Brussels and Carlsbourg-Luxembourg) and one from Liège in 1970. We found four females and one male in a bare sandy sod cut field in the Hageven-reserve in June and the beginning of July (Fig. 13). In the Netherlands the species is also very rare and restricted

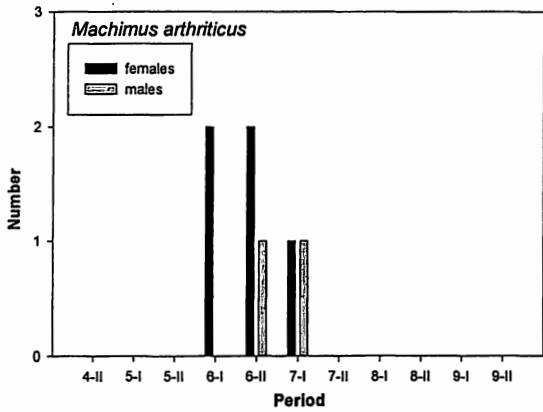


Fig. 13. The phenology of *Machimus arthriticus* in Neerpelt (Hageven).

to the large heathland areas of the Veluwe (VAN VEEN, 1996).

Machimus atricapillus

This species is the only member of the genus occurring in the coastal dunes, although at very low abundance (Fig. 14). *M. atricapillus* shows the same distribution as *D. trigonus* and is common on open sandy soils, without specific habitat requirements (no reaction on vegetation height, amount of bare sand, presence of *Calluna vulgaris*). The sex-ratio was 0.74 (significantly different from one), indicating that we, contrary to VAN VEEN (1996), caught more females with white pan- and pitfall traps. The species can be found from the end of July till the end of September with a peak in the last half of August (Fig. 15). Because of its preference for heathlands and dunes, we consider the species to be vulnerable in Flanders.

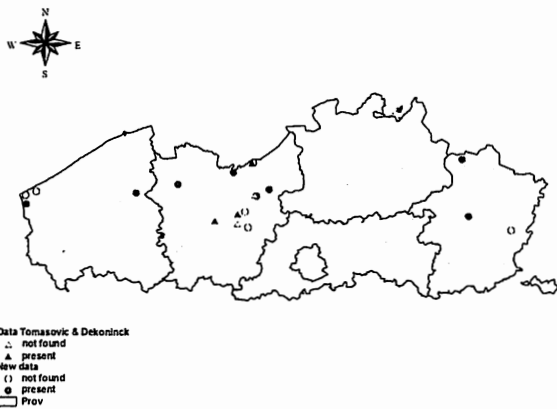


Fig. 14. The occurrence of *Machimus atricapillus* in the sampled areas.

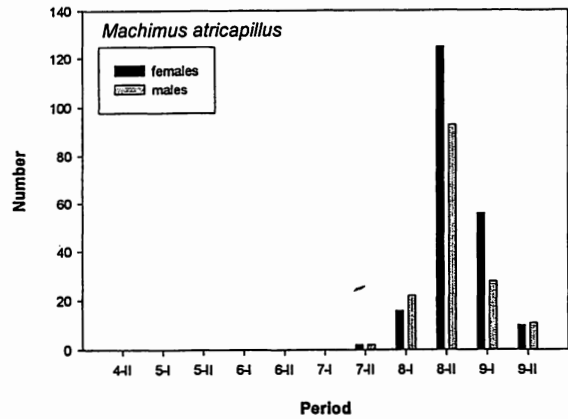


Fig. 15. The phenology of *Machimus atricapillus* in inland dunes of Flanders.

Machimus cingulatus

M. cingulatus is also widely distributed in Belgium (TOMASOVIC, 1998), but is absent from the coastal dunes (Fig. 16; see also VERLINDEN, 1982). The species needs more specific habitat requirements than *M. atricapillus*: maximal abundances appear at low vegetation height (Fig. 18).

Its sex-ratio was not significantly different from one (1.19). *M. cingulatus* is earlier active

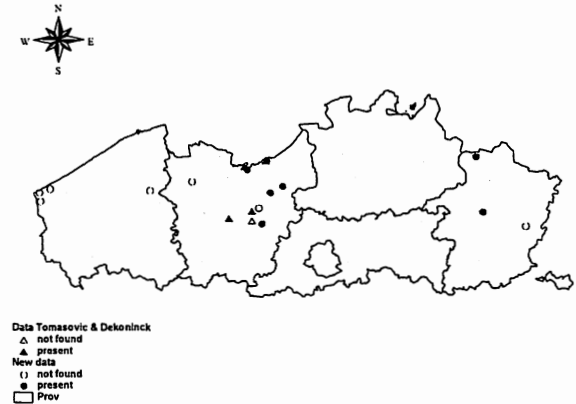


Fig. 16. The occurrence of *Machimus cingulatus* in the sampled areas.

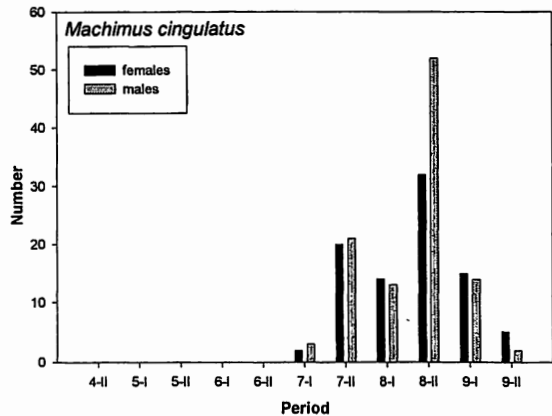


Fig. 17. The phenology of *Machimus cingulatus* in inland dunes of Flanders.

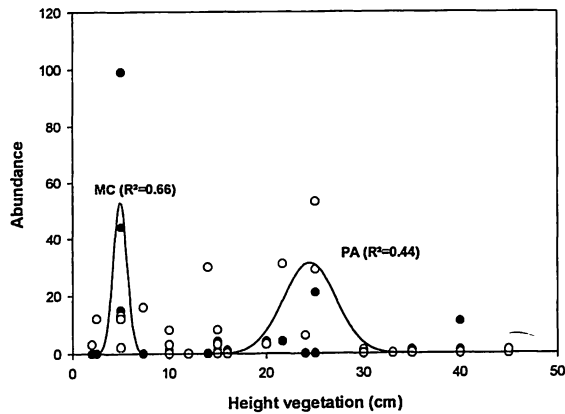


Fig. 18. The abundance of *M. cingulatus* (MC) and *P. albiceps* (PA) in function of the height of the vegetation.

than the previous, with a peak in the second half of August (Fig. 17).

Neoitamus cyanurus

During our surveys, we only found one male in a dry woodland (edges) in Moerbeke and three males and eight females in the wooded heathland of the E17-road verges in Waasmunster in the period half June-July (Fig. 19). This preference for dry deciduous woodlands on sandy soils is confirmed by Dutch data, presented by VAN DER GOOT (1985) and VAN VEEN (1996). TOMASOVIC (1998) considers this species as common and stable in Belgium.

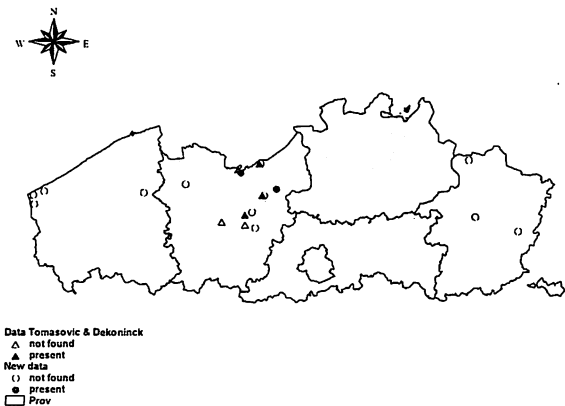


Fig. 19. The occurrence of *Neoitamus cyanurus* in the sampled areas.

Pamponerus germanicus

We captured one male of this species in the beginning of June in the valley of the Kikbeek, in birch forested heathland. *P. germanicus* is strongly declining in Belgium (TOMASOVIC, 1998) and bound to heathland and edges of dry

deciduous woodland. Before 1950, the species was found in Eastern Flanders, but seems now to be extinct in this province.

Philonicus albiceps

TOMASOVIC (1998) classifies this species as rather common and stable in Flanders. We found the species at nine places. In the coastal dunes, it is the dominant species (Fig. 20). The sex ratio mm/ff is 1.36, significantly different from one. The species has specific habitat requirements: its abundance increases with the amount of bare sand (Fig. 12), but it also needs a moderately high grassland vegetation (Fig. 18), indicating its preference for sandy soils with the presence of grass tussocks. Its phenology is also delayed in the coastal dunes (Fig. 21a,b), again indicating that lower temperatures slow down the larval development. Because of its preference for open (dynamic) sandy soils in Flanders, we consider the species as vulnerable in Flanders.

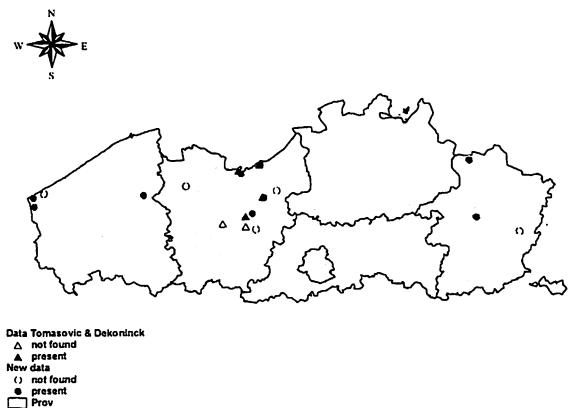


Fig. 20. The occurrence of *Philonicus albiceps* in the sampled areas.

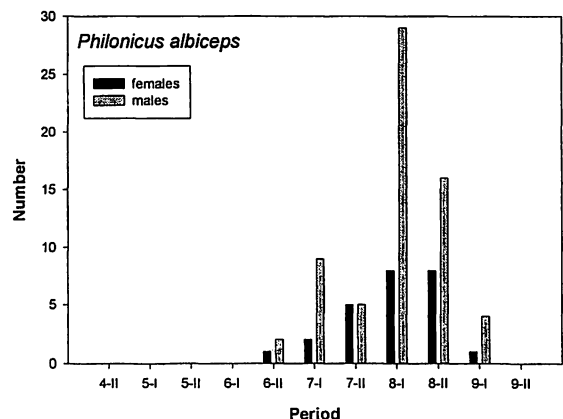


Fig. 21a. The phenology of *Philonicus albiceps* in the Flemish coastal dunes.

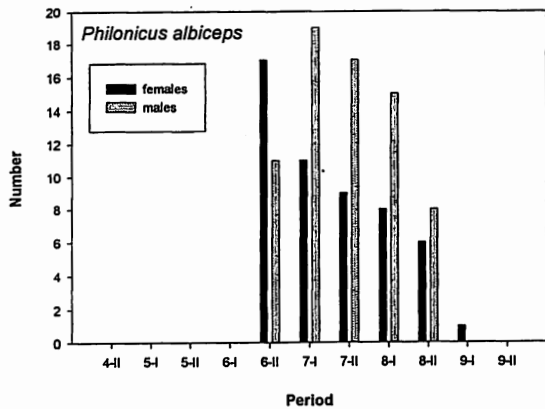


Fig. 21b. The phenology of *Philonicus albiceps* in the inland dunes of Flanders.

Conclusion

Rare species and vulnerability in Flanders

In this contribution we discuss the distribution and ecology of some Asilid flies, captured in sandy regions of Flanders. A total of 14 species were found. Of these, some extremely rare species were recaptured since a long period: *Antipalus varipes*, *Asilus crabroniformis*, *Machimus arthriticus* and *Pamponerus germanicus*.

Twelve species are highly characteristic for sandy soils and can in the future thus be considered as Red List species in Flanders because their habitat is rare. An intensive sampling campaign remains however necessary for the confirmation of their assumed Red List status. As mentioned before, four species are extremely rare in Flanders and show a strong declining trend (TOMASOVIC, 1998): *A. varipes*, *A. crabroniformis*, *M. arthriticus* and *P. germanicus*. For these species we propose the status of 'critically endangered'. *Dioctria oelandica* and *E. rufibarbis* are more common than the former species, show a declining trend, but remain rare in Flanders. For these species, we propose the status of 'endangered'. With the exception of *Dioctria atricapilla* and *D. cothurnata*, all the other discussed species are bound to sandy grounds, but can still be found in numerous sites in large numbers. Because of their habitat preference (and the rarity of that habitat: oligotrophic grasslands, dry deciduous woodlands on sandy soils, dunes) we propose them as 'vulnerable' in our region. The two mentioned *Dioctria*-species are common in widespread habitats and are probably not threatened in Flanders.

Detailed analysis of the habitat preference

Interesting is the significant reaction towards the amount of bare sandy soil of *Lasiopogon cinctus* and *Philonicus albiceps*. The latter species prefers sandy places with high vegetation tussocks, a typical habitat in the coastal dunes, where it is the only species reaching high abundances. *L. cinctus* appears to be a typical species of woodland edges on sandy soils, confirming the habitat categorisation of VAN VEEN (1996) and VAN DER GOOT (1985). *Machimus cingulatus* requires the same macrohabitat as *M. atricapillus*, but seems more sensitive to grass encroachment, since it prefers short vegetation.

Coastal versus inland dunes

In general, we can conclude that the Asilid fauna in the Flemish coastal dunes is poor. In comparison to the Netherlands, species like *Antipalus varipes*, *Eutolmus rufibarbis*, *Lasiopogon cinctus*, *Asilus crabroniformis* and *Pamponerus germanicus* are absent. VERLINDEN (1982) states that extinction events due to shrub encroachment without recolonisation probably lay at the basis of this low diversity since suitable habitat is largely present. This is in our opinion only a part of the explanation and probably only true for *A. crabroniformis*, from which old records are present from the coastal dunes. The retrieval of local farmers (and their cattle) after the Second World War has probably fastened this species' extinction. The other species all prefer more forested dunes. Since this habitat was almost completely absent till the seventies, suitable habitat was historically absent, so species were never present. Now, dune forest has developed but the accompanying species have probably not been able to colonise these habitats because of their isolated distribution in inland dunes. The establishment of dune woodland should thus enhance the Asilid richness in the future, if colonization from source populations can occur.

The coastal climate can also influence the presence of Asilid flies, since certainly the phenology of the two common species is retarded with approximately one month, indicating lower temperatures during the larval development. This factor cannot influence the absence of the previous mentioned species, since they all occur in the Holland dunes (VAN VEEN, 1996), where the climate is even colder than along the Flemish coast.

Acknowledgement

The data were obtained within some insect conservation studies, founded by the Flemish administration responsible for the environment and nature conservation (AMINAL).

Literature

- DEKONINCK W., BONTE D. & GROOTAERT P. (eds), 2000. - Onderzoek naar de herstel mogelijkheden t.b.v. het behoud van de specifieke entomofauna van de landduinen in Oost-Vlaanderen. Rapport Ent.2000.05, onderzoeksopdracht AMINAL/NA/98, Universiteit Gent & K.B.I.N., 211 pp + bijlagen.
- DEKONINCK W. & GROOTAERT P., 2001. - Onderzoek naar de faunistische waarde van de autosnelweg te Waasmunster. Rapport ENT.2001.02, studieopdracht voor het ministerie van de Vlaamse Gemeenschap, 115 pp.
- GROOTAERT P., DEKONINCK W. & BONTE D., 2001. - Therevidae (Diptera) in the East-Flemish inland dunes, pioneers on sandy soils? - *Bulletin van de Belgische Entomologische Vereniging* 137: 32-35.
- TOMASOVIC G., 1995. - Notes sur les Asilidae de Belgique et des régions limitrophes (9). Raréfaction en Europe occidentale et porté disparu en Belgique : *Asilus crabroniformis* LINNÉ, 1758 (Diptera, Brachycera, Asilidae). *Bulletin et Annales de la Société royale belge d'Entomologie*, 131(2) : 245-248.
- TOMASOVIC G., 1998. - Evolution de la faune des Asilidae (Diptères Brachycères) de Belgique au cours de ce dernier siècle. *Notes faunistiques de Gembloux* 35 : 7-19.
- TOMASOVIC G. & DEKONINCK W., 2000. - Données sur la faune de Asilidae de la Flandre Orientale - *Notes faunistiques de Gembloux* 41 : 23-32.
- VAN DER GOOT V.S., 1985. - De Snavelvliegen (Rhagionidae), Roofvliegen (Asilidae) en aanverwante families van Noordwest-Europa. *Wetenschappelijke Mededelingen van de Koninklijke Nederlandse Natuurhistorische Vereniging*, 177, 66 pp.
- VAN VEEN M.P., 1996. - De Roofvliegen van Nederland. *Wetenschappelijke Mededelingen van de Koninklijke Nederlandse Natuurhistorische Vereniging*, 216: 120 pp.
- VERLINDEN L., 1982. - The Asilidae (Diptera) of Belgium and their distribution in this country. *Bulletin et Annales de la Société royale belge d'Entomologie*, 119: 177-185.
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