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Detailed distribution and faunistics of carabid beetles (Coleoptera, Carabidae) in a meadow habitat (Western Flanders)°

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Summary

A meadow at Wevelgem (Western Flanders) was sampled for Carabidae by means of pitfall trapping during the period 29.XII.83 - 24.XI.84.Our investigations proved that a high number of carabid species inhabited the moist grassland, which is also floristic very interesting. For the most abundant species, different distribution patterns could be noticed, in most cases related to variation in either light intensity or soil humidity. Furthermore, *Bembidion gilvipes* showed a seasonal migration between the shaded and open parts of the investigated habitat. Finally, several Carabidae rare for the Belgian fauna were found.

Introduction

In earlier studies, meadows have already proven to be very interesting what concerns fauna and flora (SEGERS & HUBLE, 1985). Also in carabid beetles, many species of faunistic interest have already been found in these habitats (DESENDER et al., 1984). However a very species rich plant community does not necessarily indicate the presence of rare carabid species or a great diversity of this insect group. Moreover, THIELE (1977) postulates the distribution of Carabidae to be more determined by the structure of the vegetation rather than the species composition.

In this context, we investigated the carabid beetle fauna of a meadow at Wevelgem (Western Flanders). We studied the species composition and detailed distribution, influenced by the presence or absence of canopy (cf. trees situated at the border).

Material and methods

The investigated grassland "De Keuntjes" at Wevelgem has a surface of approximately

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1/2 hectare. Nevertheless, the vegetation shows a very great diversity : more than 66 plant species have already been found. Among those, *Oenanthe fistulosa* L., *O. aquatica* (L.) POI., *Polygonum amphibium* L. and *Lychnis flos-cuculi* L. are floristic the most interesting, while *Phalaris arundinacea* L. and *Mentha aquatica* L. are the most dominant. A row of poplar trees (*Populus x canadensis* MOENCH) borders the northern edge of the meadow.

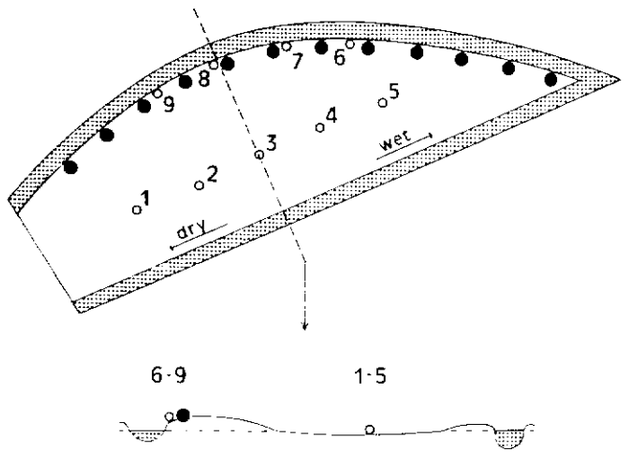

Figure 1.- The investigated meadow at Wevelgem
(●: poplar trees; o : pitfall traps; ⊞ : water surface).

The pitfall traps consist of glas jam jars (inner diameter 9 cm, depth 10 cm), filled with 10% formalin solution to which detergent is added to decrease the surface tension. Two vertical metal strips (27 cm x 7 cm) were joined at the rim in order to increase capture efficiency. These traps were emptied at fortnightly intervals during the period 29.XII.83 -24.XI.84. As a result of Winter and Spring inundation, no beetles were caught from 28.I.84 until 29.IV.84.

All carabid beetles were identified and sexed; nomenclature is according to TURIN (1981). For some species of faunistic interest, our results are compared with data on the distribution of carabids in Belgium (unpublished data).

Results and discussion

Table 1 mentions all carabid beetle species caught in the investigated habitat. Among these, *Leistus ferrugineus* and *Dromius quadrimaculatus* were gathered only by additional hand collecting.

	A	B
Acupalpus consputus (DUFTSCHMID, 1812)	6/2	1/2
Acupalpus dubius SCHILSKY, 1888	1/	-
Acupalpus flavicollis (STURM, 1825)	2/	-
Acupalpus meridianus (LINNAEUS, 1767)	/1	-
Agonum dorsale (PONTOPPIDAN, 1763)	-	7/11
Agonum fuliginosum (PANZER, 1809)	4/4	4/5
Agonum marginatum (LINNAEUS, 1758)	-	1/
Agonum moestum (DUFTSCHMID, 1812)	91/232	60/116
Agonum muelleri (HERBST, 1785)	-	2/4
Agonum nigrum DEJEAN, 1828	2/	1/1
Agonum obscurum (HERBST, 1784)	47/55	161/197
Agonum ruficorne (GOEZE, 1777)	10/8	177/193
Agonum viduum (PANZER, 1797)	3/2	2/7
Amara aenea (DE GEER, 1774)	1/	2/
Amara apricaria (PAYKULL, 1790)	-	/1
Amara communis (PANZER, 1797)	1/	14/5
Amara familiaris (DUFTSCHMID, 1812)	2/1	-
Amara lunicollis SCHIODTE, 1837	4/	2/1
Amara plebeja (GYLLENHAL, 1810)	/1	/1
Amara similata (GYLLENHAL, 1810)	-	/1
Anisodactylus binotatus (FABRICIUS, 1787)	6/3	1/11
Asaphideon flavipes (LINNAEUS, 1762)	/1	3/
Badister lacertosus STURM, 1815	-	1/
Badister unipustulatus BONELLI, 1813	3/1	1/2
Bembidion assimile GYLLENHAL, 1810	22/13	4/7
Bembidion biguttatum (FABRICIUS, 1779)	31/24	63/57
Bembidion clarki DAWSON, 1849	76/59	41/68
Bembidion dentellum (THUNBERG, 1787)	2/6	10/18
Bembidion gilvipes STURM, 1825	56/13	67/63
Bembidion guttula (FABRICIUS, 1792)	2/	4/2
Bembidion harpaloides SERVILLE, 1821	-	/1
Bembidion lampros (HERBST, 1784)	/1	5/3
Bembidion lunulatum (DUFTSCHMID, 1812)	12/4	7/3
Bembidion tetracolum SAY, 1823	4/1	12/16
Bradycellus verbasci (DUFTSCHMID, 1812)	-	1/4
Calathus melanocephalus (LINNAEUS, 1758)	/1	1/1
Clivina collaris (HERBST, 1784)	-	/1
Clivina fossor (LINNAEUS, 1758)	6/	9/3
Dromius quadrimaculatus (LINNAEUS, 1758)	-	/1
Dyschirius aeneus (DEJEAN, 1825)	1/	-
Dyschirius globosus (HERBST, 1783)	74/99	129/117
Elaphrus cupreus DUFTSCHMID, 1812	1/	-
Harpalus aeneus (FABRICIUS, 1775)	1/	-
Harpalus rufibarbis (FABRICIUS, 1792)	-	1/
Harpalus rufipes (DE GEER, 1774)	/1	1/1
Leistus ferrugineus (LINNAEUS, 1758)	-	1/
Leistus fulvibarbis DEJEAN, 1826	-	1/2
Loricera pilicornis (FABRICIUS, 1775)	1/	1/2
Nebria brevicollis (FABRICIUS, 1792)	62/47	91/77
Notiophilus biguttatus (FABRICIUS, 1779)	-	/1
Pterostichus anthracinus (ILLIGER, 1798)	201/270	191/217
Pterostichus melanarius (ILLIGER, 1798)	34/39	98/99
Pterostichus minor (GYLLENHAL, 1827)	9/14	32/41
Pterostichus nigrita (PAYKULL, 1790)	25/33	25/17
Pterostichus strenuus (PANZER, 1797)	9/7	15/21
Pterostichus vernalis (PANZER, 1796)	4/5	6/9
Stenolophus mixtus (HERBST, 1784)	1/8	2/5
Stenolophus skrimshiranus (STEPHENS, 1828)	5/1	5/2
Stenolophus teutonus (SCHRANK, 1781)	-	/1
Stomis pumicatus (PANZER, 1796)	-	14/10
Trechus obtusus ERICHSON, 1837	-	10/29
Trechus quadristriatus (SCHRANK, 1781)	1/	9/3
Trichocellus placidus (GYLLENHAL, 1827)	/1	-

Table 1.- List of carabid beetles collected by pitfall trapping and additional hand catching in the meadow "De Keuntjes" (Wevelgem) in the period 29.XII.83 - 24.XI.84 (A : number of males/females caught in the meadow; B : number of males/females caught in the edge).

On the whole, 4.540 carabid beetles were caught, belonging to 63 different species. Most abundant species are typical for eutrophic fenland and river banks. *Pterostichus anthracinus* is caught in the highest numbers, followed by *Agonum moestum*, *A. obscurum* and *Dyschirius globosus*.

In contrast to our results, GAUTSCH *et al.* (1980) found that the carabid diversity is very low in meadows, whereas it is high in crop fields.

1. Distribution patterns over the different traps

The carabid beetle fauna of the edge consists of more species as compared to the carabids collected in the meadow (meadow : 46 sp., edge : 53 sp.). As pointed out by GERSDORF (1965) and THIELE (1964), several eurytopic woodland species can be found in these habitats : *Leistus fulvibarbis, Notiophilus biguttatus* and *Stomis pumicatus*.

Besides the former species a number of other Carabids was collected in relatively low numbers only in the shaded site (e.g. *Agonum dorsale*, *Trechus obtusus*). Different factors must be responsible for the occurrence of these carabid beetles in this site, since they are very rarely found together elsewhere : *A. dorsale* is typical for dry arable land, while *T. obtusus* can be found in high numbers in rather moist places with a well developed litter layer. Furthermore, the latter species seems to prefer a dense canopy of trees (POLLARD, 1968) or a dense vegetation of grasses and sedges (DESENDER *et al.*, 1980).

Consequently, *A. dorsale* and some other xerophilic or euryhygric species (*Amara* sp., *Pterostichus melanarius* and *P. strenuus*) most probably originate from surrounding ruderal sites and cultivated fields, which are only present near the northern edge of the hayfield. This could be the reason why they were only found in relatively high numbers in pitfall traps 6 - 9.

In the most abundant species, different distribution patterns are noticed (fig. 2). *Agonum ruficorne, A. obscurum, Pterostichus melanarius, P. minor, Bembidion biguttatum* and *B. gilvipes* show a more or less pronounced preference for the shaded places in the hayfield habitat (pitfall 6, 7, 8 and 9). In literature however, only *A. obscurum* and *P. minor* seem to be mentioned to prefer a rather low light intensity and therefore occur mainly in meadow forests (LINDROTH, 1945, 1974). Although the other species do not seem to avoid shaded places, *A. ruficorne* and *P. melanarius* mostly occur in open areas. Moreover, since DESENDER *et al.*(1984) proved *P. melanarius* to show a significantly positive response for drier grassland types, the high numbers of this species, caught in pitfalls 6 - 9, can probably be explained by the drier microclimatological conditions in this part of the hayfield (see fig. 1).

Both *Bembidion biguttatum* and *B. gilvipes* show a double ecological preference : they can be found either in rather moist forests or on river banks. In our investigations, these species were indeed caught in the highest number in the most shaded places, immediately near open water.

Not a single carabid beetle species shows a distinct preference for the open part of the hayfield, although *Agonum moestum* was gathered in slightly higher numbers in pitfalls 1 - 5, compared with the results for pitfall traps 6 - 9.

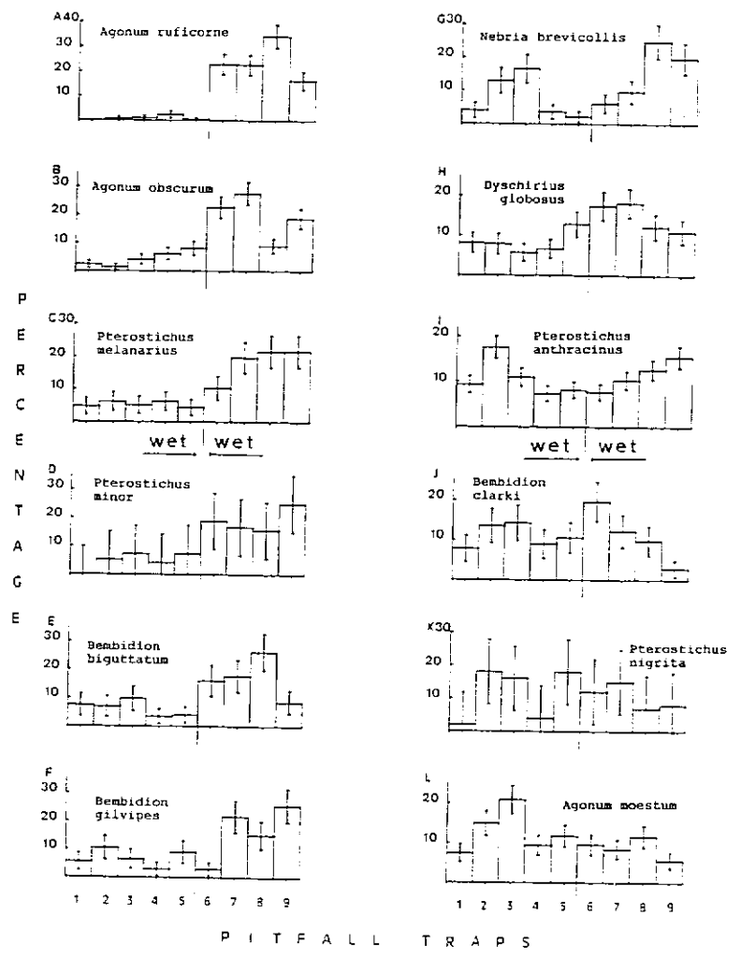

Figure 2.- Distribution patterns of the most abundant Carabids over the different traps. expressed as the percentage (± 95 % c.l.) of the total number of beetles collected : A. *Agonum ruficorne* (n : 388), B. *Agonum obscurum* (n : 460), C. *Pterostichus melanarius* (n : 270), D. *Pterostichus minor* (n : 96), E. *Bembidion biguttatum* (n : 175), F. *Bembidion gilvipes* (n : 199), G. *Nebria brevicollis* (n : 277), H. *Dyschirius globosus* (n : 419), I. *Pterostichus anthracinus* (n : 879), J. *Bembidion clarki* (n : 244), K. *Pterostichus nigrita* (n : 100) and L. *Agonum moestum* (n : 499).

Besides a response to light intensity, in some species a response to soil humidity could also be the explanation for the pitfall trap catches. In this context, *Dyschirius globosus* appears to prefer the most wet places, while *Nebria brevicollis* and to a lesser extend *Pterostichus anthracinus* were most abundant in the somewhat drier area. For the two latter species, this is in agreement with the findings of DESENDER *et al.*(1984).

Finally, *Bembidion clarki* shows a very pronounced preference for lower soil humidity only in the canopied area.

In *Bembidion gilvipes* a seasonal migration occurs between the shaded site and the open hayfield. From figure 3 it can be concluded that this small Carabid species hibernates in the shaded area (especially at the base of the trees) where inundation during Winter and Spring occurs indeed only briefly.

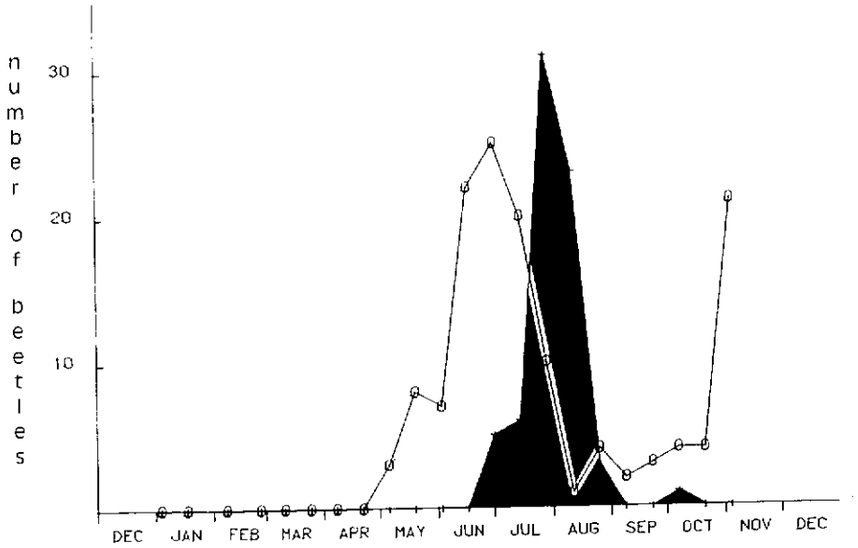

Figure 3.- Occurrence of *Bembidion gilvipes* in the meadow (pitfall traps 1 - 5; -+-; black) and the edge (pitfall traps 6 - 9; -e-; white).

Since the presence of a well developed sod layer proved to be essential for hibernation of carabids in agricultural land (DESENDER *et al.*, 1981; DESENDER, 1982), the more developed litter layer beneath the trees could also be of some importance for hibernation of this species.

2. Carabid species with special faunistic interest

Among the carabid beetles collected, some species, rare for the Belgian fauna, were noticed :

* *Bembidion clarki* (collected : 117 males, 127 females) : This species is known from only seven other localities in the western part of our country (fig. 4). Remarkable is the fact that the species is more frequently found from 1950 onwards. Most of these captures however are very recent and were done by the authors themselves. This dimorphic carabid beetle species has an Atlantic distribution (FREUDE *et al.*, 1976), explaining its restricted occurrence in Belgium. It is found in north western Europe (FREUDE *et al.*, 1976). According to JEANNEL (1941), in France *B. clarki* occurs only in the northern parts. *B. clarki* prefers river banks and rather moist places in forests, where it is found among dead leaves and mosses or at the border of ponds (JEANNEL, 1942; LINDROTH, 1945, 1974). In Belgium it is mainly found in rather wet poplar plantations. At the investigated site this rare species appeared to be one of the most abundant Carabidae, and the most numerously found species of the genus *Bembidion*.

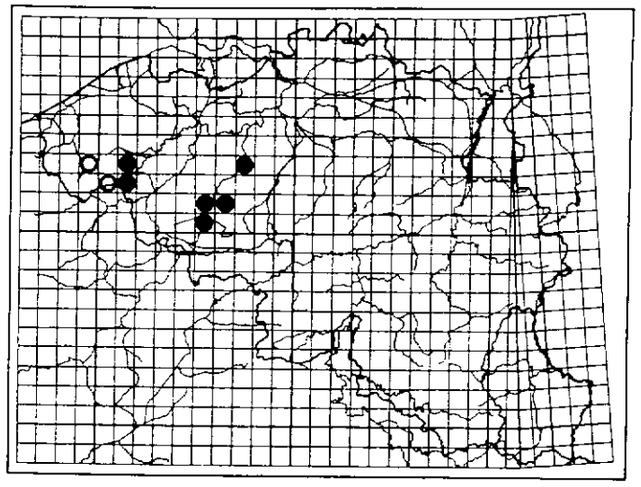

Figure 4.- Distribution of *Bembidion clarki* in Belgium (UTM grid: ○: data before 1950; ●: data from 1950 onwards; ■: data from both time periods).

* *Stenolophus skrimshiranus* (collected : 10 males, 3 females) : Has been recorded from 24 localities in Belgium. This species is on the decline since it has been found only 7 times from 1950 onwards. Although this macropterous species does not seem to have an Atlantic distribution, it is mainly found in the western part of our country (fig. 5). Furthermore, it occurs all over France and Corsica (JEANNEL, 1942). *S. skrimshiranus* shows a pronounced preference for fenland, where it is often found in association with the related species *S. mixtus*. Everywhere it is called rare or even endangered (FREUDE *et al.*, 1976; LINDROTH, 1945, 1974; TRAUTNER *et al.*, 1984).

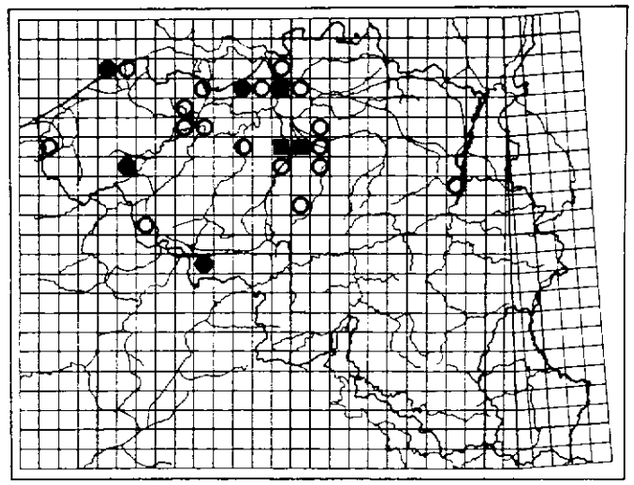

Figure 5.- Distribution of *Stenolophus skrimshiranus* in Belgium (UTM grid; ○ : data before 1950; ● : data from 1950 onwards; ■ : data from both time periods).

Some other Carabids are also of faunistic interest :

- *Agonum nigrum* : has an Atlantic distribution and mainly occurs in marshy sites, often on river banks; known from 32 UTM squares in Belgium.
- *Badister unipustulatus* : occurs on the borders of ponds, in forests among dead leaves and mosses. Local and rare everywhere in Europe; known from 33 UTM squares in Belgium.
- *Trichocellus placidus* : a hygrophilic species from grasslands and deciduous forests; also often found in fenland. Known from 26 UTM squares in Belgium.

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