

A preliminary analysis of the forest floor spiders of Flanders (Belgium)

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Summary

A comparison is made between the spider faunas of different woodland habitats sampled with pitfall traps in Flanders (Belgium). The results of our analysis are preliminary because only 37 forest stands have been incorporated in it. From the analysis we can conclude that the composition of the spider community of a given forest stand is also dependent on the surrounding habitats. Therefore forest stands embedded in diversified complexes with an intermingling of different opens and woodlands habitats have a richer spider fauna.

Résumé

Les faunes aranéologiques de différents habitats forestiers situés en Flandre sont échantillonnées à l'aide de pièges Barber et sont comparées. Les résultats obtenus ne sont que préliminaires car seulement 37 lots forestiers sont incorporés dans l'analyse. Nous pouvons conclure à partir de notre analyse que la composition de la communauté d'araignées d'un lot précis est également dépendant des habitats voisins. C'est pour cette raison que des lots forestiers situés dans un éco-complexé constitué d'un mélange d'habitats ouverts ou forestiers ont une faune plus riche en araignées.

Introduction

The purpose of this communication is to discuss the results obtained thus far in our analysis of the spider communities occurring on the soil surface of woodland habitats of Flanders. Flanders is the northern part of Belgium. Generally speaking altitude above sea level increases from north to south and from west to east but never exceeds 200 m. The forest cover of the region is very low, only some 9%. The wooded area consists of highly scattered small patches. For the moment governmental plans are being developed to integrate the highly dispersed and small remaining natural areas of the region into larger entities. Our contribution fits within that general context.

Material and methods ; study sites

The results of our analysis are preliminary because only 37 forest stands have been incorporated in it. For each stand we used the numbers of individuals caught per species in three pitfall traps (0.95 m, half-filled with a fixative), which were placed in the centre of each stand. They were operated during a complete year cycle. The sampled woodlots had a surface of one to some tenths of a hectare. They are part of several complexes which can be characterized as follows.

- The forest of Zoniën. This is by far the largest complex we sampled. It is a big area of approximately 4300 ha in the immediate vicinity of Brussels. Due to historical reasons it has always been under forest. After a heavily exploitation during the wars of the 16th and 17th century, the area was massively reafforested with beech by the Austrian Regime during the 18th century. This resulted in a tradition of beech monoculture and even in the present day the forest is very homogeneously made up of beech stands (for more than 80 %). Sixteen different stands were sampled here differing from each other in soil wetness, soil compaction, litter breakdown, composition of tree, scrub and herb layer (ZOA, ZOB, ZOC, ZOD, ZOE, ZOF, ZOG, ZOH, ZOI, ZOJ, ZOK, ZOL, ZOM, ZON, ZOO, ZOP).

Also incorporated in the data set were the samplings made in five small forest complexes : three near Ghent, two more to the West :

- The Hutsepotbos is a small forest on loamy sand of some 30 ha near Ghent. It is mainly made up of 100 year old beech. It is surrounded by roads and agricultural land, mainly pastures. Here we sampled a beech stand, a coppiced woodlot and a small stand of larch (HUA, HUB, HUC).

- The Aelmoeseneiebos is mixed deciduous forest dominated by oak on sandy loam of some 30 ha also in the vicinity of Ghent. The dominant tree species in the stand we sampled was however beech, subdominant were oak and larch (AEA).

- The Hospicebossen is a forest complex of some 60 ha on wet sandy soil. It is almost entirely planted with coniferous trees. Here we sampled a pine and a Douglas fir stand (HOA, HOB).

- Veldegem forest is a small complex of some 10 ha near Bruges. It is a mixed forest with oak, beech and larch with a scrub and herb layer. We included one sampling station from that complex (VEA) (cfr. POLLET, 1986).

- Hannecart forest has a surface of about 30 ha. It is largely composed of a wet dune area which was some sixty years ago planted with alder. In the vicinity are wet and drydune grasslands. We had also one sampling station here (HAA).

The remaining stands we included in our analysis were situated in three medium sized complexes :

- The Walenboscomplex is an area of some 400 ha of alder carr, on the higher grounds mixed with oak and birch. It is situated to the northeast of Brussels. About half of the area has been planted with Canadian poplar and drainage even made here and there pine plantations possible. Samplings of four stands were included in the analysis (TIPS, 1978) : Canadian poplar with coppiced woodland as undergrowth, a larch plantation, an alder carr and a Canadian poplar stand (WAA, WAB, WAC, WAD).

- Wijnendaele forest is a forest complex on sandy loam. It has a size of 175 ha. Many kinds of coniferous and deciduous, wet and dry stands are intermingled. Six stands were sampled (POLLET & HUBLE, 1987) : two poplar stands, an oak, an oak mixed with poplar and beech, a larch and a pine stand (WIA, WIB, WIC, WID, WIE, WIF).

- Another complex close to Bruges is Bulskampveld. It has a surface of about 300 ha. In the 18th century it was covered with heathland, fens and oak-birch woodland. The area was afforested during the 19th century especially with pine trees. At present, it is a complex of different types of deciduous, coniferous and mixed woodland and small heathland relicts. Three stands were included from that forest (ALDERWEIRELD *et al.*, 1989) : a Douglas fir, an oak mixed with beech and a pine stand (BUA, BUB, BUC).

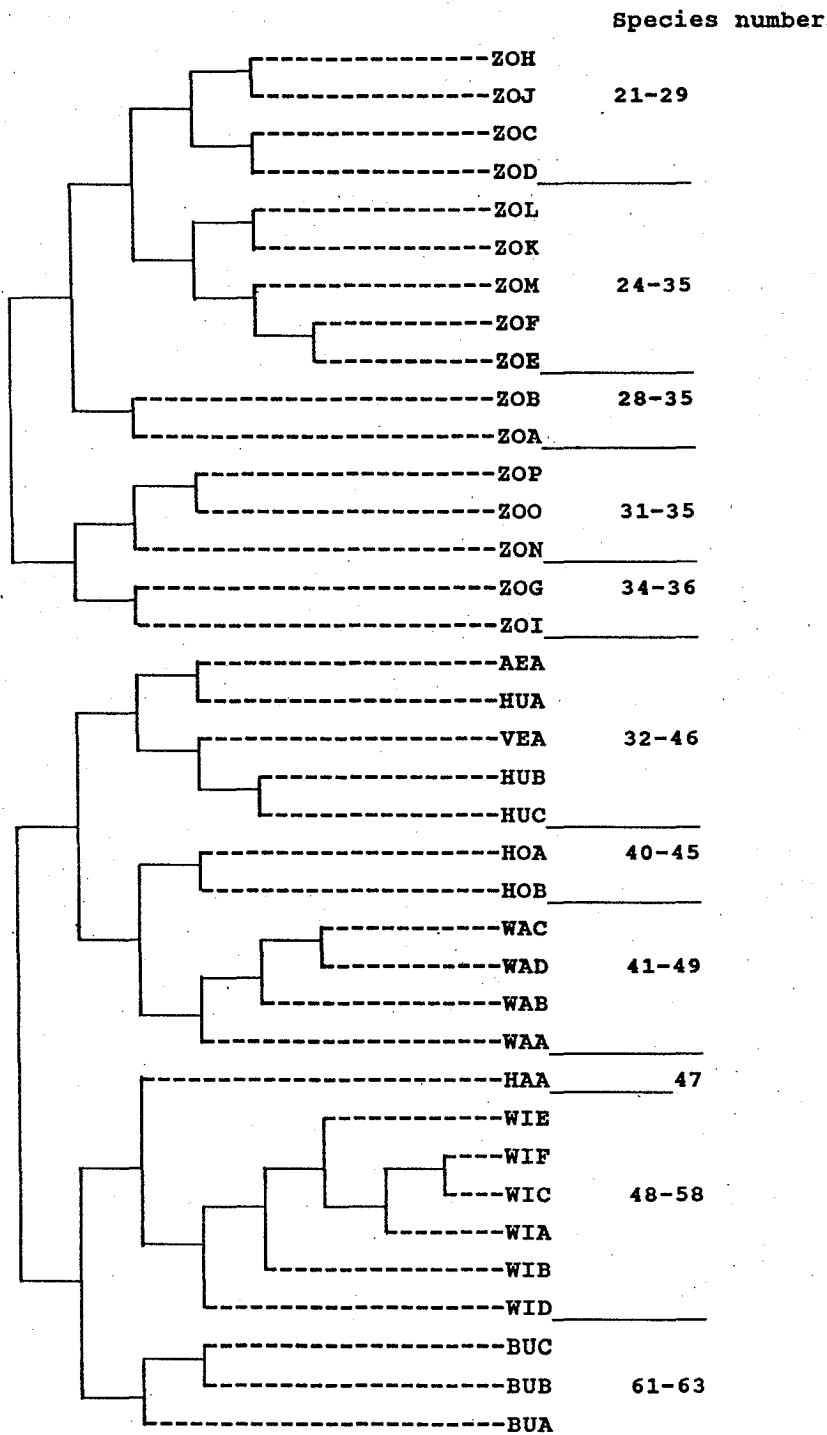
Results and discussion

Of the total number of 86 species, 73 can be called abundant : they were caught in a total number larger than the number of sampling stations, i.e in a total number larger than 37.

In order to avoid influences of differences in activity between the involved species, each species was given equal weight. This was done by transforming the catch per sampled habitat as a percentage of the total catch of the species.

As a first step in our analysis we performed a detrended correspondence analysis (HILL, 1979a). This resulted in an ordination which was not interpretable in terms of variation caused by environmental factors measured or observed in each of these stands. At first sight this surprised us, because the same analysis applied to the captures of different stands of one and the same woodland complex resulted in quite easily interpretable ordinations, like for instance a separation along the first axis between wet and dry stands and a separation of stands with a thin litter layer and a mor humus along the second axis. For the complete set we got three about equally important axes along which we got a separation of the different forest complexes rather than a separation of stands with comparable values for particular environmental factors:

Fig. 1 : Dendrogram of the sampling stations resulting from a TWINSPAN-analysis. The codes are explained in the text. Also indicated are the ranges of the number of species caught per group of sampling stations.



This can also be seen in the dendrogram resulting from a Twinspan analysis (HILL, 1979b) : Fig. 1. This clearly shows the overriding importance of the complex of which a stand is part of in the determination of its spider fauna. For instance coniferous stands with a thick litter layer are more similar to a deciduous stand with a thin litter layer of the same forest complex than to a comparable coniferous stand of another complex. For each group of sampling stations we also indicated in Fig.1 the range of the number of species caught per sampling station. We see that the sampling stations of the Zoniën forest have the lowest numbers of species. This number increases somewhat going from the closed to the open stands. The numbers of species are higher for the small forest complexes and clearly larger for the complexes of some hundred hectares. There is no relation between the size of a forest complex and the number of species found in any of its particular stands.

This result can be explained if we assume that the spider fauna of a particular stand is not only determined by the environmental conditions prevailing in it but is also highly influenced by the larger surroundings. The richer spider fauna of stands in small woodlots could be caused by the penetration and colonization of species having their optimal habitats in the surrounding open biotopes. Stands of large and diverse forest complexes like the ones near Bruges would also be enriched by species of nearby forest stands of other types or by species of nearby open habitats. This interpretation can be checked by looking for example at the species which make the difference between the stands of the Zoniën forest on the one hand and the 21 other stands on the other hand.

Species which only occur in the Zoniën forest and not in the other stands are *Cælotes inermis* and *Walckenaeria corniculans*. *Cælotes inermis* is found in quite a range of forest habitats in the southern part of Belgium. It is not found in Great Britain. In Flanders it is only sporadically found. We therefore think the reason for not being found in the 21 non-Zoniën stands to be zoogeographical, the species attaining the northwestern limits of its distribution in our country. *Walckenaeria cornicularia* is also a species which seems to be limited to woodlands of the more southern part of Belgium.

The list of species not occurring in the Zoniën forest but in one or several of the 21 other stands is as could be expected much longer : *Clubiona pallidula*, *Hahnia helveola*, *Hahnia nava*, *Hahnia pusilla*, *Pachygnatha clercki*, *Dicymbium nigrum*, *Erigonella hiemalis*, *Gonatium rubellum*, *Gongylidium rufipes*, *Minyroilus pusillus*, *Oedothorax retusus*, *Pocadicnemis pumila*, *Saloca diceros*, *Troxochrus scabriculus*, *Walckenaeria cuspidata*, *Walckenaeria dysderoides*, *Walckenaeria obtusa*, *Agyneta conigera*, *Agyneta ramosa*, *Agyneta subtilis*, *Meioneta saxatilis*, *Sintula cornigera*.

We will discuss some examples.

- *Hahnia nava* is a species which is usually found in wet open vegetation on sandy soils and not in woods. In one of the larger complexes near Bruges it was however caught in large numbers in each of the three sampled stands.

- *Pachygnatha clercki* is a species of not too dry open habitats. It was found in a lot of our 21 woodlands, sometimes in quite large numbers.

- *Dicymbium nigrum*. This aeronautic species of open wet habitat was found in large numbers in a coppiced woodland and a stand of larch of one of the small complexes near Ghent and also in the alder woodland complex of the dunes.

- *Erigonella hiemalis* and *Minyroilus pusillus* are two species bound to wet woodland conditions with a well developed moss layer. Both species were abundantly present in a wet Douglas fir stand of one of the complexes near Bruges. They also occur but in lower numbers in wet deciduous stands of the same complexes.

- *Edothorax retusus* is a species which has its optimal habitat in pasture-like habitats. It was found in high numbers in a coppiced woodland near Ghent and in small numbers in several other stands.

- Also very abundant in that coppiced woodland was *Troxochrus scabriculus*, also a species of open country which is often found in higher vegetation on sandy soils.

- *Saloco diceros* is a rare species in our country. It is typical of wet deciduous litter. It was present in all stands of one of the forest complexes near Bruges.

- *Walckenaeria dysderoides* is also a rare species. It is typical for open heathland with well developed moss carpets and for wet coniferous forest. It was found in all stands of the two complexes near Bruges.

- *Agyneta ramosa* is also rare. It is found in open marshy situations with a thick moss layer, for example some dune marshes. It was found in the majority of the stands near Bruges.

- *Meioneta saxatilis* is a species of open country where it occurs in wet rough vegetation. In our woodlands it is also found in several stands with a well developed litter layer.

- *Sintula cornigera* typically occurs in wet heathland and sphagnum bogs. It was caught in several of the stands near Bruges.

Conclusions

- The results presented here show that the composition of the spider community of a given forest stand cannot be understood solely by considering the abiotic environment and the vegetation of the site itself. Possible intrusion of species from nearby habitats should be taken into account.

- Forest stands embedded in diversified complexes with an intermingling of different open and woodland habitat types have a

richer spider fauna. Conservation and development of such diversified larger entities should be endeavoured by nature conservation and forestry authorities.

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