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## **Hydrology, vegetation structure and spider fauna of the Buitengoor, a small wet heathland area in the northern part of Belgium**

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### **RIASSUNTO**

Viene rappresentata la fauna araneologica di una piccola brughiera umida relictta nel Belgio settentrionale in relazione all'idrologia ed alla struttura della vegetazione dell'area.

Sembra che i ragni della regione paludosa aperta siano di maggiore interesse faunistico rispetto all'area paludosa boscata.

La maggiore diversità della zona aperta sembra risultare dalla elevata variazione strutturale della vegetazione e della lettiera esistente in quest'habitat.

Sono state infine ottenute diverse indicazioni in favore di una notevole differenza nella produttività di entrambi gli habitats.

Parole chiave: Ragni, Indicatori ecologici, Conservazione della Natura, Brughiera umida.

### **SUMMARY**

We investigated the spider fauna of a small wet heathland relict in the north of Belgium.

This was done in relation to the hydrology and the vegetation structure of the area. It appeared that the spider fauna of the open marshland had a greater faunal interest than the fauna of the marshy woodland of the area.

The diversity of the spider fauna of the open marshland can be seen as resulting from the high structural variation of the vegetation and the litter occurring in that habitat.

We also found several indications for a pronounced difference in productivity of both habitats.

Key words: Spiders, Ecological indicators, Nature conservation, Wet heathland.

## *Introduction*

During recent years we investigated several habitat types for their spider and/or carabid fauna and how these relate to vegetation structure and nature conservation management (e.g. MAELFAIT *et al.*, 1989, 1990, 1992, 1992). The aim of the present communication is to do this for the spider fauna of a wet heathland habitat.

### *Study area*

Our study area, the Buitengoor (51°13' N, 5°10'30" E), is situated in the northern part of Belgium in a region called the Campine. This part of the country is characterized by its poor sandy soils. From the second half of that century, a policy, aimed at the reclamation of wasteland resulted in a large-scale transformation into pine forest. The construction of canals connecting the Meuse with the Scheldt estuary, allowed the irrigation of large areas of heathland with the calcareous water of the Meuse, converting these into meadows. Later on, the use of fertilizers, coal mining and industrialisation changed the region even more drastically. Relatively important is glass industry, based on the pure sands (without any calcium minerals) of Mol, occurring in the vicinity of our study area. Sand quarries resulted in deep artificial lakes, which are now part of holiday resorts surrounding the Buitengoor.

Although there are some larger heathland areas in the Campine region, most of the remaining natural and semi-natural habitats are small, isolated remnants. This also goes through for our study area which has a surface of only some 25 hectares.

The hydrology and the vegetation of the site are described in detail in BOEYE (1992). Hereafter, we summarise these findings. The Buitengoor is a depression situated at the western slope of the Campine plateau. This leads to the discharge of nutrient poor groundwater resulting at the lower end of the depression in a small rivulet, the Vleminkloop. This is the natural hydrological situation of the site: it is the source area of a Campine rivulet. Because the upwelling groundwater is very poor in nutrients, the site in its natural situation would be covered by a vegetation adapted to nutrient poor conditions: an acidophilous or a poor fen vegetation. The presence of a small irrigation canal at the eastern side of the area, however, complicates the situation. As has been shown by the ecohydrological studies mentioned above, lime and nutrient rich water gets through the bottom of that canal in the aquifer of the Buitengoor.

Due to chemical reactions, taking place during the passage of that water through the soil, the nitrates and phosphates do not reach the soil surface. Until now, there is only an upwelling of lime enriched groundwater in particular zones of the area. This causes patches of calcicolous or rich fen vegetation.

The area is composed of three different vegetation zones, each covering up about one third of the total surface:

- pine plantations on the higher grounds surrounding the marshland
- marshy woodland dominated by alder trees in the lowest parts of the area.
- *Molinia* with in the depressions, between the hummocks, depending on the quality of the upwelling groundwater, poor or rich fen vegetation.

#### *Material and methods*

During a complete year cycle, fifteen pitfall traps were operative:

- three in the alder woodland.
- six in a zone of the open marshland with an upwelling of acid groundwater, three of which on top of *Molinia* hummocks and three in the depressions between the hummocks. Typical for these depressions are the carpets of *Sphagnum* mosses.
- six traps in a lime enriched part of the open marshland, also three on the hummocks and three in the depression.

On the basis of the material gathered in this way, we first compare the fauna of the woodland with that of open marshland as a whole. Then, we give the results of a comparison we made between the microhabitats we sampled in the open marshland. Finally we mention, but do not discuss in detail, what we found concerning the size difference between the population of *Pirata hygrophilus* occurring in the woodland, and the population of that species occurring in the open marshland.

## *Results and discussion*

In all fifteen traps taken together 2399 adult spiders were caught belonging to 103 species of which several are very rare in our country. This again illustrates the high species richness of spider faunas of heathland habitats (c.f. JOCQUÉ, 1985; MAELFAIT *et al.*, 1990).

### *Comparison of the fauna of the woodland with that of the open marshland*

Of the 2399 adult individuals we caught 1485 comprising 48 species were captured in the woodland and 914 with 82 species in the open marsh area. So, almost four times more spiders per unit of sampling effort were caught in the woodland than in the open marshland. This is a first indication that the woodland is a more productive habitat than the other.

By means of Mann-Whitney U-tests we inspected which species showed a significant preference for one of the two habitats. Of the species showing such a preference, there is only one species occurring in both habitats in fairly high numbers: *Pirata hygrophilus*. It was, however, a significant preference for the woodland. Other species with a significant preference for the woodland are (here and in the following list we have asterisked the species which are rare in our country): *Pachygnatha listeri*, *Centromerus sylvaticus*, *Oedothorax gibbosus*\*, *Micrargus herbigradus*, *Pachygnatha clercki*, *Lepthyphantes zimmermanni*, *Macrargus rufus*, *Robertus lividus*, *Microneta viaria*, *Neriene clathrata*, *Bathyphantes aproximatus* and *Agroeca brunnea*. A significant preference for the open marshland is shown by the following species: *Hygrolycosa rubrofasciata*\*, *Trochosa spinipalpis*\*, *T. terricola*, *Pirata latitans* and *Pardosa sphagnicola*\*.

In the list of species with a significant preference for the woodland we may recognize two categories:

- 1°) species which are almost exclusively found in woodlands in our country: *Pachygnatha listeri*, *Lepthyphantes zimmermanni*, *Macrargus rufus*, *Neriene clathrata* and *Agroeca brunnea*.
- 2°) the remaining species of that group; these are species which are also often found in open habitats.

With the exception of *Oedothorax gibbosus*, all these species are not rare at all. At first sight, it is surprising that these species are not encountered in the open marshland of our study area. To our experience, however, these species occur in open habitats which are more productive than the open marshland of the Buitengoor. That is a second indication that the woodland soil with its well developed herb layer is a more productive environment for spiders than the soil of the open marshland. Of the five species with a significant preference for the open marshland three are quite rare in our region. These results lead us to the conclusion that the open marshland contains a much more interesting spider fauna than the woodland. It should, therefore, be kept open and that by cutting saplings of trees and, in doing so, preventing that the open area would be overgrown by woody vegetation.

#### *Comparison of the sampled microhabitats we sampled of the open marshy area*

For the twenty most abundantly caught species, we did a number of Mann-Whitney U-tests, comparing the numbers caught in the pitfall traps operative in respectively: hummocks versus depressions, acid environment versus lime rich environment, acid depression versus remaining others, acid hummocks versus the rest, lime rich depressions versus the rest and hummocks in lime rich environment versus the rest.

Of these more abundantly caught species, there are eight without a statistically discernible preference for one of the tested contrasts. Three of them are rare in our country: *Trochosa spinipalpis*, and especially: *Drassyllus lutetianus* and *Walckenaeria alticeps*.

We find a preference for the hummocks for: *Walckenaeria atrotrialis*, *Walckenaeria nudipalpis*, *Centromerus dilutus* and for the quite rare *Hygrolycosa rubrofasciata*. A reverse preference is displayed by the also very rare wolf spider *Pardosa sphagnicola*.

A preference for the environment with an upwelling of acid groundwater is shown by *Pirata uliginosus*. This is also a rare species in our country. It can also be found in other not too dry heathland habitats (MAELFAIT *et al.*, 1990).

A preference for the acid depressions is shown by *Dolomedes fimbriatus*, a species only known from very few localities in Belgium.

There are no species only preferring or only avoiding the hummocks in the acid environment.

Not any species is significantly more occurring on the hummocks in the lime enriched environment. Two rather common *Pirata* species occur there in significantly lower numbers: *Pirata latitans* and *Pirata hygrophilus*. We suspect this is because of the relative dryness of that microhabitat.

The lime rich depression seems to be quite differentiating. This is shown by the preference for that microhabitat displayed by three abundantly caught species: *Erigone atra*, *Tallusia experta* and *Pirata tenuitarsis*. It is confirmed by the observation that the only species of the less abundantly caught ones showing a significant preference or avoidance do that for the lime rich depression: *Hahnia montana* is significantly avoiding that microhabitat, while four other species are significantly preferring it; these four species are: *Drassyllus praeficus*, *Erigone dentipalpis*, *Lophomma punctatum* and *Trichopterna thorelli*. The lime rich depressions thus seem to be important for the presence in the open marshland of the ubiquitous species *Erigone atra* and *Erigone dentipalpis* and for the also rather widely distributed species *Tallusia experta* and *Lophomma punctatum*. These species are known to occur in situations with bare ground, that is in places without a closed vegetation cover and without litter accumulation, like for instance arable land and intensively grazed pastures (MAELFAIT & DE KEER, 1990; MAELFAIT *et al.*, 1992). The same preference is also observed for *Pirata tenuitarsis*, a rare species which has also been found in large numbers in the frequently inundating border zone of a fen (JOCQUÉ, 1985). The same habitat preference seems to go through for the other rare species: *Drassyllus praeficus* and *Trichopterna thorelli*. This is probably brought about by the Calcium rich water causing the destruction of the *Sphagnum* carpets and in this way creating patches of bare soil.

We can conclude that the high species diversity of the open marshland is caused by vertical (hummocks/depressions) and horizontal (acid/lime rich) variations in habitat characteristics of importance for spiders: vegetation and litter structure. The upwelling of lime enriched groundwater in the Buitengoor thus creates an interesting microhabitat for spiders. It should be taken care of however that this lime rich upwelling does not affect the whole of the open marshland. This would, indeed, lead to the loss of other interesting species bound to acid soil conditions like for instance *Dolomedes fimbriatus*.

### *Size difference of two Pirata hygrophilus populations*

We observed a pronounced difference between the size of the *Pirata hygrophilus* specimens we collected in the woodland and those we caught in the open marshland habitats. Those caught in the woodland are quite distinctly larger (mean carapace width in micrometer unit of  $0.02 \text{ mm} \pm 95\% \text{ C.I.}: 107.6 \pm 2.0$  for males,  $107.7 \pm 2.0$  for females) than the ones we collected in the open area ( $100.0 \pm 2.0$  for males,  $102.6 \pm 2.0$  for females). This is a phenomenon which has been observed before (JOCQUÉ, 1981; VOLIRATH, 1988). It can be interpreted as a third indication for the higher productivity of the woodland soil in comparison with the soil of the open marshland.

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### REFERENCES

- BOEYE D., 1992 - *Hydrologie, hydrochemie en ecologie van ee grondwaterafhankelijke ven*. Unpublished Ph. D. University of Antwerp.
- JOCQUÉ R., 1981 - *On reduced size of spiders from marginal habitats*. *Oecologia* (Berl.), **33**: 404-408.
- JOCQUÉ R., 1986 - *Étude de l'aranéofaune d'un gradient d'humidité dans une bruyère campenoise (Belgique)*. *Mém. Soc. r. Belge Ent.*, **33**: 93-106.
- MAELFAIT J.-P., DESENDER K. & BAERT L., 1989 - *Some examples of the practical use of spiders as ecological indicators*. *Proceedings Symposium 'Invertebrates of Belgium'*, Brussels, 1989: 437-442.
- MAELFAIT J.-P. & DE KEER R., 1990 - *The border zone of an intensively grazed pasture as a corridor for spiders (Araneae)*. *Biological Conservation*, **54**: 223-238.
- MAELFAIT J.-P., JOCQUÉ R., BAERT L. & DESENDER K., 1990 - *Heathland management and spiders*. *Acta Zool. Fennica*, **190**: 261-266.

MAELFAIT J.-P., DESENDER K., POLLET M., SEGERS H. & BAERT L., 1992 - *Carabid beetle and spider communities of Belgian forest stands*. Proceedings of the 4th ECE/XIII, SIEEC, Gödöllő, 1991: 187-194.

MAELFAIT J.-P., POLLET M. & JANSSEN N., 1992 - *Spiders of marshland habitats in the north of East Flanders (Belgium)*. Proceedings of the 4th ECE/XIII, SIEEC, Gödöllő, 1991: 195-200.

VOLLRATH F., 1988 - *Spider growth as an indicator of habitat quality*. Bull. Br. arachnol. Soc., 7(7): 217-219.