

Epigaeic spiders (Araneae) from three habitats at Stryn, Nordfjord, Western Norway

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One year of pitfall sampling in (A) a narrow strip of vegetation (junipers, *Rosa* sp., small pines) close to a river bank, (B) a cultivated medium humid meadow and (C) a humid deciduous forest (*Alnus*) with some grass on the ground collected a total of 25, 48 and 32 species, respectively (in total 67 species). Shannon indices of general diversity ($\ln e$) were 1.8, 2.1 and 3.1, respectively. The three sites shared only 9 species, 57% of all species were found in only one locality. Similarity indices were low, especially between loc. A and C. Linyphiidae and Lycosidae were dominant. The latter were scarce in loc. B and C but common at loc. A (*Pardosa palustris* and *P. amentata* together comprising 43.5% of total) and net building species more scarce. The local distribution, co-existence, ecological and habitat preferences, seasonal activity and body size of some common species are briefly discussed. For some species, aspects of geographical distribution are discussed.

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INTRODUCTION

A list of species from inner areas of Sogn (partly at high altitudes) has been published (Kauri 1966). In Hordaland, there are several records (see Hauge 1989), from both high mountain areas (Hauge et al. 1978; Hauge, Kauri & Solhøy 1998; Hauge & Ottesen in prep.) and coastal areas (Andersen et al. 1980; Hauge 1989; Hauge et al. 1991). Otherwise, the west Norwegian spider fauna north of Sognefjord is very poorly known, especially in inland districts. Here, the climate becomes more continental (more like in south-eastern Norway), along the fjord, the winters being colder with more snow and the summers drier and warmer. For the first time we here present a substantial collection of spiders from the inner lowland areas of a typical fjord.

SAMPLING AREA AND METHODS

Nordfjord is one of the longest west Norwegian fjords. Stryn community is situated in its innermost part (Figure 1). Three sampling sites were chosen on the farm Bruvoll close to the small village of Olden:

Loc. A. Close to the bank of the Oldenelva river, approximately 3 m a.s.l., a narrow strip of land with dry ground covered with gravels, mosses (scarce), some small junipers, *Rosa* sp. and small pines. The locality was inundated for a short period in July.

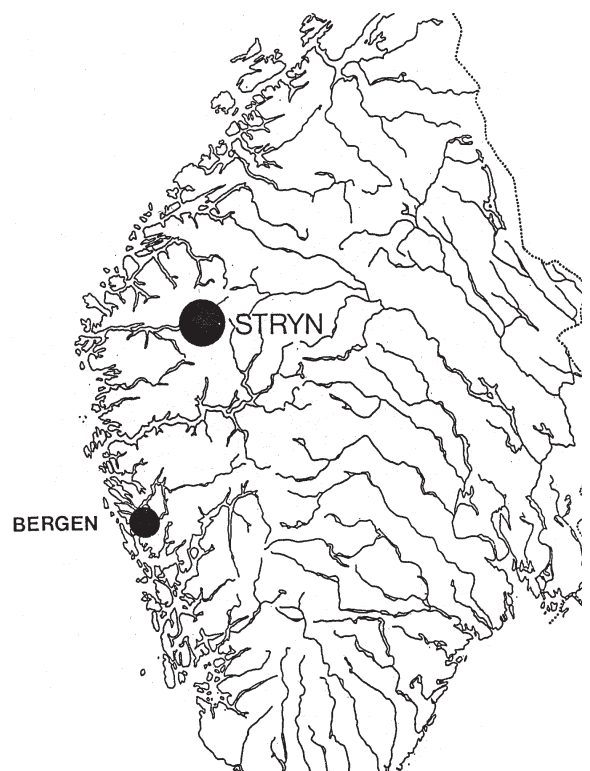


Figure 1
Stryn community, Nordfjord, western Norway.

Loc. B. A cultivated medium humid grassland situated approximately 15 m a.s.l. The area was at that time mowed at the end of each summer season, and it was separated from grazing land with a fence. The row of traps was placed parallel to the fence (1 m from it).

Loc. C. A relatively humid deciduous forest (*Alnus*) with some vegetation on the ground (mostly grass), situated approximately 40 m a.s.l.

Pitfall traps (five in each locality) were used. The glass jar traps (half filled with 4% formaldehyde) (0.33 l) had an opening diameter of approximately 6 cm. Sampling was continuous from 2 April 1982 until 5 April 1983 (at loc. C until 30 April). From the start of the sampling period until 30 Nov.1982 the traps were emptied at intervals of approximately three weeks (altogether 11 trapping periods of approximately equal lengths), and then in April 1983. The nomenclature of Linyphiidae used here follows Tanasevitch (2000).

RESULTS AND DISCUSSION

The total catch, dominated by *Linyphiidae* and *Lycosidae* (Table 1), shows three rather different spider associations (especially loc. A and loc. C), as indicated by the Renkonen index, in which the dominances of the species in the catches are included (Table 2); see Wallwork (1970). The three localities shared only 9 species (13.6 %). 57% of the species were found in only one locality. The lowest number of species (25) were found in loc A, the highest number (48 species) in loc.B. The Shannon index of general diversity was lowest in loc. A, highest in loc. C (Table 1). Two lycosid and two linyphiid species dominated at loc. A, comprising altogether 88.0% of the total. Net-builders were dominating at loc. B and C only.

The river bank (Loc. A)

Lycosidae

The number of net building species was low, and the number of cursorial species (mostly *Lycosidae*) relatively high. Among the latter, *Pardosa amentata* and *P. palustris* dominated, representing 44% of total (Table 1). The former was absent elsewhere, the latter present (but scarce) also at loc. B (Table 1). Seasonally the two species overlapped to some extent: Active males of *P. amentata* from early May until about mid July (peak in early May/mid June), *P. palustris* starting activity about a fortnight later (males from mid May to July, peak in June).

Most reports on *P. amentata* indicate a preference for relatively humid places (perhaps also with some shelter), while *P. palustris* prefers more open and somewhat drier habitats. The presence of *P. sphagnicola*, *P. pullata* and *Pirata piraticus* indicates humid

conditions, while the forest species *Pardosa lugubris* perhaps finds some shelter here. Species leakage from the surrounding also seems possible.

On the west Norwegian coast (in heathland and grass meadows) *P. palustris* is rather local in occurrence but sometimes abundant when present (Hauge et al.1991, Hauge et al. in prep.), while *P. amentata* has not been trapped. The dominating lycosids in these coastal habitats were *P. pullata* and *P. nigriceps*. In the present material (Table 1) they were scarce (*P. pullata*) or absent (*P. nigriceps*). Both species, in particular *P. nigriceps*, seem to have their main distribution in areas not too far from the coast in southern Norway (Tams-Lyche 1940, Hauge unpublished). Their northern limit of distribution in Norway is (to our knowledge) at present at about northern Trøndelag/southern Nordland (Hauge 1989). Neither of them have been reported from above the timber line. In Sweden *P. nigriceps* reaches north to Uppland only, *P. pullata* to Västerbotten (Jonsson pers. comm.).

On the other hand: *P. amentata* and *P. palustris* are common (locally dominant) in southern Norwegian low alpine areas (Hauge & Ottesen in prep.). Both are distributed north to Finnmark, in Sweden to Lappland (Jonsson pers. comm.), and at high altitudes (Holm 1950).

In addition *Trochosa terricola* is frequent and abundant in coastal western Norway (even in some woods) (Hauge et al.1991, Hauge et al. in prep.). This species is frequent and locally abundant in south-eastern Norway as well (Hauge & Wiger 1980, Tveit & Hauge 1984, Hauge unpublished), even in the inner continental parts. Otherwise it resembles *P. pullata* and *P. nigriceps* as concerns its northern and altitudinal limits in Norway. In Sweden it reaches Norrbotten (Jonsson pers. comm.). In our material the highest numbers were in the two most sheltered localities (A and C) (Table 1), where it shows densities rather similar to those found on the coast. According to Heimer & Nentwig (1991) the species prefers some shelter. However, it has often been reported (often in abundance) from a variety of habitats (Huhta 1965, Palmgren 1972, Platen et al.1991, Noflatscher 1993).

Net building species

The relative scarcity of this group (48% of all specimens) at loc. A is noticeable; comparative figures from loc. B and C are 88% and 81 %, respectively. The number of species was also low. One explanation may be the lack of suitable microhabitats for net construction, due to the lack of higher vegetation on the ground.

Most net building species were few and scarce in numbers. *Oedothorax retusus* and *Centromerus bicolor* (together 45% of all specimens) were dominant, the former reported as frequent and abundant under stones close to water (Holm 1950). Both

Table 1. Stryn, Olden. Dominances (%) of adult spiders (+ = < 1%), April 1982-April 1983.

| Species | Loc. A | Loc. B | Loc. C |
|---|--------|--------|--------|
| <i>Ceratinella brevipes</i> (Westring, 1851) | | | + |
| <i>C. brevis</i> (Wider, 1834) | | + | + |
| <i>Walckenaeria nodosa</i> O.- P. Cambridge, 1873 | + | + | |
| <i>W. acuminata</i> Blackwall, 1833 | | + | + |
| <i>W. cucullata</i> (C.L.Koch, 1836) | | + | |
| <i>W. cuspidata</i> (Blackwall, 1833) | | + | |
| <i>W. dysderoides</i> (Wider, 1836) | | | + |
| <i>W. nudipalpis</i> (Westring, 1851) | | + | |
| <i>Gonatum rubellum</i> (Blackwall, 1841) | + | | |
| <i>Dicymbium tibiale</i> (Blackwall, 1836) | + | + | 10.6 |
| <i>Dismodicus bifrons</i> (Blackwall, 1841) | + | + | |
| <i>Oedothorax fuscus</i> (Blackwall, 1834) | | + | |
| <i>O. retusus</i> (Westring, 1851) | 22.9 | | |
| <i>Mioxena blanda</i> (Simon, 1884) | | + | |
| <i>Savignia frontata</i> (Blackwall, 1833) | 1.8 | 17.4 | + |
| <i>Cnephalocotes obscurus</i> (Blackwall, 1834) | | | + |
| <i>Minyriolus pusillus</i> (Wider, 1834) | | | + |
| <i>Micrargus herbigradus</i> (Blackwall, 1854) | | + | 2.9 |
| <i>Tiso vagans</i> (Blackwall, 1834) | | + | |
| <i>Tapinocyba pallens</i> (O.P.-Cambridge, 1872) | | + | |
| <i>Erigonella hiemalis</i> (Blackwall, 1841) | + | + | |
| <i>Diplocephalus cristatus</i> (Blackwall, 1833) | + | | |
| <i>D. latifrons</i> (O.P.-Cambridge, 1863) | + | 14.7 | 29.9 |
| <i>Erigone atra</i> (Blackwall, 1841) | | 1.7 | |
| <i>Hilaira excisa</i> (O.P.-Cambridge, 1870) | | | + |
| <i>Drapetisca socialis</i> (Sundevall, 1833) | | + | |
| <i>Macrargus rufus</i> (Wider, 1834) | | + | + |
| <i>Maro minutus</i> (O.P.-Cambridge, 1906) | | 1.4 | + |
| <i>Agyneta conigera</i> (O.P.-Cambridge, 1836) | | + | |
| <i>A. ramosa</i> Jackson, 1912 | | | + |
| <i>A. subtilis</i> (O.P.-Cambridge, 1863) | | | + |
| <i>Porrhomma hebescens</i> (L. Koch, 1879) | | | + |
| <i>P. pallidum</i> Jackson, 1913 | | + | + |
| <i>Centromerus arcanus</i> (O.P.-Cambridge, 1873) | | | 7.1 |
| <i>C. bicolor</i> (Blackwall, 1833) | 21.6 | 16.4 | |
| <i>C. prudens</i> (O.P.-Cambridge, 1873) | | + | |
| <i>C. sylvaticus</i> (Blackwall, 1841) | | + | |
| <i>Helophora insignis</i> (Blackwall, 1841) | | 1.0 | 4.0 |
| <i>Bathyphantes gracilis</i> (F.O.P.-Cambridge, 1894) | | + | |
| <i>B. nigrinus</i> (Westring, 1851) | | + | |
| <i>B. setiger</i> (Blackwall, 1841) | + | + | |
| <i>Bolyphantes alticeps</i> (Sundevall, 1833) | + | + | + |
| <i>Diplostyla concolor</i> (Wider, 1834) | | + | |
| <i>Lepthyphantes ericaeus</i> (Blackwall, 1853) | | + | |
| <i>L. pallidus</i> (O.P.-Cambridge, 1871) | | + | |
| <i>Tenuipalpis alacris</i> (Blackwall, 1853) | | + | 5.0 |
| <i>T. cristatus</i> (Menge, 1866) | 1.0 | 10.5 | 9.8 |
| <i>T. menzei</i> (Kulczynski, 1887) | 2.2 | 17.6 | + |
| <i>T. zimmermanni</i> (Bertkau, 1890) | | + | 5.4 |
| <i>Linyphia triangularis</i> (Clerck, 1757) | + | | |
| <i>Neriens peltata</i> (Wider, 1834) | | + | + |
| <i>Allomengea scopigera</i> (Grube, 1859) | 1.8 | 2.3 | 10.9 |
| <i>Pachygnatha degeeri</i> Sundevall, 1830 | | 1.8 | |
| <i>Robertus lividus</i> (Blackwall, 1836) | | + | + |

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Table 1. Continued

| Species | Loc. A | Loc. B | Loc. C |
|---|--------|--------|--------|
| <i>R. neglectus</i> (O.P.-Cambridge, 1871) | | + | + |
| <i>Cryphoeca silvicola</i> (C.L.Koch, 1834) | | 5.6 | 3.2 |
| <i>Pardosa amentata</i> (Clerck, 1757) | 29.3 | | |
| <i>P. lugubris</i> (Walckenaer, 1802) | + | + | 1.1 |
| <i>P. palustris</i> (Linnaeus, 1758) | 14.2 | + | |
| <i>P. pullata</i> (Clerck, 1757) | + | | |
| <i>P. riparia</i> (C.L.Koch, 1833) | + | | |
| <i>P. sphagnicola</i> (Dahl, 1908) | + | | |
| <i>Pirata terricola</i> Thorell, 1856 | 3.1 | + | 2.9 |
| <i>Pirata piraticus</i> (Clerck, 1757) | + | | |
| <i>P. hygrophilus</i> Thorell, 1872 | | | + |
| <i>Xysticus cristatus</i> (Clerck, 1757) | | + | + |
| Number of specimens | 1739 | 1922 | 381 |
| Number of species | 25 | 48 | 32 |
| Shannon index of diversity (ln) | 1.8 | 2.0 | 3.2 |

Table 2. Similarity indices (Loc. A, B, C). Soerensen (left) and Renkonen (right)

| | | |
|---|----|----|
| B | 44 | - |
| C | 32 | 53 |
| | A | B |

| | | |
|---|----|----|
| B | 24 | - |
| C | 6 | 31 |
| | A | B |

species have been reported to prefer humid habitats. The small sized *O. retusus* prefers open areas, the larger *C. bicolor* more closed habitats (Heimer & Nentwig 1991). However, *C. bicolor* was among the dominant species in the open loc. B as well, while *O. retusus* was absent. Both species were absent from loc. C, perhaps due to competition from other dominant species here. Their phenology (Figure 2 and 3) and body size are different from each other.

The grassland (Loc. B)

This is a monoculture where no grazing occurs, resulting in an increasing height of the grass until mowing occurs at the end of the summer. So, at least temporarily, a variety of spider species may theoretically be offered suitable (and variable) conditions at different parts of the year. An edge effect due to the close neighbourhood of the grazed land should also be considered. The result is a fairly high total number of species (48) based on a whole year's catches, with a relatively high diversity index, despite the scarcity of cursorial species, compared to loc. A.

The species list from loc. B contains some well known open land species, including the aeronautic and pioneer species *Erigone atra* (males active from April until August), and some (more or less abundant) species considered to be forest species, like *C. bicolor*, *Cryphoeca silvicola*, *Tenuiphantes alacris*, *T. zimmermanni* and *T. cristatus*.

In contrast to loc. A, the grass meadow was (in the absence/scarcity of cursorial spiders) inhabited by several fairly abundant net builders. Two of them are small erigonids, the well known forest species *Diplocephalus latifrons* and the strongly hygrophilous, open land species *Savignia frontata*. The former was very abundant in the forest (loc. C) as well, where the latter was very scarce (Table 1). So, although ecologically different, they overlapped greatly seasonally (Figure 4 and 5) with each other; and also with *O. retusus* (Figure 2), which was not found at Loc.B. In body size the three species are rather similar (Heimer & Nentwig 1991). *D. latifrons* was also frequent (but sparse) in grassland areas on the western coast, more abundant in the wooded areas, while *S. frontata* here was more stenotopic, i.e. locally abundant only in the grassland and scarce elsewhere (Hauge & al. in prep.).

In addition to the two common erigoninae, as many as three linyphiinae species were (in contrast to loc. A) abundant in loc. B, all with abundances above 10 %, and partly with different habitat and ecological preferences (Table 1). *C. bicolor* (discussed above), a late autumn/winter active species (Figure 3), and the diplochrone *Tenuiphantes menzei* with a small peak in spring as well (Figure 6) overlapped seasonally in the fall, *T. menzei* perhaps reaching an earlier peak. A few males of *T. cristatus* were trapped in September/late November, but the majority (as

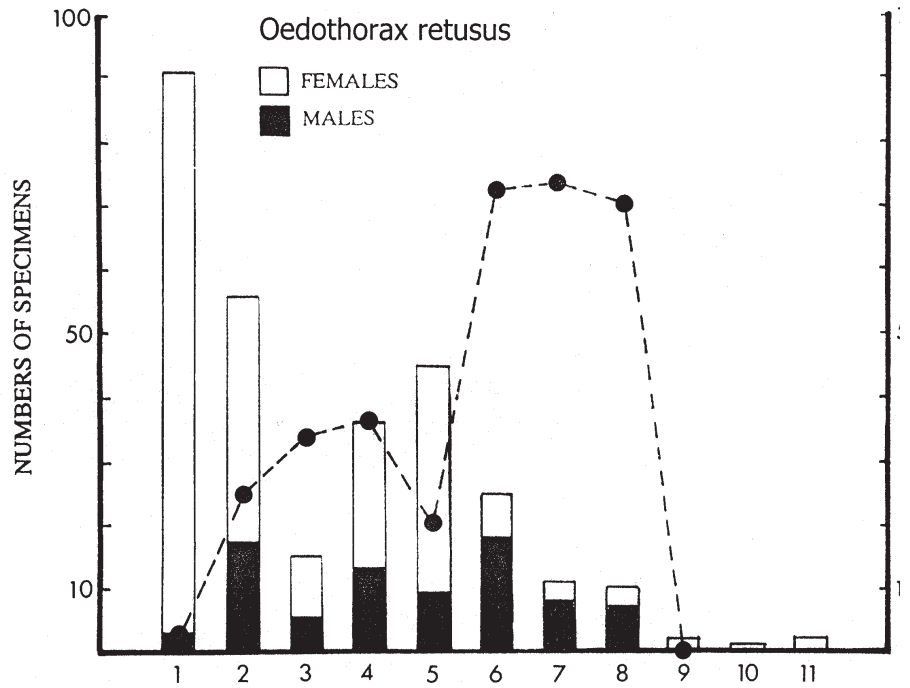


Figure 2
Oedothorax retusus (Westring, 1851). April - November 1982. Numbers of adult specimens in pitfall catches and (stippled line) percentage of males in the population.

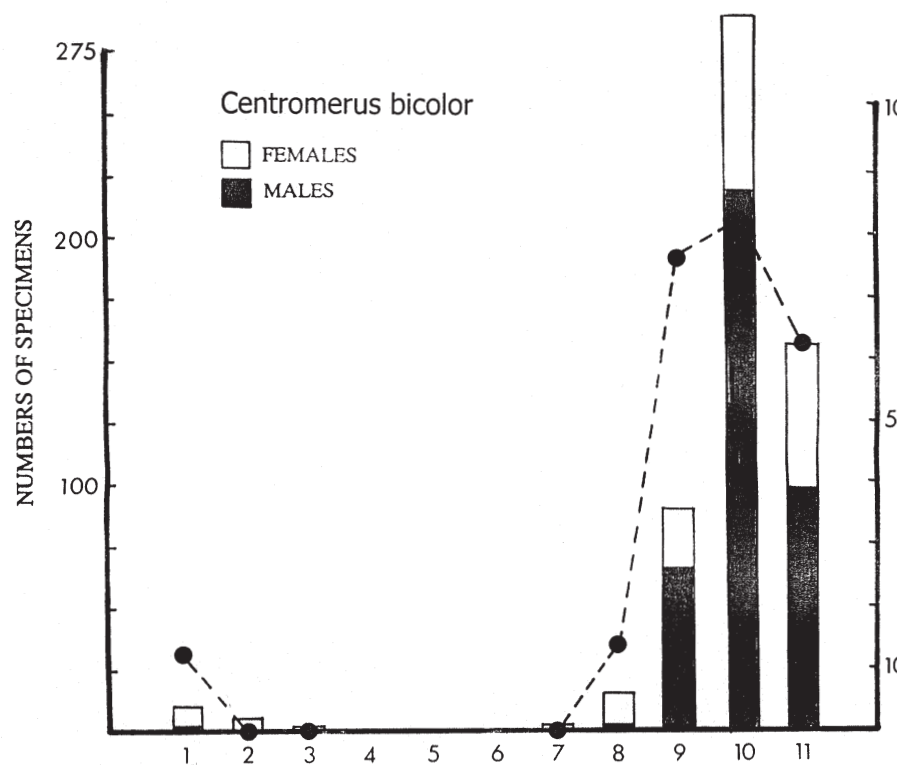


Figure 3
Centromerus bicolor (Blackwall, 1833). April - November 1982. Numbers of adult specimens in pitfall catches and (stippled line) percentage of males in the population.

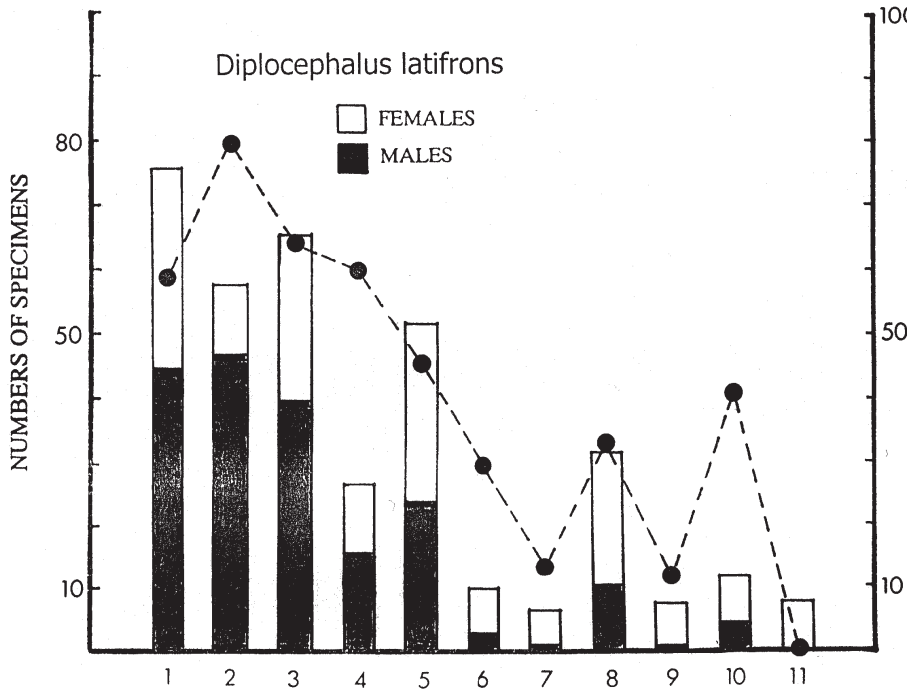


Figure 4
Diplocephalus latifrons (O.P.- Cambridge, 1863). April-November 1982. Numbers of adult specimens in pitfall catches and (stippled line) percentage of males in the population.

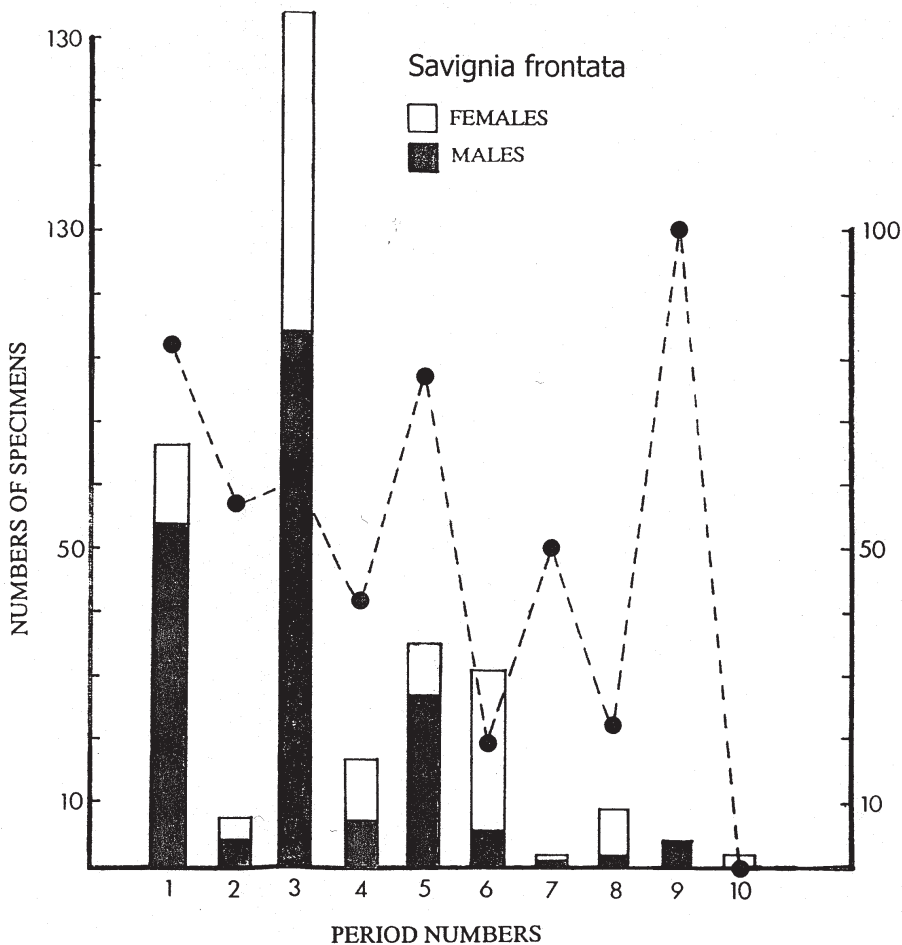


Figure 5
Savignya frontata Blackwall, 1833. April-November 1982. Numbers of adult specimens in pitfall catches and (stippled line) percentage of males in the population.

well as several males of *C. bicolor*) were taken during the long winter period, when *T. mengei* was scarce. Seasonal overlap between the two *Tenuiphantes* spp. was therefore small, between *C. bicolor* and *T. cristatus* somewhat larger. *C. bicolor* is a relatively large species, the two *Tenuiphantes* spp. are smaller.

The forest (Loc.C)

Most abundant in the catches were the two erigoninaes *Diplocephalus latifrons* (29.9 %) and *Dicymbium tibiale* (10.6 %) (Table 1), both typical forest species; the former, however, is common in grassland as well (see above).

Like *D. latifrons* (and *S. frontata*), most active males of *Dicymbium tibiale* were trapped in spring (April-mid May). *D. tibiale* is a larger species, twice the size of *Diplocephalus latifrons* (Heimer & Nentwig 1991). Compared to *D. latifrons* and *D. tibiale* the third dominant erigoninae *Micrargus herbigradus* is medium sized (with a few males captured from mid May until mid October). *D. tibiale* is locally abundant in forests in western areas (Hauge & Halvorsen in prep.), but was completely absent from open localities on the coastal islands (even in the wooded areas) where *D. nigrum* was common (Hauge et al. in prep.).

The hygrophilous *A. scopigera* was clearly most common in loc. C (Table 1). It is the largest of the *Linyphiinae* species mentioned so far. The males were trapped from late June to mid September, the few males of *T. zimmermanni* somewhat later (early September - early November) and most males of *Tenuiphantes cristatus* in winter (see above), followed by *T.*

alacris (late April - late June). The latter is a rather large species, and was seasonally overlapping with the smaller erigoninaes discussed above and with the medium sized (at least the males) *Centromerus arcanus*. The latter (abundant and present only at loc. C) was active from late April until early June. *Helophora insignis* is an autumn active species.

Concluding remarks

At loc. C conditions on the forest floor are homogenous, with grass and leaf litter dominating, and a dense canopy (at least in the vegetation period) providing relatively stable light and humid conditions.

Only two abundant linyphiids, one large and one small species, constituted approximately 80% of all adult net-builders in loc. A, probably due to unfavorable conditions for this group here (see discussion above). This is compensated for by a rich lycosid fauna (partly with abundant species), resulting in a relatively high diversity index. Despite a very sparse lycosid fauna at loc. B the diversity index is slightly higher here. The reason is a richer fauna of net-building species, perhaps due to variable conditions (including mowing) on the ground during the year. Six net building species were needed to reach a similar value (82.2 %), compared to loc. A. The highest number of species (48) was found here. Also the highest number (36) of 'rare' species (those with dominances < 1.0 %) was found here (16 and 19 species in loc. A and C, respectively). Similarly, the eight most dominant net-builders were needed to reach a similar value (82.1 %) at loc. C. The total number of species (32) was lower than in the

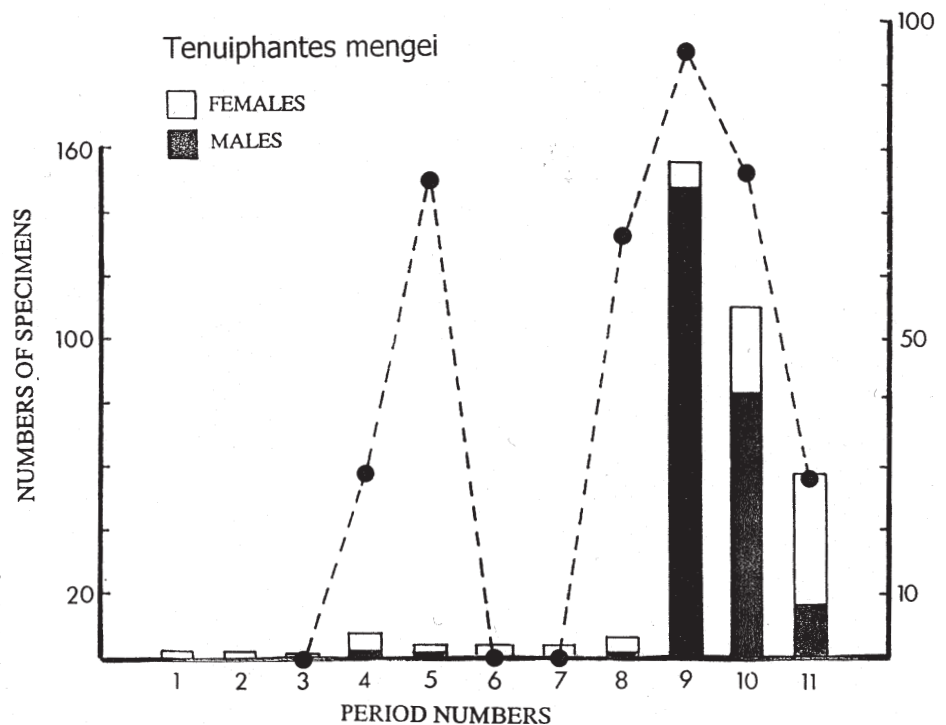


Figure 6
Tenuiphantes mengei Kulczynski, 1887. April-November 1982. Numbers of adult specimens in pitfall catches and (stippled line) percentage of males in the population.

grass meadow, perhaps due to an untouched homogenous forest floor dominated by grasses and leaf litter, as well as more stable humidity conditions and (at least in the growing season) darker conditions which may have excluded at least some open area species. However, the number of *specimens* caught in loc. C was low, contributing to a relatively high diversity index (Table 1).

SAMMENDRAG

Edderkopper fra tre habitater i Stryn, Nordfjord, Vestlandet.

På gården Bruvik i Olden (Stryn) er det i løpet av ett år samlet (med fallfeller) et edderkopp-materiale (totalt 66 arter) fra tre ulike lokaliteter: Et smalt område med klunger langs elva, en slåttemark og en oreskog. Disse huser tre edderkoppssamfunn, ganske ulike med hensyn til artssammensetning og for noen felles arters vedkommende med til dels store variasjoner i dominansverdier mellom lokalitetene. Bare 9 arter ble funnet på alle tre lokalitetene, hele 57 % av artene ble funnet på bare én av dem. Noen av de mest dominante artenes sameksistens i området er diskutert, i hovedsak basert på data om habitatpreferanser, økologi og sesongmessige aktivitetsmønstre (fenologi), til dels også deres geografiske utbredelse.

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