

# Ecology of spiders in meadows near Zurich (Switzerland)

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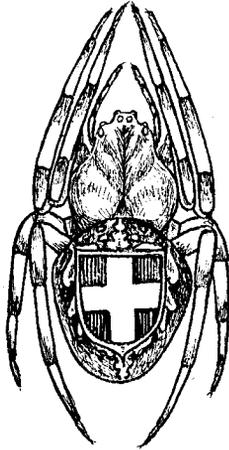
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SEPARATUM

ECOLOGY OF SPIDERS IN MEADOWS NEAR ZURICH (SWITZERLAND)

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Web-building and hunting spiders can play an important rôle in the biocoenoses of grassland ecosystems concerning density, biomass and energy flow (1), (3), (4), (7), (8), (9). Many questions on the ecology of spiders are still open. This study on the ecology of spiders in meadows near Zurich should answer some of these questions.

The studies were conducted from 1976-1979 in uncultivated and cultivated meadows near Zurich. The species composition of the spiders in the vegetation stratum was determined by sweeping. The species composition and the activity densities (Aktivitätsdichte) of the epigeic spiders were studied with the help of pitfall traps. The spider's prey spectra were examined through direct field observation. The population densities were measured with the method of squares.

R e s u l t s

Spiders in the vegetation stratum of uncultivated meadows

In the vegetation stratum of uncultivated meadows mainly web spiders of the families Argiopidae, Tetragnathidae, Agelenidae, Theridiidae, Dictynidae, Linyphiidae, Micryphantidae as well as hunting spiders of the families Salticidae, Thomisidae, Pisauridae and Clubionidae were found. The predominant species are listed in Tab. 1.

Concerning the number of individuals quantitative prey analyses have shown that the food of numerous web spiders living in the vegetation stratum mainly consists of small Diptera, winged aphids etc. (Tab. 2). The prey spectrum of Thomisidae which ambush insects on plants is also largely composed of small Diptera. In regard to biomass, the food of large orb web spiders in certain types of uncultivated meadows predominantly consists of grasshoppers and/or bees (5).

The density of spiders in the vegetation stratum of uncultivated meadows came to about 10 spiders/m<sup>2</sup> in spring/summer 1979.

Spiders in the vegetation stratum of cultivated meadows

In the vegetation stratum of cultivated meadows, mostly web spiders of the families Argiopidae, Tetragnathidae, Theridiidae and hunting spiders of the family Thomisidae are found. The predominant spider species are listed in Tab. 1. Their prey consists mainly of small Diptera (6).

The density of all spiders in the unmowed vegetation stratum of a cultivated meadow was about 1.6 spiders/m<sup>2</sup> in spring 1979. After mowing, the number of these spiders was reduced by more than 50%.

TABLE 1

The predominant spider species, caught with the sweep net in the vegetation stratum of uncultivated and cultivated meadows near Zurich in summer 1979.

Spider family	Spider species	Type of meadow	
		unculti- vated	culti- vated
Argiopidae	<i>Mangora acalypha</i> (Walckenaer 1802)		x
	Species of Table 2	x	
Tetragnathidae	<i>Tetragnatha extensa</i> (Linnaeus 1785)	x	x
	<i>Tetragnatha pinicola</i> L. Koch 1870	x	x
	<i>Pachygnatha degeeri</i> Sundevall 1830		x
Micryphantidae	<i>Hylyphantes nigrinus</i> * (Simon 1884)	x	
Theridiidae	<i>Theridion ovatum</i> (Clerck 1757)	x	x
	<i>Theridion bimaculatum</i> (Linnaeus 1767)	x	x
	<i>Theridion impressum</i> L. Koch 1881		x
Thomisidae	<i>Xysticus cristatus</i> (Clerck 1757)	x	x
	<i>Xysticus kochi</i> Thorell 1872		x
Salticidae	<i>Evarcha arcuata</i> (Clerck 1757)	x	
	<i>Heliophanus flavipes</i> C.L. Koch 1848	x	
Pisauridae	<i>Pisaura mirabilis</i> (Clerck 1757)	x	

\*) WIEHLE associates this species with Micryphantidae as well as with Linyphiidae (9),(10).

TABLE 2

Prey composition of orb web spiders (Argiopidae and Tetragnathidae) in an uncultivated meadow near Zurich-Opfikon in summer 1979.

	Diptera	Homoptera	Hymenoptera
<i>Argiope bruennichi</i> (Scopoli 1772)	53.9 %	27.1 %	12.8 %
<i>Araneus diadematus</i> Clerck 1757	59.5 %	18.7 %	16.6 %
<i>Araneus quadratus</i> Clerck 1757	74.5 %	13.1 %	8.8 %
<i>Nuctenea</i> * <i>cornuta</i> (Clerck 1757)	79.8 %	9.6 %	0.4 %
<i>Tetragnatha extensa</i>	81.3 %	8.1 %	0.7 %
$\bar{x}$	69.8 %	15.3 %	7.9 %

\* *Nuctenea* Simon [= *Araneus* Clerck]

### Epigeic spiders of cultivated meadows

On the ground of cultivated meadows near Zurich, web spiders of the family Micryphantidae (*Erigone atra* (Blackwall 1841), *Erigone dentipalpis* (Wider 1834), *Oedothorax fuscus* (Blackwall 1834)) and hunting spiders of the families Lycosidae (*Pardosa agrestis* (Westring 1861), *Pardosa palustris* (Linnaeus 1785), *Trochosa ruricola* (Degeer 1773)) and *Tetragnathidae* (*Pachygnatha degeeri*) predominate.

The Micryphantidae mostly feed on Collembola (Sminthuridae), aphids and small Diptera. Lycosidae prey also mainly on small, soft bodied insects such as Collembola, aphids etc. (6).

The density of epigeic web spiders in cultivated meadows near Zurich varied between 15 and 42 spiders/m<sup>2</sup> in spring/summer 1979. The density of hunting spiders has not been determined yet.

The activity density (= number of epigeic spiders/trap/day) was significantly lower after mowing (Mann-Whitney U-test, P < 0.05).

The epigeic spiders of uncultivated meadows have not been investigated.

### D i s c u s s i o n

A comparison of the species composition of spiders in uncultivated and cultivated meadows shows that many spider species dominant in uncultivated meadows also dominate in cultivated meadows (e.g. *Tetragnatha extensa*, *T. pinicola*, *Theridion ovatum*, *T. bimaculatum*, *Xysticus cristatus*).

There exist nevertheless great differences between the live systems of uncultivated and cultivated meadows. In the latter the habitat as well as the eggs of many spiders are periodically destroyed through mowing, whereas the spiders in the uncultivated meadows live undisturbed. Mowing has therefore a negative influence on the spider populations. This is shown by the following facts:

- 1 - The spider density in the vegetation stratum of uncultivated meadows is significantly higher than in the vegetation stratum of cultivated meadows.
- 2 - Hunting spiders of the families Salticidae and Pisauridae are frequently found in uncultivated meadows, but are almost fully missing in cultivated meadows.
- 3 - Large web spiders (e.g. *Agelena labyrinthica* (Clerck 1756), *Argiope bruennichi*, *Araneus quadratus*) are found in uncultivated meadows in relatively high densities, but are rare in cultivated meadows.
- 4 - The spider density in cultivated meadows becomes significantly reduced after mowing.

Investigations by KAJAK and coworkers in cultivated meadows in Poland gave similar density values for the spiders of the vegetation stratum as those reported here, though the

spectrum of the spider species was different (3), (4). The same is true for the epigeic spiders, where the Lycosidae dominate in Poland, whereas in Switzerland the Micryphantidae are more important. Since the latter are not even mentioned in the Polish papers it is possible that they have not been investigated. This may explain the lower density of epigeic spiders found in the Polish cultivated meadows. Concerning the density of the spiders of the vegetation stratum of uncultivated meadows, an about five times lower value was found in Zurich than in Poland, where a forest meadow has been investigated.

Despite these differences the Polish authors have likewise shown that the spider densities in cultivated meadows are significantly lower than in uncultivated meadows. In addition they observed too, that many spiders in the vegetation stratum of meadows are primarily predators of Diptera (2), (3), (4). As the density of spiders in cultivated meadows is significantly lower than in uncultivated meadows, the energy flow through the spider populations of the cultivated meadows is distinctly lower.

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