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The Activity of Spiders in Coppiced Chestnut Woodland in southern England

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Introduction

Although the phenology of spiders has received considerable attention in recent years (Cherrett, 1963; Duffey, 1962, 1963; Merrett, 1967, 1968, 1969; Pearson & White, 1964), little attention has been paid to woodland populations. Apart from the studies of Gabbutt (1956), Williams (1962), Turnbull (1960) and Edgar (1971) all working in oak woodland, no recent studies have been made despite the importance of spiders in many woodlands as the dominant arthropod predators. On the continent Van der Drift (1951) gives results for a few species from beech woodland. Tretzel (1954) and Broen & Moritz (1963) give phenological data for a large number of species in a wide range of different habitats in Germany. The present paper describes the phenology of surface active species from a restricted area of mature chestnut coppice over a two year period.

Study area and methods

The area studied was in Blean Woods National Nature Reserve, Kent, and lay on a 10 degree slope facing north-west. The soil is a brown earth developed on alluvial sand overlying London clay. Litter depth is variable but on average less than 2 cms and consists of approximately 97% chestnut and 3% beech litter. The vegetation consists of a canopy of pure sweet chestnut (*Castanea sativa* Mill.) which was last coppiced about 60 years ago with an understorey of coppiced beech (*Fagus sylvatica* L.). No ground vegetation is present. Rainfall for the site is relatively low, the mean annual figure being about 600-700 mm with the wettest period from August to November.

The pitfall traps used consisted of plastic beakers 7 cms deep and 5 cms internal diameter. These were placed in glass jars let into the ground to reduce disturbance when the traps were emptied. Each trap was half filled with ethyl glycol, a preservative which appears to have no repellant effect on the surface active fauna. Six of these traps were placed in a circular array 10 m in diameter at the centre of the site and emptied at approximately two weekly intervals over the period January 1967 to January 1969. Nomenclature follows Locket & Millidge (1951, 1953).

Results

Over the two year period of study, a total of 40 species of spiders were trapped, of which 27 (68%) belonged to the family Linyphiidae while the remainder were distributed between seven other families. In terms of numbers trapped, one species, *Amaurobius terrestris*, accounted for 21% of the total and the six most abundant species accounted for 69% of the total. The results for the activity of these six most abundant species are presented as histograms of numbers in Figure 1. Because the dates on which traps were emptied did not coincide exactly in the two years, the results have been presented in the form of catches in each two week interval for convenience of collation. Although the numbers of individuals trapped in the two years varied considerably, both the overall period of activity and the time of peak activity remained relatively constant. This is demonstrated for *Macrargus rufus* and *Lycosa lugubris* in Figure 2 which shows the numbers trapped in the two years. This was also found to be the case by Merrett (1967), who was able to collate the results of three years trapping without introducing serious errors in the interpretation of his phenological data.

Of the remaining 34 species, only five occurred sufficiently frequently for phenological data to be valid. The phenology of the 11 most abundant species, together with two others not previously taken in pitfall traps in this country, is described below. The remaining species are simply listed with the numbers trapped.

Phenology of individual species

Amaurobius terrestris (Wider). Total numbers trapped - 304♂♂, 28♀♀. A species active throughout the year but with a marked peak of male activity in September, October and early November (Figure 1a). It is

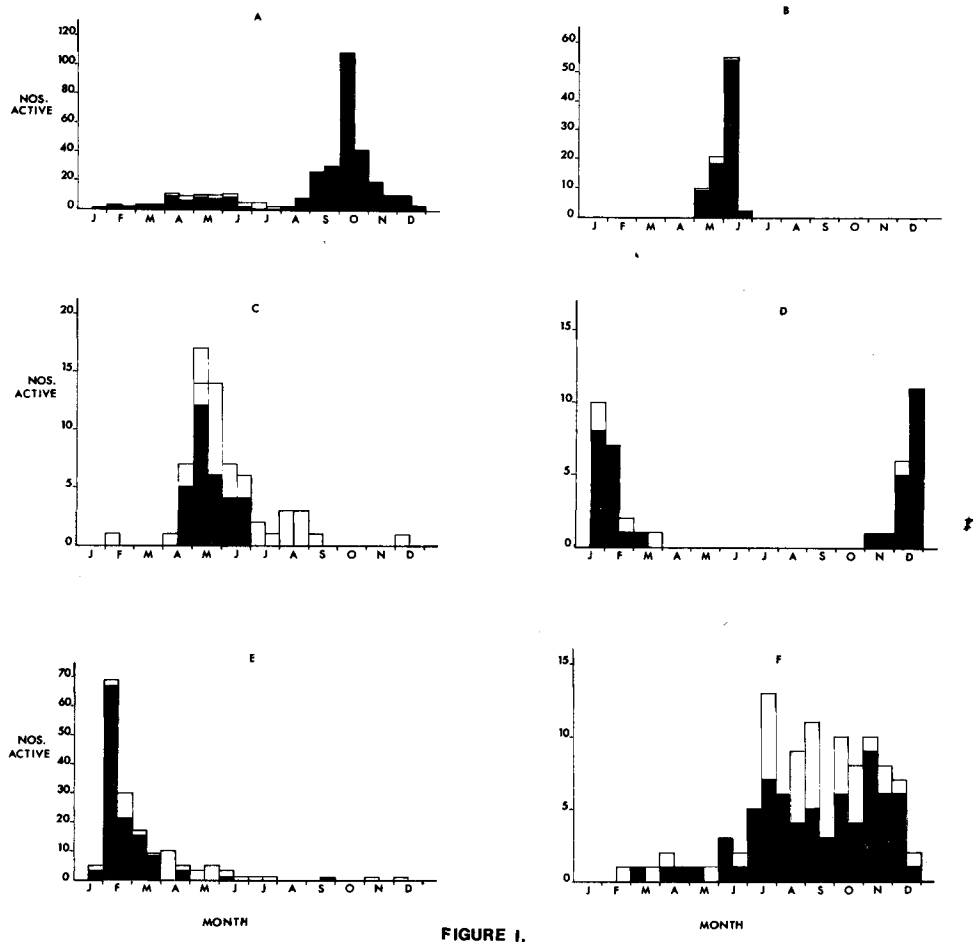

FIGURE 1.

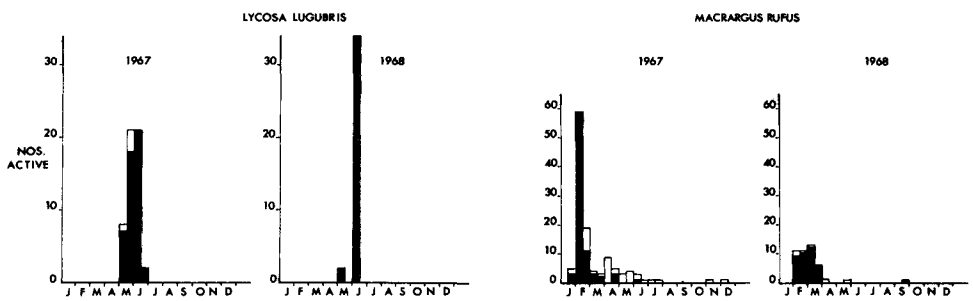

FIGURE 2.

Fig. 1: Activity histograms for the six most abundant species. Males shown black, females shown white. A. *Amaurobius terrestris*, B. *Lycosa lugubris*, C. *Microneta viaria*, D. *Centromerus sylvaticus*, E. *Macrargus rufus*, F. *Lepthyphantes zimmermanni*.

Fig. 2: Activity histograms for *Lycosa lugubris* and *Macrargus rufus* in 1967 and 1968 separately. Males shown black, females shown white.

interesting that Goodier (1970) found a similar pattern of activity for the closely related species *Amaurobius atropos* with peak male activity in September and October.

Hahnia helveola Simon. 13♂♂, 13♀♀. This species was active from November until May, but with males active from November to March only. This agrees with the results of Merrett (1968) who recorded a few males in October but with no significant peak in male activity.

Lycosa lugubris (Walckenaer). 83♂♂, 5♀♀. A markedly stenochrone species as far as this study was concerned, with a period of activity from mid-May to mid-June (Figure 1b). Merrett (1968) trapped *L.lugubris* between mid-April and the beginning of September with male activity at its peak in May. Van der Drift (1951) trapped a few individuals in early March while both he and Tretzel (1954) found peak male activity in May

Robertus lividus (Blackwall). 8♂♂, 5♀♀. The main activity period was in June and the first two weeks of July, with a few individuals active at other times of the year. Tretzel (1954), on the basis of much larger numbers, described it as a diplochrone species with a major activity peak in June and July and a secondary peak in September and October. Pearson & White (1964) also found a marked peak in activity in June and July.

Walckenaera acuminata Blackwall. 11♂♂, 11♀♀. This species was active from November to March with a few females active in summer and a slight peak in male activity in February. Merrett (1969) took males from October to March while female activity continued throughout the year, except in September. Both Duffey (1963) and Pearson & White (1964) found it to be active throughout the year, but did not separate sexes.

Wideria mitrata (Menge). This species, new to Britain, was represented by only five individuals, 3♂♂, 2♀♀ (Swann, 1971). The major activity period was in the first two weeks of May, but a single female was taken in December. Tretzel (1954) recorded its activity period as March and April with a single female in June, but again on the basis of only five individuals. It will probably be found that this species has a somewhat less stenochrone activity period when greater numbers are trapped.

Tigellinus furcillatus (Menge). 9♂♂, 7♀♀. This rather rare species was taken from June to August with males active in June only. The only other available record from traps is that of Tretzel (1954) who took a single male in August.

Microneta viaria (Blackwall) (Figure 1c). 31♂♂, 31♀♀. An abundant species unusual in that males and females were trapped in equal numbers. It was active virtually throughout the year but with a peak of male activity in May, June and July. Merrett (1969) found males active from late March to early June, as did Tretzel (1954).

Centromerus sylvaticus (Blackwall) (Figure 1d). 35♂♂, 5♀♀. This is a winter active species which was taken from the beginning of November to the beginning of April. This agrees closely with the results of Merrett (1964) who, however, trapped females through until July while Tretzel (1954) found females active throughout the year. Males showed peak activity in December and January, which also agrees with previous findings.

Centromerus jacksoni Denis. This rare species has previously been obtained from beech litter at various localities in southern England and it may well be an immigrant from the areas of coppiced beech that surround the study site. It was represented by five females trapped in March, April, June and December. It has not been taken previously in pitfall traps.

Oreonetides abnormis (Blackwall). 6♂♂, 3♀♀. This species showed a restricted period of activity from the end of June to the end of September with males active in June only. Merrett (1969) records it from May to the end of August, but Cherrett (1963) took adult females in November and February on high Pennine moorland.

Macrargus rufus (Wider) (Figure 1e). 120♂♂, 40♀♀. An abundant species which was active throughout the year, but with an extremely sharp peak in male activity in the first two weeks of February. Merrett (1969) found a similar sharp peak of male activity in the second half of February while Van der Drift (1951) and Tretzel (1954) both found peaks in March.

Lepthyphantes zimmermanni Bertkau (Figure 1f). 68♂♂, 66♀♀. This species is active throughout the year but with a higher level of male activity from September to December. Duffey (1963) took this species

only between June and November, but Merrett (1969) also took it throughout the year with the major period of activity from July to November.

Discussion

The results presented here must be interpreted with caution owing to the relatively low number of spiders trapped. However, for the more abundant species in the traps the results agree well with those of previous workers and in particular the linyphiid species had activity periods which could be classified according to the scheme of Merrett (1969), adapted from Tretzel (1954):

(1) males active in winter (November-February)
(2) males active in spring (February-April)
(3) both sexes active in summer (mainly stenochrone species)
(4) both sexes active the year round

In the present study *Walckenaera acuminata* and *Centromerus sylvaticus* could be classified in group (1) and *Macrargus rufus* in group (2). Group (3) included *Tigellinus furcillatus, Oreonetides abnormis, Wideria fugax* and possibly *Wideria mitrata*, while group (4) was represented by *Lepthyphantes zimmermanni* alone. Only *Microneta viaria* showed a period of activity which could not be classified in this scheme, with males active in summer only but females active throughout the year. However, since Merrett (1969) also found exceptions to these categories it is probable that a somewhat wider range of activity patterns will eventually be described for linyphiid species.

An interesting feature of all the studies mentioned so far is the marked synchrony in activity periods for the same species in widely separated areas in Europe, from Germany to the north of England. Although the peaks of male activity vary by a month or so, the actual period of activity appears to be relatively constant for the few species for which adequate data is available. A good example is *Macrargus rufus* in which males are active from October to April and females are active all the year round, with a sharp male activity peak in February or March. Pearson & White (1964b) have shown that the seasonal activity of moorland spiders can be related to both day length and temperature variations. In particular it appeared that certain summer active species had a critical day length, below which little or no activity occurred and above which activity showed a reasonable correlation with temperature. For winter active species the situation would appear to be the reverse in that there appears to be an upper threshold, both of day length and temperature, above which little activity occurs. Thus in the case of *Centromerus sylvaticus* this upper threshold corresponds to a day length of about 9 hours and a maximum air temperature of 12° C, while for *Macrargus rufus* the corresponding figures are 12 hours day length and 17° C (experimental details will be published elsewhere). It is therefore not clear from these studies whether day length or environmental temperature is the most important factor in the control of activity duration. On the one hand day length would seem to vary more regularly on a seasonal basis than either maximum or minimum temperatures, while on the other, day length will increase from lower to higher latitudes and it is difficult to envisage this as being the controlling mechanism over a wide area. Whatever the case, it is clear that only careful experimental analysis, in which the various environmental factors are isolated, will provide the answer.

Summary

The phenology of surface-active spiders in coppiced chestnut woodland in Southern England was studied over a two year period using pitfall traps. Of the 40 species trapped, 11 occurred sufficiently frequently to make phenological observation possible. In general the results were in agreement with those of previous workers both in this country and on the continent. In particular, most linyphiid species fall into the categories of seasonal activity described by Merrett (1969). The results are discussed with reference to the synchrony of activity periods over a wide area of Europe in relation to the environmental factors controlling activity periods.

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mitrata (Menge). We also wish to thank the Nature Conservancy (South-East Region) for providing facilities at Blean Woods N.N.R. This work was carried out while the senior author was supported by an NERC research assistantship, financed by a grant to Dr I.N.Healey (Ref. number GR/3/1243).

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Appendix 1

List of less abundant species trapped

Dysdera erythrina (Walckenaer)	1 ♀
Harpactea hombergi (Scopoli)	1 ♂
Clubiona terrestris Westring	1 ♂
Zora spinimana (Sundevall)	1 ♂, 11 ♀
Neon reticulatus (Blackwall)	1 ♂, 1 ♀
Lycosa amentata (Clerck)	1 ♂
L. nigriceps Thorell	1 ♂
Cicurina cicur (Fabricus)	4 ♂
Pachygnatha degeeri Sundevall	1 ♂
Ceratinella brevipes (Westring)	1 ♂
Wideria fugax (O.P.-Cambridge)	4 ♂
Dicymbium nigrum (Blackwall)	1 ♂
Maso sundevalli (Westring)	1 ♀
Micrargus herbigradus (Blackwall)	2 ♂
Diplocephalus picinus (Blackwall)	1 ♀
Porrhomma microphthalmum (O.P.-Cambridge)	1 ♀
C.prudens (O.P.-Cambridge)	3 ♂
C.dilutus (O.P.-Cambridge)	1 ♂, 2 ♀
Bathyphantes concolor (Wider)	1 ♂, 2 ♀
B. gracilis (Blackwall)	5 ♂
Taranucnus setosus (O.P.-Cambridge)	1 ♀
Stemonyphantes lineatus (Linnaeus)	1 ♂
Lepthyphantes tenuis (Blackwall)	5 ♂
L.tenebricola (Wider)	1 ♀
L.pallidus (O.P.-Cambridge)	1 ♂, 2 ♀
Helophora insignis (Blackwall)	1 ♀
Linyphia clathrata Sundevall	2 ♂