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A STUDY OF SPIDERS (ARANEAE) ON MAPLE TREES (*ACER* SPP.)

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We began this study to determine whether spider species occur randomly on maple species or whether they are selective in picking either their host species or their position on that host. Several papers have been published on habitat selection of spiders in relation to structural components or microclimate (Barnes, 1953; Barnes & Barnes, 1954, 1955; Cherrett, 1964; Duffey, 1962a, 1962b, 1966; Hackmann, 1957; Kuenzler, 1958; Norgaard, 1951). Duffey (1956) and Kuenzler (1958) also discussed the influence of microclimate on the activities of spiders. None of the above, however, dealt with arboreal spiders with the exception of Duffey (1956) who discussed aerial dispersal rather than habitat selection.

METHODS

The spiders were collected from maple trees in Albion, Michigan, in September through November, 1967. Six species of maples were sampled, sugar maple (*Acer saccharum* Marsh.), box elder (*A. negundo* L.), silver maple (*A. saccharinum* L.), Norway maple (*A. platanoides* L.), red maple (*A. rubrum* L.), and black maple (*A. nigrum* Michx.). The trees utilized were in residential areas, some of which bordered parks, rivers or open fields. Some trees were solitary, others were in groups, some with intermingling branches. Collections were made from trees with trunk diameters of 6 inches to 3 feet and those parts of each tree were searched that could easily be examined while standing on the ground.

The specimens were collected individually and placed in numbered vials containing 70 per cent alcohol. Field notes were taken for each individual including tree species, location on tree, location on leaf, shape of leaf, web construction, and presence of insects. In the laboratory the specimens were separated and regrouped according to tree species, location on tree, and location on leaf. This preliminary separation facilitated identification. Kaston (1948) was used for identification of spider species.

One or more specimens of each species of spider was confined in separate 4 x 6 x 1½ inch plastic boxes on live maple leaves bearing aphids. In the case of *Araniella displicata*, aphids were placed in the web. Some vinegar flies (Drosophilidae) and flower flies (Syrphidae) were later introduced in some of the boxes.

OBSERVATIONS

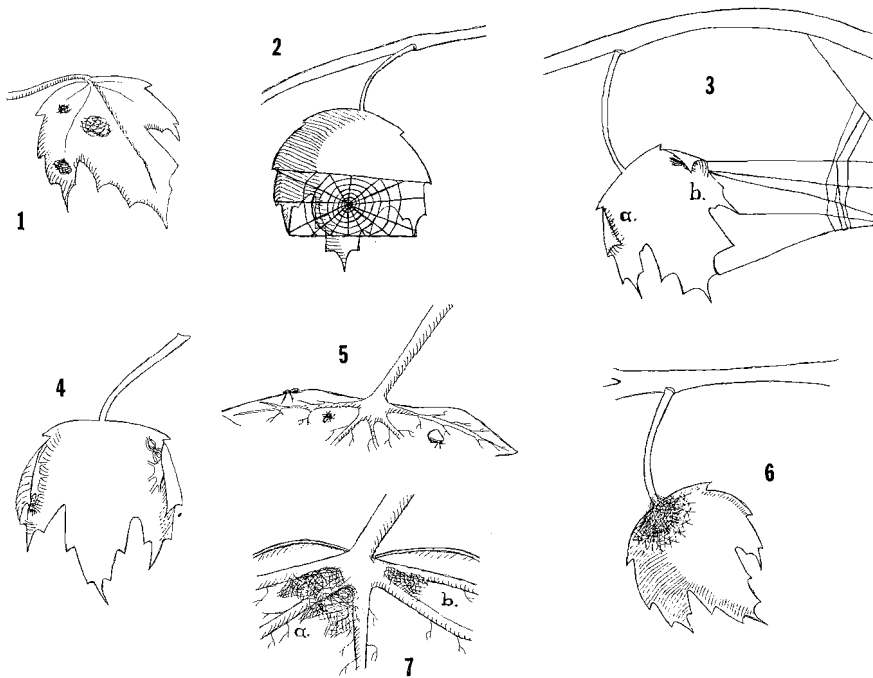
Nine species of spiders were found on maple trees in Albion. All were small to medium-sized species, 2 to 9 mm. in length, and represented six families.

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Most have been reported by various authors as being collected in other habitats by sweeping grasses or from shrubs or leaf litter and two are common "house spiders." Most specimens seen in this study were on leaves. The species and the numbers collected are given in Table 1.

Table 1. Numbers of each spider species collected from each maple species.

| <i>Species of Spiders</i> | <i>Species of Trees</i> | | | | | | <i>Totals</i> |
|----------------------------------|-------------------------|---------------|---------------|---------------|------------|--------------|---------------|
| | <i>Sugar</i> | <i>Box E.</i> | <i>Silver</i> | <i>Norway</i> | <i>Red</i> | <i>Black</i> | |
| <i>Argiophidae</i> | | | | | | | |
| <i>Araniella displicata</i> | 28 | 10 | 2 | 2 | 4 | 3 | 49 |
| <i>Tetragnatha viridis</i> | 9 | 5 | - | 4 | 4 | 2 | 24 |
| <i>Clubionidae</i> | | | | | | | |
| <i>Chiracanthium inclusum</i> | 19 | 8 | - | - | 2 | - | 29 |
| <i>Dictynidae</i> | | | | | | | |
| <i>Dictyna sublata</i> | 4 | 2 | - | - | - | - | 6 |
| <i>Linyphiidae</i> | | | | | | | |
| <i>Pityohyphantes phrygianus</i> | 9 | - | - | - | - | - | 9 |
| <i>Theridiidae</i> | | | | | | | |
| <i>Achaearenea tepidariorum</i> | 6 | - | 1 | 4 | - | - | 11 |
| <i>Theridion murarium</i> | 7 | - | 1 | 2 | 4 | - | 14 |
| <i>Thomisidae</i> | | | | | | | |
| <i>Philodromus pernix</i> | 4 | - | - | - | - | - | 4 |
| <i>Philodromus rufus</i> | 12 | 2 | - | - | 3 | 5 | 22 |
| No. of Spiders | 98 | 27 | 4 | 12 | 17 | 10 | 168 |
| No. of Trees Sampled | 52 | 24 | 16 | 11 | 7 | 3 | 113 |
| Spiders per Tree | 1.88 | 1.12 | 0.25 | 1.09 | 2.43 | 3.33 | 1.49 |



- Fig. 1. Dorsal surface of leaf showing webs of *Dictyna sublata* (Hentz).
 Fig. 2. Ventral surface of leaf showing orb web of *Araniella displicata* Hentz.
 Fig. 3. a. Retreat of *Philodromus pernix* Blackwall on ventral surface of leaf.
 b. Retreat and portion of orb web of *Tetragnatha viridis* Walckenaueur.
 Fig. 4. Ventral surface of leaf showing retreats and waiting positions of *Chiracanthium inclusum* Hentz.
 Fig. 5. Ventral surface of leaf showing positions of *Philodromus rufus* (Walckenaueur) on surface, on edge, and in hole on edge.
 Fig. 6. Ventral surface of leaf showing basal web of *Pityohyphantes phrygianus* (Koch).
 Fig. 7. Basal webs of (a) *Achaearanea tepidariorum* (Koch) and (b) *Theridion murarium* Emerton on the ventral leaf surface.

Each species of spider was consistently found occupying a specific portion of the leaf with little overlap between species. The web and spider positions for each species are illustrated in Figures 1 to 7. All species were found on the underside of the leaf except *Dictyna sublata* (Hentz) which utilized small indentations on the top of the leaf for its web (Fig. 1). Comstock (1948) reported that this is a common spider on buildings where it builds sheet webs over a retreat in some small opening. *Araniella displicata* Hentz, an orb weaver, completely covers the center of the leaf with its web (Fig. 2). *Tetragnatha viridis* Walckenaueur, another orb weaver, sometimes rolls one corner of a leaf which it uses as a retreat and its orb web is found between the leaf and twigs (Fig. 3b). *Chiracanthium inclusum* Hentz (Fig. 4) and *Philodromus pernix* Blackwall (Fig. 3a) roll one edge of the leaf as a retreat and run out after prey. *Philodromus rufus* (Walckenaueur) also runs down its prey but does not roll the leaf edge. It frequently sits on the edge of the leaf in a position where it can see both leaf surfaces at the same time. (Fig. 5). *Pityohyphantes phrygianus* (Koch) (Fig. 6), *Achaearanea tepidariorum* (Koch) (Fig. 7a), and *Theridion murarium* Emerton (Fig. 7b) seemed to overlap most in their micro-

habitat position; all three were found at the leaf base. The latter two built much smaller webs and were found on more host species than the first named.

The immatures in most cases were found on the leaves of the lower branches on the outer margin of the tree. Many molted skins were found in that area also. Molted skins found closer to the center of the tree were larger. The mature and nearly mature specimens of each species were taken closest to the center of the tree from leaves with well established webs or retreats.

In the feeding experiments with caged spiders the spiders did not appear to eat aphids. They were observed eating vinegar flies and flower flies when those were introduced.

DISCUSSION

We believe the interspecific subdivision of the maple leaf by spider species is an indication of preference in selection of microhabitat. We also believe the differences in occurrence and density of spider species between tree species may be indicative of microhabitat selection. There are probably several factors which enter into the selection.

The size and shape of the leaves are probably the most important factors in microhabitat selection. Cherrett (1964) found that the distribution of two species of orb-weavers in a bog was restricted to sites of a particular architecture. Duffey (1962a, 1962b, 1966) also found that plant form and other structural aspects of the microenvironment play an important role in the numbers and distribution of spiders and their webs in a habitat. The sugar maple leaf is approximately in the middle of the range of possible sizes and shapes of maple leaves and all nine species of spiders were found on sugar maple. Black and red maple leaves are less lobed than sugar maple and had higher proportions of spiders per tree. However, there were so few specimens of black and red maples sampled that the findings are not conclusive. Silver maples, of which we sampled several, have the narrowest leaves of the maples sampled and they had the fewest spiders per tree. Ranking between black, red and sugar maples, with two to three spiders per tree, and silver maple with one spider per four trees, were box elder and Norway maple, with one spider per tree. Box elder generally has non-lobed leaflets narrower than sugar maple leaves. Norway maple has broad leaves yet had a low spider population. We saw no obvious structural characteristic to account for the low spider population on Norway maples. This is not a native tree but we do not believe that fact in itself would affect the size of spider populations.

Correlated with leaf structure and tree shape there are probably microclimatic differences between maple species comparable to those found by Platt and Wolfe (1950) on oak leaves. These differences would be greatest at the leaf surfaces where the spiders are. It seems to us that the narrow leaves of silver maple would give less shielding and thus allow greater environmental extremes than would the leaves of other species. Several workers have shown that microclimatic factors are important in the microdistribution of spiders though some species are stimulated by different factors than are other species (Barnes & Barnes, 1954, 1955; Cherrett, 1964; Norgaard, 1951; Turnbull, 1964).

Food supply is important. The presence of a population of spiders is dependent upon an even greater population of insects to sustain it. Cherrett (1964) found that prey availability did not influence the location of webs of two orb-weavers. Turnbull (1964), however, working with *Achaearanea tepidariorum* inside a laboratory, found that the spider selects sites randomly and readily

moves if no prey is caught. If prey is caught, the spider remains and fills the area with webbing.

Of the various insects available as food to spiders on maple trees, aphids are usually the most abundant. However, even though aphids have been found in spider webs, they probably do not constitute any major portion of the spider's food. There are no records of spiders eating aphids and all attempts to feed aphids to spiders in captivity failed. We assume that the spiders prey on other insects that come to feed on aphids or their honeydew. If it is true, and if the numbers of other insects are correlated with numbers of aphids, this might account for the low numbers of spiders on Norway maple. Our subjective judgment is that Norway maple has smaller aphid populations than the other species used in this study.

The spider data were taken in such a way that we do not know how many spiders were taken from any one tree. We do know they were not evenly distributed among trees, and trees that contained spiders tended to have several species while many trees seemed bare of spiders. Without empirical data our subjective judgment is that good "spider trees" were also good "aphid trees."

When young spiderlings emerge they travel by ballooning and often balloon toward light which probably accounts for their distribution at the tree edges. The movement of the population toward the center of the tree with maturity might be due to reactions to microclimatic factors or to some form of intra- or interspecific competition. As the young spiders mature their food requirements increase and change. Muma and Muma (1949), in a study of prairie spiders, reported that specific maturity peaks are extremely important in interspecies competition, causing subsequent fluctuations in density and changes in distribution. Differences in maturity peaks of the nine species on maples and resultant differences in food requirements are possible factors influencing radial position on the tree through interspecific competition.

In conclusion, we suggest that the establishment of these spider species is dependent upon their finding broad, lobed leaves which provide adequate site architecture for their particular webs. Their subsequent survival and movements are dependent upon an adequate food supply.

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THREE NEW SPECIES AND A KEY FOR THE GENUS *CALLIDORA* (HYMENOPTERA: ICHNEUMONIDAE)

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The genus *Callidora* (subfamily Porizontinae) has traditionally contained a single European species, *Callidora albovincta* (Holmgren). Townes (1969) redefined the genus and included a second species (*Campoplex analis* Gravenhorst). At the same time he referred to three undescribed species, two from North America and one from the Philippines. Descriptions of these three are presented here together with a key to all five species now in *Callidora*.

Several relationships within this genus are noteworthy. The two North American species, *tegularis* and *surata*, are morphologically most alike. Quite distinct from these, but similar in body shape and propodeal sculpture is the European species *analis*. The remaining two, *albovincta* and *atrognatha*, have distinctive propodeal carinae in addition to a thorax which is more elongate in profile than that of the other species. Thus *Callidora* can be divided into two species groups which are easily distinguished on the basis of body shape and propodeal sculpture.

It should be noted that among the specimens of *albovincta* cited below, one is from Japan. Previously this species has been recorded only in Europe. This makes the apparent relationship between *albovincta* and *atrognatha* (the Philippine species) more understandable.