

## ORB-WEAVER ABUNDANCE IN THREE FORESTED COMMUNITIES IN THE SOUTHERN APPALACHIAN MOUNTAINS OF SOUTH CAROLINA

Very little quantitative information exists on the relationship between spider abundance and plant community. In reviewing the literature on the variability of spider abundance from place to place, Rypstra (Rypstra, A. L. 1986. *Amer. Midland Nat.*, 115:42-51) listed three general factors as "determinants" of the number and distribution of spiders: (1) vegetation (as structure), (2) abundance of insects, and (3) the physical environment (primarily temperature and humidity). Some workers have documented a close association between abstract vegetation communities and spider communities (Barnes, R. D. and B. M. Barnes. 1955. *Ecology*, 36:658-66; Luczak, J. 1963. *Ekol. Polska A.*, 11:159-221). Luczak (op. cit.) went as far as to point out that a given "biotope" will harbor a specific association of spider species. Although Rypstra (op. cit.) was concerned with relative abundance of web spiders in general and not with the relative abundance of various species in different communities, her conclusions seem to be compatible with those of Barnes and Barnes (op. cit.) and Luczak (op. cit.). Here, I present data indicating that the abundance of several species of orb-weavers is significantly different in three forested communities in the mountains of South Carolina.

While sampling vegetation in a mesic cove forest community and in a nearby xeric oak-hickory community in the southern Appalachians of South Carolina, I noticed a marked difference in the abundance of *Leucauge venusta* (Walckenaer). This orb-weaver was much more abundant in the mesic cove forest (Station Cove) than in the drier oak-hickory woods (Walhalla). In 1984, I initiated a procedure to quantify the abundance of several orb-weavers in the two communities, and in 1985, I followed the same procedure in a hemlock ravine community (Battle Creek). Two permanent strip transects 40 m x 1.5 m were established in each of the three communities. The transects were walked monthly (about mid-month) between 1000 and 1400 hours and all adult orb-weavers seen in webs were counted. Representative specimens of each species encountered were collected and deposited in the Clemson University Arthropod Collection, Department of Entomology, Clemson University, Clemson, South Carolina.

All three study areas are found in Oconee County, South Carolina along the eastern edge of the Blue Ridge physiographic province. Station Cove, the mesic cove community, is approximately 8 kilometers north of Walhalla, South Carolina (34°46'N 83°04'W). The oak-hickory community (Walhalla) is 2 kilometers south of Walhalla, and the hemlock ravine (Battle Creek) is approximately 20 kilometers southwest of Walhalla. Station Cove is dominated by tulip poplar (*Liriodendron tulipifera*), beech (*Fagus grandifolia*), basswood (*Tilia heterophylla*), and white ash (*Fraxinus americana*). The Walhalla oak-hickory site is dominated by white oak (*Quercus alba*), scarlet oak (*Quercus coccinea*), and mockernut hickory (*Carya tomentosa*). The dominant canopy trees at Battle Creek hemlock ravine are eastern hemlock (*Tsuga canadensis*), beech, and tulip poplar. A dense shrub layer of evergreen *Rhododendron* spp. is present at Battle Creek, a less dense layer of *Lindera benzoin* and *Asimina triloba* is

Table 1.—Orb-weaver abundance in three forested communities in the southern Appalachians. Study sites: SC-Station Cove; BC-Battle Creek; WA-Walhalla. Data were collected from Station Cove in 1984 and 1985 and from Walhalla and Battle Creek in 1985 and 1986. Numbers indicate adult orb weavers encountered on two 40 m x 1.5 m transects walked at each site.

SPECIES	JUNE			JULY			AUG			SEPT		
	SC	BC	WA	SC	BC	WA	SC	BC	WA	SC	BC	WA
<i>Araneus bicentenarius</i>	0/0	1/0	1/0	0/0	2/0	1/0	0/0	1/0	1/0	0/0	0/0	0/0
<i>Eustala anastera</i>	0/0	0/0	0/1	0/0	0/1	0/0	0/0	0/0	0/0	0/0	0/0	0/0
<i>Leucauge venusta</i>	112/80	40/52	1/2	18/22	8/12	2/1	6/8	0/0	0/0	0/0	0/0	0/0
<i>Mangora maculata</i>	0/0	0/0	0/0	0/0	0/0	0/0	23/28	6/10	1/3	20/25	15/18	5/5
<i>Mecynogea lemiscata</i>	0/0	0/0	10/12	0/0	0/0	8/10	0/0	0/0	6/10	0/0	0/0	0/0
<i>Metepira labyrinthea</i>	0/0	0/0	2/2	0/0	0/0	2/3	0/0	0/0	2/3	0/0	0/0	1/1
<i>Micrathena gracilis</i>	0/0	0/0	0/1	0/0	1/0	4/6	0/0	0/0	6/8	0/0	0/0	1/1
<i>Micrathena mitrata</i>	0/0	0/0	0/0	4/5	2/2	0/0	8/10	5/6	6/8	2/4	4/6	12/18
<i>Neoscona domiciliorum</i>	0/0	0/0	0/0	0/0	0/0	0/0	8/6	10/6	1/1	10/8	15/20	0/1
<i>Verrucosa arenata</i>	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	7/10	0/0	0/0	6/11

present at Station Cove, and a sparse layer of saplings and mixed shrubs is present at the Walhalla oak-hickory site. Relative site moisture was calculated for each site using Parker's (Parker, A. J. 1982. *Phys. Geogr.*, 3:160-68) Topographic Relative Moisture Index (an index ranging from 0-100 using slope angle, aspect, and other microsite variables). According to the index, Station Cove is the most mesic site with a 56, Battle Creek is mid-mesic with 45, and the Walhalla site falls near the xeric end of the index at 24.

The results here indicate that a marked difference exists in orb-weaver abundance between the mesic and xeric sites (Table 1). At Station Cove and Battle Creek, *Leucauge venusta* (Walckenaer) was the dominant early summer spider, being especially abundant at Station Cove; however, at the more xeric Walhalla site *Mecynogea lemniscata* (Walckenaer) was the dominant orb-weaver in June and July, with *Leucauge venusta* rare. *Mangora maculata* (Keyserling) was the dominant late summer (August and September) orb-weaver at Station Cove and shared dominance with *Neoscona domiciliorum* (Hentz) and *Verrucosa arenata* (Walckenaer) at Battle Creek (Table 1). In August at the Walhalla site, *Mecynogea lemniscata*, *Micrathena gracilis* (Walckenaer), and *Micrathena mitrata* (Walckenaer) were all abundant, while in September *Micrathena mitrata* was dominant.

The data from the three sites seem to indicate that, at least in the southern Appalachians, *Leucauge venusta*, *Mangora maculata*, *Neoscona domiciliorum*, and *Verrucosa arenata* are primarily species of densely-shaded mesic sites. (Gaddy and Morse (Gaddy, L. L. and J. C. Morse, 1985. *South Carolina Agr. Exp. Stat. Bull.*, p. 1094) noted that in South Carolina *Neoscona domiciliorum* is abundant in Coastal Plain swamps.) Conversely, *Mecynogea lemniscata* and *Metepeira labyrinthea*, neither of which was observed along transects in Station Cove and Battle Creek, appear to be spiders of more open, xeric sites. The site preference of *Micrathena mitrata*, which was common at all three sites in August and September, is unclear. *Araneus bicentarius* McCook and *Eustala anastera* (Walckenaer) were found at both the Walhalla site and at Battle Creek; however, because of their rarity at the two sites, no conclusions concerning site preference can be reached (Table 1).

The relationship between site moisture, canopy coverage, and species composition has not been adequately studied. Because quantitative analyses of the physical parameters (light intensity, soil moisture, absolute humidity, etc.) or the measurement of relative abundances of insects were not undertaken at the three sites, it is impossible to pinpoint the factors that regulate species dominance and distribution. Light intensity, for example, is obviously an important factor in orb-weaver site selection. The data presented here, however, indicate that some orb-weavers respond to moisture gradients. Furthermore, the data support the general conclusions of Barnes and Barnes (op. cit.) and Luczak (op. cit.) concerning associations between spider and plant communities and strongly infer that, like other organisms, orb-weavers probably have optimal environmental conditions under which they are most abundant.

**L. L. Gaddy**, Route 1, Box 223, Walhalla, South Carolina 29691.