BIOLOGY AND HABITATS OF THE LYNX SPIDER *OXYOPES SCALARIS* HENTZ (ARANEAE: OXYOPIDAE)[1]

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ABSTRACT: *Oxyopes scalaris* Hentz is found most frequently on woody vegetation. Color and pattern vary considerably between local populations, and these morphs are interfertile. Mating is very brief, lasting only a few seconds. The egg sac is securely fastened to foliage and is guarded by the female. Prey is rapidly captured, prey being grasped by the first two pairs of legs. The spiders rest at night suspended from foliage by a thread. Adults are found from late spring to summer. Females construct egg sacs in early to midsummer, and the immatures overwinter.

Oxyopes scalaris Hentz is one of the most widespread species of nearctic spiders. While it is most abundant in and west of the Rocky Mountains, it is found in most of the eastern states, the Mexican Plateau, and sporadically through Canada (Brady 1964). For a number of years we have accumulated data on certain aspects of the biology and habitats of the species from different areas of the United States: Cutler in east-central Minnesota; Jennings in northern Arizona, New Mexico, south-central Nebraska, and western Wisconsin; and Moody in southern California. This paper summarizes our observations on habitat associations, seasonal occurrence, feeding behavior, mating behavior, color variations and egg-sac construction of *O. scalaris.*

In Minnesota, *O. scalaris* has been collected chiefly on *Pinus* spp. (once on *Juniperus horizontalis* in a stand of *Pinus*). Southwestern collections of *O. scalaris* are also from *Pinus*, especially *P. edulis* and *P. ponderosa*, but this spider also occurs on other woody plants. In California, this spider is found in a diverse habitat range, including grasses, forbs, and shrubs.

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Cutler collected *O. scalaris* in Idaho while beating *Sarcobatus*, a xerophytic shrub. Brady (1974) reported that *O. scalaris* is very common on sagebrush (*Artemisia* spp.) and similar shrubs throughout the West. With the exception of collections from *Lepidium montanum*, specimens of *O. scalaris* were absent in sweep-net collections from 43 species of grasses and forbs in New Mexico (Jennings 1971). There is a trend for the species to be collected from woody vegetation, usually conifers, in north-central and northeastern states, and in mountainous parts of the West.

Table 1 is a composite of our observations and literature references to previous habitat associations of *O. scalaris*.

Ecological investigations have shown that particular species of foliage-hunting vagrant spiders, such as *O. scalaris*, are often significantly more abundant on one vegetation type than on another. This phenomenon is especially well known for thomisids and salticids (Cutler unpublished) and it will probably be observed in other foliage-searching vagrant spiders, such as the Anyphaenidae and Clubionidae.

Predation and Feeding

Under laboratory conditions prey is captured by a short stalk, followed by a pounce onto the prey. The prey is grasped by the spiny first two pairs of legs, in basket fashion, and forced toward the chelicerae. Prey items are not macerated, unless very small (ca. 1/10 the size of the spider), and carcasses are thereby recognizable. Prey capture takes only a few milliseconds. Vision seems to be the chief cue to capture, although tactile stimuli also may play a role. Prey taken under laboratory conditions included representatives of Araneae (Clubionidae, Oxyopidae, Salticidae, Thomisidae, and Theridiidae) and Insecta (Diptera, Homoptera, and Lepidoptera). Jennings and Pase (1975) found females guarding egg sacs and eating scolytid beetles on ponderosa pine foliage in Arizona. A female was observed feeding on a phalangid on ponderosa pine foliage in Nebraska.

Cannibalism can occur with both juveniles and adults, and is the rule if two or more individuals are confined together in the laboratory. A mature female *O. scalaris* was collected in New Mexico feeding on a penultimate male.

Mating Behavior

The mating behavior of *O. scalaris* has been observed many times in the laboratory by Moody. The male approaches the female, tapping the substratum with his outstretched first pair of legs. If receptive, the female assumes a cataleptic pose, with her legs curled inward for the brief instant of copulation. The spiders assume mating position II of Gerhardt. Copulation is so brief as to cast doubt that mating has actually occurred, but spiderlings emerge from sacs made by previously virgin females that had mated in this fashion. Sometimes the female emerges from catalepsis before copulation is complete, in which case the male loses a leg to the female. Second copulations are infrequent.

Gerhardt (1927, 1933) describes a similar mating behavior in *O. ramosus* (Mart. & Goez) and *O. heterophthalmus* Latr. The extreme rapidity of mating, allowing only one insertion of the embolus for about 20 seconds (Gerhardt 1933), probably accounts for the belief that it is difficult to get *Oxyopes* to mate under laboratory conditions.

Egg Sac

The egg sac of *O. scalaris* is characteristically a white flattened or lenticular disc, 7-10 mm in diameter, firmly attached to the substrate. The eggs are non-agglutinated and approximately 0.8 mm in diameter. Outlines of the eggs are impressed on the outer layers of silk and are clearly visible through the sac. This silk is tough and difficult to tear apart. The sparseness of egg sacs in collections is readily accounted for, since they adhere to foliage and are not dislodged by beating or sweeping. Sacs made in vials tend to be flatter than field-collected material and lack guy threads, possibly because of the nature of the substrate.

Jennings collected *O. scalaris* egg sacs from *Pinus ponderosa* foliage in the field. They had a maze of guy threads almost obscuring the shape of the sac. Cutler provided one female with a *P. banksiana* branch inserted in moist sand in a gallon jar. The female constructed an egg sac similar to field-collected sacs.

The female crouches over the sac in a characteristic position with legs slightly outstretched (fig. 1). She defends the sac and captures prey that comes near. Two sacs are customarily made under laboratory conditions.

The number of eggs and postembryonic stadia confined to sacs, based on 8 sacs collected by Jennings in Arizona and New Mexico, averaged 71, range 56-88. One second egg sac constructed in the laboratory had 26 eggs. Three sacs from *Pinus banksiana* in Wisconsin averaged 87 eggs and postembryonic stadia, range 82-94. Brady (1964) reports that a single egg case from Arizona contained 45 embryos.

Nielsen (1932) described and illustrated the sac of *O. ramosus,* and Jerrard (1972) illustrated the sac of *O. heterophthalmus.* Both are similar to the sac of *O. scalaris,* which supports Brady's (1964) contention that the three species are related. The egg sac of *O. salticus* Hentz, the only other nearctic *Oxyopes* whose egg sac has been described, is different: roughly spherical and half the size of the *O. scalaris* sac (Brady 1964).

Out of the 7 sacs (4 California, 3 Minnesota) for which data were recorded, an average of 21 days (range 19-26 days) elapsed from time of completed sac to time of emergence of spiderlings under laboratory conditions. Upon emergence, the young remain close to the sac and molt within 1-3 days before dispersing. After molting, they wander and become somewhat cannibalistic if not provided with ample food.

Parasitoids

In August, 1974, Jennings collected a female *O. scalaris* guarding an egg sac on ponderosa pine foliage near Hastings, Nebraska. The female and sac were preserved in ethanol and later opened and examined in the laboratory. The sac contained 3 uneclosed eggs (probably nonviable), 1 unemerged spiderling (enclosed within a membrane), 1 spiderling, and 55 parasitoids or hyperparasitoids (fig. 2). These parasites were all in the pupal stage, hence they could only be tentatively identified as Pteromalidae.

Fig. 1. Female *Oxyopes scalaris* guarding egg sac.

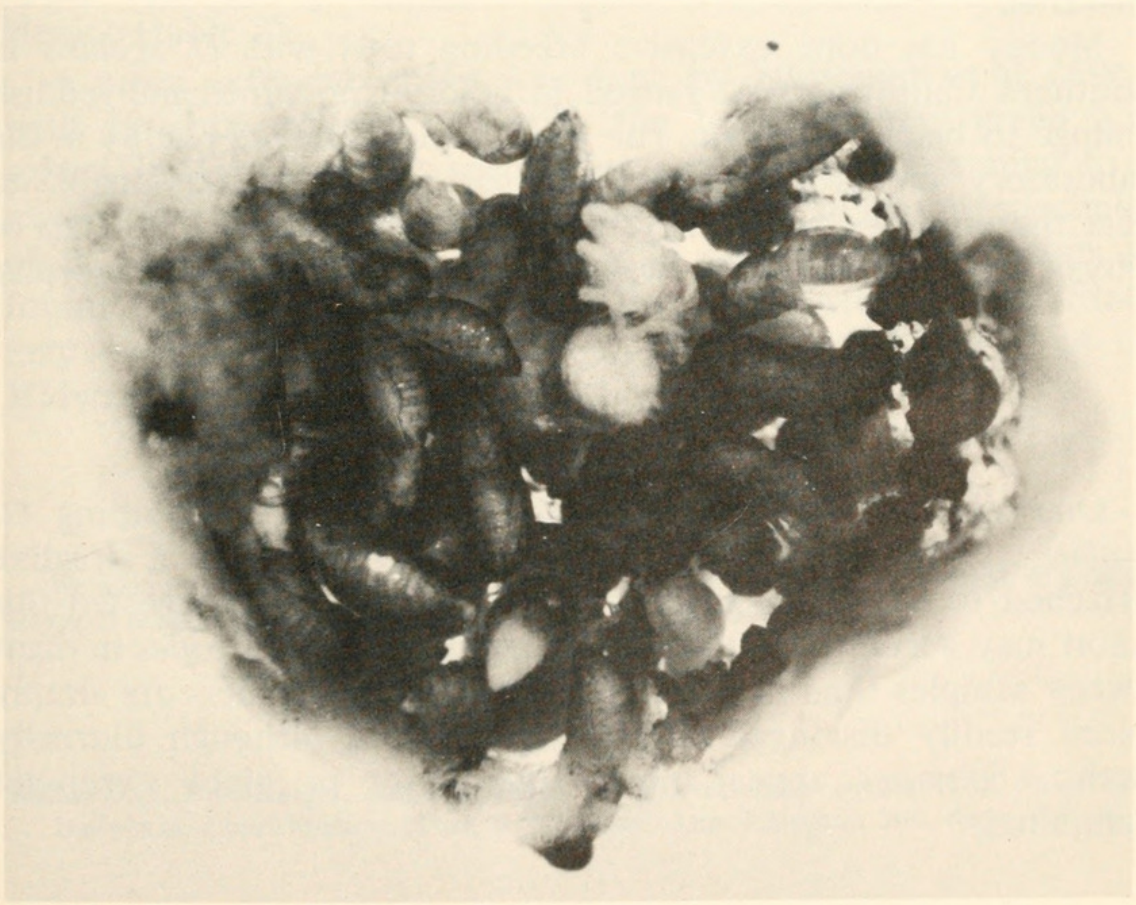

Fig. 2. *Oxyopes scalaris* egg sac with spiderling and parasitoids.

Color Variation

O. scalaris is extremely variable in color and pattern, perhaps accounting in part for seven synonyms, the best known being *O. rufipes* Banks. The basic patterns (Brady 1964, figs. 87-90) remain the same, but can be masked by increased scale and seta density. Pale gray individuals are characteristic in the western chaparral and intermountain deserts and plains, while dark brown (almost black) individuals are found in the Pacific Northwest and New England. These differences are most easily noted in live specimens.

Populations within a few kilometers may differ markedly in coloration. Moody observed this phenomenon in California, and Cutler observed it in northwestern Wisconsin and east-central Minnesota. A characteristic pattern from Minnesota and Wisconsin is: dorsum of opisthosoma with few white setae, overall dark brown, russet marks on each side of the anterior third of opisthosoma, more rarely in the cardiac region. Freshly molted Minnesota laboratory specimens have some gray pilosity, but most field-collected specimens lacked this pile. Juveniles tend to retain more of these gray scales than adults, based on field-collected material.

Moody has done extensive breeding tests with *O. scalaris* in southern California that ranged in color from white and reddish orange to blackish brown. The parent spiders mated readily in the laboratory and produced viable offspring, but she was unable to rear the juveniles to maturity. There appears to be no biological or physical barrier to gene flow between the different color morphs.

Rest

One of the peculiarities of *Oxyopes* species, including *O. scalaris,* is that they rest at night suspended from a dragline attached to the underside of a leaf. Lowrie (1971) suggested this habit may account for the greater abundance of *Oxyopes* in night sweep samples than in day sweep samples: the spiders are simply more readily dislodged while resting. Thus, although diurnally active, *Oxyopes* appear most abundantly in night sweep-net samplings.

Seasonal Cycle

In Minnesota there is a definite cycle in the appearance of the instars. For two years small numbers of spiders were consistently taken on a monthly basis (May-October) in a stand of planted *Pinus banksiana* in southwestern Anoka County. Size estimates indicated there are approximately six instars after young leave the egg sac, the last being the mature spider (table 2). Catches were small, and there was no attempt to be quantitative in sampling. All samples were collected in the period between 1100 and 1400 hours. Spiders reach maturity in early summer, but by August no adults were collected. In captivity, however, females have survived until December. Early to half-grown immatures overwinter to mature the following spring. Mature males were taken only in June in Minnesota and Wisconsin. Both Bristowe (1958) and Nielsen (1932) state that *O. heterophthalmus* Latr. has this same general life history cycle in England and Denmark, respectively.

Data from specimens collected in Wisconsin indicate the seasonal cycle there is probably the same as in Minnesota. In Arizona and New Mexico the pattern is roughly the same as in the upper Midwest, but mature individuals appear earlier in New Mexico (table 2).

A more extensive study was done by Whitcomb et al. (1966) with *Peucetia viridans* (Hentz), the large southern green lynx spider. In Arkansas, this species has a seasonal cycle similar to *O. scalaris,* except that it is delayed about a month. Mature specimens of *P. viridans* are found in July, and only very early instars are found in April. *O. scalaris* from the southeastern United States may show a different seasonal cycle than we observed in the Midwest and Southwest.

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Table 1. Habitat associations of *Oxyopes scalaris* Hentz.

Associations	Localities	References or Sources[1]
Coniferous Trees		
Abies concolor	New Mexico	(Matlack and Toliver)
Juniperus sp.	Kansas	Heinrichs and Thompson, 1968
Juniperus horizontalis	Minnesota	(Cutler)
Juniperus monosperma	New Mexico	(Jennings)
Juniperus scopulorum	New Mexico	(Jennings)
Juniperus virginiana	Missouri	Dowdy, 1951
Pinus sp.	Connecticut	Kaston, 1948
Pinus banksiana	Michigan	Allen, Knight, and Foltz, 1970
	Minnesota	(Cutler)
	Wisconsin	(Jennings) (Cutler) (Jennings and Stary)
	Manitoba	(DeBoo)
Pinus echinata and *Pinus taeda*[2]	Arkansas	Peck, Warren, and Brown, 1971
Pinus edulis	New Mexico	(Jennings) (Toliver) (Benton and Jennings)
Pinus ponderosa	Arizona	(Jennings) Jennings and Pase, III, 1975 (Coffman)
	California	Dahlsten, 1961
	Nebraska	(Jennings)
	North Dakota	(Tagestad)
	South Dakota	(Tagestad)
Pinus resinosa	Michigan	(Peterson)
	Minnesota	(Cutler)
	Wisconsin	(Jennings and Stary)
Pinus strobus	Minnesota	(Cutler)
Pinus virginiana	Maryland	Howden and Vogt, 1951
Pseudotsuga menziesii	British Columbia	Turnbull, 1956
Tsuga canadensis	New York	(Cutler)
Deciduous Trees and Shrubs		
Artemisia sp.	Utah	Fautin, 1946
	Western North America	Brady, 1964 and Gertsch, 1949
Artemisia tridentata	New Mexico	(Jennings)
Baccharis pilularis	Utah	Tilden, 1951
Berberis fremontii	Arizona	(Jennings)
Berberis haematocarpa	New Mexico	(Jennings)
Ceanothus sp.	California	(Moody)
Chilopsis linearis	New Mexico	(Pierce)
Chrysothamnus sp.	New Mexico	(Jennings)
Cowania mexicana	Arizona	(Jennings)

Table 1. (continued)

Associations	Localities	References or Sources[1]
Fallugia paradoxa	New Mexico	(Jennings)
Pyrus malus	New Jersey	Specht and Dondale, 1960
Quercus grisea	New Mexico	(Jennings and Toliver)
	New Mexico	(Jennings, Toliver and Matlack)
Ribes sp.	New Mexico	(Jennings)
Sarcobatus sp.	Idaho	(Cutler)
	Utah	Fautin, 1946
Tamarix pentandra	New Mexico	(Jennings)
Tetradymia sp.	Utah	Fautin, 1946
Undet. shrubs and trees	California	(Moody)
Herbaceous Vegetation		
Andropogon virginicus	North Carolina	Barnes and Barnes, 1955
Asclepias kansana	Kansas	Fitch, 1963
Lathyrus odoratus	New Mexico	(Jennings)
Lepidium montanum	New Mexico	(Jennings)
Pisum sativum	New Mexico	(Jennings)
Undet. grasses	California	(Moody)
Undet. herbaceous vegt. in deciduous woodland	Missouri	(Cutler and Jennings)
Undet. roadside vegt.	California	(Moody)
Parasitic Plants		
Arceuthobium americanum Host: *Pinus contorta*	Colorado	(Penfield)
Arceuthobium vaginatum Host: *Pinus ponderosa*	Colorado	(Penfield)
Other Habitats		
In house	New Mexico	(Campbell)
Pitfall trap (in *Artemisia* community)	Wyoming	(Schmid)
Disturbed *Agropyron-Poa*, forbs and shrubs	Utah	Hayward, 1945
No clear distinction between field and forest	North Carolina	Berry, 1970
On automobile	New Mexico	(Matlack)
On outside walls of house	New Mexico	(Matlack)
Under car hood	New Mexico	(Benton and Toliver)
On garden wall	New Mexico	(Matlack)

[1] Previously unpublished records in parentheses.

[2] Collections not separated by tree species.

Table 2. Seasonal occurrence of *Oxyopes scalaris*.

State	Life stage	Specimens collected per month						
		Apr.	May	June	July	Aug.	Sept.	Oct.
Minnesota Anoka Co.	juv.		(6)	(6)	(2)	(6)	(5)	(16)
	males			(4)				
	penult. females			(1)		(3)		
	females			(4)	(1)			
Wisconsin	juv.		(2)	(11)	(6)			
	males			(4)				
	females			(5)	(9)	(2)		
Arizona	juv.	(1)	(5)	(3)	(6)	(1)		
	penult. males	(1)						
	males			(8)	(2)			
	penult. females	(1)						
	females			(12)	(7)	(1)		
New Mexico	juv.		(10)	(17)		(13)	(29)	(2)
	penult. males		(2)	(7)				
	males		(6)	(11)				
	penult. females		(1)					
	females		(8)	(16)	(1)	(3)		