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PREDATION BY *PISAURINA MIRA* (ARANEAE, PISAURIDAE) ON *LYGUS LINEOLARIS* (HETEROPTERA, MIRIDAE) AND OTHER ARTHROPODS

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ABSTRACT

In the Delta area of Mississippi, a 13-month sampling program in old-field habitats adjacent to cotton fields demonstrated high densities of *Pisaurina mira* in June, which was coincident with high *Lygus lineolaris* populations. In July, *P. mira* populations were lower by 50% and *L. lineolaris* by almost 100%. From August through October, *P. mira* populations continued to decline while *L. lineolaris* increased. Field observations in the same old-field habitats indicated *L. lineolaris* to be the most frequently captured prey item of *P. mira*. In laboratory feeding experiments over a 3-year period, all *P. mira* individuals consumed *L. lineolaris* and 22 of 35 other species of co-occurring potential arthropod prey. These data suggest that the predator *P. mira* may affect *L. lineolaris* populations and can survive on other prey when *L. lineolaris* is less abundant.

INTRODUCTION

Members of the Pisauridae in North America are wandering spiders that do not build snares and are typically found on vegetation or at water margins throughout North America (Carico 1972). *Pisaurina mira* (Walckenaer) is one of the most common spiders in the eastern United States and occurs in woods, old-fields, and meadows, but is especially abundant in the ecotonal areas between woods and fields (Carico 1972). This species can be an important predator in row crops and has been recorded from rice (Woods and Harrel 1976), sugarcane (Negm et al. 1969), peanuts (Agnew et al. 1985), soybeans (LeSar and Unzicker 1978), cotton (Whitcomb and Bell 1964), and alfalfa (Wheeler 1973). *P. mira* has been documented recently in the laboratory as a voracious predator on the tarnished plant bug (TPB), *Lygus lineolaris* (Palisot) (Heteroptera, Miridae) (Young 1989). The TPB is an economically important pest on many crops in the United States, feeds on over 350 species of plants, and is abundant in habitats adjacent to row crops (Young 1986). Since these are the same habitats in which *P. mira* is abundant, it is possible that this spider could have a significant impact on TPB populations. The purpose of this study was to delineate the seasonal populations of *P. mira* in field edge habitats, and to determine which arthropods were present in those same habitats which *P. mira* could feed upon.

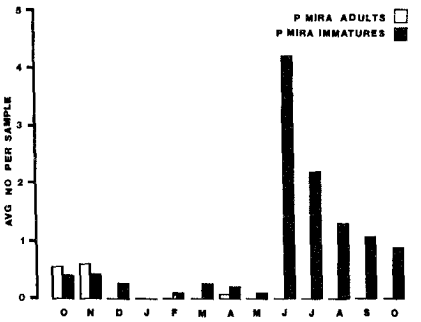

Figure 1.—Average number per sample of *Pisaurina mira* adults and immatures for each of 13 consecutive months in old-field habitats adjacent to cotton fields in Washington County, Mississippi.

METHODS AND MATERIALS

Field.—Arthropods were collected by sweepnet and/or vacuum (D-vac®), 10 sweeps or 10 row-feet per sample, at 15 undisturbed early-successional sites adjacent to cotton fields in Washington County, Mississippi. Sampling was conducted on alternate weeks during the period October 1985 through October 1986. All *P. mira* and potential prey were removed from the samples, counted, and determined as to immature or adult. On an irregular basis throughout the 13-month period, observations of *P. mira* predation on various prey at these same sites were recorded.

Laboratory.—Individuals of *P. mira*, obtained from the above-mentioned and other similar sites during 1984-86, were placed in plastic cups (4 by 10 cm) with a cloth-mesh cover and maintained in an environmental chamber at 25°C, 80% RH, and a 14:10 (L:D) photoperiod. The feeding protocol involved starving (water available) each spider for the seven days after capture, placing an individual live prey in each container, recording the prey status after 24 hours, and removing the unconsumed material. Spiders not consuming prey were offered one adult TPB, which was always accepted. The starvation—feeding—recording cycle was then repeated several times for each spider using different potential prey in each cycle. These feeding trials were conducted during the late summer and fall of 1984-1986, with both *P. mira* and potential prey collected from the same sites. Each potential prey species was offered to 3-10 different spiders, depending upon availability of the prey.

RESULTS AND DISCUSSION

Seasonal occurrence.—During the 13-month sampling period, 44 adult *P. mira* were captured, with 98% occurring in October and November (Fig. 1). Three-hundred and seventy immatures were also captured, with the largest number (40%) occurring in June. These patterns of occurrence indicate that adults and late-instar immatures overwinter, that eggs hatch in May with dispersal of immatures from nursery webs in June, and that *P. mira* is univoltine. Published information from other collection sites indicate a similar pattern. Adults of *P. mira* are most abundant during June in Illinois (Jones 1940), Kansas (Fitch 1963), and Tennessee (Gibson 1947), and during May in North Carolina (Berry 1971) and Arkansas (Peck et al. 1971). Immatures were most abundant during

Table 1.—Field observations of prey capture by *Pisaurina mira*.

Prey taxon	Prey stage	No. observations
Heteroptera: Miridae		
Lygus lineolaris (Palisot)	Adult	2
L. lineolaris	Immature	3
Polymerus basalis (Reuter)	Adult	1
Homoptera: Cicadellidae, Undet. sp.	Immature	2
Coleoptera: Chrysomelidae		
Diabrotica undecimpunctata howardi Barber	Adult	2
Diptera: Muscidae, Undet. sp.	Adult	1
Hymenoptera: Apidae		
Apis sp.	Adult	1

September in Ohio (Elliott 1930) and Tennessee (Gibson 1947), during August in North Carolina (Berry 1971) and Kansas (Fitch 1963), and abundant throughout the June to October period in Illinois (Jones 1940) and Arkansas (Peck et al. 1971). Mississippi populations appear to develop earlier than those further north, but there is no evidence for a second generation.

Field observations of predation.—A survey of the spider literature revealed an absence of records involving prey of *P. mira*. Considering the dense and low vegetation in which this species is most abundant, perhaps the lack of prey records is not surprising. During several hundred hours of field work over a 13-month period, only 12 *P. mira* with prey were recorded (Table 1). The species captured were among the most abundant species present at the time of the observations. Five of the 12 prey records (43%) involved the TPB, and since the TPB comprised considerably less than 43% of the arthropod population (Young unpubl. data), it is possible that *P. mira* demonstrated some specificity for the TPB.

Laboratory observations.—Over a 3-year period, 41 individuals of *P. mira* were offered 36 species of prey representing 22 families of insects in eight orders and three families of spiders (Table 2). Not all of these potential prey were captured and consumed, as 77 of the 179 specimens were rejected (43%). Thirteen species (56 individuals) were completely rejected by *P. mira*. Situations in which the potential prey was as large or larger than the spider, or considerably smaller, usually resulted in an absence of prey capture, as did the presence of probable

Table 2.—Laboratory observations of prey capture by *Pisaurina mira*.

Prey taxon	Prey life state	Prey mean body length (mm)	*P. mira mean* body length (mm)	Prey consumed	
				Yes	No
COLEOPTERA					
Carabidae					
Lebia viridis (Say)	Ad	5	5	6	
Coccinellidae					
Cycloneda munda (Say)	Ad	5	6		4
Hippodamia convergens Guerin	Ad	6	7		8
Chrysomelidae					
Diabrotica undecimpunctata howardi Barber	Ad	7	9	2	3

DIPTERA					
Syrphidae, Undetermined species	Ad	6	6	4	
Calliphoridae, Undet. sp.	Ad	6	7	3	
HEMIPTERA					
Coreidae, Undet. sp.	Imm	14	10		4
Lygaeidae					
Blissus sp.	Ad	3	7	2	5
Geocoris punctipes Say	Ad	4	5	6	2
Oncopeltis sp.	Ad	15	8		3
Oncopeltis sp.	Imm	8	9	2	
Miridae					
Lygus lineolaris (Palisot)	Ad	5	7	10	
Taylorilygus pallidulus Blanchard	Ad	4	6	5	
Nabidae					
Reduviolus roseipennis (Reuter)	Ad	7	8		4
Tropiconabis capsiformis (Gemar)	Ad	8	7	1	2
Pentatomidae					
Stiretrus anchorago (F.)	Ad	8	7	1	2
Reduviidae					
Sinea diadema (F.)	Ad	13	10		3
Zelus sp.	Imm	12	13		6
HOMOPTERA					
Cicadellidae					
Chlorotettix sp.	Ad	5	7	6	
Gyponana sp.	Ad	5	9	3	
Fulgoridae, Undet. sp.	Ad	8	9		2
Membracidae					
Spissistilus festinus (Say)	Ad	5	8		6
HYMENOPTERA					
Halictidae					
Augochlor sp.	Ad	5	7	6	
Undet. sp.	Ad	8	13	3	
LEPIDOPTERA					
Geometridae, Undet. sp.	Imm	11	10		4
Noctuidae					
Heliothis sp.	Imm	7	7	6	
Spodoptera sp.	Imm	7	7	6	
Syntomidae					
Ctenucha sp.	Ad	9	9	3	
Yponomeutidae					
Atteva sp.	Ad	10	8		4
NEUROPTERA					
Chrysopidae					
Chrysopa sp.	Imm	6	6		5
ORTHOPTERA					
Acrididae, Undet. sp.	Ad	8	8	3	
Tettigoniidae					
Neoconocephalus sp.	Imm	5	7	5	
ARANEAE					
Oxyopidae					
Oxyopes salticus Hentz	Imm	4	8	8	
Salticidae					
Metaphidippus sp.	Imm	3	9	3	3
M. galathea (Walck.)	Ad	4	6	5	4
Phidippus sp.	Imm	6	9	4	
Thomisidae					
Misumenoides formosipes (Walck.)	Imm	2	6		3

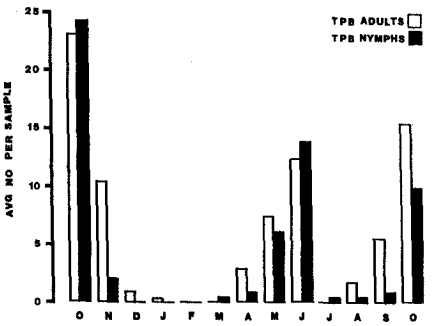

Figure 2.—Average number per sample of *Lygus lineolaris* adults and nymphs for each of 13 consecutive months in old-field habitats adjacent to cotton fields in Washington County, Mississippi.

distasteful prey (coccinellids and coreids). When the offered prey was also a predator, such as nabids or other spiders, prey capture sometimes did not occur. The size range of *P. mira* adults and juveniles utilized in these feeding trials was 5-13 mm body length and that of accepted prey was 4-14 mm. Twenty-three species were accepted as prey under these laboratory conditions, and four additional species were observed as prey in the field. These 27 prey species were among the most abundant arthropods at the sampled sites, suggesting that *P. mira* can capture most arthropod species on vegetation within a particular size range. It must be remembered, however, that all laboratory spiders were offered, and accepted, adult TPB at some time during their captivity.

Potential impact on TPB populations.—The seasonal distribution of TPB at the same sites from which *P. mira* was collected is presented in Fig. 2. Population peaks of TPB occur in October and June, with the June peak followed in July by a veritable absence of TPB. The population peak of *P. mira* was also in June (Fig. 1). This correspondence of high population levels in June indicates that the TPB was abundantly available as prey for *P. mira* at that time. Subsequent population decline of TPB in July (Fig. 2) may have been due to emmigration out of field margins into cotton and/or mortality due to predators such as *P. mira*. Field and laboratory observations also suggest that when TPB is abundant, *P. mira* will be a frequent predator of this prey, and when TPB is relatively scarce, *P. mira* can readily feed on other prey.

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