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LIFE HISTORY AND ECOLOGY OF THE ARMORED SPIDER *MONOBLEMMA MUCHMOREI* (ARANEAE, TETRABLEMMIDAE)

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ABSTRACT. The armored spider *Monoblemma muchmorei* Shear 1978 occurs in the wet subtropical forest of the Caribbean National Forest, Luquillo, Puerto Rico. It is found almost entirely in bamboo litter between 100 and 110 m in elevation and shares this habitat with a number of other species of spiders, ants and other small arthropods. The two sexes come together with no evidence of prior courtship, mate, and may remain *in copula* for many hours. A small decorated egg sac is produced with only one egg in each sac. The female tends the unusually large spiderling for a week or more and appears to offer some protection from other small invertebrates. For reasons not understood, second instar spiders suffered a high mortality rate, up to 70%. In captivity, the adults may live for eight months or more. Observations on the predator-prey interactions among *M. muchmorei* and other small invertebrates are reported. At least 30 species of spiders in 16 families are found associated with *M. muchmorei* in the bamboo litter.

Keywords: Bamboo litter, reproduction, predation, Puerto Rico, leaf litter

Spiders of the family Tetrablemmidae occur in tropical areas around the world and include 30 genera and 130 species (Platnick 2006). The term "armored" refers to the series of separate, latitudinally arrayed sclerites around the abdomen. The genus *Monoblemma* Gertsch 1941 occurs in tropical Africa and the tropical Americas, with several species being found in the Caribbean region (Shear 1978). Nothing has been published on the choice of habitat or the life history on this or any other species of the family.

Monoblemma muchmorei Shear 1978, is a very small (~ 0.9 mm), dark orange-red spider (Fig. 1). This species has been collected in the nearby Virgin Islands, and perhaps in Columbia (Shear 1978). We made our collections in the Caribbean National Forest (CNF), Luquillo, Puerto Rico, in the wet subtropical forest (Ewel & Whitmore 1973). This species was found almost exclusively in bamboo litter (*Bambusa vulgaris* Schrad.) between 100 and 110 m in elevation. We extensively sampled leaf litter, including bamboo litter, from all the principal forest habitats without finding additional specimens. Examples of other habitats sampled include old mahogany plantations at lower elevations, areas dominated by sierra palm at mid elevations, and dwarf forests at higher elevations, each with a different litter type.

METHODS

Beginning in 1992 and continuing to 2004, over 800 forest litter samples were collected in 13 forested study areas, ranging in elevation from 100 to 1065 m in the Caribbean National Forest (CNF) on the mountain El Yunque in Puerto Rico. In so far as possible, each 0.25 m^2 sample was taken within areas of consistent leaf coverage of no less than 1 m^2, including all litter down to the soil surface. Each sample was placed in a cloth bag and subsequently sorted in a large white photo developing tray at the University of Puerto Rico's El Verde Field Station. Often, once the bulk of the larger inert material (leaves, twigs, stones, etc.) had been examined and removed from the tray, the behavior of many organisms, especially of ants and other potential

[1] Deceased

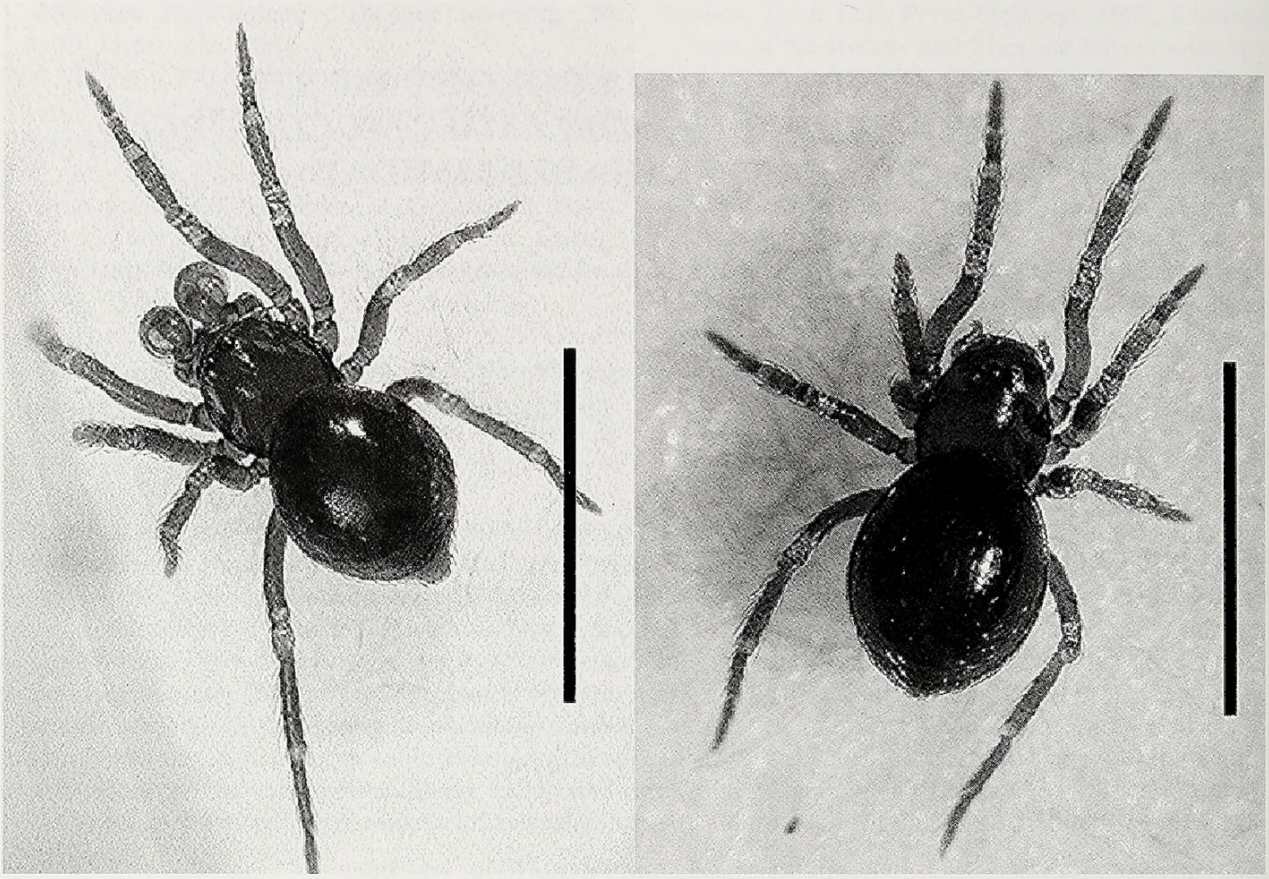

Figure 1.—*Monoblemma muchmorei*. Dorsal views of male (left) and female (right). Scale bars = 1 mm.

predators, was observed. Spiders and other arthropods of interest were preserved in 75% ethanol to be identified and counted later, while specimens of *M. muchmorei* were placed live in Petri dishes for observation.

Live specimens were kept in small plastic culture dishes (47 mm diameter with absorbent pad), some with pieces of moss. Other spiders were kept in larger standard culture dishes (90 mm diameter). Initially the pads of the smaller dishes were moistened with two drops of water. These were in turn kept in larger plastic lidded containers in which damp sponges were also placed to ensure a high humidity. The temperature was maintained between 20–22° C. Pairs also were kept in the smaller dishes to allow closer observation. The larger dishes containing moss were used to keep up to ten or more individuals for various purposes including estimates of longevity and time to maturation. They were fed with the collembolan *Sinella curviseta* Brooks. Individual spiders appeared to require at least one medium sized collembolan every three days. If hungry, spiders immediately seized a collembolan when it was added to the dish whether it fell into webbing or to the bottom of the dish. Specimens were periodically observed for activities that attracted our attention, for example, females engaged in creating webbing, or for interactions between individuals. Images were taken using a Bausch & Lomb trinocular dissecting scope mounted with a Coolpix 960 digital camera.

Angelita Trail area.—The area known as the Angelita Trail was of particular interest as it was here that we found the Tetrablemmidae. The Angelita Trail is at the outer windward edge on the northeastern side of the CNF. It borders the Rio Mameyes and is easily accessed via Route 988. The area ranges from 100–150 m in elevation. The topography is deeply dissected by both intermittent and permanent streams. The forest itself is considered as Tabonuco Forest. It is a mixed, relatively young, second growth forest of uncertain land use history, and includes a variety of trees such as Tabonuco, *Dacryodes excelsa* Vahl., Ausobo, *Manilkara bidentata* (A. D.C.), Motillo, *Sloanea berteriana* Choisy, Guaba, *Inga*

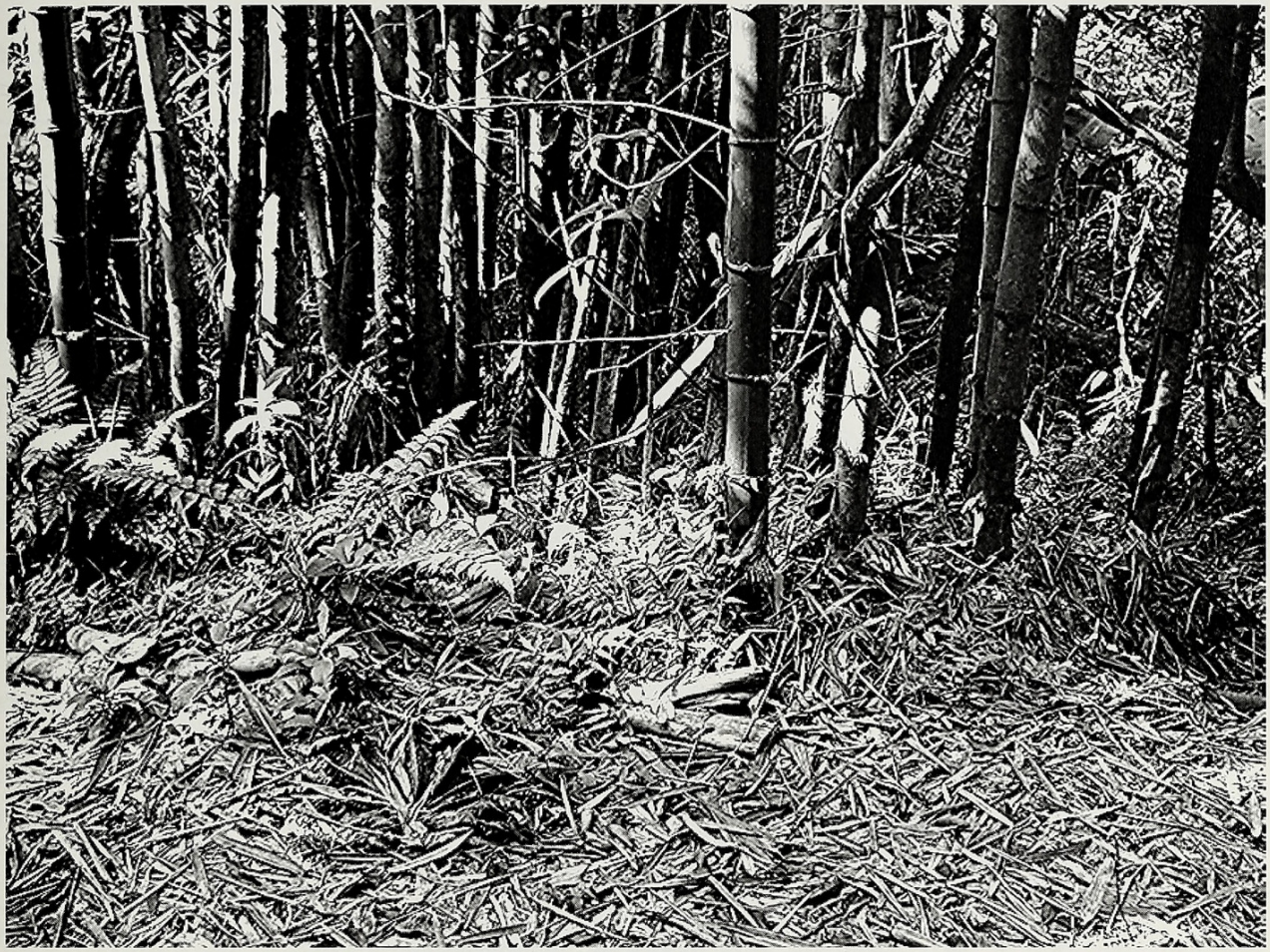

Figure 2.—Stand of *Bambusa vulgaris* at lower end of Anglita Trail, Caribbean National Forest, Puerto Rico.

vera Willd., and Guamà, *I. laurina* (Sw.) Willd. and introduced species such as Bamboo *Bambusa vulgaris* Schrad. and a number of Breadfruit *Artocarpus altilis* (Parkinson). Trumpet-tree *Cecropia peltata* L. is not abundant, suggesting little local hurricane disturbance. There is a highly variable sparse understory. Localized bamboo stands (Fig. 2) occur along the margins of Route 988 and in a loose aggregation of wetter stream-side soils at lower elevations (± 100 m). Unlike most other species of trees in the area, bamboo tends to shed leaves year round. The bamboo litter in areas protected from wind and excessive runoff is usually relatively thick, 1 or more decimeters in depth. Where subject to heavy runoff or flooding after heavy rains, the litter is thin and scattered or absent.

Rainfall averages about 350 cm/yr of which approximately one third is dissipated through evapotranspiration. There are about 100 rain-free days/yr (Garcia-Martino et al. 1996; Weaver 1991). The mean annual air temperature is estimated to be somewhat more than 26° C with the soil temperature about 1° C less. Accordingly, at the lower elevations of the Angelita Trail area, the forest may better be termed a tropical rather than a subtropical forest (Holdridge 1967; Whittaker 1975).

In February 2000, in a transect of deciduous forest litter samples taken along the Angelita Trail, a single specimen of a species of Tetrablemmidae was collected. It was subsequently determined to be *Monoblemma muchmorei*. In February 2001, a similar set of samples was collected, this time with notes taken on each sample's exact locality, including a more detailed description of the leaf litter contained in each sample. No *M. muchmorei* were found. In February 2002 another leaf litter collection was made. When the samples were sorted, once again a single male *M. muchmorei* turned up in a tabonuco leaf sample taken near a clump of bamboo at 110 m. It was noted that no collections had been made exclusively of bamboo litter. So, in December

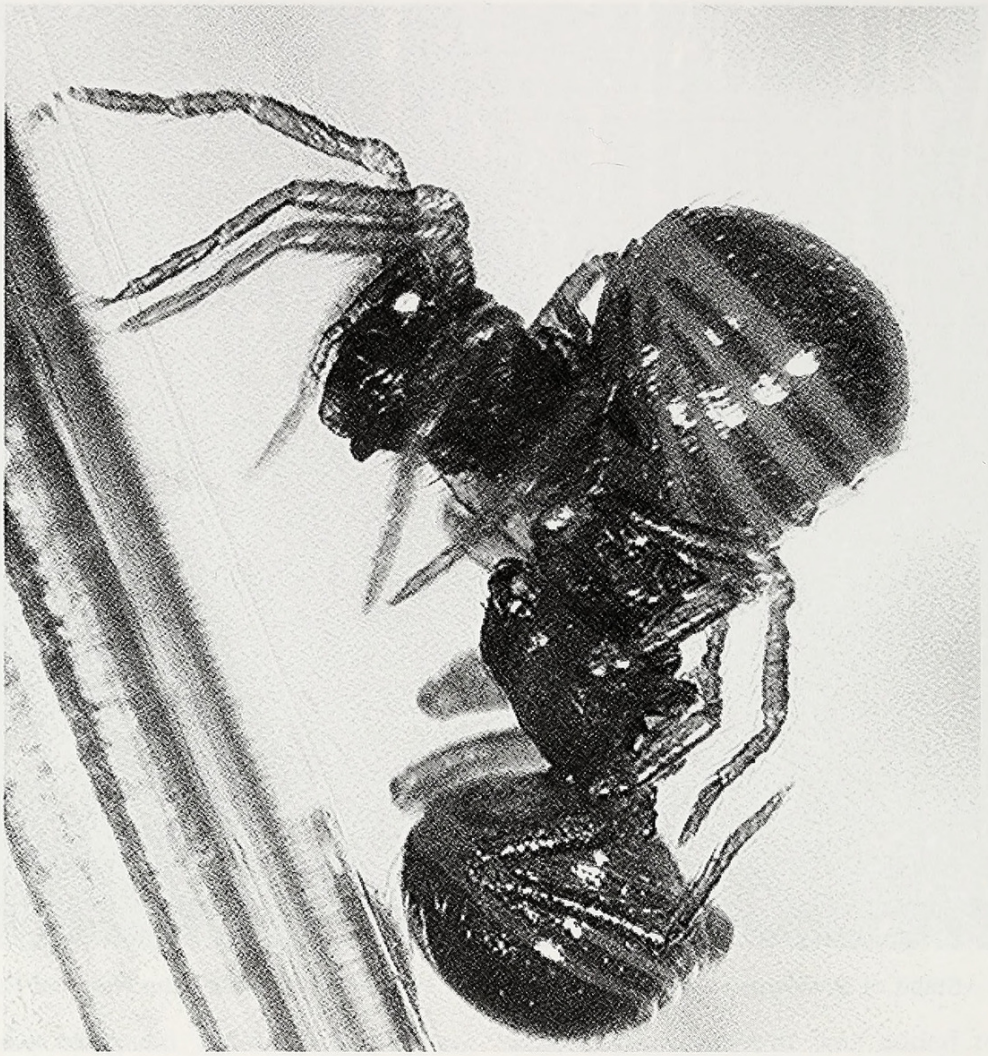

Figure 3.—Mated pair of *Monoblemma muchmorei*. Male located beneath female. Male's left palp is activated. scale bar = 1 mm.

2002, a special collection of three bamboo litter samples was made near where the specimen had been collected in February. *Monoblemma muchmorei* showed up in abundance. In May 2003 and February 2004, the bamboo litter was extensively sampled with the species occurring in all samples except those where water runoff or flooding had scattered the litter. The bamboo litter at 150 m was extensively sampled in May 2003 and again in February 2004, yielding no specimens of *M. muchmorei*. Over the years a large number of bamboo samples were collected in other study areas from 250–500 m without yielding *M. muchmorei*. Indeed, only a limited number of other species typically found in the forest litter were found in these samples.

Voucher specimens of *M. muchmorei* Shear have been deposited in the Museum of Comparative Zoology, Cambridge, Massachusetts; the U.S. National Museum, Washington, DC; the British Museum of Natural History, London; and the American Museum of Natural History, New York. Voucher specimens of other species collected during this study are maintained in the authors' collection.

RESULTS

Comparison of species present in deciduous forest and bamboo litter.—Thirty spider species from 16 families were taken in the forest and bamboo litter samples between February 2000 and February 2004 (Table 1). The deciduous leaf litter in the Angelita area, from 100 to 150 m in elevation, varied greatly in structure from sample to sample. It was typically less than 1 dm in depth. In contrast to that of bamboo it was usually less densely packed and less permanently positioned, often scattered about by wind and rain. Forest litter

Table 1.—Spider collection data, Angelita Trail area, Caribbean National Forest, Luquillo, Puerto Rico. Each litter sample = 0.25 m^2 from top to soil surface. *n* = number of individuals; m^{-2} = number of individuals per meter square; * = species typically found above litter.

Litter type	Forest						Bamboo					
Date	Feb. 2000		Feb. 2001		Feb. 2002		Dec. 2002		May 2003		Feb. 2004	
Elevation in meters	110–150		100–150		110–150		110		100–110		100–110	
Number of samples	10		10		10		3		9		7	
Total sample area m^2	2.50		2.50		2.50		0.75		0.75		0.75	
Species	*n*	m^{-2}	*n*	m^{-2}	*n*	m^{-2}	*n*	m^{-2}	*n*	m^{-2}	*n*	m^{-2}
Caponiidae												
Nops blandus (Bryant 1942)	—	—	—	—	1	0.4	1	1.3	—	—	—	—
Corinnidae												
Corinna javuyae Petrunkevitch 1930	—	—	—	—	—	—	—	—	—	—	1	0.6
Phrurolithus insularis Petrunkevitch 1930	—	—	—	—	2	0.8	5	6.7	25	11.1	2	1.1
Dipluridae												
Masteria petrunkevitchi (Chickering 1964)	44	17.6	2	0.8	15	6.0	44	58.7	81	36.0	20	11.4
Linyphiidae												
Lepthyphantes microserratus Petrunkevitch 1930	3	1.2	6	2.4	3	1.2	—	—	1	0.4	—	—
Mysmenidae												
Calodipoena caribbaea (Gertsch 1960)	—	—	5	2.0	4	1.6	—	—	1	0.4	1	0.6
Ochyroceratidae												
Ochyrocera sp. 1	—	—	44	17.6	5	2.0	—	—	1	0.4	1	0.6
Theotima minutissimus (Petrunkevitch 1929)	127	50.8	152	60.8	161	64.4	71	94.7	163	72.4	48	27.4
Oonopidae												
Ischnothyreus peltifer (Simon 1891)	—	—	—	—	—	—	—	—	3	1.3	—	—
Oonops castellus Chickering 1971	7	2.8	—	—	7	2.8	7	9.3	7	3.1	5	2.9
Oonops ebenecus Chickering 1972	—	—	—	—	—	—	—	—	7	3.1	6	3.4
Gamasomorpha lutzi Petrunkevitch 1929	—	—	3	1.2	—	—	—	—	—	—	1	0.6
Triaeris stenaspis Simon 1891	—	—	1	0.4	4	0.1	—	—	2	0.9	—	—
Pholcidae												
Modisimus cavaticus Petrunkevitch 1929	37	14.8	6	2.4	—	—	—	—	—	—	2	1.1
Modisimus coeruleolineatus Petrunkevitch 1929	—	—	—	—	7	2.8	—	—	11	4.9	—	—
Modisimus montanus Petrunkevitch 1929	29	11.6	—	—	17	6.8	1	1.3	7	3.1	8	4.6
Prodidomidae												
Neozimiris nuda Platnick & Shadab 1976	1	0.4	—	—	1	0.4	2	2.7	6	2.7	—	—

Table 1.—Continued.

Species	*n*	m^{-2}	*n*	m^{-2}	*n*	m^{-2}	*n*	m^{-2}	*n*	m^{-2}	*n*	m^{-2}
Salticidae												
Corythalia gloriae (Petrunkevitch 1929)*	—	—	—	—	—	—	—	—	—	—	2	1.1
Corythalia signatus (Banks 1890)	1	0.4	—	—	—	—	—	—	—	—	—	—
Emathis portoricensis Petrunkevitch 1930	—	—	—	—	—	—	—	—	5	2.2	—	—
Jollas minutus Petrunkevitch 1930	4	1.6	1	0.4	3	1.2	10	13.3	21	9.3	4	2.3
Sparassidae												
Pseudosparianthis jayuyae Petrunkevitch 1930	—	—	2	0.8	1	0.4	3	4.0	4	1.8	—	—
Stasina portoricensis Petrunkevitch 1930	3	1.2	—	—	—	—	—	—	—	—	1	0.6
Tetrablemmidae												
Monoblemma muchmorei Shear 1976	1	0.4	—	—	1	0.4	67	89.3	170	75.6	42	24.0
Tetragnathidae												
Leucauge regnyi (Simon 1897)*	1	0.4	1	0.4	2	0.8	—	—	—	—	—	—
Theridiidae												
Styposis sp?	—	—	—	—	—	—	2	2.7	6	2.7	1	0.6
Thymoites guanicae (Petrunkevitch 1930)	4	1.6	—	—	1	0.4	5	6.7	—	—	1	0.6
Theridiosomatidae												
Ogulnius gloriae (Petrunkevitch 1930)	—	—	—	—	—	—	—	—	—	—	1	0.6
Theridiosoma nechodomae Petrunkevitch 1930	6	2.4	—	—	4	1.6	—	—	—	—	—	—
Theridiosomatidae sp?	2	0.8	—	—	—	—	—	—	—	—	—	—
Total species	15		11		18		12		18		18	
Total individuals	270		223		239		218		521		147	
Total individuals m^{-2}		108.0		89.2		95.6		87.2		248.1		84.0

seldom developed a near-soil layer of decomposed material. The most abundant species overall were *Theotima minutissimus*, *Monoblemma muchmorei*, and *Masteria petrunkevitchi* respectively.

The relative abundance of each species in each litter type is shown in Table 2, arrayed from those demonstrating the greatest degree of preference for forest litter down to those that prefer bamboo litter. Of those species most commonly found in forest litter, *Ochyrocera* sp? (Ochyroceratidae) is found in larger leaf litter that is much less compact at the surface and the pholcid, *Modisimus cavaticus* (Pholcidae) is found most often in litter that provides pockets of larger open spaces, as under a palm stem, where it produces a substantial web. Such spaces do not normally occur in bamboo litter. By comparison *Modisimus montanus* clearly prefers small spaces like the tightly curled leaves of tabonuco in which to make its web; thus, this species can be found in the more tightly spaced bamboo litter more frequently though it still prefers forest litter. The very small parthenogenetic spider, *Theotima minutissimus* (Ochyroceratidae) was equally present in both types of litter (Edwards et al. 2003). This was consistent with our observations throughout the forest. It tended to be found in wetter litter with more

Table 2.—Comparison of relative abundance of spiders in the two types of litter examined, arrayed in decreasing (relative) order from forest to bamboo litter (far right column). Family names are given in parentheses. The notation "n_f" and "n_b" refer to numbers of spiders in Forest and Bamboo respectively, m^{-2} = number per square meter of litter.

Litter type	Forest	Bamboo		Forest	Bamboo	
Total sample area in m^2				7.50	4.75	
Species name	n_f	n_b	$n_f + n_b$	m_f^{-2}	m_b^{-2}	m_f^{-2}/m_b^{-2}
Ochyrocera sp. 1 (Ochyroceratidae)	49	2	51	6.53	0.42	15.52
Modisimus cavaticus (Pholcidae)	43	2	45	5.73	0.42	13.62
Lepthyphantes microserratus (Linyphiidae)	12	1	13	1.60	0.21	7.60
Calodipoena caribbaea (Mysmenidae)	9	2	11	1.20	0.42	2.85
Stasina portoricensis (Sparassidae)	3	1	4	0.40	0.21	1.90
Gamasomorpha lutzi (Oonopidae)	3	1	4	0.40	0.21	1.90
Modisimus montanus (Pholcidae)	46	16	62	6.13	3.37	1.82
Triaeris stenaspis (Oonopidae)	5	2	7	0.67	0.42	1.58
Theotima minutissimus (Ochyroceratidae)	440	282	722	58.67	59.37	0.99
Nops blandus (Caponiidae)	1	1	2	0.13	0.21	0.63
Thymoites guanicae (Theridiidae)	5	6	11	0.67	1.26	0.53
Oonops castellus (Oonopidae)	14	19	33	1.87	4.00	0.47
Modisimus coeruleolineatus (Pholcidae)	7	11	18	0.93	2.32	0.40
Masteria petrunkevitchi (Dipluridae)	61	145	206	8.13	30.53	0.27
Pseudosparianthis jayuyae (Sparassidae)	3	7	10	0.40	1.47	0.27
Neozimiris nuda (Prodidomidae)	2	8	10	0.27	1.68	0.16
Jollas minutus (Salticidae)	8	35	43	1.07	7.37	0.15
Phrurolithus insularis (Corinnidae)	2	32	34	0.27	6.74	0.04
Monoblemma muchmorei (Tetrablemmidae)	2	279	281	0.27	58.74	0.01
Leucauge regnyi (Tetragnathidae)	4	—	4	0.53	—	—
Corinna jayuyae (Corinnidae)	—	1	1	—	0.21	—
Ischnothyreus peltifer (Oonopidae)	—	3	3	—	0.63	—
Oonops ebenecus (Oonopidae)	—	13	13	—	2.74	—
Corythalia gloriae (Salticidae)	—	2	2	—	0.42	—
Corythalia signatus (Salticidae)	1	—	1	0.13	—	—
Emathis portoricensis (Salticidae)	—	5	5	—	1.05	—
Styposis sp? (Theridiidae)	—	9	9	—	1.89	—
Ogulnius gloriae (Theridosomatidae)	—	1	1	—	0.21	—
Theridiosoma nechodomae (Theridosomatidae)	10	—	10	1.33	—	—
Theridiosomatidae sp?	2	—	2	0.27	—	—
Number of species	23	26	30			
Total individuals	732	886	1618			
Total number m^{-2}				97.60	186.53	

decayed material close to the soil. *Phrurolithus insularis* (Corinnidae) and *Oonops castellus* (Oonopidae) have a slight preference for bamboo litter. The small diplurid (adults ± 5 mm) *Masteria petrunkevitchi* (Dipluridae) also appears to favor bamboo litter. Although it is found in many types of litter on the mountain, *Masteria* usually occurs near the bottom of deeper litter. In many hours of searching we have failed to find any substantial webbing that could be assigned to this species. *Jollas minutus* (Salticidae) clearly prefers denser litter.

Habitat of *M. muchmorei*.—With the two single specimen exceptions noted above, *M. muchmorei* was taken only in bamboo litter near the bottom of the Angelita transect. As noted earlier, unlike most other species of trees in the area, bamboo tends to shed leaves year round. The litter can accumulate to a considerable depth especially on more level ground. *M. muchmorei* occurred most fre-

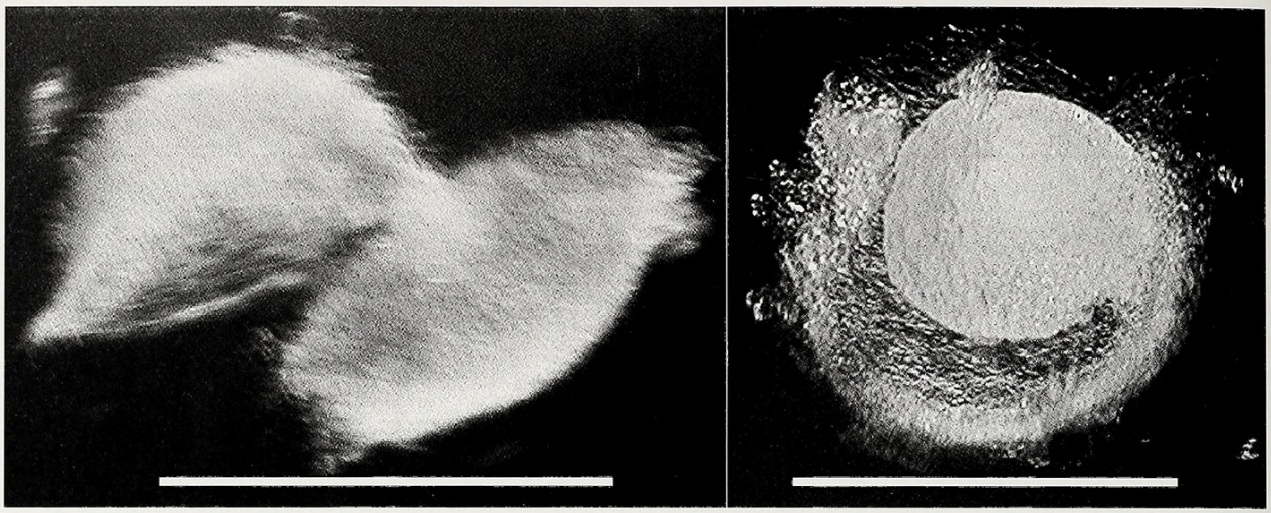

Figure 4.—Egg sac and egg of *Monoblemma muchmorei*. Right: hemispherical top portion and lenticular bottom portion separated. Left: single egg on bottom portion. Note that top and bottom portions separated cleanly. Scale bar = 0.4 mm.

quently in the bamboo litter subject to less disturbance by wind or water. Here the upper layers formed a flatter surface of drier undecayed leaves that acted to shed water. Under this layer there is a transitional layer of leaves that progressively decays down to the soil where the leaves are thoroughly decayed. This is different from the litter composition under the deciduous trees in the forest, where the leaves show less decay at the soil surface. To test if this difference impacted the local fauna, we collected five bamboo litter samples each from the upper relatively undecayed layer and from the transitional decomposing layer beneath. In these samples the upper layer had an average 5.2 (1–11) individuals of *M. muchmorei* and the lower transitional layer had an average of 38 (15–61) individuals. The structure as well as the type of leaf litter dictated the choice of living spaces for *M. muchmorei*. On steep slopes and where wind and water had broken up the litter piles, few if any *M. muchmorei* were found. Of the 141 specimens of *M. muchmorei* counted, females outnumbered the males: females 83 (59%), males 58 (41%).

Behavior and reproduction in *M. muchmorei*.—In December 2002, while at the field station, 3 pairs of adult *M. muchmorei* were placed in small dishes with strands of moss shortly after being captured. Within 1 hour, one pair mated and remained *in copula* for approximately 14 hours (09:30–23:15 h). They came together while walking around on the bottom of the dish. No obvious courtship was observed. The male simply turned venter side up as the female approached from above and wrapped his first legs around the cephalothorax of the female and immediately inserted his right embolus. They remained together with virtually no further movement from that point on. There was no evidence that the palps were alternated.

Subsequently, seven additional matings have been observed. In each case the positions taken between the sexes did not differ significantly from the first observation. Whether on the bottom or side of the dish or once in webbing in moss, the female always approached while the male was venter up. No activity that could be described as courtship was ever observed. Two pairs engaged almost as soon they were placed together. These two engagements lasted 5 and 7 hours. Each male quickly seized the female, wrapping first legs around the cephalothorax, sometimes the second pair of legs as well, on the anterior part of the abdomen. The third pair of legs loosely held the female's abdomen from below (Fig. 3). In all cases the bodies were held so closely together that it was not possible to clearly see how the palps were handled beyond the fact that one palp could usually be seen a little to the side. This suggests that only one palp was ever used. For long periods, often for hours, there was virtually no movement or alternation of the palps.

Where mating had been observed, egg sacs were produced 3–4 weeks later. The white egg sac, ~ 0.4 mm in diameter, has a shallow dish

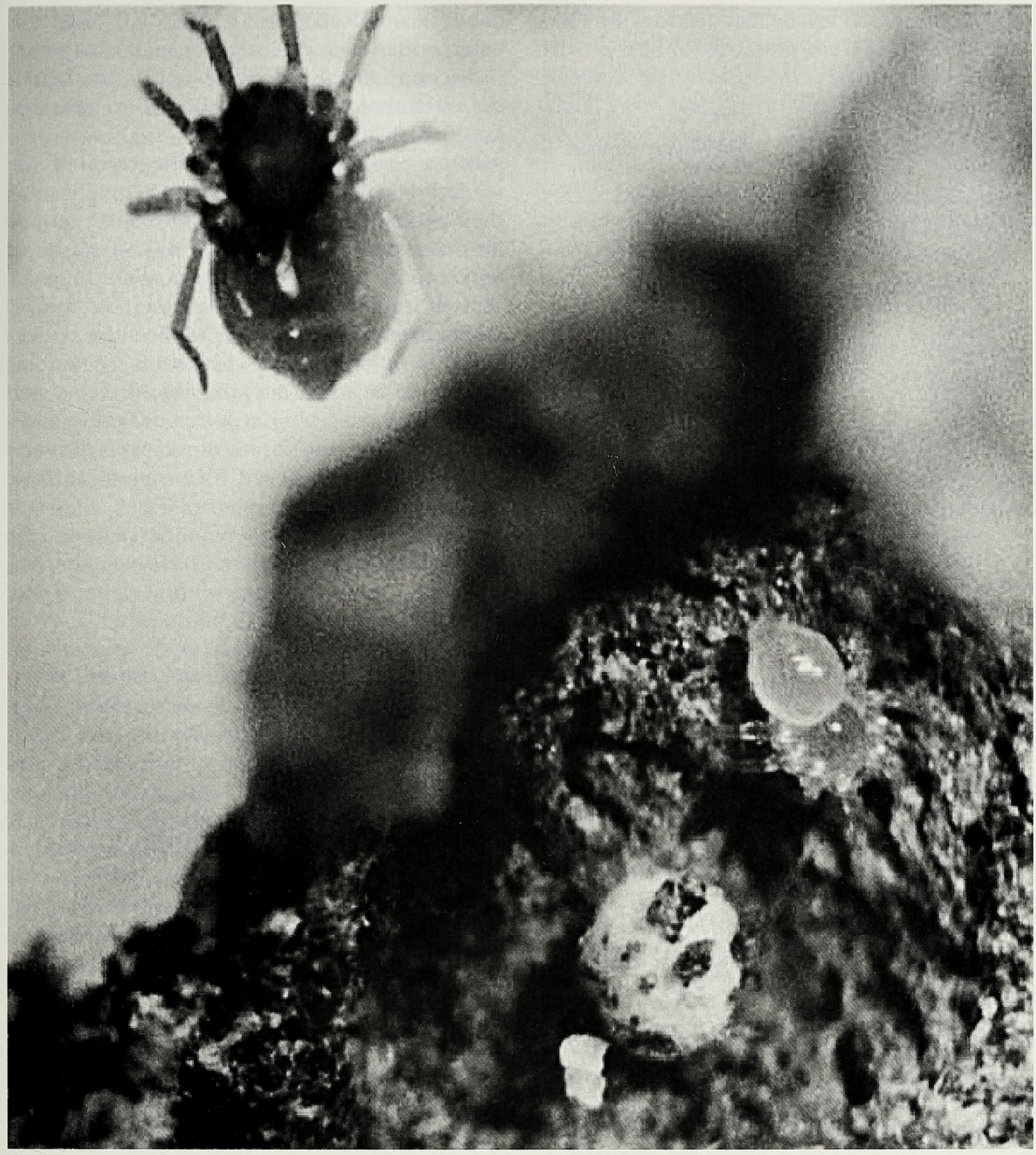

Figure 5.—Mother, newly emerged spiderling, and decorated egg sac of *Monoblemma muchmorei*.

bottom and tall hemispherical top, with a loosely joined vague equator between the halves (Fig. 4). It was usually decorated with small bits of leaves or moss, typically placed on a surface such as a piece of leaf or vertically on the side of the dish. Hatching occurred approximately 3–4 weeks following the production of the egg sac. In all cases in which there were very small pieces of leaves or other dark material available in the dishes, the females decorated the eggs. In dishes with moss, the females were often found in vaguely woven spherical webs. Only a small amount of silk was used and there was no regular pattern to the webbing. This webbing did not play a significant role in prey capture although collembola were occasionally entangled within. Males were more often wandering about and not remaining in webbing.

Spiderlings emerged by splitting the two halves of the egg sac. Newly hatched (2nd instar) spiderlings were translucent light yellow,

Table 3.—Small invertebrate predator and prey organisms other than spiders (Table 1) usually present in bamboo litter. Most of the species listed were present in all samples in modest numbers, from a few to several dozen. The ants that nested in the litter varied greatly, from small numbers to hundreds.

ARACHNIDA
PSEUDOSCORPIONIDA
Chthoniidae
Tyrannochthonius imitatus Hoff 1959.
Syarinidae
Ideobisium puertoricense Muchmore 1982.
SCHIZOMIDA
Schizomidae
Luisarmasius yunquensis (Camilo & Cokendolpher 1988). Rare.
COLLEMBOLA
Sminthuridae
Ptenothrix borincana Soto-Adames 1988.
Calvatomina nymphascopula Soto-Adames 1988.
Calvatomina rufescens (Reuter 1890).
Entomobryidae
Lepidocyrtus caprilesi Wray 1953.
Pseudosinella violeta Mari Mutt 1986.
Paronellidae
Campylothorax sabana Mari Mutt 1987.
Onychiuridae
Onychiurus (Protaphorura) herus Christiansen & Bellinger 1980.
INSECTA
Formicidae
Ponerinae
Anochetus kempfi Brown 1978.
Odontomachus ruginodis Smith 1937.
Hypoponera opacior Forel 1893.
Formicinae
Brachymyrmex heeri Forel 1874.
Myrmicinae
Pyramica rogeri Emery 1890.
Solenopsis azteca Forel 1893.
Pheidole moerens Wheeler 1908.
Pheidole sculptior Forel 1893.
Monomorium ebeninum Forel 1891.
Wasmannia auropunctata Roger 1863.
Cyphomyrmex minutus Mayr 1862.

~ 0.4 mm length. The first instar skin remained in the bottom part of the egg sac. On emerging, spiderlings immediately went to webbing produced by the female. The female stayed in close proximity for at least a week (Fig. 5). During this time, the females killed any collembola or other small organisms that came near. In one case a pile of 8 large uneaten collembola collected beneath the web.

Second instar spiderlings fed on the smallest collembola, but often appeared to have difficulty subduing its prey. Relatively few progressed to the third instar. The color of the spiderlings progressed to a darker yellow as they matured and only became reddish orange on maturation. The apparent high mortality of the second instar spiders was disturbing although it has been noted that there were also few younger instars found in the litter collections. In other rearing experiments, second instar spiderlings of *Theotima minutissimus*, and *Ochyrocera* sp?. similarly had difficulty feeding and advancing to the third instar. Beyond this stage *Sinella* posed no problem as food for any of these species.

Predation.—In some bamboo samples, the nests of the ant *Wasmannia auropunctata* Roget were often abundant within wetter, inner closely packed litter, sometimes with 25 or more individuals in each nest. *Wasmannia* consistently seized the darkly colored sminthurid collembolan *Ptenothrix borincana* Soto, but not the reddish *Calvatomina rufescens* Reuter. This ant also occasionally seized the larger *Campylothorax sabana* Wrey and in one instance another ant species, *Solenopsis azteca* Forel, as well as the very small spiders *Theotima minutissimus* and *Calodipoena caribbaea* (Mysmenidae). Less abundant but consistently present, another ant, *Monomorium ebeninum* Forel, preyed mainly on *Campylothorax sabana* and other similarly sized and colored collembolans. *Monomorium* also seized very small beetles and once a second instar salticid *Jollas minutus*. In some samples, the ant *Pheidole moerens* Mayr was abundant but was never observed attacking any other living organism. In a large petri dish with an adult female *Styposis* sp? (Theridiidae), eight *M. muchmorei* were captured in *Styposis* webbing. No species of ant paid any attention to *M. muchmorei*. Small numbers of two species of pseudoscorpions, *Tyrannnochthonius imitatus* Hoff and *Ideobisium puertoricense* Muchmore were present in most bamboo and forest litter samples, neither of which were observed to prey on any organism. None of the spiders collected paid any attention to *M. muchmorei*. The various identifiable arthropods observed are listed in Table 3.

Once spiderlings in captivity had achieved the third or fourth instar, they usually survived to maturity. As noted earlier, few second instar spiderlings raised in captivity survived; on average one out of five. Adults brought in from the field survived on average four months. Some died immediately and others lived for as long as six months. Adults that had matured in captivity, however, typically survived from 5–6 mo. One female died at the age of nine months after producing eight egg sacs. We observed no predation on this spider in the field. In captivity, however, they were observed getting entangled in the webbing of other spiders, especially the webs of *Styposis*. Assuming that our inability to successfully get these spiders through to the third instar is not the case in the field, and that they produce only one egg at a time there as well, *M. muchmorei* apparently has a very low natural mortality rate.

DISCUSSION

The very specific choice of habitat by *M. muchmorei* in Puerto Rico as well as the paucity of information in the literature on the habitat of the many species of the family Tetrablemmidae is intriguing. *Bambusa vulgaris* was imported from southeast Asia into the Americas and subsequently into Puerto Rico early in the 19th century (McClure 1993; Londono 2001). It is often used today to stabilize steep areas along roadsides and near streams to reduce erosion in areas that flood. It is worth considering the possibility that *M. muchmorei* was introduced along with the bamboo. We suggest that it would be worthwhile to pay particular attention to bamboo litter worldwide. Further, Lehtinen (1981) has suggested that the genus *Monoblemma* may need to be reexamined. *Monoblemma muchmorei* may belong to another genus and other specimens, including those that Shear examined from Angelica Rock, may be another species, or even a different genus.

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