

SHORT COMMUNICATION

THE PREY AND PREDATORS OF *LOXOSCELES INTERMEDIA* MELLO-LEITÃO 1934 (ARANEAE, SICARIIDAE)

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ABSTRACT. We examined the prey caught in *L. intermedia* webs in one fragment of forest and in the garage of an urban house in Curitiba, Brazil. A total of 693 prey items was recorded in 131 webs. The prey richness was greater in the forest. The results show that *L. intermedia* is a dietary generalist. We found remains of *L. intermedia* in the feces of a frog and a bat in the forest.

Keywords: Diet, brown spider, synanthropic fauna, loxoscelism, Brazil, frog, bat

The sedentary species of the genus *Loxosceles* are hunting and weaving spiders active mostly at night. The webs of some species in this genus are durable, large, irregular and sticky, with the spiders constantly adding silk threads to the web, which serves as a retreat and a snare. The webs are built in a great variety of habitats, including around buildings that provide many ideal microhabitats (Bücherl 1961; Hite et al. 1966; Galiano 1967). *Loxosceles* spiders can capture prey in their web or when walking around at night (Gorham 1968). Qualitative lists of the prey captured by *L. laeta* (Nicolet 1932) (Levi & Spielman 1964), *L. rufipes* (Lucas 1834) (Delgado 1966), *L. reclusa* Gertsch & Mulaik 1940 (Hite et al. 1966) and *L. gaucho* Gertsch 1967 (Rinaldi et al. 1997) have been published.

In Curitiba, capital of the southern Brazilian state of Paraná, hundreds of bites caused by *Loxosceles* species are registered each year. Two species occur in the city: *L. intermedia* Mello-Leitão 1934 (with 90% of records) and *L. laeta* with 10% (Fischer 1994). Among the conditions favoring the growth of *Loxosceles* populations in and around urban centers are the abundance and richness of prey and the absence of potential predators. In this study, we documented the range of prey captured in *L. intermedia* webs and recorded the fauna present in the

same microhabitat in one fragment of forest and in a house in Curitiba.

We made weekly visits from December 1993 to March 1995 to a forest located in the Santa Monica field club, in the district of Colombo (25°23'22.9"S, 49°09'01.3"W). The area is up to 950 meters above sea level and the climate is humid subtropical mesothermic, with fresh summers and with severe and frequent frosts (Maack 1981). The native vegetation was transitional between forest with *Araucaria* and Atlantic forest, now replaced in some areas with *Eucalyptus*. The present study was carried out in one of the fragments (16.24 ha) close to a camping area. Initially, we searched for *Loxosceles* in all of the trees (native and exotic) present in the fragment but spiders were present only in five of 20 *Eucalyptus* trees planted at the border of the forest fragment. The vegetation around the *Eucalyptus* was essentially grass and small herbaceous plants.

Webs containing the remains of prey present in holes, hollows and bark peels from five *Eucalyptus* (up to 7 m above ground level) and the fauna present in the same places, were sampled. *Loxosceles intermedia* webs consist of a central area with a larger concentration of silk from which radiate irregular sticky threads of varying thickness. The webs cover the surface where the spiders live. The

form and size of the webs depend on the substratum on which the web is built.

Abandoned webs with remains of food were collected and prey items were removed with forceps from webs with the spider present. We did not distinguish webs of adults and juveniles, nor if the spider present in the web was the same in successive samples. We considered as associated fauna the animals present in the same microhabitat as *L. intermedia* webs; these animals were collected through visual search and with the use of forceps and fixed in 70% alcohol. The identity of animals that we could not collect was recorded. The material is deposited in the Arachnological collection of Dra. Vera Regina von Eickstedt in the section of poisonous arthropods of the Immunologic Production and Research Center (SESA-PR), Piraquara, Paraná, Brazil.

In the urban building, visits were undertaken every 15 days to the garage of a masonry house located within the urban perimeter of Curitiba (25°23'28.3"S, 49°17'28.2"W). The spiders were present in a pile of lumber of 100 cm height, 200 cm width and 40 cm depth, placed against a wall. The method of collection of the prey and of the associated fauna was the same as that used in the trees.

During the study period we sampled 91 webs in the forest and 40 in the garage. The webs of *Loxosceles* species capture a wide range of invertebrate prey, with the range of potential prey groups in the forest being greater than in the building. Of the 55 prey groups sampled, 27 (49%) were exclusive to the forest, 3 (5.4%) were exclusive to the building, and 25 (45%) occurred in both habitats (Table 1). The greater prey richness in the forest ($\chi^2_{(1)} = 6.2$, $P < 0.01$) reflected the larger variety of microhabitats, and the greater diversity, abundance and proximity of vegetation, although the Sorensen similarity index of the prey captured in the building and in the forest was rather high (0.64). Thus, spiders that colonized the building did not have access to the same prey richness, but more than 50% of the prey was similar to the prey in the forest.

The 693 prey items found in *L. intermedia* webs represented five invertebrate groups, Insecta being the dominant group in both habitats (Table 1). Levi & Spielmann (1964) reported that virtually all Arthropoda that occurred in a basement site were represented in the webs of *L. laeta*. Likewise, for *L. intermedia*, only nine higher taxa in the forest and one in the building were not recorded in the webs (Table 1). This demonstrates a low selectivity of the *L. intermedia* web.

The diet of *L. intermedia* often contains taxa rejected by other spiders. For *L. intermedia*, we recorded the capture of groups considered to be antagonist enemies of spiders, including wasps (Pompilidae and Ichneumonidae) and ants (Formi-

cidae), as well as chemically noxious taxa such as Chrysomelidae, Pentatomidae, Opiliones, Heteroptera and Staphylinidae. The capture of heavily sclerotized or dangerous prey has been recorded for other species of *Loxosceles* (*L. laeta*: Levi & Spielmann 1964; *L. reclusa*: Hite et al. 1966). According to Riechert & Harp (1987), the degree to which potentially injurious or large prey are taken varies with local prey abundance and the relative availability of different prey types. In the present study, Corinnidae, Salticidae and Opiliones were captured in a period of low resource availability, i.e. at a time when no other prey were found in the webs.

Cannibalism was recorded once in the forest for a female spider that ate a juvenile. We also found a dead female without an abdomen in an *L. intermedia* web. This spider appeared to have been eaten by a conspecific. No cannibalism or dead spiders occurred in *L. intermedia* webs in the building.

Of the 36 invertebrate groups ($n = 1427$ animals) collected alive near the webs of *L. intermedia*, 22 were exclusive to the forest, 14 were present in both habitats, and none was exclusive to the building. Pholcidae, Salticidae, Selenopidae and Theridiidae were the most frequent Araneae families. Even so, only Corinnidae and Salticidae occurred as prey in the webs. When the amount of food was high (identified by the presence of many prey in the webs), *L. intermedia* shared the microhabitat with other Arachnida but did not use them as prey. The spiders Selenopidae and Eusparassidae, although frequent in the trees, were not found in *L. intermedia* webs (Table 1). The fauna associated with the wood dumps in the garage was less diversified than that in the trees. Of the invertebrate groups recorded alive, only lepidopteran larvae were not found in the webs. As in the forest, the Araneae families Salticidae, Pholcidae and Araneidae were abundant (Table 1).

In the forest, two vertebrates were confirmed as predators of *L. intermedia*: *Sinax* gr. *rubra* (Amphibia, Hylidae) and the bat *Eptesicus brasiliensis* (Mammalia, Vespertilionidae). The identification was based on analysis of fecal pellets, which contained fragments of exoskeleton. The presence of amphibians (Leptodactylinae), lizards (Squamata) and six nests of a bird (insect predator) found in the hollows of *Eucalyptus*, suggested that these could also be potential predators (Table 1). Foelix (1996) considered amphibians and reptiles to be important spider predators. Delgado (1966) recorded the gecko *Tapidurus peruvianus* as a predator of *L. rufipes* in Peru. There are few mammalian predators of spiders, e.g., shrews and bats, although the South American woolly monkey *Lagothrix* apparently prey on a poisonous *Loxosceles* with no adverse effects (Foelix 1996). Two *L. intermedia* were observed being eaten by ants (subfamily Myrmicinae).

Table 1.—Number of prey items collected in *L. intermedia* webs and the associated fauna (AF fauna collected in the same microhabitat as *L. intermedia* webs) in urban forest and in a building. Numbers indicated at order level are the sums of catches given at family level.

Taxon	Forest		Building	
	Prey	AF	Prey	AF
PLATYHELMINTHES				
Turbellaria	—	6	—	—
ANNELIDA				
Oligochaeta	1	—	—	—
MOLLUSCA				
Gastropoda	—	2	—	—
CRUSTACEA				
Isopoda	84	315	40	60
INSECTA				
Thysanura	—	3	—	—
Collembola	1	—	—	—
Blattariae	7	3	10	2
Isoptera	3	—	1	—
Orthoptera	—	2	5	4
Gryllidae	—	2	5	4
Hemiptera	7	11	2	0
Aradidae	2	—	—	—
Corimelaenidae	—	—	—	—
Cydnidae	—	—	1	—
Miridae	1	—	—	—
Pentatomidae	1	1	—	—
Reduviidae	2	10	—	—
Scutelleridae	1	—	—	—
Nymph	—	—	1	—
Homoptera	1	5	—	—
Cicadidae	1	5	—	—
Psocoptera	—	4	—	—
Coleoptera	51	8	28	1
Carabidae	—	2	2	—
Cerambycidae	4	—	1	—
Chrysomelidae	12	1	3	—
Curculionidae	1	—	1	—
Elateridae	3	—	5	1
Lampyridae	—	—	1	—
Passalidae	3	—	—	—
Scarabaeidae	1	3	1	—
Scolytidae	3	—	1	—
Staphylinidae	3	—	2	—
Tenebrionidae	1	02	—	—
Various Fragments	20	—	11	—
Hymenoptera	145	117	77	52
Apidae (Meliponinae)	6	—	1	—
Braconidae	13	—	2	—
Formicidae	93	97	69	52
Ichneumonidae	1	—	—	—
Monomachidae	16	—	—	—
Pompilidae	3	—	—	—
Vespidae	1	20	—	—

Table 1.—Continued.

Taxon	Forest		Building	
	Prey	AF	Prey	AF
Various Fragments	12	—	5	—
Diptera	39	0	11	0
Acalyptradae	1	—	2	—
Anosopodidae	1	—	1	—
Asilidae	1	—	—	—
Bibionidae	7	—	—	—
Culicidae	1	—	1	—
Muscidae	3	—	2	—
Mycetophilidae	1	—	—	—
Phoridae	3	—	—	—
Phychodidae	3	—	—	—
Sciaridae	3	—	—	—
Stratiomyidae	12	—	1	—
Tabanidae	1	—	—	—
Tipulidae	2	—	2	—
Various Fragments	—	—	2	—
MYRIAPODA				
Diplopoda	1	—	—	—
Chilopoda	—	4	—	—
ARACHNIDA				
Opiliones	6	184	—	—
Pseudoescorpiones	1	24	—	—
Araneae	4	438	0	81
Araneidae	—	49	—	6
Ctenidae	—	14	—	—
Lycosidae	—	10	—	1
Pholcidae	—	46	—	27
Theridiidae	—	67	—	—
Corinidae	2	3	—	—
Eusparassidae	—	7	—	—
Salticidae	1	156	—	47
Selenopidae	—	86	—	—
Thomisidae	—	1	—	—
CHORDATA				
Amphibia	2	6	—	—
Leptodactylidae	—	2	—	—
Hylidae	—	4	—	—
Reptilia	—	1	—	—
Mammalia	—	4	—	—
Vespertionidae	—	4	—	—

However, it was not possible to determine whether the ants had killed these spiders or if the spiders had died from other causes. We have not detected any potential predators (occasional or common) of *L. intermedia* in residential areas of Curitiba.

The results of this study indicate that *L. intermedia* is a generalist feeder that uses a low-cost sit-and-wait predation strategy. The urban habitat provides more than 50% of the prey types found in the natural habitat, it has a lower density of other spiders (Table 1) and a possible lack of natural ene-

mies. All these factors probably contribute to the persistence of *L. intermedia* in urban areas.

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LITERATURE CITED

- Bücherl, W. 1961. Aranhas do gênero *Loxosceles* e loxoscelismo na América. *Ciência e Cultura* 13: 213–224.
- Delgado, A. 1966. Investigación ecológica sobre *Loxosceles rufipes* (Lucas, 1834), en la región costera del Perú. *Memórias do Instituto Butantan* 3:683–688.
- Fischer, M.L. 1994. Levantamento das espécies do gênero *Loxosceles* Heineken & Lowe, 1832, no município de Curitiba, PR. *Estudos de Biologia* 38:67–86.
- Foelix, R.F. 1996. *Biology of Spiders*. Second edition. Oxford University Press, New York. 330 pp.
- Galiano, M.E. 1967. Ciclo biológico y desarrollo de *Loxosceles laeta* (Nicollet, 1849). *Acta Zoológica Liloana* 23:431–464.
- Gorham, R. 1968. The brown recluse spider. *Journal of Environmental Health* 31:138–143.
- Hite, M.J., W.J. Gladney, J.L. Lancaster, Jr. & W.H. Witcomb. 1966. Biology of the brown recluse spider. *Arkansas Agriculture Experimental Station Bulletin* 71:2–26.
- Levi, H.W. & A. Spielman. 1964. The biology and control of the South American brown spider, *Loxosceles laeta* (Nicolet), in a North American focus. *American Journal of Tropical Medicine and Hygiene* 13:132–136.
- Maack, R. 1981. *Geografia física do Estado do Paraná*, 2nd ed. Livraria José Olympio, Rio de Janeiro.
- Riechert, S.E. & J.M. Harp. 1987. Nutritional ecology of spiders Pp. 645–672. *In* *Nutritional Ecology of Insects, Mites, Spiders and Related Invertebrates* (F. Slansky & J.G. Rodrigues, eds.). J. Wiley & Sons, New York.
- Rinaldi, I.M.P., L.C. Forti. & A.A. Stropa. 1997. On the development of the brown spider *Loxosceles gaucho* Gertsch (Araneae; Sicariidae) the nympho-imaginal period. *Revista Brasileira de Zoologia* 14:697–706.

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