

Interactions Between the Chilean Recluse Spider (Araneae: Sicariidae) and an Araneophagic Spitting Spider (Araneae: Scytodidae)

MAURICIO CANALS,^{1,2,3} NICOLÁS ARRIAGADA,⁴ AND RIGOBERTO SOLÍS⁴

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ABSTRACT In Chile, all necrotic arachnidism is attributed to the Chilean recluse spider, *Loxosceles laeta* Nicolet, a species that shares the microenvironmental habitats with the spitting spider *Scytodes globula* Nicolet. The latter species has been proposed as a potential predator of *L. laeta*. For this research, we studied the interaction between both species during individual encounters to assess the possibility of population regulation of *L. laeta* cohorts exposed to this potential predator. We found that in most encounters *S. globula* prevailed. Also, *S. globula* preys on spiderlings of *L. laeta*, with a population effect on cohorts of this species. These findings suggest that *S. globula* may be influencing *L. laeta* populations in central Chile. The population regulation of *L. laeta* by predation would be important because this species, in the absence of predators, has a high reproductive rate, and it can maintain populations of large size. However according to our results, although *S. globula* may aid in the reduction of both spiderling and adult *L. laeta* populations, and perhaps other *Loxosceles* species, it is insufficient for biological control of *Loxosceles* species. Its presence together with other control measures such as hygiene of the rooms can help to decrease loxoscelism incidence.

KEY WORDS *Loxosceles laeta*, *Scytodes globula*, spider predation, loxoscelism

Introduction

Loxoscelism is a health problem caused by the bite of spiders of the genus *Loxosceles* (Araneae: Sicariidae). The cases in Chile are attributed to *Loxosceles laeta* (Nicolet), *Loxosceles gaucho* Gertsch in Argentina, *Loxosceles intermedia* Mello-Leitão in Brazil, *Loxosceles reclusa* Gertsch and Mulaik in the United States, and *Loxosceles rufescens* (Dufour) in Mediterranean areas (Gertsch 1967, Gertsch and Ennik 1983, Reyes et al. 1991, Vetter 2008).

In Chile, all necrotic arachnidism is attributed to the Chilean recluse spider, *L. laeta*, a species that may be preyed upon by the spitting spider *Scytodes globula* Nicolet (Araneae: Scytodidae). The biology of these two species is not well known (Fernandez et al. 2002; Canals et al. 2004, 2008; Canals and Solís 2013, 2014; Taucare-Ríos et al. 2013).

L. laeta is a solitary spider of domestic habitats, found within households usually in dark corners, cracks, closets, clothing, and bath towels, but sometimes can be found outdoors. Its activity is preferentially nocturnal; high temperatures are a factor that favors its development (Schenone and Letonja 1975; Schenone 1998, 2003, 2004; Schenone et al. 2001). With respect to diet, in Chile it has been reported that this spider feeds on flies, moths, and other small arthropods (Levi and Spielman 1964; Schenone et al. 1970, 1989, 2001; Schenone 1998, 2003, 2004; Parra et al. 2002). From the medical point of view, the epidemiology of loxoscelism incidents coincides with nocturnal activity. Epidemiology also suggests larger spider populations and greater activity during the summer (Schenone 1998, 2003, 2004; Schenone et al. 2001).

A potential predator of *L. laeta* in Chile is the solitary species, *S. globula*, a member of a group of spiders known as spitting spiders with recognized araneophagic habits (Gilbert and Rayor 1985, Bowden 1991). The *Scytodes* spiders feed on spiders and insects such as Diptera, Lepidoptera, and Mantodea, avoiding sclerotized and aggressive prey (Fernandez et al. 2002). During predation these spiders spit an adhesive substance through their chelicerae, immobilizing their prey (Foelix 1996, Araujo et al. 2008). These spiders are active during twilight and night and their thermal preferences and desiccation tolerances are similar to those of *L. laeta* (Alfaro et al. 2013, Canals et al. 2013). *S. globula* is distributed in South America in Chile,

¹ Programa de Salud Ambiental, Instituto de Salud Poblacional, Escuela de Salud Pública Salvador Allende G., Santiago, Chile.

² Departamento de Medicina, Facultad de Medicina, Universidad de Chile, Santiago, Chile. CP: 8380413 and Departamento de Zoología; Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Concepción, Chile.

³ Corresponding author, e-mail: mcanals@uchile.cl.

⁴ Departamento de Ciencias Biológicas Animales, Facultad de Ciencias Veterinarias y Pecuarias, Universidad de Chile, Santiago, CP: 8820808 Chile.

Bolivia, Argentina, Brazil, and Uruguay. Like *L. laeta*, this species is common in human dwellings and gardens of houses of central Chile (Fernandez et al. 2002).

While there are references that suggest predation on *L. laeta* by *S. globula*, there are few studies that support this (Fernandez et al. 2002, Canals and Solís 2013). For example, Ramires (1999) and Ades and Ramires (2002) documented the results of encounters between *S. globula* and three species of *Loxosceles*: *L. laeta*, *L. gaucho*, and *L. intermedia*. These authors reported that within 30 min of introduction, virtually all *L. laeta* were alive, although they were victims of the adhesive substance and wrapped in silk lines. Of the 22 predation events recorded, on three occasions the defense of *L. laeta* caused leg autotomy in *S. globula* and, in two instances, it was *L. laeta* which preyed on *S. globula*.

Knowing that the activity rhythms, thermal preferences, and tolerance to desiccation of these species are similar, it is necessary to describe the direct interaction that occurs when these species meet (Hertz et al. 1993, Angilletta et al. 2002). If an encounter between *L. laeta* and *S. globula* is produced, we need to know the outcome of the interaction between these species both at the individual level (predatory acts) and population level (ability to regulate the population) in order to determine if *S. globula* can be an effective biological control agent (Wiedenmann 2000).

In this study, we analyzed the interaction between *S. globula* and *L. laeta* during individual meetings and the possibility of population regulation of cohorts of *L. laeta* exposed to this potential predator, with the following working hypotheses: 1) as there is some experimental evidence that suggests predation of *L. laeta* by *S. globula*, we propose that the most common response in individual meetings of the two species will be the death of *L. laeta*; 2) as there is some experimental evidence that suggests predation of *L. laeta* by *S. globula*, we propose that this species has the potential to regulate populations of *L. laeta*.

Materials and Methods

Individual Interactions. Forty sexually differentiated individuals of *L. laeta* and *S. globula* were collected inside institutional storehouses and inside human dwellings in the cities Santiago and Valparaíso in Chile between December 2012 and December 2013. Sexual differentiation can be recognized from 5th and from 6th moult in *S. globula* and *L. laeta*, respectively (Galiano 1967, Fernandez et al. 2002, Canals and Solís 2014). The spiders were maintained individually in 750-ml plastic bottles, from the reception of the individuals to the beginning of the experimental trials.

All individuals were maintained with a photoperiod of 12:12 (L:D) h, at $20 \pm 2^\circ\text{C}$, near the preferred temperature of both species (Alfaro et al. 2013) in the laboratory of Ecology and Behavior of Faculty of Veterinary Sciences at the University of Chile. The temperature was monitored with a maximum–minimum thermometer. Prior to the initiation of experimental encounters, spiders were transferred to an incubator with inverted

L:D cycle, where they were maintained for at least 7 d. This allowed experimental trials to be conducted during the day, but in the scotophase of the spiders.

Thirty-two interspecific encounters were performed in sealed circular plastic containers (diameter 19.5 cm; depth 7 cm). The encounters were recorded with a high resolution digital video camera (SONY HDR-CX 700, Chicago, USA), with night shot, in WAV format. The rivals in each encounter were randomly chosen. They were sexed, and their body mass was measured with an analytic balance Shimadzu (AUX 220, Japan; ± 1 mg). The capture and the manipulation of individuals were performed by using brushes, anatomic tweezers, and rubber gloves, avoiding direct contact with the spiders.

First, the resident spider was introduced in the experimental arena and was maintained for 1 wk for habituation before the encounter. Thirty-two individuals of *L. laeta* (66.21 ± 90.30 mg) and 32 individuals of *S. globula* (76.33 ± 23.87 mg), with a body mass ratio $R = \text{mass of } S. \textit{globula} / \text{mass of } L. \textit{laeta} = 0.607 \pm 0.448$, were used in the encounters. Sixteen individuals of *L. laeta* (11) were male ($m_b = 105.21 \pm 48.75$ mg) and 16 female ($m_b = 238.82 \pm 66.14$ mg), and 18 individuals of *S. globula* (Sg) were male ($m_b = 71.17 \pm 21.68$ mg) and 14 female ($m_b = 82.80 \pm 24.76$ mg). The encounters were distributed in the following form: 7 Sg♂-Ll♂, 11 Sg♂-Ll♀, 9 Sg♀-Ll♂, and 5 Sg♀-Ll♀. In 16 of the 32 encounters, *S. globula* was the resident spider and in 16 it was the intruder. At the beginning of the encounter, the new individual was introduced at 10 cm from the resident spider. The experimental trials lasted at least 60 min, ending when one spider killed and sucked its prey at least for 20 min. In case when both were alive at the end of 60 min, the experiment lasted another 60 min. If neither were attacked or killed, the encounter was considered a draw.

In the videos, the frequency and the sequence of the behavioral events during spider interactions were recorded and analyzed, where an aggressive encounter was defined as physical contact between the spiders, resulting in the death of one spider. The description and nomenclature of behavioral events followed Gilbert and Rayor (1985) and Fernández et al. (2002) for the construction of the ethogram. The 10 behavioral events considered were—1) Alert posture, 2) Leg retraction, 3) Tapping, 4) Prey palpation, 5) Spitting, 6) Scraping (reciprocal rasping of pedipalps and cutting the threads of the web), 7) Reach (prey capture), 8) Roll (enveloping), 9) Biting, and 10) Nibbling. In each experiment, the death of the spiders and leg loss by *S. globula* were recorded.

With the behavioral event sequence that formed the ethogram, a flux diagram was built indicating the frequency of the events. The frequency of aggressive encounters in relation to the total number of encounters was recorded, and the proportion of aggressive encounters ($PA = \text{number of aggressive encounters} / \text{total number of encounters}$) and their confidence intervals ($CI_{0.95} = p \pm 1.96 \sqrt{(pq/n)}$) were calculated. Also, the proportion of victories of *S. globula* was recorded ($PV = \text{number of victories of Sg} / \text{number of aggressive}$

encounters) with its confidence interval. The effect of residency (resident vs. intruder) on PA and PV was analyzed with the Fisher exact test, which provides the exact *P*-value (Fisher *p*) for proportion differences for small *n*. The effects of the body mass of *S. globula*, the body mass of *L. laeta*, and the body mass ratio on PA and PV of each spider was analyzed by logistic regression. The models were— $\text{logit} (*) = \beta_0 + \beta_1 M_{bSg}$, $\text{logit} (*) = \beta_0 + \beta_1 M_{bLl}$, and $\text{logit} (*) = \beta_0 + \beta_1 R$, where M_{bSg} is the body mass of *S. globula*, M_{bLl} the body mass of *L. laeta*, *R* the body mass ratio, and (*) was PA or PV whichever variable was studied. To study interactions between M_{bSg} and sex in aggressive encounters and in victories of *S. globula*, we consider three body mass intervals: small $M_{bSg} < 70$ mg; medium $70 \text{ mg} < M_{bSg} < 100$ mg, and large $M_{bSg} > 100$ mg, and we performed χ^2 test in the sex–body mass contingency tables.

Effect on Cohort Development. Six adult females of *L. laeta* with their egg sac were captured and introduced separately in a plastic box of 35 by 25 by 20 cm³ during summer season. Boxes were held at ambient laboratory temperatures to simulate that of unheated houses in Santiago. Temperature and relative humidity inside the box were recorded with a digital Sychrometer with remote probe AZ8723 (AZ Instruments Corp, England). The six boxes were maintained with a photoperiod of 12:12 (L:D) h and were placed on a rack and randomly rotated every 2 wk to avoid effects due to the particular position of each box. These spiders, with their egg sacs, were maintained until eclosion of the spiderlings. Each of the spiders with their egg sacs were randomly assigned into either experimental group: Sg(–): a group of three cohorts that developed without *S. globula*, and Sg(+): a group of three cohorts in which an adult *S. globula* captured in Santiago was introduced into the box. Beginning at eclosion (day 0), the spiderlings were inspected and counted every 2 wk, recording the number of survivors, the dead individuals, and the exuvia. The day 0 for each cohort were as follows: Sg(–)₁: December 20; Sg(–)₂, Sg(+)₁, and Sg(+)₂: January 1; and Sg(–)₃ and Sg(+)₃: February 7. The dead spiderlings and exuvia were removed. Spiderling instars were determined by counting the exuvia and comparing these with the morphological characteristics of the spiderlings described by Galiano (1967) and Galiano and Hall (1973).

At each inspection, the individuals were photographed at 50 cm distance with a reference mark of known dimensions. At this time, 10 mealworm larvae (*Tenebrio molitor* L.) were introduced in the box. These larvae vary in size during development, so that larvae at an appropriate size to be handled by the spiderlings (at most three times their body size) were chosen. Also, 10 drops of water were deposited in the corner of the box to provide humidity. In the Sg(+) cohorts, the spiderlings were initially maintained with their mothers until the latter was killed by a *S. globula*. In Sg(–) cohorts, the *L. laeta* mother was removed at the date equivalent to the death of a mother in a Sg(+) cohort. When the adult of *S. globula* died, it was replaced by a new adult of this species. A total of 11 adult *S. globula*, 5 females

and 6 males, were used during the experiment. Thus, Sg(+) cohorts always had one predator inside the box. During each inspection, the spiderlings were observed for 20 min, recording and photographing activities such as predation and cannibalism.

At each inspection, the number of live spiderlings was recorded (*N*). From photographs, the body length (prosoma + opistosoma) of all spiderlings whose position permitted measurement was recorded. The measurements were made with ImageJ 1.32 software (NIH).

In each cohort, the number of spiderlings alive on each count occurrence was divided by the initial number placed in the box (*N*/*No*), and a regression model was fitted, $\ln(100N/No) = b_1t + b_0$. This allowed us to estimate the mortality rate ($\mu = |b_1|$). The curves generated between treatments were compared with ANCOVA for homogeneity of slopes, considering the cohorts as the independent variables, $\ln(100N/No)$ as the response variable, and time as the covariable. Planned comparisons were performed to contrast Sg(+) and Sg(–) cohorts.

Linear regressions were performed between mean body size (*mbs*) and time (*t*) and between maximum body size (*Mbs*) and time. The models were $(*) = \beta_0 + \beta_1 t$, where (*) was *mbs* or *Mbs*, depending on the variable analyzed. The progression of these variables was compared with ANCOVA, considering only the length of the experiment where all cohorts had live spiderlings (171 d).

Results

Individual Interactions. In the encounters in which *S. globula* was the winner, the predator behaviors—tapping, spitting, scrapping, reach and roll, biting, and nibbling—were observed in 100% of cases. Alert posture was observed in 80% and leg retraction in 40%, (Fig. 1).

Of the 32 encounters, 19 aggressive encounters were observed: PA = 0.594 ± 0.087 ; CI_{0.95}: [0.474; 0.664]. Of these, *S. globula* was the winner in 13 of the encounters, obtaining PV = 0.684 ± 0.106 ; CI_{0.95}: [0.475; 0.893]. Leg loss by *S. globula* was observed only on one occasion (3.13%). This individual was killed by *L. laeta*.

The sex of fighters did not affect the probability of aggressive encounter. Of the 18 male and 14 female *S. globula* used in the study, nine aggressive encounters were observed by males and in 10 by females providing a 50% (CI_{0.95}: [26.9; 73.1]) and 71.4% aggression percentage (CI_{0.95}: [47.7; 95.1]; Fisher *p* = 0.29). Similar results were observed with *L. laeta* wherein eight of 16 aggressive encounters occurred with males (50%; CI_{0.95}: [25.5; 74.5]) and 11 of 16 aggressive encounters with females (68.8%; CI_{0.95}: [46.1; 91.5]; Fisher *p* = 0.48). The sex of fighters also did not affect the probability of victory. Five male (55.6%; CI_{0.95}: [23.1; 88.1]) and eight female (80.0%; CI_{0.95}: [55.2; 100]) *S. globula* were winners (Fisher *p* = 0.35), while three female and three male *L. laeta* were winners (Fisher *p* ≈ 1).

There were no differences in PA when *S. globula* was the resident spider, 0.438 ± 0.124 , CI_{0.95}: [0.195; 0.681] or when it was the intruder: 0.75 ± 0.108 ,

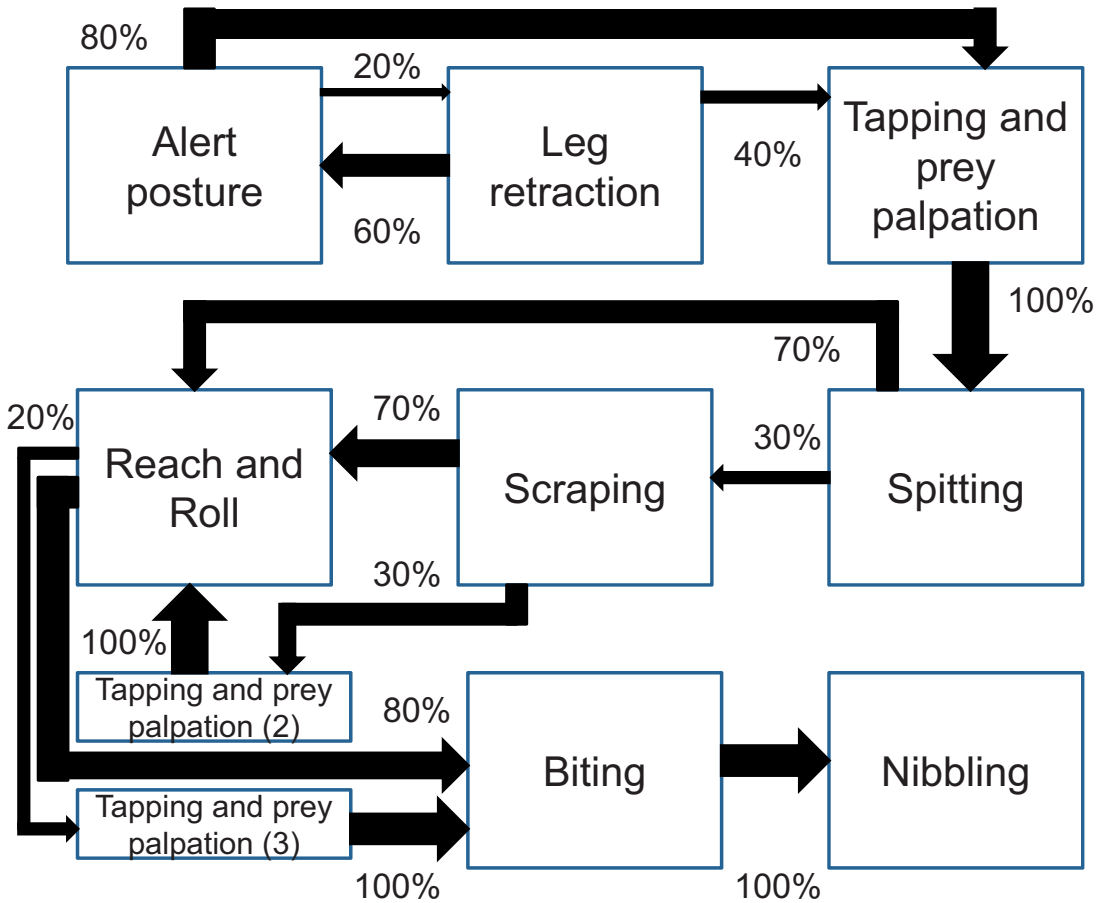


Fig. 1. Ethogram of predatory behaviors expressed by adult *S. globula* when encountering adult *L. laeta* during paired interspecific encounters in 19.5-cm circular chambers.

CI_{0.95}: [0.538; 0.962] (Fisher $p=0.149$) or in PV between when *S. globula* was resident: 0.857 ± 0.132 , CI_{0.95}: [0.598; 1.000] or when it was the intruder: 0.583 ± 0.142 , CI_{0.95}: [0.304; 0.862] (Fisher $p=0.331$).

Body mass of *S. globula* adequately predicted PA ($\text{logit(PA)} = -3.66 + 0.055m_b$, Wald = 4.738, $P=0.029$; probability of good classification (PGC) = 0.533) and also adequately predicted PV ($\text{logit(PV)} = -8.03 + 0.062m_b$, Wald = 3.872, $P=0.049$; PGC = 0.833; Fig. 2). Interactions between body mass and sex were not found ($\chi^2 = 2.8$, $P=0.24$ and $\chi^2 = 2.3$, $P=0.32$ for aggressive encounters and victories of *S. globula*, respectively). In contrast, the mass ratio R did not predict PA well ($\text{logit(PA)} = 0.727 + 1.138R$, Wald = 1.997, $P=0.158$) or PV ($\text{logit(PV)} = 1.332 + 2.587R$, Wald = 1.928, $P=0.165$). Also, the body mass of *L. laeta* did not predict PA ($\text{logit(PA)} = 0.793 + 0.004m_{bLL}$, Wald = 0.193, $P=0.66$) or PV of this species ($\text{logit(PV)} = 1.395 - 0.004m_{bLL}$, Wald = 0.431, $P=0.521$).

Effect on Cohort Development. The environmental conditions of the two experimental groups were the same (Fig. 3). In two of the Sg(-) cohorts, 79 and 106 spiderlings emerged from the egg sac. In the third cohort, an exceptionally low number of 12 spiderlings

emerged from the egg sac. In Sg(+) cohorts 146, 81, and 101 spiderlings emerged from the egg sac.

In the three Sg(+) boxes, eight adult predator spiders were necessary to achieve the establishment of the predators. In five introductions *L. laeta* killed *S. globula* (three males and two females) while in the other three opportunities, three males of *S. globula* killed the three established female *L. laeta*.

After >550 experimental days, all Sg(-) cohorts had live adult spiders. In the Sg(-) containers, the longest surviving *L. laeta* had molted up to 10 times and survived from 517–566 d. In contrast, in all Sg(+) containers, all spiderlings were dead at 182, 270, and 275 d post-predator introduction for cohorts 1–3, respectively. In the latter cohorts only three molts were obtained, while in the same time frame in Sg(-) cohorts two to seven molts were observed among spiderlings.

A higher daily mortality rate of the spiderlings was obtained in Sg(+) cohorts (0.0201 ± 0.001276) than in Sg(-) cohorts (0.010572 ± 0.000991 ; $F_{5,86} = 3.017$, $P < 0.001$; Planned comparisons: $F_{1,86} = 20176.7$, $P < 0.001$; Fig. 4). The mortality rates for each cohort were—Sg(-)₁: 0.012 ± 0.0006 ($R^2 = 0.96$, $P < 0.001$), Sg(-)₂: 0.011 ± 0.0013 ($R^2 = 0.81$, $P < 0.001$), Sg(-)₃:

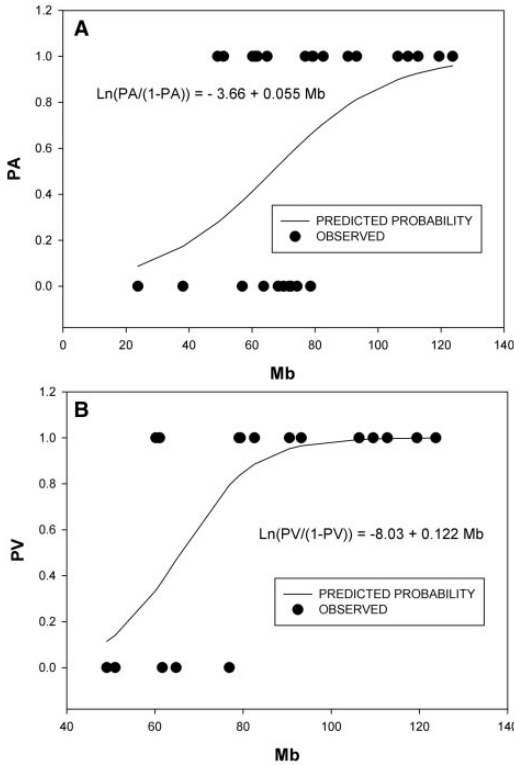


Fig. 2. Logistic regressions between the (A) probability of aggressive encounter (PA) and (B) probability of victory (PV) by adult *S. globula* on the body mass (g) of *S. globula* (Mb) in paired interspecific encounters with adult *L. laeta* in 19.5-cm circular chambers.

0.006 ± 0.0004 ($R^2 = 0.96$, $P < 0.001$), Sg(+)₁:
 0.024 ± 0.0027 ($R^2 = 0.86$, $P < 0.001$), Sg(+)₂:
 0.018 ± 0.0027 ($R^2 = 0.92$, $P < 0.001$), Sg(+)₃:
 0.022 ± 0.0016 ($R^2 = 0.92$, $P < 0.001$).

During equivalent time periods, the mean body length of the spiderlings was similar in all cohorts, but the maximum body length during this time was 3.92 ± 0.24 mm in Sg(-) cohorts and 3.17 ± 0.07 mm in Sg(+) cohorts ($F_{1,66} = 55.32$, $P < 0.001$). Furthermore in Sg(+) the variance was lower (Bartlett test = 46.2, $P < 0.001$). The slope of maximum body length increase was different among all cohorts ($F_{5,66} = 3.54$, $P < 0.001$). Also when Sg(-) and Sg(+) groups were compared, a significant difference was found ($F_{1,74} = 25.84$, $P < 0.001$; Fig. 5).

Discussion

In studying behavioral responses of *S. globula* using a different prey species, Fernández et al. (2002) described *S. globula* as expressing all behavioral displays reported in this study, but to a greater extent. For example, in our study alert posture and leg retraction only were observed in 80% and 40% of cases, respectively (Fig. 1). Interestingly, of the 10 behavioral displays described by these authors, we only recognized eight in an isolated form. Tapping always occurred with

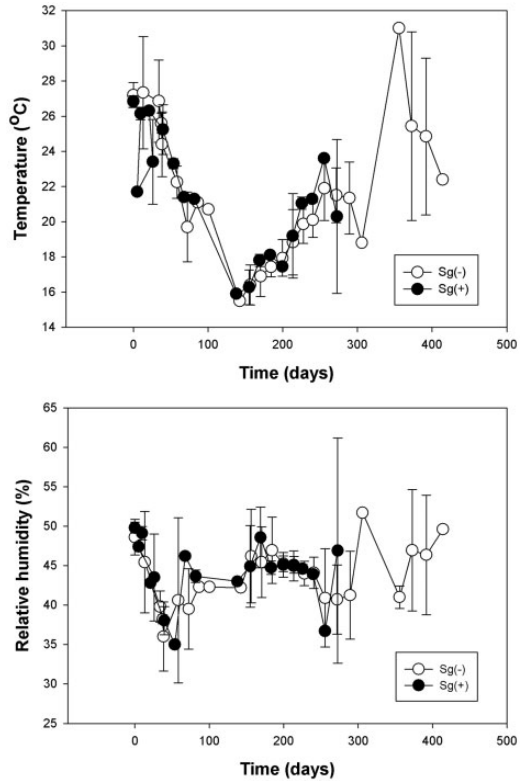


Fig. 3. Variation of temperature and relative humidity during the experimental time in Sg(-) and Sg(+) cohorts.

prey palpation, while reach always occurred with roll and thus were considered a single event.

When a predatory event occurred, the sequence of events by *S. globula* was not always the same. For example, in three of 32 encounters, the tapping display was repeated alternating with other displays, such as spitting, reach and roll, and biting. Tapping display may be part of a strategy destined to ensure the immobility of the prey before nibbling. Also, during tapping display *S. globula* more frequently used the left first and second leg, than the right legs, agreeing with that reported by Ades and Ramirez (2002). These behavioral displays, favored by the length of the legs, could increase its success of survival by reducing the risk of counterattack during a predatory event. Spitting is used to immobilize prey (Gilbert and Rayor 1985), increasing the probability of predatory success.

The probability of an aggressive encounter, a situation where interactions led to the death of one of the spiders, was only moderate, occurring in only approximately 60% of the occasions, which may be related to motivational factors of the predator or the prey. For example, one evident factor would be the time lapse since the predator last meal. This factor was partially controlled by the time of acclimation in laboratory, which ensured at least 2 to 3 wks without prey. Neither the sex of the predator nor that of the prey, regardless of which species was the resident, had an effect on the probability of an aggressive encounter or the

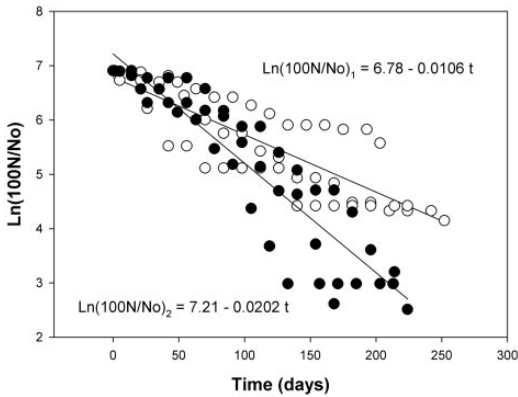


Fig. 4. *L. laeta* spiderling cohort survival rate, expressed as $\ln(100N/No)$ in chambers without *S. globula* ($Sg(-)$) and in chambers with one adult *S. globula* ($Sg(+)$).

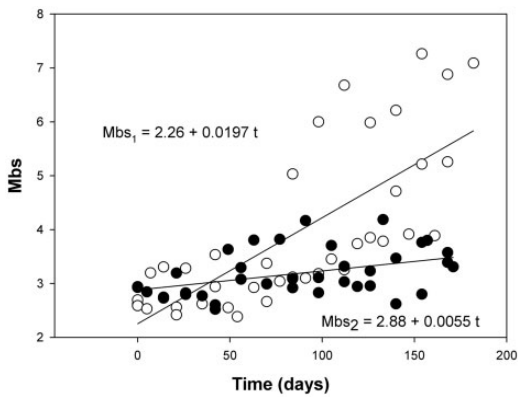


Fig. 5. Regression lines between the maximum body size (Mbs) of *L. laeta* spiderlings without a *S. globula* ($Sg(-)$) (Mbs_1) and with *S. globula* ($Sg(+)$) (Mbs_2) and time.

probability that *S. globula* was the winner of these encounters. This probability was only moderately high, 68.4%, which may be a consequence of the fact that the prey, *L. laeta*, was a larger and is considered a quicker spider (Canals et al. 2008) that exceeded by 64% the body mass of *S. globula*. *L. laeta* aggressive behavior was especially striking when encountering *S. globula* adults in the three $Sg(+)$ chambers that contained a *L. laeta* female with her young. Such a challenge with spider introductions was previously described by Canals and Solís (2013) who stressed the special situation represented by a large female guarding her spiderlings being confronted by a predator. In their study, they documented the offspring-guarding female expressing high aggressiveness, and they attributed this to the likely need for increased food intake leading to the aggressive behavior and thus becoming a more difficult prey. This idea is reinforced because the spiders in general appear to be territorial, especially at low prey availability (Riechert 1981).

In the individual encounters we only observed a 3.1% leg loss level among *S. globula*. However in the

$Sg(+)$ chambers, leg loss occurred in three of eight encounters (37.5%). Previous reports of encounters between *S. globula* and the species *L. laeta*, *L. gaucho*, and *L. intermedia* suggested a 13.6% leg loss level (Ades and Ramires 2002), which is between these two values.

Of all analyzed predictors of an aggressive encounter and a victorious encounter by *S. globula*, only the body mass of *S. globula* was a good predictor of both PA and PV. The greater the body mass of *S. globula*, the higher the PA and PV values by *S. globula* were. The body mass of the subadults and adults of *S. globula* used in this study varied between 23.8 and 123.7 mg, and the variations in mass represented variations in developmental instars. It appears that the effect of the body mass on PA and PV would be explained by the experience and ability of the predator acquired during its development. All individuals of *S. globula* with body mass over 85 mg had aggressive encounters and all resulted in winners. (see Fig. 2).

All $Sg(-)$ cohorts still had live spiders and in all $Sg(+)$ cohorts all spiderlings were killed before reaching at most the fourth instar, with a maximum body size lower than that of $Sg(-)$ spiderlings after an equivalent time period. Furthermore, the mortality rate in $Sg(+)$ cohorts was about twice that of $Sg(-)$ cohorts. Predation of spiderlings by the mother was not observed, contrasting with several predation events on *T. molitor* larvae. This fact, the short time that spiderlings share with their mothers and that this time was matched for the experimental groups allows to discard predation by the mother as a cause of differential mortality rate among the experimental groups. The mortality rate in both experimental groups is explained in part by natural causes and spiderling cannibalism, which was observed on two occasions during the inspection of different cohorts and was described for *L. laeta* (Vetter and Rust 2010). Although the actual amount of cannibalism during the experiments was not recorded because the boxes were inspected only once every 2 wk, the cannibalism event numbers would have been similar across the six boxes, because of the similar maintenance conditions. We believe that the presence of the predator in the three $Sg(+)$ boxes did not result in more cannibalism events due to the sharing of the larvae with the predator, because *S. globula* has a marked preference for less chitinous prey (Fernandez et al. 2002), and during the inspections when the mealworm larvae were introduced the spiderlings immediately preyed and fed on them.

In the $Sg(+)$ cohorts, the predation of spiderlings by an adult *S. globula* was added to these causes of mortality, and was directly observed on three occasions during the count of the spiderlings. Thus, the difference in mortality between the experimental groups is attributable to predation and represents the maximum potential effect of *S. globula* on the mortality rate of cohorts of *L. laeta*. Provided our experimental design, the difference in the body size between the spiderlings of the experimental groups and the absence of later instars in the predator-positive treatment are likely explained by predation of the larger individuals by *S. globula*.

In Chile, *S. globula* is found inside human dwellings, alone or coexisting with *L. laeta* (Fernandez et al. 2002, Canals and Solís 2013). In other countries, *S. globula* has been reported outside of human dwellings, as a peridomiciliary spider (Fisher and Vasconcellos-Neto 2005a,b). Spiders of the genus *Loxosceles* frequently are found with other spider families such as Pholcidae, Theridiidae, Salticidae, and Selenopidae, but the interaction of members of these families with *Loxosceles* species has been poorly studied (Sandidge 2004, Fisher et al. 2006). In Chile, only *S. globula* has been reported as a predator of *L. laeta* (Fernandez et al. 2002, Canals and Solís 2013). Interactions between *L. intermedia* and *Pholcus phalangioides* (Fuesslin) have been studied in Brazil. *Loxosceles* species were frequently found in the web of *P. phalangioides*, but without clear population effects (Fisher and Krechmer 2007). These authors found that *P. phalangioides* preyed on adults and spiderlings of *L. gaucho*, *L. laeta*, and *Loxosceles hirsuta* Mello-Leitao. Sandidge (2004) reported predation of *L. reclusa* by three cosmopolitan, synanthropic spiders: *P. phalangioides* (Pholcidae), *Achaearanea tepidariorum* (Koch) (Theridiidae), and *Steatoda triangulosa* Walckenaer (Theridiidae), reporting that only the latter two spiders had a negative, but nonsignificant, population relationship with *L. reclusa*. Sandidge (2004) did not find individuals of *L. reclusa* in *P. phalangioides* webs, a fact that he explained by a different spatial distribution of the species; *L. reclusa* was found in webs at floor level, and *P. phalangioides* was found in webs in high corners near the ceiling of the rooms. However, Fisher and Krechmer (2007) reported that this fact might be explained by the custom of *P. phalangioides* of removing and rebuilding their webs.

Food availability may be an important factor to explain the results of Fisher and Krechmer (2007) and Sandidge (2004), because the spiders studied by these authors are opportunistic spiders that usually feed on insects. In contrast, although *S. globula* feed on insects such as Diptera, Lepidoptera, and Mantodea, it is mainly an araneophagic spider that preys on several *Loxosceles* species and other spiders such as Salticidae and spiders of the genus *Drassodes* (Jackson et al. 1998, Ades and Ramires 2002, Fernandez et al. 2002, Canals and Solís 2013).

In Chile, *S. globula* shares the habitat and the preferred microenvironments with *L. laeta* inside human dwellings, preying naturally on *L. laeta* (Fernandez et al. 2002, Canals and Solís 2013). Thermal preferences and desiccation tolerances suggest that the species share >80% of their thermal niche (Alfaro et al. 2013, Canals et al. 2013). Both species are nocturnal, making encounters between them highly probable. This study showed that on most occasions this encounter has a favorable result for *S. globula*. But also, in a considerable proportion of interactions, *L. laeta* preys on *S. globula*. Our results demonstrate that under the laboratory conditions used herein, *S. globula* preyed on spiderlings of *L. laeta*, with a clear effect on the mortality rate of cohorts of this species. However, there is a report of coexistence of adults and spiderlings of both species in areas smaller than 1 m² (Canals and Solís

2013). These findings suggest that *S. globula* is naturally interacting with the population of *L. laeta* in central Chile. The population regulation of *L. laeta* by predation would be important because this species, in the absence of predation, has a high basic reproductive rate, $R_0 = 2.1$, and it can maintain large populations with high dispersion capacity (Canals and Solís 2014). However, according to our results, although *S. globula* may impact the number of spiderlings and adults of *L. laeta* and perhaps other *Loxosceles* species in a coexisting environment, *S. globula* is not an efficient biological control agent suitable for *Loxosceles* species management. Its presence, however, together with other control measures such as hygiene and cleaning of infested rooms, may help to decrease loxoscelism incidents.

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