Body size, duration of embryonic development, growth rate, mother–offspring interaction, and diet in *Sosippus floridanus* Simon (Araneae: Lycosidae)

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Summary

Field and laboratory studies were conducted on *Sosippus floridanus* (Araneae: Lycosidae) in a scrub habitat (Hopkins Prairie) in Florida. In the field, adult females, offspring, and egg sacs on 20 webs were monitored during 2003. Morphometric measurements were recorded for total body length, length of femur, patella-tibia, metatarsus, and tarsus, as well as length and width of the carapace and labium. Sexual size dimorphism was observed: adult females had larger total body and tarsal lengths. Egg sacs were constructed at night (between 2230 and 0345 h) and were carried by females between 3 June and 23 July. Numbers of spiderlings emerging from egg sacs ranged from 22–61 (mean 42.8) and 14–57 (mean 39.2), under field and laboratory conditions, respectively. Each web was characterised by a tube-like retreat extending into a funnel-shaped structure at the top, with silk lines emanating outward for 12–40 cm away from the funnel. Eight of 20 webs were constructed on the ground; the remaining 12 between 0.4–0.7 m above the ground. Females seized entrapped prey and carried it into the retreat, followed by their offspring which aggregated around the prey item and began feeding while it was still in the mother's jaws. After 18–21 days of age, young were rarely observed in the retreat, and fed on prey at the location where it was entrapped. *Sosippus floridanus* fed on a wide variety of arthropod prey consisting of insects and spiders. The gestation period ranged from 14–19 days for eggs under natural conditions, and 11–14 days under constant climatic conditions in the laboratory. Most spiderlings were able to emerge from the egg sac without maternal assistance. Immature spiders showed a strong tendency toward maintaining a close proximity with one another while on the web.

Introduction

Spiders are typically solitary arachnids. Out of over 30,000 known spider species, group-living behaviour has been reported for only 30+ species (Avilés, 1997). Depending on the species, the degree of social interaction can range from extended parental care to living in relatively permanent groups (Buskirk, 1981). The most common form of parental care in spiders is exhibited by those species in which the mother lacerates the egg sac, enabling the spiderlings to emerge, and/or passively or actively guards her spiderlings for a period of time that typically ranges from a few days to over a week (D'Andrea, 1987). Typically, spiderlings do not capture prey during this period and utilise remaining yolk supplies to meet their metabolic requirements (Foelix, 1996). In addition, the newly hatched young are characterised by varying degrees of gregariousness which usually ceases after the first post-eclosion moult (Higashi & Rovner, 1975).

In most wolf spiders (Lycosidae), a female usually carries her egg sac, which is attached to the spinnerets, under the abdomen (Rovner *et al.*, 1973). Immediately after hatching, spiderlings crawl up onto the dorsum of their mother where they are carried about until the first post-eclosion moult (Punzo, 2003).

Sosippus floridanus Simon (Lycosidae) is one of the few members of a group of sedentary lycosids known as funnel-web spiders (subfamily Hippasinae) (Brady, 1962). Although they resemble vagrant wolf spiders in retaining the egg sac-carrying habit, Hippasinae are unique among non-burrowing, New World lycosids in that they lead a rather sedentary lifestyle. They construct funnel-shaped sheet webs that resemble those constructed by agelenids (Gertsch, 1979). Compared with the more common vagrant lycosids, they exhibit a certain degree of sociality in that a female shares a web with her young offspring. It should be mentioned that two Old World lycosid subfamilies share this web-building trait with Hippasinae, although they construct sheet webs rather than funnel webs (Lehtinen & Hippa, 1979).

Webs are usually found on the ground in open, sandy habitats, or above ground in shrubs and cacti, with skirts of silk extending 10–30 cm outward from the entrance to the funnel (Brach, 1976). The funnel retreats can be found extending downward under surface debris. Females often sit at the mouth of the funnel surrounded by their offspring in numbers that can range from 20–90 (Gertsch, 1979; Buskirk, 1981). Young may remain with their mother on the web for up to 5 months (Brach, 1976).

This type of social interaction allows offspring to remain in close proximity to their mother, where they are frequently observed making physical contact with her. The young make contact by touching the legs, palps and body of the female with their legs and palps (Punzo, pers. obs.). When prey is captured the female typically withdraws into the retreat carrying the prey with her. The young subsequently follow her and engage in communal feeding. In addition, the close proximity of mothers to their young creates a condition where young spiders on a web are subjected to a variety of visual and chemical stimuli emanating from their mother or siblings.

In this study we report on various aspects of the natural history and ecology of *S. floridanus*, including body size in adults, web construction, mother–offspring interactions, interaction between hatchlings, duration of embryonic development (gestation period), growth rate, and diet composition.

Material and methods

Field studies and general description of study area

Sosippus floridanus was studied at Hopkins Prairie, an inland scrub habitat (Big Scrub) within the Ocala

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National Forest, located just off State Road 314, 15 km north-east of Silver Springs, Florida (Marion County). It is best characterised as Florida scrub habitat, with well-drained sandy, siliceous entisol soils that are among the driest and least fertile soils in Florida (Myers, 1990). Dominant shrub and tree layer species include saw palmetto (*Serenoa repens*), sand pine (*Pinus clausa*), live oak (*Quercus geminata*), scrub oak (*Q. inopona*), rusty lyonia (*Lyonia ferruginea*), dwarf palm (*Sabal etonia*), and Florida rosemary (*Ceratiola ericoides*). Dominant ground cover vegetation includes beak rush (*Rhynchospora megalocarpa*), milk peas (*Galactia* spp.), gopher apple (*Licania michauxii*) and lichens (*Cladonia leporina*, *C. prostrata* and *Cladina evansii*). The ground contains areas with pronounced layers of litter, and scattered clumps of vegetation interspersed with patches of barren sand.

Seventy-two webs containing adult females with their egg sacs or young were monitored every other day between the months of March through September 2003. Only data obtained from webs in which the female survived until the young left the web ($n=20$) were used for analyses on field data. The positions of the female and young within the funnel web were also recorded. In order to determine diet composition, undigested prey within these 20 webs were identified on a weekly basis, between 1 June and 1 August (8 sample periods). Prey items were removed from the webs carefully with the aid of iris microdissection scissors and forceps, placed in 70% ethanol, and returned to the laboratory for subsequent identification to order, superfamily, or family, depending on state of digestion.

Morphometric data

The following measurements were recorded for each adult female (>18 mm, $n=20$) located on a web, and for males (>12 mm, $n=100$) collected in the same area using pitfall traps (Model 2838A, BioQuip, Gardena, California): (1) total body length (TBL); (2) carapace length (CL); (3) carapace width (CW); (4) length (LL) and (5) width (LW) of labium; (6) femur length (FmL); (7) patella-tibia length (Pt-TbL); (8) metatarsus length (MtL); and (9) tarsus length (TsL). To take measurements, females were gently eased off their web with a fine camel-hair brush, and males were removed from pitfall traps with a flattened wooden tongue depressor. The spiders were then placed individually in *Drosophila* vials (Carolina Biological Supply, Burlington, North Carolina). Each vial opening was fitted with a cork stopper which had a centrally-located glass tube through which carbon dioxide could be introduced into the vial from a portable CO_2 cylinder. Spiders were anaesthetised with CO_2, and measurements were taken using a Unitron Model 440 dissection microscope (Boca Raton, Florida) fitted with an ocular micrometer. All measurements were recorded between 15–18 July. After measurements were taken, females were allowed to recover fully and returned to their webs. Males were held in captivity for future studies. Differences between means for males and females were compared using a student *t*-test (Sokal & Rohlf, 1995).

Webs in the field were also monitored carefully after females deposited egg sacs, and the number of days between deposition and emergence of spiderlings was recorded for 12 egg sacs.

Growth rate in the field

Ten immature spiders from each of five additional webs were monitored at random approximately once every 3 weeks, between 9 June and 18 July, in order to determine rate of growth. Between 1 January and 31 December, spiders were also collected using pitfall traps. Traps consisted of 300-ml plastic containers placed into the ground with the lip of the container at ground level. Five rectangular grids (30 × 20 m), separated by a minimum distance of 50 m, were established at the study area. Traps were set along linear axes, 30 m in length, using a yellow rope laid on the ground. Each linear array of traps was separated by a distance of 4 m, and traps were set at intervals of 5 m. Each trap contained about 4 cm of a 50/50 mixture of ethylene glycol and water. Traps were checked on a weekly basis, and the number of individuals/month (for immatures, adult males and females) over the course of the year was recorded. Differences were compared using a Chi-square test (Sokal & Rohlf, 1995).

For immature spiders on webs, measurement of carapace width began within 36 h after the day (day 4) when they had left their mother's back and crawled onto the web. Spiders were coaxed off the web with a fine camel-hair brush, measured, and placed in vials containing 70% ethanol. Similar measurements were taken for pitfall-trap specimens, with a dissecting microscope to the nearest 0.1 mm using an ocular micrometer. Carapace width has been shown to be a reliable estimator of post-embryonic developmental rate in spiders (Hagstrum, 1971). Means were compared using an analysis of variance (ANOVA) with a Bonferroni-adjusted alpha level of $p=0.05$ (Sokal & Rohlf, 1995).

Laboratory housing conditions and experiments

Twenty males, and 15 females which had not yet deposited egg sacs, were collected from the field and brought back to the laboratory. Males and females were placed individually in 10-l glass aquaria (holding cages). The floor of each aquarium was covered with vermiculite to a depth of 4 cm. Several artificial plants were placed in each aquarium to add structural complexity to the habitat and to facilitate web construction. All females constructed funnel webs within their holding cages within 24 to 72 h. Aquaria were housed in a climate-controlled room (25 ± 0.2 °C; 70–75% RH; 12L:12D photoperiod regime).

All spiders were fed on a mixed diet of adult crickets (*Acheta* spp.), cockroaches (*Periplaneta americana*) and fruitflies (*Drosophila virilis*). Prey were placed on the web for females, and on the aquarium floor for males.

Gestation period

Experiments were conducted to compare the rate of embryonic development for egg sacs exposed to natural, fluctuating conditions of temperature, RH and photoperiod in the field, with egg sacs maintained under controlled laboratory conditions. Fourteen egg sacs were placed individually in plastic *Drosophila* vials immediately after being constructed by females, and maintained under identical climatic conditions to those described above in a Percival Model 85A environmental chamber (Boone, Iowa). The number of days between time of deposition and emergence of spiderlings was recorded for each egg sac from which spiderlings were observed to emerge ($n=10$).

Maternal–young interaction and emergence of young from egg sac

Experiments were conducted to determine if young could emerge from egg sacs without assistance from their mother. Thirty unbreached egg sacs were placed individually in glass vials (50 mm in height; 30 cm in diameter) and capped with perforated plastic stoppers. Egg sacs were observed on a daily basis to see whether or not young would emerge.

To determine whether or not interaction of the mother with her offspring was important for their survival, 20 pairs of unrelated middle-instar spiders were placed at opposite ends of 100 mm glass petri dishes containing no web material, one pair/dish. After 15 min their position within the dish was recorded. Recording was repeated at hourly intervals for 4 h, and then after 24 h, 2 days, and 3 days. Distances separating the spiders within each dish were modified from those proposed by Downes (1994) in his study on the social spider *Phryganoporus candidus* (L. Koch) (Desidae), and defined as follows: (1) in physical contact with one another (touching); (2) close (<10 mm apart); (3) intermediate (16 to 40 mm apart); (4) far (41 to 55 mm); and (5) distant (>55 mm). These distances were based on over 80 h of observation of young on webs in the field. A Chi-square test was used to test for differences between the frequency distributions of various time intervals (Sokal & Rohlf, 1995).

Results

Morphometric data

The results for various measurements for males and females are listed in Table 1. Significant differences between the sexes (sexual dimorphism) were found only for total body length ($t=10.87$, $p<0.05$) and tarsus length ($t=14.26$, $p<0.05$).

Egg sac construction, number of emerging spiderlings, and gestation period

All egg sacs were constructed at night, between 3 June and 6 July, and between 2230 and 0345 h (Eastern Standard Time). They were carried by females in webs between 3 June and 23 July, and between 18 June and 16 July, under field and laboratory conditions, respectively (Table 2). The gestation period ranged from 14–19 days (mean 16.9 ± 1.73 SE) for eggs in the field, and from 11–14 days (mean 12.8 ± 0.82) under laboratory conditions. This difference between means was significant ($t=12.96$, $p<0.05$).

The number of spiderlings emerging from egg sacs ranged from 22–61 (mean 42.8 ± 6.85 SE), and 14–57 (39.2 ± 5.88), under field and laboratory conditions, respectively (Table 2). These means were not significantly different ($p>0.05$). Emerging spiderlings, in the field and in captivity, climbed onto the dorsum of the mother's abdomen and remained there until their first moult, a period of 3–4 days.

Parameter	Males	Females
TBL	12.81 (2.12)[a]	18.2 (1.21)[b]
CL	6.23 (0.54)[a]	6.61 (1.01)[a]
CW	4.48 (0.35)[a]	4.91 (0.42)[a]
LL	0.88 (0.13)[a]	0.94 (0.14)[a]
LW	0.79 (0.07)[a]	0.88 (0.11)[a]
FmL	6.24 (0.73)[a]	5.83 (0.37)[a]
Pt-TbL	7.22 (0.62)[a]	6.78 (0.44)[a]
MtL	6.56 (1.11)[a]	5.92 (1.01)[a]
TsL	3.94 (0.43)[a]	2.69 (0.26)[b]

Table 1: Morphometric data for adult males ($n=100$) and females ($n=20$) of *Sosippus floridanus*. TBL=total body length; CL=carapace length; CW=carapace width; LL=labium length; LW=labium width; FmL=femur length; Pt-TbL=patella-tibia length; MtL=metatarsus length; TsL=tarsus length. All measurements expressed in mm for spiders measured between 15–18 July, in Marion County, Florida. Data expressed as means (±SE). Values in rows followed by a different letter are significantly different (t-test, $p<0.05$).

	Field conditions			Laboratory conditions			
Egg sac	*N*	DD	DE	Egg sac	*N*	DD	DE
1	37	21 June	07 July	1	46	24 June	05 July
2	54	23 June	09 July	2	31	21 June	04 July
3	48	25 June	11 July	3	49	28 June	10 July
4	51	13 June	29 June	4	23	19 June	02 July
5	29	16 June	03 July	5	55	26 June	08 July
6	44	12 June	27 June	6	38	22 June	02 July
7	22	03 June	19 June	7	14	18 June	29 June
8	61	22 June	05 July	8	37	04 July	16 July
9	34	05 July	23 July	9	57	01 July	14 July
10	47	06 July	22 July	10	42	27 June	08 July
11	35	24 June	10 July				
12	52	26 June	12 July				
MGP		16.9 (±1.73 SE)				12.8 (±0.82)	

Table 2: Numbers of hatchling spiderlings that emerged from egg sacs deposited by females under laboratory conditions (25 ± 0.2°C; 70–75% RH; 12L:12D photoperiod regime) as well as for eggs that hatched under field conditions. Data from 2003. N=number of emerging spiderlings; DD=date egg sac was deposited; DE=date spiderlings emerged; MGP=mean gestation period (in days); difference between laboratory and field data was significant ($p<0.05$).

Construction of webs in the field

Webs were constructed either on the ground ($n=8$) or from 0.4–0.7 m above the ground ($n=12$). Ground webs occurred on the ground in sandy areas ($n=5$) or in clumps of decaying cactus (*Opuntia*) plants ($n=3$), and were characterised by a tube-like silken retreat extending into a funnel-shaped structure at the top, with emanating silk lines extending outward for 12–40 cm. Webs built above the ground were located within fronds of saw palmetto.

Prey capture, diet composition, and location of female and spiderlings

During early morning hours (0730–0930) females were usually observed resting at the mouth of the funnel retreat. If young were present they typically positioned themselves in a circle or semicircle around her body. Between 0930 and 1500 h, females moved back and forth between the outer boundaries of the web and the mouth of the retreat. The young usually left the web and dispersed when they were 75–90 days old (>1.0 cm in length).

Prey	*N*	NW
Insecta		
Coleoptera (A)		
Brachypteridae	4	3
Carabidae	9	7
Elateridae	5	5
Lampyridae	22	20
Lycidae	3	3
Scarabaeidae	4	4
Unidentified	11	9
Dictyoptera		
Blattaria (cockroaches) (N)	10	7
Mantoidea (mantids) (N)	4	4
Diptera (A)		
Agromyzidae	5	5
Asilidae	2	2
Calliphoridae	7	6
Culicidae (mosquitos)	32	20
Drosophilidae (vinegar flies)	29	18
Muscidae	12	10
Syrphidae	10	8
Tabanidae	14	8
Tephritidae (fruitflies)	22	15
Tipulidae	4	3
Unidentified	12	9
Ephemeroptera (A)		
Baetidae	13	11
Heptageniidae	9	5
Ephemeridae	6	6
Hemiptera		
Coreidae (A)	2	2
(N)	4	4
Lygaeidae (A)	14	10
(N)	2	2
Miridae (A)	11	10
Unidentified (A)	8	7
(N)	7	4
Homoptera		
Aleyrodidae (white flies) (A)	25	16
Achilidae (A)	2	2
(N)	3	3
Cicadellidae (A)	10	8
Cicadidae (A)	2	2
Fulgoridae (A)	10	7
(N)	5	3
Membracidae (A)	11	9
Unidentified (A)	9	9
Hymenoptera		
Symphyta (wasps)		
Bethylidae (A)	2	2
Braconidae (A)	5	4
Ichneumonidae (A)	5	5
Chalcididae (A)	12	10
Chrysididae (A)	2	2
Cynipidae (A)	1	1
Unidentified (A)	9	6
Formicoidea (ants)		
Formicidae (A)	19	13
Apoidea (bees)		
Apidae (A)	5	5
Colletidae (A)	3	3
Halictidae (A)	5	3
Isoptera (termites) (A)	28	17
Lepidoptera		
Heterocera (moths)		
Geometridae (A)	1	1
Unidentified (A)	3	2
(L)	3	3
Rhopalocera (butterflies)		
Hesperiidae (A)	2	2
Lycaenidae (A)	3	2
Nymphalidae (A)	5	5
	2	2
Pieridae (A)	11	9
Satyridae (A)	2	2
Neuroptera		
Chrysopidae (A)	21	14
Unidentified (A)	7	5
Odonata		
Calopterygidae (A)	3	3
Coenagrionidae (A)	1	1
Lestidae (A)	1	1
Orthoptera		
Acrididae (grasshoppers) (N)	7	6
Gryllacrididae (leaf-rolling crickets) (N)	4	4
Gryllidae (crickets) (N)	8	5
Tettigoniidae (A)	2	2
(N)	4	3
Unidentified (N)	7	5
Thysanoptera (A)	8	7
Arachnida		
Araneae		
Araneidae (A)	12	10
Gnaphosidae (A)	2	2
Lycosidae (A)	4	4
(I)	3	3
Unidentified (A)	7	7
(I)	7	4
Opiliones (A)	3	3
Unidentified (A)	2	2
(I)	4	4

Table 3: Total numbers (*N*) of prey items identified from webs of *Sosippus floridanus* under natural conditions. Data compiled weekly from 20 webs from 1 June to 1 August (8 sample periods). Life cycle stage of prey designated as A (adult), N (nymph), L (larva), or I (immature). The number of webs (out of 20) containing a particular prey item as designated as NW.

Immatures				Adults			
09 June	30 June	18 July	06 August	25 August		16 September	
				♂	♀	♂	♀
n=41	*n*=62	*n*=55	*n*=38	*n*=29	*n*=64	*n*=34	*n*=57
1.66[a]	1.78[a]	2.91[b]	3.39[b]	4.46[c]	4.68[c]	4.44[c]	4.69[c]
(0.19)	(0.25)	(0.36)	(0.38)	(0.42)	(0.28)	(0.48)	(0.38)

Table 4: Carapace widths (in mm) for spiders sampled from five webs (10 spiders/web) as well as pitfall traps over the course of a reproductive season. Data expressed as means (±SE). Values in rows followed by different letters are significantly different (ANOVA, with Bonferroni-adjusted alpha level, $p<0.05$).

Typically, when prey were observed being ensnared in webs, the female moved quickly from the mouth of the funnel to the struggling prey. She then seized it and usually brought it back into the retreat. Early-instar spiderlings, between 4–18 days old, usually waited in the retreat, where food was carried to them by their mother. The young then aggregated around the prey item secured in the mother's jaws and began to feed. After 18–21 days, the young were rarely observed within the retreat and they fed on prey at the location within the web where the prey was entrapped, without assistance from their mother.

The prey items found in the webs of *S. floridanus* are listed in Table 3. This list indicates that *S. floridanus* feeds on a wide variety of insects and arachnids. Insects and spiders captured by *S. floridanus* include species that spend a significant amount of time on the ground, including beetles (Coleoptera), cockroaches (Blattaria), ants (Formicidae), and crickets (Gryllidae and Gryllacrididae), as well as those commonly found crawling up on shrubs such as fireflies (Lampyridae), mantids (Mantoidea), hemipterans (plant bugs), homopterans, caterpillars (Lepidoptera), and orthopterans (grasshoppers and katydids). In addition, many kinds of aerial insects are captured including flies (Diptera), alate termites (Isoptera), moths and butterflies, mayflies (Ephemeroptera), lacewings (Neuroptera), and bees and wasps (Hymenoptera).

Thirteen to 20 (65–100%) of the webs examined contained ants (Formicidae), fireflies (Lampyridae), mosquitos (Culicidae), fruitflies (Tephritidae), vinegar flies (Drosophilidae), white flies (Aleyrodidae), alate termites (Isoptera), and lacewings (Chrysopidae). Half of the webs contained araneid spiders, chalcid wasps, lygaeid and mirid bugs, baetid mayflies, and muscid flies.

Phenology

With the exception of December and January, immature spiders were found throughout the year and were significantly more abundant than adults (Fig. 1; $\chi^2=27.81$, $p<0.01$). Spiderlings that hatch in August overwinter as immatures, finding shelter under leaf litter, rocks, and other ground surface debris, in shallow ground holes, and within bark crevices. Males and females that hatched earlier in the year were found overwintering as adults. There were no significant differences between the numbers of adult males and females throughout the sampling period ($\chi^2=2.07$, $p>0.05$).

Growth rate

Mean body sizes under natural conditions, for immature stages of both sexes as well as adult males and females at various sampling periods, are listed in Table 4. There was an overall significant effect of time (date) on body size ($F=28.12$, $p<0.05$). Immatures had attained a significantly larger size by 18 July, as compared with spiders measured on 9 June and 30 June. Another significant increase in size was achieved by adult males and females by 25 August.

Maternal–young interaction and emergence of young from egg sac

In 4 out of 30 unbreached egg sacs, without the presence of a maternal parent to provide assistance, spiderlings failed to emerge and starved. Successful emergence was observed in the other 26 egg sacs. Spiders spent most of their time in physical contact or close proximity (Table 5). The percentage of time spent in close proximity increased from 25–35% over the first 2 h of observation, to 55–60% at the 2 and 3-day intervals, respectively. As time progressed fewer spiders were seen at the furthest distances (far and distant). At 24 h only

Time interval	Touching	Close	Intermediate	Far	Distant
15 min	6 (30)	7 (35)	3 (15)	1 (5)	3 (15)
1 h	5 (25)	5 (25)	4 (20)	4 (20)	2 (10)
2 h	7 (35)	7 (35)	4 (20)	1 (5)	1 (5)
3 h	8 (40)	9 (45)	1 (5)	1 (5)	1 (5)
4 h	7 (35)	12 (60)	1 (5)	0 (0)	0 (0)
1 day	6 (30)	13 (65)	0 (0)	1 (5)	0 (0)
2 days	7 (35)	11 (55)	2 (10)	0 (0)	0 (0)
3 days	6 (30)	12 (60)	2 (10)	0 (0)	0 (0)

Table 5: Distances maintained between 20 pairs of middle-instar *Sosippus floridanus*. Spiders were placed in pairs in 100-mm petri dishes and the distance between them recorded at various time intervals. Distances defined as: touching (in physical contact); close (<10 mm apart); intermediate (16–40 mm apart); far (41–55 mm); distant (>55 mm). Observations were recorded at 15 min after the spiders were initially placed in the petri dish, and at various time intervals afterwards. Data expressed as number of pairs followed by the percentage of 20 pairs (in parentheses) showing various degrees of proximity.

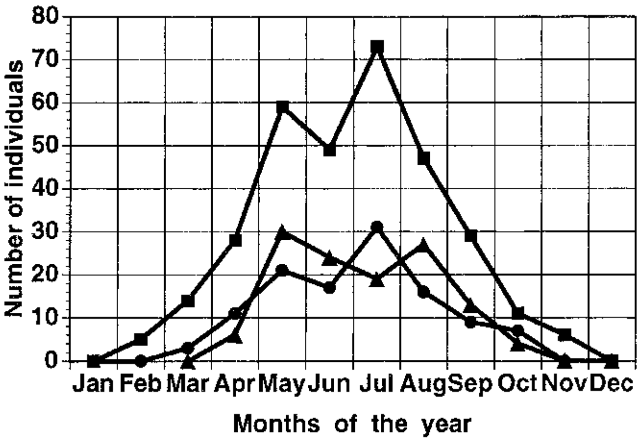

Fig. 1: Total numbers of immature and adult *Sosippus floridanus* collected in pitfall traps set in a scrub habitat at Hopkins Prairie, Florida, over the course of a year. Squares = immatures; circles = adult males; triangles = adult females.

one pair were separated by a distance of 41–55 mm. The frequency distributions for distance categories at the 1-h and 3-day time intervals were significantly different ($\chi^2 = 13.85$, $p < 0.01$).

Discussion

Sosippus floridanus was a common element of the spider fauna of the Hopkins Prairie inland scrub habitat. Although immatures were found from February to November, their peak period of occurrence was from May through August. The earliest that adult males were collected was in March, and they were most abundant from May through August. Adult females were not collected until early April, and their period of peak abundance was similar to that of males. In addition, body sizes increased significantly by mid-July, and again by late August.

The length of the gestation period was significantly reduced for eggs housed in the laboratory compared with those in the field. This may be attributed to the controlled environmental conditions of temperature and relative humidity in the laboratory. Naturally-occurring fluctuations in temperature and RH have been reported to affect the rate of embryonic development in a variety of terrestrial arthropods, including insects (May, 1985; Punzo, 2000), centipedes and millipedes (Cloudsley-Thompson, 1961), solifugids (Punzo, 1998) and other species of spiders (Pulz, 1987).

The fact that webs were constructed both on and off the ground suggests that web placement may depend on specific features of the microhabitat, including soil type and vegetation structure, as well as availability of suitable sites that are not already occupied by other web-building spiders. These general features of the environment have been known to affect microhabitat selection in many terrestrial arthropods (Polis, 1991; Punzo, 2000) as well as web site location in araneid spiders (Wise, 1993).

The prey items collected from the webs of *S. floridanus* in the field indicate that this spider is a generalist predator like other web-building spiders. In addition, although webs were never found more than 0.7 m above the ground, many aerial insects including flies, mayflies, damselflies, white flies, wasps, bees, moths and butterflies, and lacewings were trapped, as well as arthropods that move over the ground surface (ants, beetles, cockroaches, spiders) or crawl up into shrubs or trees (hemipterans, homopterans, orthopterans, arachnids). It is interesting to note that although present at this study site, walking stick insects (Phasmatodea), stink bugs (Pentatomidae), ladybird beetles (Coccinellidae), blister beetles (Meloidae), and velvet ants (Mutillidae) were not identified from any of the webs. Pentatomids, meloids, coccinellids, and mutillids are well known for their chemical defence. Perhaps, if these insects are caught, they are not attacked by *S. floridanus* which, unlike some orb-weavers, is not capable of wrapping the prey in a thick silk covering to minimise the repellant chemicals or stinging defences. If entrapped, these insects may be removed from the web instead. Phasmatids are generally palatable, and so their absence cannot be explained.

Although females did not lacerate the egg sac, as has been reported in other species of lycosids (Foelix, 1996), spiderlings emerged successfully from 87% of egg sacs without any maternal assistance. Females did not actively feed their young. There was no evidence of females seeking to share or regurgitating food. Prey that had been entrapped in the web were seized by the female and dragged into the retreat. Young spiders (4–18 days old) followed their mother into the retreat and fed upon the prey while it was in the female's chelicerae. Females typically fed with their young until only the outer cuticle of the prey remained. In some cases, the young continued to feed upon what remained of the macerated prey after it had been dropped by the female. Frequently, in these communal feeding bouts, the digestive juices and partially-digested prey surrounded the prey item, forming a somewhat continuous mixture from which all of the spiders fed.

After 18–21 days of age, immatures seldom entered the web retreat but fed on prey at those sites where prey became entrapped. Typically, those individuals closest to the prey would attack first. This is in agreement with a previous study by Downes (1994) on the social spider *Phryganoporus candidus*, which showed that out of 20 immature spiders to make first contact with a prey item, 85% were among those nearest to it. Similar results have been reported for other social spiders including *Anelosimus eximius* (Keyserling) (Brach, 1975) and *Stegodyphus mimosarum* Pavesi (Crouch & Lubin, 2000).

Growth rate as measured by carapace width showed an increase as the reproductive season progressed, from early June to late August. Immatures showed no significant change during June, but there was a significant increase in size by 18 July, and again by 25 August, when most spiders attained adult size.

Immatures and adults were active at the ground surface in all months except December and January. Peak abundance for all life cycle stages was observed from May through August. This corresponds to peak periods of abundance reported for other species of vagrant lycosids in the south-eastern United States (Kuenzler, 1958; Draney, 1997).

Immature spiders showed a tendency to stay in close proximity with their siblings in laboratory tests. This may be influenced by chemical cues associated with the integument or that occur on the silk. Spiders in close proximity can respond in greater numbers to entrapped prey, thereby facilitating transfer of nutrients more rapidly to a greater number of individuals. It has been shown that one advantage of sociality in species of spiders with more elaborate social interactions is that it enables them to capture larger prey (Nentwig, 1985). This, in turn, provides them with greater caloric intake per capture. Future studies on *S. floridanus* should attempt to assess the range in size of prey captured, and whether this is in any way associated with survivorship, growth rate and fecundity.

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