Conserving tarantulas in the Atlantic Forest, Argentina

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Final Report

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About the Logo

The project logo was entirely designed by the research team. It has the project title (in Spanish) on top and the funding support entity located below. The spider at the center was drawn by a team researcher and is a typical mygalomorph spider of the family Theraphosidae (commonly known as tarantulas). The spider is above the geographical shape of Misiones province (location where this project took place). The spider and the province have an orange color resembling the characteristic natural color of the soil that Misiones posses. As background, the logo has a picture of the Atlantic Forest vegetation, mainly showing ferns.

And here we can observe the logo come to life…

Nelson Ferretti (main researcher)

I'm from Bahía Blanca, Argentina and I have a Ph.D in Natural Sciences obtained at the Universidad Nacional de La Plata. I'm researcher assistant of CONICET (National Council for Technical and Scientific Research) since 2014. My work focuses on Taxonomy, Systematics, Biogeography, Ecology and Ethology of mygalomorph spiders from Argentina.

Gabriel Pompozzi (researcher)

He obtained the degree of Licentiate in Biological Sciences in 2009 at Universidad Nacional del Sur and he is currently doing the Ph.D at this Institution. His study focuses on the diversity, density and structure of spiders in natural and modified habitats. He has a Ph.D. scholarship from CONICET (National Council for Technical and Scientific Research) since 2010.

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She obtained the degree of Licentiate in Biological Sciences in 2013 at Universidad Nacional del Sur and she is currently doing the Ph.D at this Institution. Her specific interests focus on sexual selection and reproductive biology of mygalomorph spiders. She has a Ph.D. scholarship from CONICET (National Council for Technical and Scientific Research) since 2013.

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She obtained the degree of Licentiate in Biological Sciences in 2013 at Universidad Nacional del Sur and she is currently doing the Ph.D at this Institution. Her specific interests focus on ecology, sexual behavior and conservation of tarantulas. She has a Ph.D. scholarship from CONICET (National Council for Technical and Scientific Research) since 2014.

Abstract

This project aims to estimate de diversity and conservation status of tarantulas at the Atlantic Forest in Misiones province, Argentina. This region has been identified as a biodiversity hotspot and is suffering an extreme degree of forest fragmentation and degradation. Tarantulas are the largest and longest lived spiders of the world with natural populations threatened by habitat disturbances and captures for pet commerce. The proposal will contribute to the knowledge of the diversity, distribution, biology, habitat requirements and conservation status of tarantulas, by seasonal samplings. Also, this project will promote informative about tarantulas by workshops, environmental education and illustrated catalogs.

Outcomes

The primary outcome of this project is to know what species are present at the Atlantic forest in Misiones, Argentina and their abundance in the area. This key outcome will contribute to the systematic, distribution and the abundances of species in the region. Also, an update of the species cited in Misiones province, and at the Atlantic forest will be achieved. Moreover, the study of the distribution and abundances could help to the examination of possible sympatric species inhabit the Atlantic forest. The seasonal activity of the species is important due to the possible sympatric condition of many of them and the interpretation of the reproductive period of the species and the estimation of the spiderlings emergence for future captive breeding. This project aims to contribute with the knowledge of the conservation status given by the abundances of spiders in natural and altered areas and future categorization of Argentinean species in the IUCN Red List. Finally, we expected to inform community about what species are present in the Atlantic forest, how they live and if they are dangerous for people. Moreover, we will make workshops in schools, radial and Tv interviews about tarantulas and why to conserve them. Also, an illustrated catalog with biological data will be prepared for the administration of Natural Reserves.

Dissemination materials produced by the project

This Rufford supported project has managed to create significant impact on community regarding the importance of ***why conserving tarantulas*** even if they are creepy spiders!...and that is the vision from the community that we tried to change. For that purpose we made a considerable amount of dissemination materials.

Stickers, cups and T-shirts used by the research team for public talks

Classroom projector for public talks

Posters provided to the administrations of National Parks and Natural Reserves

First field campaign

Natural history

In late April and early May we made our first field trip. Our study site was located at southeastern of Misiones province, at Oberá department. The Natural Reserve was the CIAR (Centro de Investigaciones Antonia Ramos) (27°26´39.8´´ S - 54°56´23.2´´ W). This natural reserve comprehends 500 ha approximately of native forests located at about 150 meters above sea level. We spent 20 days of active development of the project activities.

We made day and night active searching for About 4 hours each. During the first days of the field campaign we were able to locate some specimens of a medium size tarantula occupying burrows on the substrate sometimes covered with leafs and sticks. These burrows were occupied by adult females. We registered a total of seven adult females living in burrows.

The mean entrance diameter of the female´s burrows were of 31.8mm ± 7.12 (n = 7), and the burrow length was of 139.75mm ± 49.85 (n = 7). No evidences of silk lining the burrow or closing the entrances were observed. The temperature inside female´s burrows was of about 23°C and soil ph was 7.5. The body size variation of females (n = 4) was: total length: 33.76 ± 3.32; carapace length: 14.26 ± 2.95; carapace width: 13.00 ± 3.00.

Typical burrow entrance of a female

Habitat where burrows were found

Juveniles tarantulas always were found occupying crevices or short burrows under stones, fallen logs or even inside decomposed logs. We recorded a total of 16 juveniles.

Small juvenile found underfallen logs.

Males were located walking at sunsets between 18:00 pm and 00:00 am. We located 12 adult males. One male was found at sunset occupying a small crevice under a big stone. The body size variation of males (n = 12) was (measurements are given in millimeters): total length: 33.46 ± 2.12; carapace length: 15.36 ± 1.46; carapace width: 14.03 ± 0.99.

Some specimens were examined *in situ* at laboratory installations of the "Centro de Investigaciones Antonia Ramos" and then released to their natural environment. We identified the individuals as *Vitalius roseus* due the presence of diagnostic characters indicated by Bertani (2001): presence of a small, almost vestigial, male spur (Fig. 1C), more than five spines closely arranged on the prolateral male palpal tibia, by the male palpal bulb shape (Fig. 1A, B) and the female shape of the spermathecae (Fig. 1D) together with the presence of long hairs ventrally on femora and many long hairs on the coxae, abdomen being black ventrally and patellae and metatarsi dorso-laterally slightly pinkish (Fig. 2A, B).

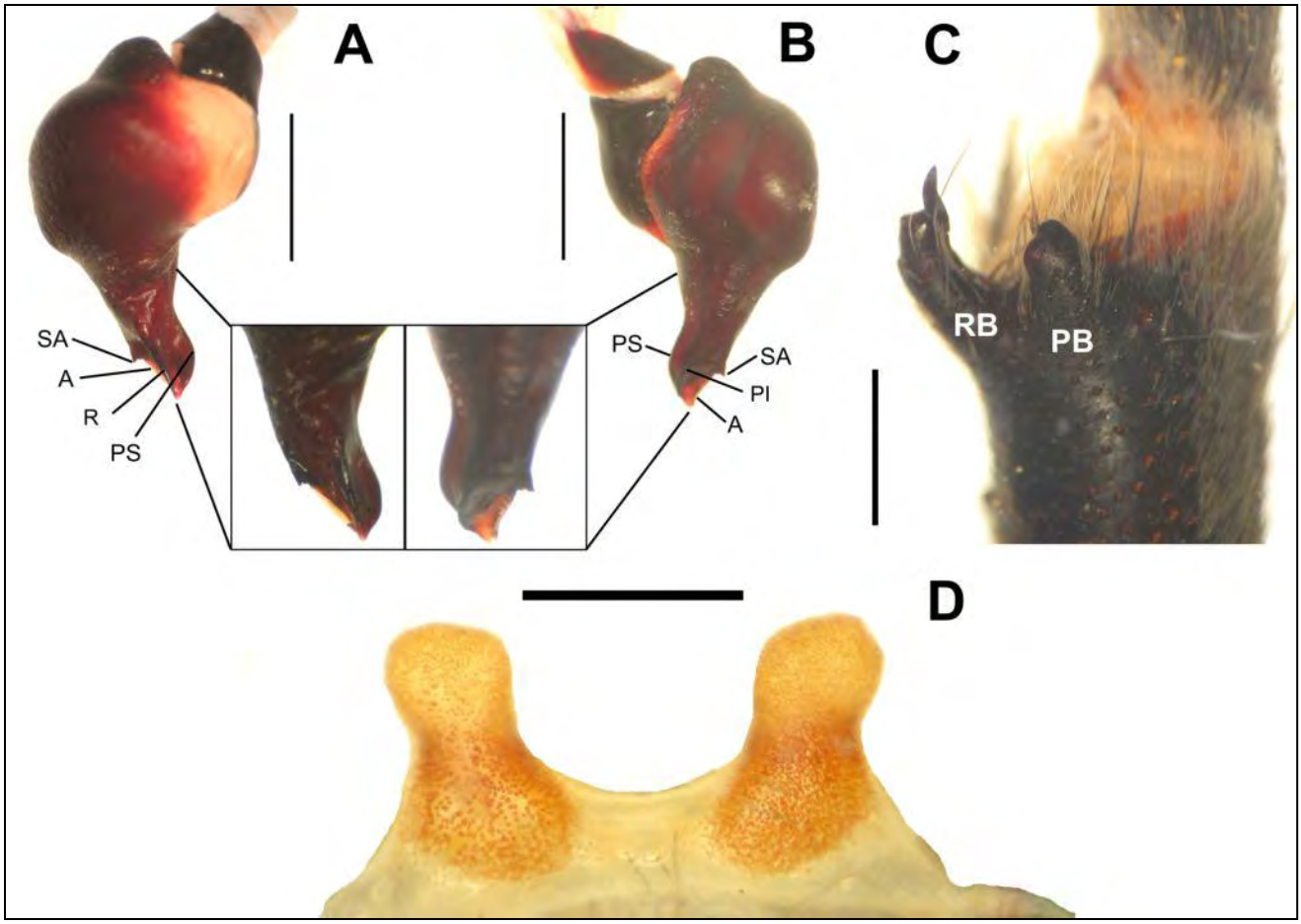
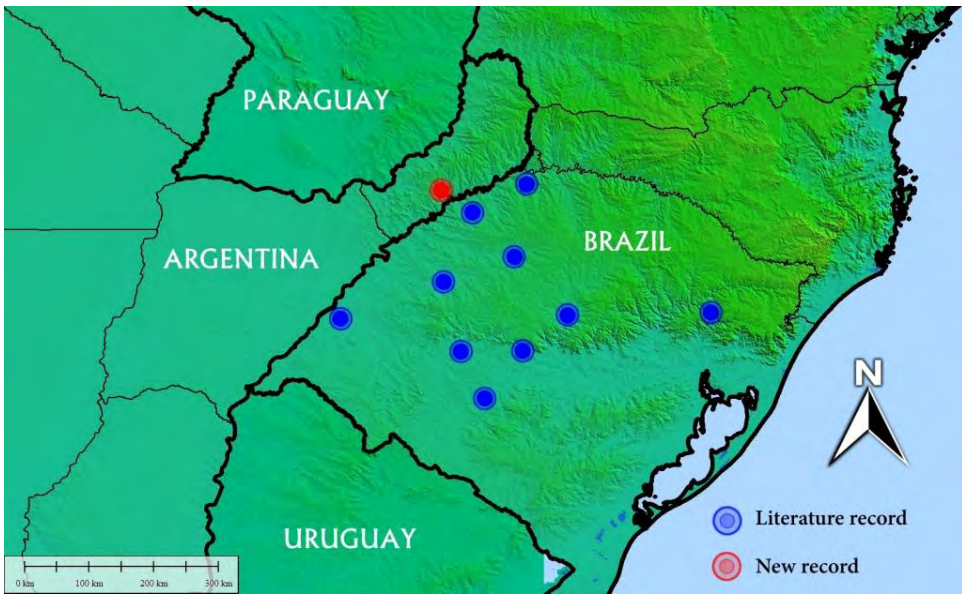


Figure 1. A. Right male palpal bulb, retrolateral. B. Right male palpal bulb, prolateral. C. Male spur. D. Female spermathecae, dorsal view. Bulb keels: A = apical; PI = prolateral inferior; PS = prolateral superior; R = retrolateral; SA = subapical. Male spur: PB = prolateral branch; RB = retrolateral branch. Scale bar = 1 mm.

Figure 2. Adult female (A) and male (B) of Vitalius roseus

Based in the collection of individuals of *Vitalius roseus*, we confirm this species for Argentina, also distributed in southwestern Brazil. The occurrence of this species at southeastern Misiones province, Argentina is near to its distribution in Brazil. Previous literature records of the species reported its distribution to many localities only at the State of Rio Grande do Sul inhabiting subtropical subcaducifolius forest (Bertani 2001).

The *Vitalius* species occupy mainly forested regions and are distributed in southeastern Brazil and only one species is cited for northeastern Argentina, *V. paranaensis* Bertani, 2001 (Lucas et al. 1993; Bertani 2001).



This species is reported for center, north and west in the State of Paraná, Brazil. In northeastern Argentina, this species is reported for Iguazú locality at northwestern Misiones province (Bertani 2001).

Reproductive behavior

The presence of walking males at field is indicative of the reproductive period of the species (Costa and Pérez-Miles 2002; Pérez-Miles et al. 2005), and in *V. roseus* males are active during April and May (autumn in southern hemisphere). The

occurrence of some males in April and May were also reported as the examined material from Bertani (2001) and is similar to the results found in our work. We carried out 22 experiments between nine males and five females under laboratory conditions. All interactions took place in cages measuring 40 x 30 and 25 cm high with soil as substrate and a burrow artificially constructed in the soil. Males were carefully deposited on the soil in the opposite side of the burrow. Additionally, we made four encounters in the open field by locating two females in their own burrows. Four males were exposed to each female, one every day. The events took place during the sunset and at night.

Wandering male of Vitalius roseus at night.

From the laboratory experiments, we observed that most males courted after they made contact with the female silk or after they made contact with her. The courtship behavior was similar to that reported for other theraphosids (Costa & Pérez-Miles 2002, see Ferretti et al. 2013 for a review) involving body vibration caused by leg III movements, palpal drumming, tapping the female with extended forelegs and palpal drumming over the female´s genital zone. The palpal drumming was less frequent than body vibrations. Females refused to mate during all trials; instead they escaped or remained inside the burrow. Only one female bite over the male carapace and cannibalized him, after the male courted, elevated and tried to make the first palpal insertion.

Adult female of Vitalius roseus killing an adult male.

At the field, we observed males courtship behavior after contact with female silk around the burrow. Male courtship involved corporal vibration and palpal drumming. During the first interaction the female emerged from her burrow and responded to male courtship. The female calling, involved vigorous tapping with the first and second pair of legs against the substrate at the entrance of the burrow. This is the first time this behavior is recorded for the genus and could be similar to that of species in other genera. Arguably, female response to male courtship was first observed by Prentice (1992) for *Aphonopelma* species. Quirici & Costa (2005) and Copperi et al. (2012) found that *Eupalaestrus weijenberghi*, *Acanthoscurria suina* and *Grammostola vachoni* respond to male courtship suggesting that such action would not only inform the male about her willingness to copulate, but also help the male orient himself towards the burrow entrance.

When spiders made contact, the female elevated her body to an angle of almost 90° with the substrate, with her first pair of legs elevated and legs III and IV over the substrate. Then the male pushed the female, raising her, clasping female fangs and palpal drums her genital zone. No insertion was observed and the spiders separated. The male pushed again the female but the coupled lost their equilibrium, separated and the female immediately retreated into her burrow. During the other three encounters the males courted but the females never responded to male courtship. No attacks were observed.

Couple of adults male and female of Vitalius roseus. A. Male courting (left) and female at burrow entrance (right). B. Male (left) clasping female (right) chelicerae.

Although we made a considerable amount of mating trials during the reproductive period of the species, we were unable to observe a successful copulation of these spiders. A possible situation may be that we found mated females that actively rejected males or refused to copulate. Therefore, this preliminary result matches to that found for another species, *E. weijenberghi* (Pérez-Miles et al. 2007), in which the mating system has monogamous females and polygamous males. However, this hypothesis needs to be elucidated with more data.

Diversity and abundance of other mygalomorph spiders recorded

We observed some specimens of Mygalomorphae spiders belonging to the families Actinopodidae, Dipluridae and Nemesiidae (see Table). The Dupluridae species was identified as *Diplura paraguayensis* (Gerschman & Schiapelli, 1940). One adult female was located inhabiting a dense silk tube and a short burrow under a fallen log on a forest.

Date	Sex	Location on the Reserve	Family	Observations
24-apr-14	Juvenile	Access trail	Nemesiidae	Burrow under stone
25-apr-14	Female	Forest behind CIAR	Dipluridae	Under log
26-apr-14	Juvenile	Access trail	Nemesiidae	Open burrow
26-apr-14	Juvenile	Access trail	Nemesiidae	Open burrow
26-apr-14	Male	Access trail	Nemesiidae	Wandering between leafs
26-apr-14	Female	Access trail	Nemesiidae	Open burrow
26-apr-14	Female	Access trail	Dipluridae	Silk tube under log
27-apr-14	Female	Behind plant restoration	Actinopodidae	Closed burrow on river bank
27-apr-14	Juvenile	Behind plant restoration	Actinopodidae	Closed burrow on river bank
29-apr-14	Juvenile	Access trail	Nemesiidae	Open burrow

Adult female of Diplura paraguayensis

One adult female and one juvenile of an undetermined species of the genus *Actinopus* were found inhabiting along a river bank.

Adult female of Actinopus sp. and her burrow with trap-door

Finally, four juveniles, one adult male and an adult female were observed from the family Nemesiidae. These specimens belong to the species *Stenoterommata iguazu* Goloboff, 1995. Juveniles and the female were located occupying dense silk tubes and a long burrow with open entrances.

Adult male of Stenoterommata iguazu

Second field campaign

In late September and early October we made our second field trip. Our study sites were located at central and northern of Misiones province. The Natural Reserves were Parque Nacional Iguazú, Iguazú deparment (25°31´5´´ S - 54°8´2.2´´ W) and Reserva

de Vida Silvestre Urugua-í (RVSU), General Manuel Belgrano department (25°59′15.6′′ S - 54°06′43.6′′ W).

The Iguazú National Park has an area of 67620 ha and lies within the Alto Paraná Atlantic forest. The Iguazú River ends in the Paraná River 23 km beyond the falls, after a 1320 km course. Inside the park it becomes up to 1,500 m wide and turns first south, then north, forming a large U-shape. Its banks are densely populated by trees, including the "ceibo" (Cockspur coral tree), whose flower is Argentina's national flower. The vegetation of the park also features "lapacho negro" and "lapacho amarillo" (Bignoniaceae), as well as "palmito" trees and the 40-metre-high "palo rosa" (Apocynaceae).

The Reserva de Vida Silvestre Urugua-í has an area of about 3243 ha and is located at the Atlantic forest of higher Paraná. The vegetation is characterized by "lapachos" (*Tabebuia ipe* and *T. alba*), the "incienso" (*Myriocarpus frondosus*), the "petribí" (*Cordia trichotoma*) and "araucarias" (*Araucaria angustifolia*). Also there are many specimens of Lauraceae, such as *Nectandra megapotamica* and *N. lanceolata*; the "guatambú" (*Balfourodendrum riedelianum*) and "pindó" (*Arecastrum romanzofianum*).

Activities at these two areas involved active searching during day and night (using head lamps) and compilation of data about natural history of the specimens found.

Diversity and Natural history

Family Theraphosidae

Genus *Vitalius*

Species *Vitalius paranaensis* Bertani, 2001

We found 5 juveniles and one adult male of this species inhabiting under stones and fallen logs along the Macuco trail at the Iguazú National Park. This tarantula species

has been cited in Misiones province and also occur in the State of Paraná, Brazil (Bertani 2001). It can be distinguished by having the metatarsus I straight; embolus short; male spur well developed and with sternum, coxae and abdomen ventrally black.

Adult male and juvenile of Vitalius paranaensis

Family Theraphosidae

Genus *Vitalius*

Species *Vitalius longisternalis* Bertani, 2001

We observed 2 juveniles and one female of this species at Iguazú National Park occurring in sympatry with *V. paranaensis*. Juvenile tarantulas always were found occupying crevices or short burrows under stones, fallen logs and the female was located inhabiting a deep burrow. The highest abundance of this species was registered

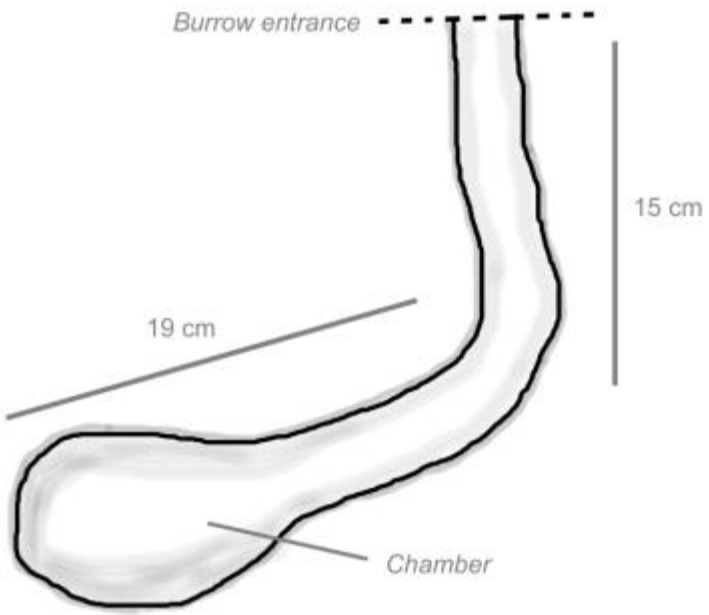
at the Reserva de Vida Silvestre Urugua-í. At this area we observed 6 small juveniles living under stones and 7 adult females inhabiting burrows.

Males and females of *V. longisternalis* can be easily distinguished from the other *Vitalius* species by the presence of a much longer than wide sternum. This species has been cited for the subtropical subcaducifolious forests of the States of Paraná and Santa Catarina, west of "Serra do Mar" in Brazil (Bertani 2001). Thus, based on the capture of individuals of *Vitalius longisternalis*, we confirm this species for Argentina.

Adult female of Vitalius longisternalis showing the longer than wide sternum (yellow arrow)

The mean entrance diameter of the female´s burrows were of 33.75mm ± 6.6 (n = 7), and the burrow length was of 293.33mm ± 70.23 (n = 3). No evidences of silk lining the burrow or closing the entrances were observed. The burrows were excavated cautiously thus the internal shape can be observed. Most burrows showed an almost

vertical tube and then curved to an angle of about 90° that ended in a larger chamber. The body size variation of females (n = 4) was: total length: 38.15 ± 1.66; carapace length: 13.57 ± 1.54; carapace width: 15.72 ± 1.45.



Burrow entrance and general aspect from Vitalius longisternalis

Small juvenile of Vitalius longisternalis under a stone (left); measuring an adult female (right)

Regarding the observation of some burrows of adult females of *V. longisternalis* we were able to estimate the spatial pattern or distribution of this species in a specific area. At the biological station at the Natural Reserve Urugua-í, we considered an area of about 100m x 80m (approximately 8000m^2). We registered 7 burrows and applied the methodology of the Average Nearest Neighbor Distance through the index "R" (Clark & Evans 1954). To evaluate the spatial distribution of *V. longisternalis* we measured the distance of one individual of the population and to the nearest neighbor (Ri). The matrix of distances is shown below:

	Burrow 1	***Burrow 2***	***Burrow 3***	***Burrow 4***	***Burrow 5***	***Burrow 6***	***Burrow 7***
Burrow 1	-						
Burrow 2	54,2	-					
Burrow 3	28,7	26,5	-				
Burrow 4	25,3	29,6	3,46	-			
Burrow 5	21,10	34,1	11,4	13,6	-		
Burrow 6	10,20	88,15	36,8	33,3	26,4	-	
Burrow 7	33	54,12	31,9	31,2	38,8	42,2	-

Then, the index R was calculated as follows:

$$R = \frac{O\ (averd)}{E\ (averd)}$$

Where *O (averd)* is the average distance of the observed distances, and *E (averd)* is the average distance of the estimated distances. An R index value among 0 – 1 indicates a cluster spatial distribution, whereas an index value higher than 1 but lower than 2 indicates a random spatial distribution.

The index value obtained for *V. longisternalis* was **R = 0.686** and could be indicating a clustering spatial arrangement of the burrows.

Although, we did not estimate the availability, abundance and spatial arrangement of the suitable sites for burrowing construction, a possible explanation of the aggregation could be that the poor dispersal capabilities of the spiderlings restrict them to settle into high density groups, composed primarily of siblings (Reichling et al. 2011). Moreover, the presence of young burrows observed in this area where adults are common provides additional support for this hypothesis (Ferretti et al. 2014), suggesting that the primary dispersal mode of this species is by walking.

Family Theraphosidae

Subfamily Ischnocolinae

We located 2 specimens of a small unidentified tarantula of the subfamily Ischnocolinae. Due to their small size we presumed that maybe they are juveniles, thus we are breeding those specimens to adult in order to make an accurate identification. Specimens were found inhabiting under big stones with no silk or burrow at the Urugua-í Natural Reserve. This subfamily is characterized by small tarantulas with many spines on legs, without urticating setae and bearing a simple palpal bulb.

Diversity and abundance of other mygalomorph spiders recorded

We observed some specimens of Mygalomorphae spiders belonging to the families Idiopidae, Dipluridae and Nemesiidae (see Table). The Dupluridae species was identified as *Diplura paraguayensis* (Gerschman & Schiapelli, 1940), the Idiopidae belongs to *Idiops hirsutipedis* Mello-Leitão, 1941 and the Nemesiidae were *Stenoterommata iguazu* Goloboff 1995 and *Rachias timbo* Goloboff 1995.

Idiops hirsutipedis and their burrow with trapdoor (left); adult female of Diplura paraguayensis (right)

Date	Sex	Location	Family	Observations
27-sep-14	Juvenile	Iguazú NP	Nemesiidae	Under log
28-sep-14	Female	Iguazú NP	Idiopidae	Trapdoor on substrate
28-sep-14	Female	Iguazú NP	Nemesiidae	Under log
29-sep-14	Juvenile	Iguazú NP	Dipluridae	Open burrow
01-oct-14	Juvenile	Urugua-í	Nemesiidae	Under stone
02-oct-14	Female	Urugua-í	Dipluridae	Open burrow
04-oct-14	Juvenile	Urugua-í	Nemesiidae	Silk tube under log
04-oct-14	Juvenile	Urugua-í	Nemesiidae	Silk tube under stone
04-oct-14	Juvenile	Urugua-í	Dipluridae	Under log
04-oct-14	Juvenile	Urugua-í	Dipluridae	Under log
04-oct-14	Juvenile	Urugua-í	Nemesiidae	Silk tube under stone

Outreach activities

Activities carried out in this context are aimed at the local community, especially for park rangers at natural reserves. During 2014 we organized various talks and workshops that were open to the public.

As a result of the support received, for example the incorporation of a classroom projector, it has been possible to offer the workshops at some national parks and natural reserves administrations. The activities not only involved a theoretical talk but also included a practice section which people can take a look the morphology of tarantulas by using a stereoscopic microscope; they can examine an exuviae of an adult goliath spider and also observe the more common tarantulas of the Atlantic forest in

Misiones with pictures in posters. Moreover, after the public talks and workshops we gave free stickers of the project to the audience.

It is important to note that many of the public talks were oriented to park rangers and tourist guides from the natural areas. This was an excellent opportunity to train those people who usually are in contact with these spiders at the natural areas, and that in many cases they don't know the name of the species or if they are dangerous to tourists.

Publications

One publication from the project has been already accepted for publication:

"**First record of *Vitalius roseus* (Mello-Leitão, 1923) (Araneae: Theraphosidae: Theraphosinae) in Argentina: distribution map, natural history, and sexual behaviour**" submitted to Arachnology (formerly Bulletin of the British Arachnological Society, UK) to be published in the first volume of the next year.

There is a lot of writing and analysis to be done. We will be working in the first record of *Vitalius longisternalis* in Argentina together with a large amount of data on natural history of this species.

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