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**The Spider *Loxosceles adelaida* GERSTCH, 1967 (Araneae, Sicariidae)  
in the Karstic Area of Ribeira Valley, PETAR,  
São Paulo, Brazil**

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**Abstract:** Species of *Loxosceles* spiders are a public health problem in many regions of the world by causing severe dermonecrosis and/or complement dependent haemolysis upon envenomation. *Loxosceles* spiders are present in several different habitats, including the karstic environment. Due to the substantial increase of tourism in caves of Brazil in the last few years and the medical importance of these arachnids the mapping *Loxosceles* species in karstics areas of this country is important. Caves of Parque Estadual Turístico do Alto Ribeira (Iporanga, São Paulo State, Brazil) have been surveyed in order to identify the presence of *L. adelaida* in that important touristic circuit in Brazil, which is visited by thousands tourists every year. This study includes preliminary ecological observations about the behavior of *L. adelaida* within the caves and in the adjacent forest outside of the caves.

**Key words:** Spiders, *Loxosceles adelaida*, ecology, loxoscelism, venom, cave, PETAR

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## Introduction

Envenomation by brown spiders of the genus *Loxosceles* Heinecken and Lowe, 1832 of North America, the Middle East, South Africa and South America commonly results in impressive local necrotic skin lesion and more rarely causes systemic effects, including profound intravascular haemolysis (GERSTCH, 1967; Newlands *et al.*, 1982, GERSTCH and Ennik, 1983; Barreto *et al.*, 1985; Futrell, 1992; Sezerino *et al.*, 1998).

*Loxosceles* sp. are the most poisonous spiders in Brazil. Children who develop the more severe systemic effects after envenomation nearly always die. At least three different synanthropic species of *Loxosceles* of medical importance are known in Brazil: *L. intermedia* (Mello-Leitão, 1934), *L. laeta* (Nicolet, 1849) and *L. gaucho* (Gertsch, 1967). More than 3,000 cases of envenomation by *L. intermedia* alone are reported each year. Because of a lack of understanding of the mechanism of action of the venom, an effective treatment is not available.

Studies on the effect of venom from synanthropic species of *Loxosceles* have been extensively reported. However were rare analyses of the venom from those living in natural environment.

*Loxosceles* spiders are present in several different habitats. In the anthropic ambience they live in dark, dry places in houses, such as doorsteps, wall cracks, spaces behind pictures, furniture or even curtains, as well as in household rubbish and buildings (Gertsch, 1967; Gertsch and Ennik, 1983). They are found in different altitudes and diverse ecosystems. In the natural environment its natural biotope is tree hollows, dry leaves, ravine cracks, rocky walls and caves.

According to Trajano (1987) these spiders are among the members of the Brazilian hypogea fauna and are the most common throglophile arachnid.

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To date, two species of *Loxosceles* spiders were registered as belonging to troglophile fauna in caves of Brazil *Loxosceles adelaida* (Brignoli, 1972, Eickstead, 1975) and *L. similis* (Gonçalves-de-Andrade *et al.*, 2001). The venom of both species was characterized and its toxicity was analyzed (Pretel *et al.*, 2005; Silvestre *et al.*, 2005). The results revealed that the venom of *L. adelaida* and *L. similis* are potentially able to cause envenomation with the same severity of those produced by synanthropic species.

The outstanding presence of those spiders in the Brazilian karst and the fact that Brazil is a country with large number of caves - 3,990 described and registered in Cadastro Nacional de Cavernas-CNC (Sociedade Brasileira de Espeleologia, 1990) - added to increase of tourism in caves in Brazil in the last years justify the study of the distribution of *Loxosceles* spiders in this ecosystem.

Thus the justification for the mapping of *L. adelaida* in karstic areas of PETAR, a major most touristic area in Brazil that hosts thousands tourists each year, lies in the association of tropical forest and the extensive cave system.

## Materials and Methods

### *Study Sites*

The Parque Estadual Turístico do Alto Ribeira (PETAR) is located in the Southwestern part of São Paulo State, in the Iporanga and Apiaí counties, Ribeira Valley. It is a natural reserve with an area of 35,712 ha on the left margin of the upper reaches of the Ribeira River. The altitude of the hilly terrain of the park varies from about 100 to 1000 m above the sea level. Most of its 35712 ha is situated on the Paranapiacaba Mountain Ridge. Together with the other neighbour reserves-Fazenda Intervalas State Park, Serra do Mar Environmental Protection Area, Xitue Ecological Station and Carlos Botelho State Park-it constitutes one of the most protected areas of the state of São Paulo. Those five areas represent more than 400,000 ha of protected Atlantic Rain Forest.

Geology of PETAR region is mainly characterized by carbonate rocks of the Açungui Group, Lajeado Subgroup. This group is a thick sequence of metasedimentary and metavolcanic rocks with ages ranging from the Middle to the Upper Proterozoic. The environmental importance of the area is due to the association between usually well preserved tropical forest and cave systems whose unique underground scenery combines a wide variety of speleothem forms and Quaternary palaeontological sites (Karmann and Ferrari, 2000).

The twenty studied caves are located in Iporanga county, São Paulo State and present calcareous litology. The data of the register number, register name, latitude and longitude of the visited caves have been obtained from the CNC and are listed below: SP-09 Casa de Pedra cave: 24°28'46"S-48°35'23"W; SP-012 Alambari de Baixo cave: 24°33'15"S - 48°39'5500"W; SP-020 Morro do Couto cave: 24°31'14"S - 48°41'43"W; SP-021 Morro Preto cave: 24°31'19"S - 48°41'54"W; SP-025 Água Suja cave: 24°31'25"S-48°42'27"W; SP-026 Córrego Grande I cave (Synonym Cafezal cave): 24°31'03"S-48°42'47"W; SP-030 Laje Branca cave: 24°32'57"S- 48°43'15"W; SP-041 Santana cave: 24° 31'51"S-48°42'06"W; SP-044 Abismo da Paçoca, 24°33'57"S-48°43'0000"W; SP-46 Grilo cave: 24°32'0100"S-48°42'5000"W; SP 49 Córrego Seco cave: 24°33' 05"S-48°40'58"W; SP-054 Ouro Grosso cave: 24°32'32"S-48°40'37"W; SP-58 Pérolas cave: 24°33' 51"S-48°44'33"W and SP-466 Páscoa cave: 24°34' 03"S-48°43'01"W.

The undescribed and uncatalogued (in CNC SBE) caves Laboratório I, Laboratório II, JJ 27, Abismo do Bráulio, Sete Portas and Macuco have been included for their insertion in the studied area.

### *Methodology of Capture of Spiders and Identification*

The spiders were captured manually within and outside the caves from the caves of PETAR (capture licenses numbers: 40320/2002 from Instituto Florestal, SP, Brazil and 20/2002 from IBAMA, Brazil).

The taxonomic studies were performed by morphological analysis using a stereomicroscope with micrometric ocular (Leica®) and an image analysis program (Leica® QWin, Cambridge, UK).

## Results and Discussion

*Loxosceles adelaida* was found inside nineteen the twenty surveyed caves. This is the first report of this species of brown spider in the following caves: Casa de Pedra, Alambari de Baixo, Morro do Couto, Morro Preto, Água Suja, Córrego Grande I, Laje Branca, Abismo da Paçoca, Grilo, Córrego Seco, Ouro Grosso, Pérolas, Páscoa and in the uncatalogued caves Laboratório I, Laboratório II, JJ27, Abismo do Bráulio, Sete Portas and Macuco.

Reports of *Loxosceles adelaida* in Santana cave were previously made by Eickstedt (1975). Dessen *et al.* (1980) observed *L. adelaida* in Santana and Morro Preto caves. Such study however presents no registered observations of these spiders in the adjacencies of these caves, a fact reported in the present study. Dessen *et al.* (1980) referred the presence of *Loxosceles* sp. in Água Suja cave. That spider was also verified in this cave and it was identified as *L. adelaida* in the present study.

It is noteworthy that *Loxosceles* spiders are ubiquitous and can be found anywhere in the cave as observed in this study. Such finding is consistent with the significant adaptive capacity of this spider and can be in contradiction with the common belief that *Loxosceles* is a sedentary spider and that is present only in the mouth cave area.

The presence of *L. adelaida* was noted not only in the interior of caves, but also in the adjacent forests of the caves Morro Preto, Couto, Santana and Ouro Grosso.

Its is also important to highlight the observed pervasive capacity of the brown spider. Its presence was marked not only inside the visited caves but also in the forest areas presenting rock and earth walls as verified in the way to the caves Córrego Grande I, Água Suja, Couto, Morro Preto, Ouro Grosso, Páscoa, Paçoca, Casa de Pedra and Abismo do Bráulio.

It is also relevant that even in the presence of natural shelters such as caves the *Loxosceles* spiders invade natural areas with anthropic activity that mimetic the natural shelters. This behavior could be proven as of the actual finding of the *L. adelaida* population in an abandoned man made lead mine on the way to Grilo cave and in the abandoned constructions of the infrastructure of this mine. Equally occupied by *L. adelaida* spiders are the areas of the forest in the vicinities of the trail to Alambari de Baixo, Paçoca and Páscoa caves where the presence of the human occupation vestiges such tiles, break piles and debris were also noted.

The geographic distribution of *L. adelaida* has been, therefore, updated, adding the analysed areas in this study to those data published by GERSTCH (1967), Brignoli (1972), Eickstedt (1975), Trajano (1987), Pinto-da-Rocha (1995) and Zeppelini-Filho *et al.* (2003): Grajaú, RJ, Brazil (GERSTCH, 1967); SP-178 Olho de Cabra cave, Altinópolis, SP, Brazil (Zeppelini-Filho *et al.*, 2003); SP-183 Fradinhos Cave, Altinópolis, SP, Brazil (Zeppelini-Filho *et al.*, 2003); SP-184 Cinco Bocas cave Altinópolis, SP, Brazil (Zeppelini-Filho *et al.*, 2003); Prata cave Altinópolis, SP, Brazil (uncatalogued in CNC) (Zeppelini-Filho *et al.*, 2003); SP-09 Casa de Pedra cave, Iporanga, SP, Brazil; SP-012 Alambari de Baixo cave, Iporanga, SP, Brazil; SP-020 Morro do Couto cave, Iporanga, SP, Brazil; SP-021 Morro Preto cave, Iporanga, SP, Brazil; SP-025 Água Suja cave, Iporanga, SP, Brazil; SP-026 Córrego Grande I cave (Synonym Cafezal cave), Iporanga, SP, Brazil; SP-030 Laje Branca cave, Iporanga, SP, Brazil; SP-041 Santana cave, Iporanga, SP, Brazil (Eickstedt, 1975); SP-044 Abismo da Paçoca, Iporanga, SP, Brazil; SP-46 Grilo cave, Iporanga, SP, Brazil; SP 49 Córrego Seco cave, Iporanga, SP, Brazil; SP-054 Ouro Grosso cave, Iporanga, SP, Brazil; SP-58 Pérolas cave, Iporanga, SP, Brazil; SP-466 Páscoa cave, Iporanga, SP, Brazil; Laboratório I (uncatalogued in CNC), Iporanga, SP, Brazil; Laboratório II (uncatalogued in CNC), Iporanga, SP, Brazil; JJ 27 (uncatalogued in CNC), Iporanga, SP, Brazil; Abismo do Bráulio (uncatalogued in CNC), Iporanga,

SP, Brazil; Sete Portas (uncatalogued in CNC), Iporanga, SP, Brazil; Macuco (uncatalogued in CNC), Iporanga, SP, Brazil; SP-18 Areias de Cima (Areias I) cave, Iporanga, SP, Brazil (Brignoli, 1972; Trajano, 1987); SP- 274 Tigre cave, Ribeira, SP, Brazil (Pinto-da-Rocha, 1995); SP-275 Tocão cave, Ribeira, SP, Brazil (Pinto-da-Rocha, 1995); PR-106 Rocha cave, Adrianópolis PR, Brazil (Pinto-da-Rocha, 1995); PR-108 Ermida Paiol do Alto cave, Adrianópolis, PR, Brazil (Pinto-da-Rocha, 1995); PR-118 Bom Sucesso cave, Cerro Azul, PR, Brazil (Pinto-da-Rocha, 1995); PR-123 Ermida do Paiol de Capim cave, Cerro Azul, PR, Brazil (Pinto-da-Rocha, 1995); PR-128 Buraco dos Seiscentos cave, Adrianópolis, PR, Brazil (Pinto-da-Rocha, 1995); PR-131 Taborda cave, Adrianópolis, PR, Brazil (Pinto-da-Rocha, 1995); PR-137 Ermida do Maciel cave, Adrianópolis, PR, Brazil (Pinto-da-Rocha, 1995); PR-138 Mina do Paqueiro cave, Adrianópolis, PR, Brazil (Pinto-da-Rocha, 1995).

The fact that *Loxosceles* spiders reside not only in the interior of caves but also in the rocky environment outside the cave and in areas modified by man that provide them shelters, added to the increasing touristic potential of the karstic environment in Brazil demonstrate the need for careful investigation of *Loxosceles* spiders, the etiologic agent of the severe human accident, in this biotope.

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