

## SHORT COMMUNICATION

### Construction of a pre-ballooning silk platform by *Actinopus* Perty, 1833 spiderlings (Mygalomorphae: Actinopodidae)

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**Abstract.** Spiders of the genus *Actinopus* Perty, 1833 are known to engage in ballooning, but this behavior has never been observed in the field. Here, we report and describe the observation of pre-ballooning behaviors by *Actinopus* juveniles in nature, including the use of a silk platform for ballooning take-off. Ten individuals were also collected and observed for ballooning behaviors in laboratory conditions. Both in nature and in the laboratory, individuals exhibited behaviors such as raising their legs and spinnerets, possibly to facilitate the perception of mechanical signals such as air currents. The pre-ballooning silk platform was observed in an area devoid of bushes and trees, which suggests that the spiders may have built this platform to compensate for a lack of vertical structures in the vicinity.

**Keywords:** Dispersal, dragline, suspended ballooning, sensorial behavior, trapdoor spider

<https://doi.org/10.1636/JoA-S-24-036>

Mygalomorph spiders, which include tarantulas, trapdoor spiders and purse-web spiders are generally characterized by low vagility, with dispersal mainly limited to wandering mature males during reproductive periods, and the dispersal of spiderlings from their maternal burrow (Pérez-Miles & Perafán 2017; Buzatto et al. 2021). Ballooning, a behavior in which silk is used by

small spiders to disperse through the air, is one of the most effective ways that spiderlings can disperse; however, it appears to be uncommon in the Mygalomorphae, as it has only been reported a few times in the families Atypidae Thorell, 1870, Actinopodidae Simon, 1892, Halonoproctidae Pocock, 1901 and Idiopidae Simon, 1889 (Enock 1885; Baerg 1928;

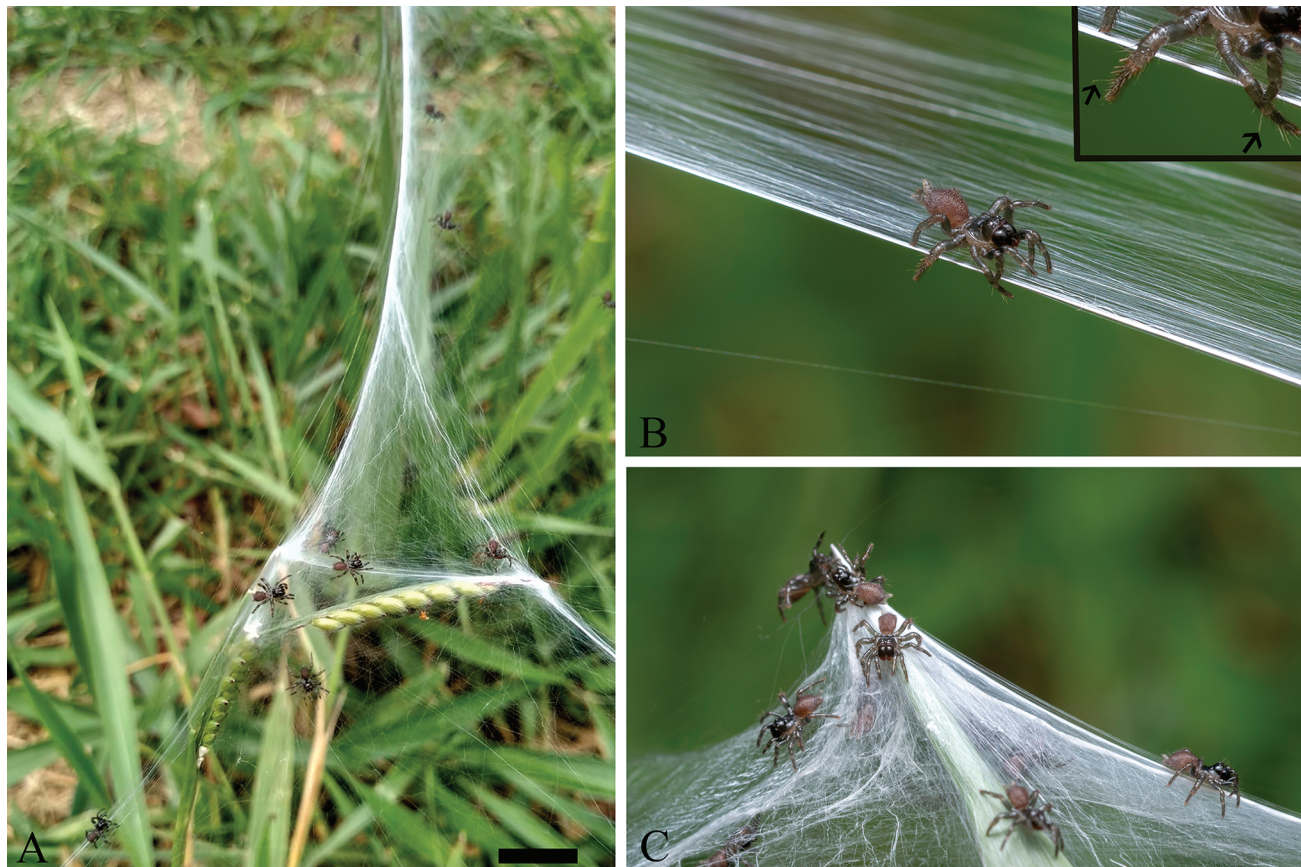


Figure 1.—Silk platform and pre-ballooning behavior in spiders of the genus *Actinopus*: A, silk platform overview; B, *Actinopus* spiderling stretching its legs and elevating its abdomen and spinnerets (black arrows showing the tactile setae); C, *Actinopus* spiderlings ready for dispersal from a silk platform constructed on vegetation. Scale bar = 6 mm.

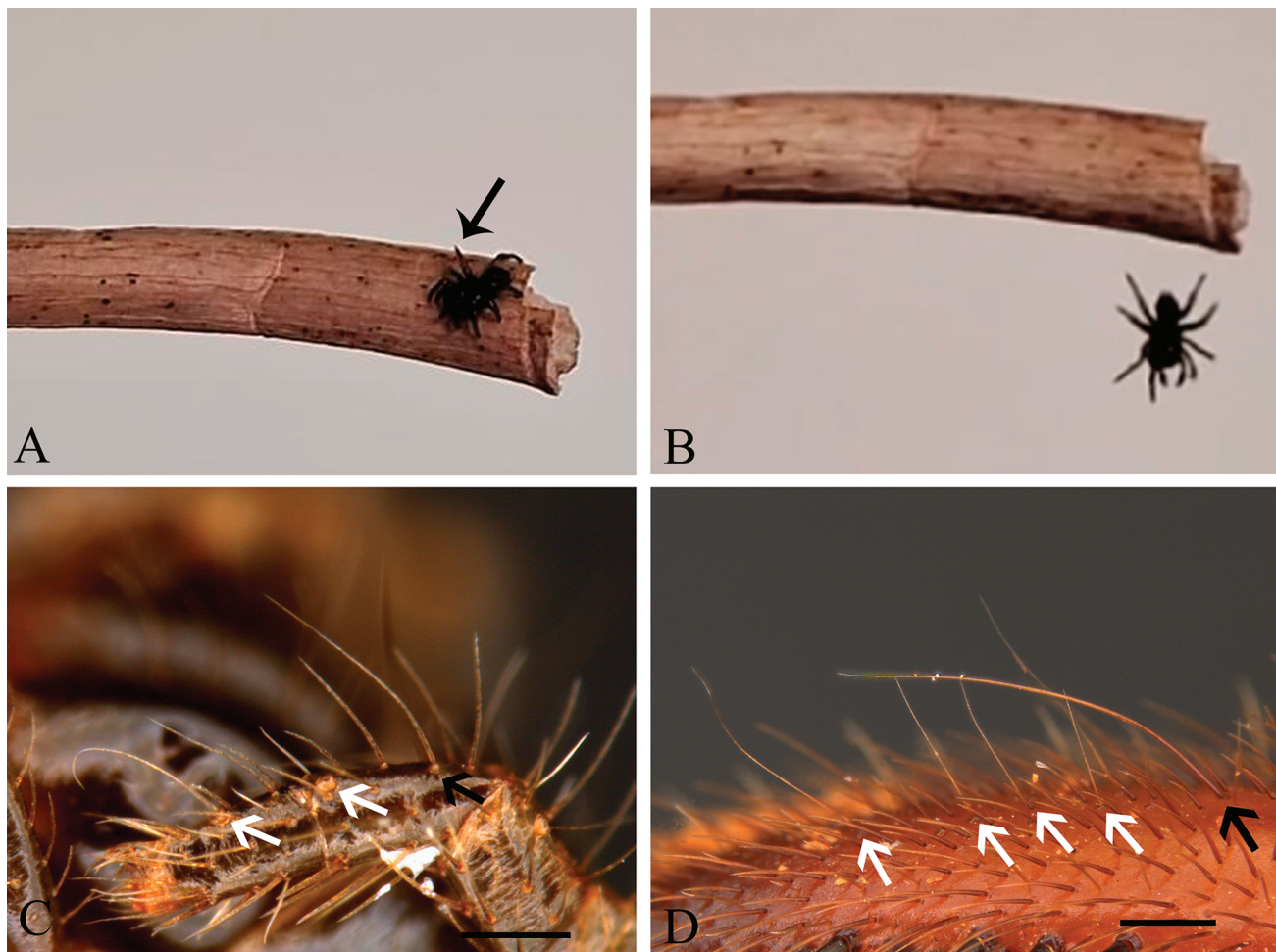


Figure 2.—*Actinopus* spiderling preparing to start ballooning in a laboratory setting and cuticular structures of legs: A, spiderling raising leg III, possibly as mechanical perception (black arrow showing the leg III raised); B, spiderling launching itself downwards with anchoring silk threads; C, lateral view of tarsus of a spiderling of *Actinopus*; D, lateral view of tarsus of a female *Actinopus*. In C–D, black arrows show the modified tactile setae and white arrows indicate the filiform trichobothria. Scale bars = 0.5 mm.

Coyle 1983, 1985; Eberhard 2006; Ferretti et al. 2013; Kuwada-Kusunose et al. 2016; Rossi et al. 2021).

Ferretti et al. (2013) observed ballooning behavior in juveniles of the trapdoor spider genus *Actinopus* Perty, 1833 (family Actinopodidae) during an experiment conducted in laboratory conditions. Moreover, there is unpublished evidence of this phenomenon in the natural environment: eight *Actinopus* spiderlings were collected at approximately 1.2 meters above the ground by beating the foliage of a small tree (R.P. Indicatti pers. obser.). A few silk threads were observed at the site, but no evidence of a specific structure for ballooning was found. Here, we report the first observation of a silk structure (referred to as a pre-ballooning platform) being constructed and utilized by spiderlings of an unidentified species of *Actinopus*, presumably for engaging in ballooning. Additionally, we discuss the specific behaviors that spiderlings exhibit during pre-ballooning (in nature and in the laboratory) and identify potential morphological features that may have an influence on this behavior.

The specific record took place on 30 October 2023, at 12:57 pm, at the Universidade Estadual Paulista (UNESP) Rio Claro campus, in the state of São Paulo, Brazil (22°23'53.3"S, 47°32'38.2"W). The weather station at 'Centro de Análise e Planejamento Ambiental' (CEAPLA), Instituto de Geociências e Ciências Exatas/UNESP, in Rio Claro, provided data on temperature, humidity, and wind speed during the period from 12:00 pm to 2:00 pm.

To document ballooning behaviors, pictures of spiderlings were taken at the pre-ballooning platform as well as during the laboratory experiment. After initial observation at the site, ten individuals (spiderlings) were collected

for the laboratory experiment, after which they were deposited in the Coleção Aracnológica Diamantina (CAD), UNESP, Rio Claro (accession number CAD 1921). For the laboratory experiment, the spiders were placed on a small pedestal approximately one meter above the floor in an area that periodically experienced a soft breeze. To show morphological structures potentially associated with ballooning, the tarsus and metatarsus of leg I of an adult female (CAD 922, from Marechal Floriano, Espírito Santo state, Brazil) and a spiderling of *Actinopus* were dissected and photographed in lateral view in a stereomicroscope (Leica M205C).

There was no record of wind in the observation area from 12:00 pm to 2:00 pm (the last time spiderlings were seen on the platform), except for at 1:00 pm, when 0.4 m/s of wind was recorded. During this period, the average temperature varied between 29.3°C and 32.1°C, and the air humidity varied between 63% and 71%. The pre-ballooning platform was located above a grassy area in a spot lacking surrounding bushes or trees. A large number of the spiderlings moved toward the edges and higher areas of this platform (Fig. 1A). As they got to these areas, the spiderlings moved their abdomens upward, raising their legs I–III randomly and extending their spinnerets (Figs. 1B, C). During the laboratory experiment, the spiderlings exhibited pre-ballooning behaviors consistent with those observed in nature and also consistent with the account provided by Ferretti et al. (2013) (Figs. 2A, B). However, we did not observe actual ballooning of individuals in nature or in the laboratory experiment. Regarding morphological structures associated with ballooning, we noticed very long setae on the distal

articles (tarsi and metatarsi) of the legs (see black arrows in Fig. 1B). Figs. 2C, D show these putative tactile setae, which are longer than the others and clearly distinguishable from the filiform trichobothria (in Figs. 2C, D, white arrows point to trichobothria, and black arrows indicate modified tactile setae). These setae can also be found in adult females (Fig. 2D). It is well known that some cuticular structures, such as trichobothria, aid in the ability to perceive mechanical stimuli and could possibly have a role in the behavior that has been observed. It is not possible to determine whether these long setae provide any sensory purpose; however, as the breeze touched the extended legs, these cuticular structures appeared to sway (Fig. 1B).

*Actinopus* spiders can be found in a variety of environments, ranging from humid tropical forests to areas of natural or modified fields with little or no vegetation (Millenpeier et al. 2023, figs. 1 E, F; Miglio et al. 2020; Sherwood & Pett 2022, figs. 30–32; Ríos-Tamayo et al. 2023, figs. 2, 3). The spiders found in areas with a high tree density may climb up these vertical structures, hang from branches, and in this way get carried by the wind. In the current record, the silk platform constructed by the spiderlings was situated in an open and flat area without any kind of tree. The ‘dropping on a dragline’ type of ballooning has been reinforced here by the observation in nature of a silk platform constructed by *Actinopus* spiderlings. This suggests a possible alternative structure that *Actinopus* spiders could employ as a vertical pedestal in environments without high vegetation, such as open fields.

The fact that there was no wind during the observation period also caught our attention. According to Morley & Robert (2018), in general, spiders perform ballooning when wind speed is low. It is well known that grounded structures, such as trees and branches, have the ability to modify electric fields and act as ‘lightning rods’ which also play a role in ballooning (Borra 1995; Clarke et al. 2013, 2017; Feynman et al. 2013; Morley & Robert 2018). Similar to the air flow stimuli, these electrical field stimuli are perceived by trichobothria (Morley & Robert 2018).

Finally, it is also possible that ballooning in *Actinopus* may not be the main method for dispersal (Ríos-Tamayo & Goloboff 2018), since there are only two records of this behavior in nature (i.e., the records summarized in this study). Moreover, only a small number of specimens were observed by Ferretti et al. (2013) ( $n = 13$ ) in the laboratory, and in the R.P. Indicatti unpublished record ( $n = 8$ ).

#### ACKNOWLEDGMENTS

We are grateful to Luis Osorio for information about *Actinopus* in natural settings, Gabriel Costa for information and literature recommendations regarding “electric fields in ballooning”, and Bruno Buzatto for comments and suggestions concerning the idea of this work.

We would also like to thank the “Centro de Análise e Planejamento Ambiental” (CEAPLA/IGCE/UNESP) at Rio Claro for providing data on temperature, humidity, and wind speed used in this study. This study was funded by Fundação de Amparo à Pesquisa do Estado de São Paulo (24/06108-2 to AGL and 22/12596-4 to JPLG) and Pró-Reitoria de Pós-Graduação and Pró-Reitoria de Pesquisa of UNESP (PROPG/PROPE N° 05/2022 to AGL). Finally, we would like to thank the reviewers for their corrections and suggestions.

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Manuscript received 17 September 2024, revised 29 October 2024, accepted 8 November 2024.