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PREDATION OF THE GRANULAR GLASS FROG *COCHRANELLA GRANULOSA* (CENTROLENIDAE) BY THE SPIDER *ERIOPHORA EDAX* (ARANEIDAE)

DEPREDACIÓN DE LA RANA DE VIDRIO GRANULADA *COCHRANELLA GRANULOSA* (CENTROLENIDAE) POR LA ARAÑA *ERIOPHORA EDAX* (ARANEIDAE)

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Resumen.– Aunque numerosos informes documentan la depredación de ranas por arañas, esta interacción sigue siendo poco comprendida. La mayoría de los eventos de depredación entre ranas y arañas se atribuyen a arañas fosoriales y errantes, con solo el 9 % involucrando arañas tejedoras de telarañas. La rana *Cochranella granulosa* es relativamente común en Costa Rica, especialmente en bosques lluviosos de tierras bajas y montanos. Aquí, informamos un caso de depredación de esta rana por la araña *Eriophora edax*, una especie nocturna tejedora que construye telarañas grandes y fuertes capaces de capturar pequeños vertebrados voladores. Esta observación tuvo lugar el 6 de octubre de 2017 a las 21:50 h en el campus de Atenas de la Universidad Técnica Nacional en Costa Rica. Este incidente marca solo la segunda instancia registrada de *Eriophora edax* depredando vertebrados. Presentamos y discutimos este caso en el contexto de otros casos documentados de depredación de ranas por arañas.

Palabras clave.–Anfibios, Costa Rica, dieta, presa, telas de araña.

Abstract.– Although numerous reports document frog predation by spiders, this interaction remains poorly understood. Most predation events between frogs and spiders are attributed to fossorial and wandering spiders, with only 9 % involving web-building spiders. The Granular Glass frog, *Cochranella granulosa*, is relatively common in Costa Rica, particularly in lowland and montane rainforests. Here, we report a case of predation involving this frog by the spider *Eriophora edax*, a nocturnal orb-weaver that constructs large, strong webs capable of capturing small flying vertebrates. This observation took place on 6 October 2017 at 21:50 h on the Atenas campus of the Universidad Técnica Nacional in Costa Rica. This incident marks only the second recorded instance of *Eriophora edax* preying on vertebrates. We present and discuss this case in the context of other documented instances of frog predation by spiders.

Key words.–Amphibians, Costa Rica, diet, orb-webs, prey.

Due to their abundance, moderate size, and soft skin, amphibians are a common food source for various predators, both vertebrate and invertebrate, particularly arthropods (Duellman & Trueb, 1986). Alongside vertebrate predators, numerous invertebrates, especially spiders, prey on amphibians (Pough et al., 2001; Nyffeler & Altig, 2020). While fossorial and wandering spiders are among the most frequent predators of small anurans and lizards in Neotropical forests (Folt & Lapinski, 2017; Prémel & Torres, 2021), certain frogs can also become entangled in webs, where they are subsequently killed and consumed (Duellman & Trueb, 1986).

Glass frogs, belonging to the family Centrolenidae, are small, arboreal species native to Central and South America (Ruíz-Carranza & Lynch, 1991). Their name derives from the transparent undersides of their bodies (Guayasamín et al., 2009). The genus *Cochranella* currently comprises 15 species, two of which are found in Costa Rica (https://amphibiaweb.org/cgi/amphib_query?where-scientific_name=Cochranella&rel-scientific_name=contains&include_synonymies=Yes).

The Granular Glass frog, *Cochranella granulosa* (Taylor, 1949), is a small, uniformly dark green frog typically marked with

scattered large blue to black spots (Savage, 2002). It has an obtuse snout in profile, dark green bones, a white stripe on the upper lip, a white parietal peritoneal sheath, a white pericardium, and a white digestive tract (Savage, 2002). Adult males range from 22.5 to 29 mm in standard or snout-vent length, while adult females measure between 29 and 32 mm (Savage, 2002).

This glass frog is strictly nocturnal and typically calls from trees 5 to 10 m above fast-flowing streams (Savage, 2002). It inhabits Lowland Moist and Wet Forests, as well as Premontane Wet Forests, according to Holdridge's life zone classification (Holdridge, 1967). Its wide distribution spans from southern Honduras, through scattered localities in Nicaragua, and both slopes of Costa Rica, extending into Panama and reaching as far as Ecuador (Culebras et al., 2020; Guayasamín et al., 2020; Barrio-Amorós et al., 2022).

Eriophora edax (Blackwall, 1863) (Araneidae) is a relatively large spider, with a body length of 12–16 mm and a leg span of 50–80 mm (Levi, 1970; Nyffeler & Knörnschild, 2013). It has a yellowish-brown prosoma with a central dark brown longitudinal stripe that aligns with the color of the clypeus. The opisthosoma is white and black dorsally, with two anterior tubercles and one at the posterior end (Levi, 1970). This species is found from the USA to Brazil (Levi, 1970) and is a nocturnal orb-weaver commonly found in open and disturbed areas. Its web is large, vertical, and strong, spanning up to 1.5 m in diameter (Nyffeler & Knörnschild, 2013). The spider typically positions itself at the web's center, head facing downward (Ceballos et al., 2005). It forages exclusively at night, constructing a new web each evening and dismantling it by dawn (Ceballos et al., 2005). The genus *Eriophora* is known for constructing orb-webs of exceptional size and strength, often suspended on long bridge lines. This "web gigantism" may have evolved as an adaptation to capture flying vertebrates, such as bats and birds (Nyffeler & Knörnschild, 2013). Here, we document a predation event where *Eriophora edax* captured and consumed a Granular Glass frog.

On 6 October 2017 at 21:50 h, during a nocturnal wildlife tour, we observed a web belonging to *Eriophora edax* at the Atenas Campus of the Universidad Técnica Nacional (UTN) in Atenas County, Alajuela, Costa Rica (9.9392° N, 84.3800° W; 415 m a.s.l.; Fig. 1). The frog was wrapped in spider silk and completely immobile, apparently dead, indicating that it had likely fallen victim some time earlier (Fig. 2). The spider was feeding on the frog's dorsum. We observed the event for about 10 min, during which we took photographs from a safe distance without disturbing the spider, which continued feeding as usual.

We identified the frog based on our field experience and by noting some basic characteristics of this species. We compared our photos with images from the internet and the literature for

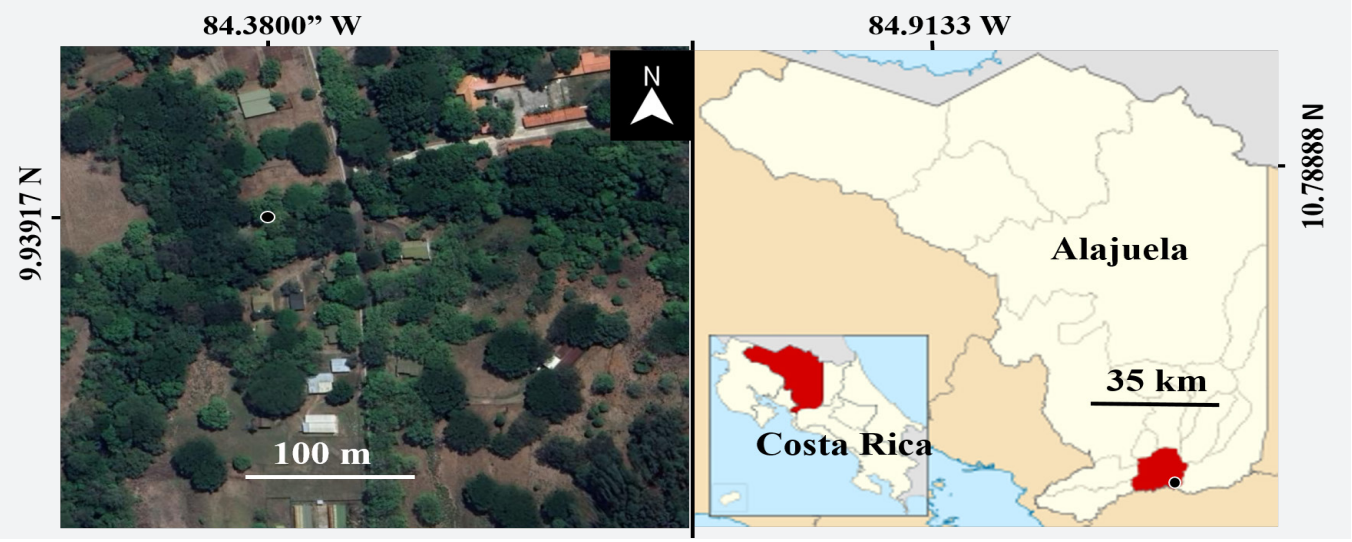

Figura 1. Sitio de observación (punto negro) en el que *Eriophora edax* depreda una rana de cristal, *Cochranella granulosa*, en el campus Atenas de la Universidad Técnica Nacional, Balsa, cantón de Atenas (marcado en rojo) in la provincia de Alajuela (delineada en blanco pero mostrada en rojo en el mapa de Costa Rica). Figura basada en Google Earth (sección izquierda) y Wikipedia bajo licencia Creative Commons Attribution-ShareAlike 3.0 license (sección derecha).

Figure 1. Observation site (black dot) where *Eriophora edax* predated a Granular Glass frog, *Cochranella granulosa*, at the Atenas campus of Universidad Técnica Nacional, Balsa, Atenas County (highlighted in red) in Alajuela Province (outlined in white but shown in red on the map of Costa Rica). Figure based on Google Earth (left section) and Wikipedia under the Creative Commons Attribution-ShareAlike 3.0 license (right section).

confirmation (especially Savage 2002). We followed a similar process for the spider but also confirmed its identification with the expert Emanuel Rodríguez Rojas, a colleague from our university Universidad Técnica Nacional, in Atenas, Costa Rica.

There are numerous reports worldwide of spiders preying on small vertebrates, including fish, mammals, frogs, and lizards (Nyffeler & Vetter, 2018; Nyffeler & Altig, 2020; Reyes-Olivares et al., 2020; de Oliveira Meneses et al., 2021). These reports feature a diverse array of organisms, such as the tarantula *Sericopelma immensum* preying on a juvenile venomous snake, *Bothrops asper* (Núñez Escalante & Moreno Chinchilla, 2021), and the wandering spider *Ancylometes bogotensis* targeting a *Basiliscus galeritus* (Pérez Galvis et al., 2024). Among the many documented cases, several involve the mentioned species of wandering spider, *Ancylometes bogotensis*, preying on amphibians and reptiles across Central and South America (e.g., Höfer & Brescovitt, 2000).

The literature is extensive; however, in the case of frogs, the spiders most commonly involved are large cursorial spiders, particularly wandering spiders, with the family Hylidae being the most frequently predated (Nyffeler & Altig, 2020; de Oliveira Meneses et al., 2021). Frog predation by aerial-web or funnel-web weavers accounts for only 9 % of the 374 incidents compiled by Nyffeler & Altig (2020). These predation events typically occur when frogs hopping from shrub to shrub are intercepted in the strong aerial webs of araneid, nephilid, or theridiid spiders (Nyffeler & Altig, 2020). In Costa Rica, most documented

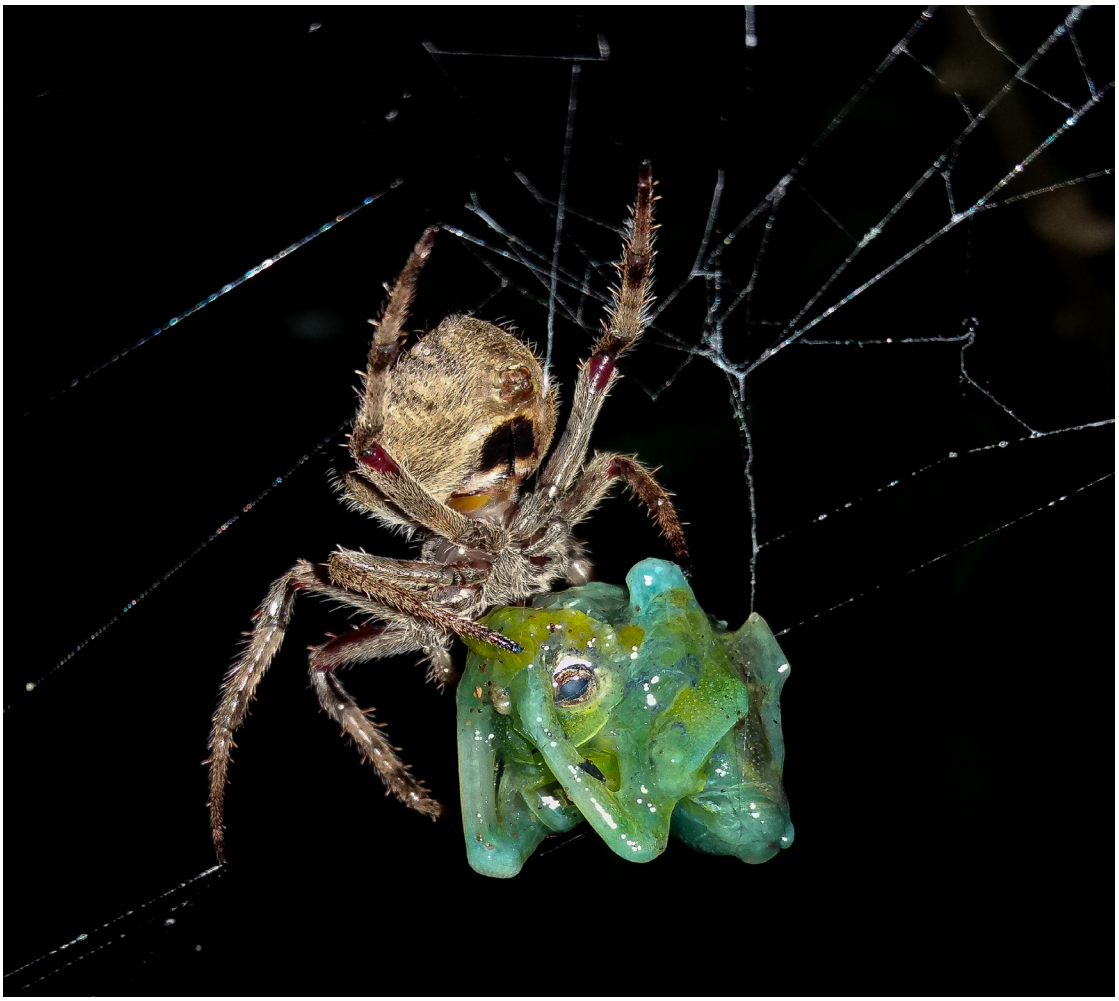

Figura 2. *Eriophora edax* consumiendo una rana de cristal, *Cochranella granulosa*, en su telaraña en el campus Atenas, Universidad Técnica Nacional, Balsa, cantón de Atenas, Alajuela, Costa Rica. Foto: Diego Coto.

Figure 2. *Eriophora edax* consuming a Granular Glass frog, *Cochranella granulosa*, in its web at the Atenas campus, Universidad Técnica Nacional, Balsa, Atenas County, Alajuela, Costa Rica. Photo: Diego Coto.

instances of spider predation on vertebrates involve wandering spiders, primarily from the genus *Cupiennius* in the family Trechaleidae (Folt & Lapinski, 2017; Cambronero et al., 2022; Mora et al., 2023).

The capture and consumption of the Granular Glass frog by *Eriophora edax* is noteworthy, as it represents only the second documented instance of vertebrate prey for this spider. The first recorded case involved an unidentified small tree frog found in a web of the same spider species, also in Costa Rica (Greenstone, 1984). Insects, particularly those of the order Lepidoptera, constitute the primary diet of *Eriophora edax* (Ceballos et al., 2005; Meraz et al., 2012). As a "sit-and-wait" predator, *Eriophora edax*, like other web-building spiders (Heiling, 1999), raises the intriguing question of how it manages to capture frogs. In another instance, an adult Spiny Cochran frog, *Teratohyla spinosa*, was found trapped in the web of an adult female *Eriophora* sp. (Folt & Lapinski, 2017). Similarly, the Granular Glass frog from Atenas was ensnared. Tree frogs and glass frogs move by walking and jumping through vegetation and may accidentally fall into orb-webs, just like other spider prey.

A key objective of ecology is to understand how organisms interact and coexist in their environments. Although further research is necessary to assess the full impact of spider predation on frog populations (Nyffeler & Altig, 2020), anecdotal observations like this one provide valuable insights that help connect individual events to broader ecological patterns. These contributions, while specific, can help enhance our understanding of predator-prey dynamics and their implications for biodiversity.

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