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Predation of Sumichrast's vesper rat *Nyctomys sumichrasti* by the lizard *Basiliscus plumifrons*

Depredación de la rata vespertina de Sumichrast *Nyctomys sumichrasti* por la lagartija *Basiliscus plumifrons*

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There are 33 Cricetidae species in Costa Rica, including Sumichrast's vesper rat, *Nyctomys sumichrasti*. It is relatively uncommon but potentially locally common to abundant. In Costa Rica, it primarily inhabits the canopy and is rarely seen due to its nocturnal and arboreal habits. In México, it has been observed both in treetops and on the ground amidst dense vegetation and trees. During a tour at Selva Verde Lodge in northern Costa Rica, we observed a predation event. We took pictures of it from about 5 m avoiding disturb the predator. We identified the predator on site, and later we confirmed the prey identification reviewing our pictures and comparing them with other pictures and field guides and taxonomic keys. On March 19, 2023 at 17:28 hr we observed an adult female green basilisk (*Basiliscus plumifrons*) preying and consuming a Sumichrast's vesper rat. The basilisk chased the rat across the floor, grabbed it with its jaws, killed it and then swallow it. The whole process took about 40 min. *Nyctomys sumichrasti* visits buildings at Selva Verde where basilisks are always present. These basilisks are diurnal while *N. sumichrasti* is nocturnal, but they can coincide in activity and location. Recently, a female basilisk hunted a night lizard, and weeks earlier, a male of the same species consumed a young green iguana at the same area.

Key words: Basilisks; Costa Rica; humid forest; rodents; Selva Verde.

En Costa Rica hay 33 especies de Cricetidae, incluida *Nyctomys sumichrasti*, una rata relativamente poco común. En Costa Rica, habita principalmente en el dosel y rara vez se le ve debido a sus hábitos nocturnos y arbóreos. En México, se le ha observado tanto en las copas de los árboles como en el suelo en medio de vegetación densa y árboles. Durante una caminata en Selva Verde Lodge en el norte de Costa Rica, observamos un evento de depredación. Tomamos fotos desde aproximadamente 5 m para no perturbar al depredador. Identificamos al depredador en el lugar y luego confirmamos la identificación de la presa al comparar nuestras fotos con otras imágenes, guías de campo y claves taxonómicas. El 19 de marzo de 2023 a las 17:28 hr, observamos a una hembra adulta de basilisco verde (*Basiliscus plumifrons*) que depredó y consumió una *Nyctomys sumichrasti*. El basilisco persiguió a la rata por el suelo, la agarró con sus mandíbulas, la mató y luego la engulló. Todo el proceso duró aproximadamente 40 minutos. *Nyctomys sumichrasti* visita edificios en Selva Verde lodge donde siempre hay basiliscos. Estos son diurnos, mientras que *N. sumichrasti* es nocturna, pero pueden coincidir en actividad y ubicación. Recientemente, un basilisco verde hembra capturó una lagartija nocturna, y semanas antes, un macho de la misma especie consumió una cría de iguana verde en la misma área.

Palabras clave: Basiliscos; bosque húmedo; Costa Rica; roedores; Selva Verde.

There are 2,652 described species of rodents globally, constituting approximately 40 % of all mammals, thus making Rodentia the most diverse order within the class (ASM 2023). The diversity within this order is attributed to successive radiations, underscoring its adaptive capacity and expansion within the group (Auffray *et al.* 2009). Rodents exploit a vast array of foods and inhabit a wide variety of habitats (Espinoza Medinilla *et al.* 2006). While often considered pests due to their impact on agriculture and potential disease transmission (Mukherjee *et al.* 2004), rodents also serve a significant ecological role as prey for numerous small carnivores (Sillero-Zubiri and Gottelli 1995; Mukherjee *et al.* 2004).

Small rodents are the primary prey of specialized small mustelids (Norrdahl and Korpimaki 2000), while many raptors and predatory birds rely on rodents (Trejo and Guthmann 2003). Additionally, a substantial number of snakes feed on rodents (Zipkin *et al.* 2020). Despite this, only a few lizard species are known to prey on rodents. While collared lizards (*Crotaphytus* spp.; Crotaphytidae) primarily feed on arthropods, larger individuals also capture small vertebrates, including rodents (O'Shea 2021). The black iguana (*Ctenosaura similis*) has been reported as a predator of *Oryzomys*, *Scotinomys*, and *Sigmodon* (Fitch and Hackforth-Jones 1983). Notably, other large lizards such as Helodermids and especially Varanids are known to consume vertebrates, including rodents (Pianka and Vitt 2006; O'Shea 2021).

Cricetidae is the second most diverse family within Rodentia, containing 849 species (ASM 2023). Costa Rica

harbors 33 Cricetidae species (Mora and Ruedas in press), including Sumichrast's vesper rat (*Nyctomys sumichrasti* Saussure, 1860). This species is found in lowland and lower montane forests, ranging from Jalisco and southern Veracruz, México to central Panamá, at elevations of 0 to 1,800 m (Musser and Carleton 2005; Reid 2009; Samudio *et al.* 2016).

In Costa Rica, Sumichrast's vesper rat inhabits various forest types, from evergreen to dry and cloud forests, as well as secondary and riverine forests. It's also found near clearings and agricultural areas, such as sugar cane fields (León-Paniagua 2017), throughout the country. Here, it mostly resides in the canopy and it is rarely seen due to its nocturnal and arboreal habits (León-Paniagua 2017). In México, it's been spotted in treetops and on the ground amidst dense vegetation and trees (León-Paniagua 2017). This rat's diet encompasses fruits, seeds, leaves, and insects (Hunt *et al.* 2004). Typically, it forages 3 m or more above ground (Reid 2009). This medium-sized rat measures 102-137 mm in head-body length and weighs 40-67 g (Reid 2009).

Some of the most captivating lizard species in Costa Rica are the basilisks, famously known as Jesus Christ lizards due to their remarkable ability to run on water (O'Shea 2021). Basilisks have been noted as participants in trophic relationships with other vertebrates (Quirós Rosales *et al.* 2023). While some of these predatory interactions might occur frequently, they are rarely observed. Recent reports detail 2 instances: a male green basilisk *Basiliscus plumifrons* Cope, 1875 preying on a young green iguana *Iguana rhinolopha*, Wiegemann, 1834 (Alvarado *et al.* 2022), and a female green basilisk preying on a yellow-spotted night lizard *Lepidophyma flavimaculatum* Dumeril, 1851; Quirós Rosales *et al.* 2023).

Green basilisk's diet primarily consists of arthropods, especially insects, particularly small juveniles (Hirth 1963). However, larger individuals incorporate a notable amount of flowers, seeds, fruits, and leaves into their diet (Hirth 1963; Savage 2002). Nonetheless, adult and sub-adult basilisks occasionally consume vertebrates. Instances include an individual reportedly eating a bat (Hirth 1963), a subadult consuming a frog (Cover 1986), and captive individuals consuming small fish (guppies; Kober 2012). Kober (2012) also documented that green basilisk forage in water.

Adult male green basilisks can exceed 900 mm in length, with tails representing 72-75 % of their total length. Males measure 122-250 mm in snout-vent length, while females range from 146-174 mm (Savage 2002; Leenders 2019). Sporting an emerald green color and striking yellow eyes, males exhibit prominent dorsal and tail crests, distinguishing them from smaller female and juvenile counterparts (Savage 2002; Leenders 2019).

Endemic to Middle America, green basilisk is found in humid lowlands at moderate elevations, ranging from sea level to 780 m (McCranie 2018; Leenders 2019). This diurnal species typically inhabits areas near streams, rivers, and along riverbanks, often perching on vegetation, logs, rocks, and bushes (Savage 2002; Leenders 2019). Adult basilisks are highly arboreal, adept at climbing and often found high up in trees (McCranie 2018; O'Shea 2021).

The role of predation is critical in structuring ecosystem function and structure (Berger *et al.* 2001; Kotrschal *et al.* 2017). Most species face the risk of predation at some point in their life (Kotrschal *et al.* 2017). As a result, predation plays a crucial role in establishing feeding connections between species, aiding in the understanding of significant patterns and dynamics within biological communities (Pimm *et al.* 1991; Hall and Raffaelli 1993).

Understanding predation is essential for comprehending animal ecology and behavior. Unfortunately, specific instances of predation, especially on tropical rodents, are scarce in the literature. In this context, we present the first documented case of an adult green basilisk preying on Sumichrast's vesper rat, a significant event given that this is only the second known instance of mammalian predation by this basilisk species, the first being a small bat.

Sarapiquí region, in the province of Heredia, northern Costa Rica, is well-known for its various ecotourism activities (Jones and Spadafora 2017). The region boasts several biological stations and reserves that attract numerous researchers and visitors, significantly contributing to the expansion of knowledge about its biodiversity (Butterfield 1994). During a visit to this region, we conducted a guided tour for general nature observation. While walking the trails of Selva Verde Lodge (10° 27' 03" N, 84° 04' 12" W; 78 m; Figure 1), we witnessed a predation event. We photographed the event from about 5 m avoiding to disturb the predator. We identified the predator on-site and subsequently confirmed the prey's identification by reviewing our pictures and comparing them with field guides and keys by Reid (2009) and Villalobos-Chaves *et al.* (2016).

Selva Verde Lodge is situated in the Tropical Wet Forest (TWF) life zone, which experiences an average annual rainfall of about 4,000 mm (Alvarado *et al.* 2022). The TWF is characterized by tall, multi-stratal, evergreen forest, with some canopy species briefly deciduous. Canopy trees grow to heights of 45–55 m, sporting round to umbrella-shaped crowns and unbranched trunks reaching up to 30 m and measuring 100–200 cm in diameter at breast height (dbh; Hartshorn 1983). The understory often showcases stilt-rooted palms, while the shrub layer stands 1.5–2.5 m tall, frequently with abundant dwarf palms; occasional unbranched treelets and large broad-leaved herbs are also present (Hartshorn 1983).

On March 19, 2023, at 17:28 hr, we observed an adult female green basilisk (*Basiliscus plumifrons*) preying on a Sumichrast's vesper rat at Selva Verde Lodge. The basilisk seized the rat near one of the lodge's buildings, chased it across the floor, captured it with its jaws, killed it, and swallow it (Figure 2). The ingestion of the rat started from the tail and rear, continuing in that direction, without the basilisk attempting to flip it. Thus, the head was the last part of the rat to be swallowed by the basilisk (Figure 2). The entire process took about 40 min, after which the basilisk darted

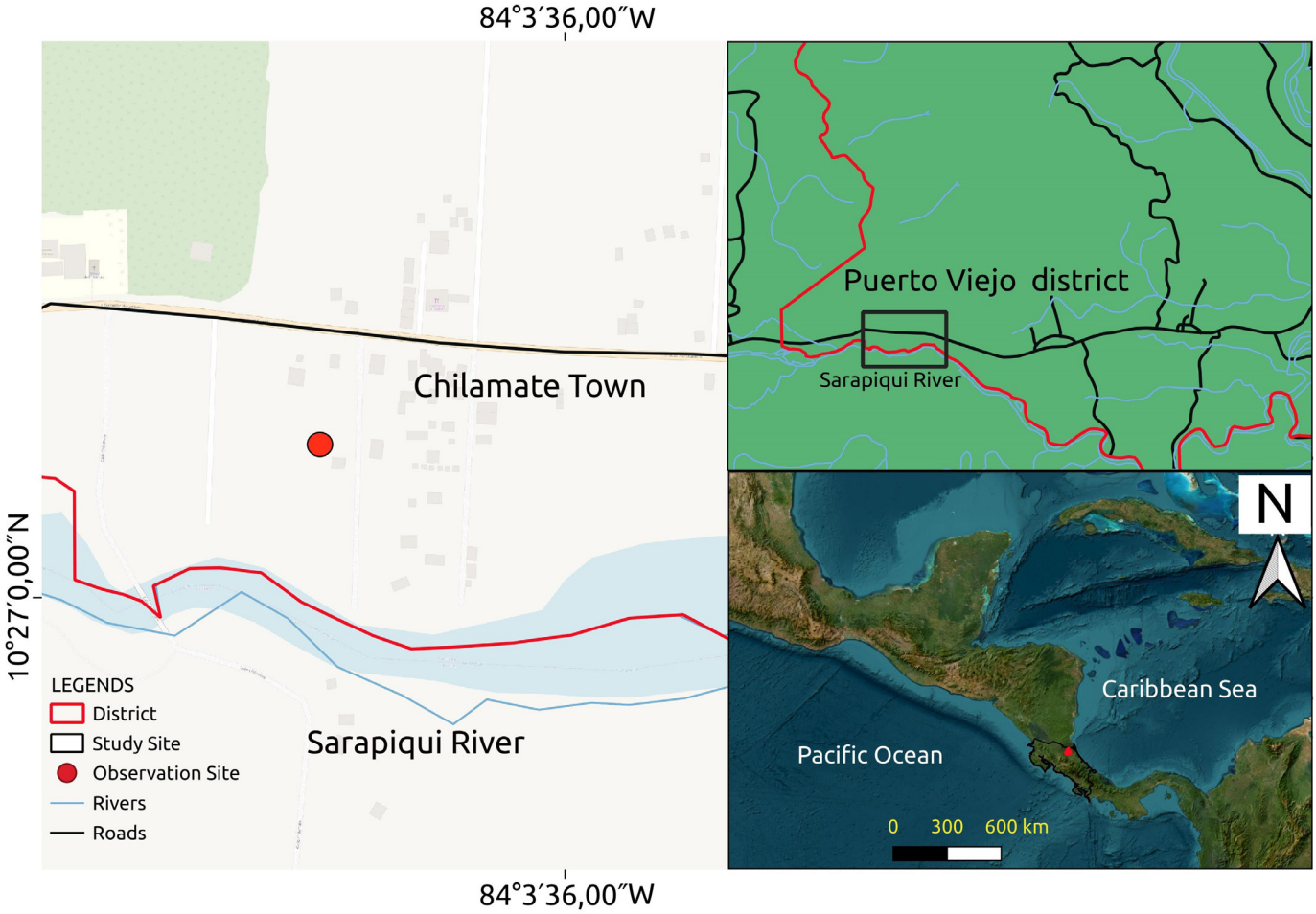

Figure 1. Site (red dot) where a Sumichrast's vesper rat *Nyctomys sumichrasti* was captured and ingested by an adult female green basilisk (*Basiliscus plumifrons*) at Selva Verde Lodge, Sarapiquí, Heredia, Costa Rica. Map by: G. Chaves.

away toward a nearby tree where it is often seen sleeping at night. The female basilisk we are reporting on spent the night in a small tree near one of the lodge buildings. The rat moved on a somewhat slippery, waxed cement floor with limited grip, which may have been a crucial factor in the predation event. The basilisk spotted the rat, which moved but not as quickly as required, allowing the basilisk to capture it. During the time of this event (17:30 hr), the basilisk was still active and vesper rats were commencing their nocturnal activity.

Some reptiles are frequently sighted in the vicinity of Selva Verde Lodge, at the same time, vesper rats are regular visitors to human buildings, where they may encounter predators such as basilisks that are commonly found around the buildings at Selva Verde Lodge (J. M. Mora pers. obs.). Moreover, both species are arboreal and relatively common in the humid forests of Costa Rica's northern lowlands (Timm *et al.* 1989; Alvarado *et al.* 2022). While the green basilisk is diurnal and the Sumichrast's vesper rat is nocturnal, they may overlap in activity hours and locations.

In another event, a female green basilisk captured a night lizard in the area of Selva Verde Lodge, but early in the morning (07:10 hr), a time when both species may coincide (Quirós Rosales *et al.* 2023). Another green basilisk captured a hatchling green iguana (*Iguana rhinolopha*) at 09:36 hr, as both species exhibit diurnal activity (Alvarado *et al.* 2022). In this case, the male basilisk grabbed the hatchling iguana from the back of its body and began eating it, starting from the tail and moving toward the head (Alvarado *et al.* 2022).

Large lizards in the Middle America region, mainly iguanas, ctenosaurs, and basilisks, are primarily herbivorous (Mora 2010; Astorga-Acuña and Mora 2023). However, most of them at least opportunistically consume vertebrate prey (Astorga-Acuña and Mora 2023; Quirós Rosales *et al.* 2023). Basilisks in Mesoamerica are known to prey on several vertebrate species, yet only one mammal predation event was reported, involving a free-tailed bat (Molossidae; Hirth 1963), before this report.

Understanding the structure of food webs contributes to our comprehension of ecosystem function and biodiversity loss (Zeng *et al.* 2014). Despite the high diversity of rodents and lizards in the Neotropics, only a limited number of predation events between these 2 groups have been observed and documented. Therefore, even opportunistic observations such as the one we are presenting here deserve publication, aiming to enhance our understanding of trophic relationships and other ecological roles of small rodents in tropical habitats.

Figure 2. A Sumichrast's vesper rat *Nyctomys sumichrasti* being consumed by an adult female green basilisk (*Basiliscus plumifrons*) at Selva Verde Lodge, Sarapiquí, Heredia, Costa Rica. Photo by: R. Alvarado, and deposited in the UTA Digital Collection (The University of Texas at Arlington) under catalog number: UTADC 9896.

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