

SHORT COMMUNICATION

First observation of *Lethocerus cordofanus* (Hemiptera: Belostomatidae) preying on *Afronycteris nana* (Chiroptera: Vespertilionidae)Kelvin CHEN¹ , Mark MASSAAD², Ricardo DE LIMA³, Ana RAINHO³ and Ricardo ROCHA⁴¹Department of Ecology, Evolution and Natural Resources, Rutgers University, New Brunswick, New Jersey, USA, ²Department of Agriculture, Food and Forest Sciences (SAAF), University of Palermo, Palermo, Italy, ³Centre for Ecology, Evolution and Environmental Changes, and Department of Animal Biology, University of Lisbon, Lisbon, Portugal and ⁴Department of Biology, University of Oxford, Oxford, UK

Abstract

Giant water bugs (Hemiptera: Belostomatidae) are key predators in freshwater ecosystems and have been reported to feed on several species of vertebrates, including fishes, amphibians and reptiles. Here, we report the opportunistic predation of an adult female vesper bat (*Afronycteris nana*) by a giant water bug (*Lethocerus cordofanus*) in a temporary pond in a rice paddy in Guinea-Bissau, West Africa. To our best knowledge, this is the first instance of natural predation upon a mammal by a giant water bug to be documented in a scientific report.

Key words: *Afronycteris nana*, Belostomatidae, Guinea-Bissau, *Lethocerus cordofanus*, predation, temporary pond, Vespertilionidae.

Giant water bugs (Hemiptera: Belostomatidae) are aquatic predators distributed across tropical and temperate regions and are colonizers of temporary freshwater bodies, where they play a key role in regulating aquatic food webs (Williams 2006; Ohba 2019). Species in subfamily Lethocerinae can reach sizes of more than 11 cm long (Henry 2009) and in addition to regularly consuming fishes and anurans (Hirai & Hidaka 2002; Ohba *et al.* 2008; Rocha *et al.* 2014), have also been observed preying on snakes (Mori & Ohba 2004; Ohba 2012), turtles (Ohba 2011) and birds (Matheson 1907; Menke 1979). Despite their reputation as habitual vertebrate predators, recent reviews of published reports have not revealed any instances of giant water bugs preying on mammals (Ohba 2019; Valdez 2020).

Vesper bats (Chiroptera: Vespertilionidae) are a speciose family of simple-nosed, insectivorous chiropterans with a near-global distribution. A growing body of evidence suggests that a significant proportion of predation on bats is opportunistic (Lima & O'Keefe 2013; Rocha & López-Baucells 2014). However, no studies have yet reported insects to be potential bat predators. Our observed prey species was the banana bat *Afronycteris nana* (Peters, 1852), a diminutive vespertilionid with a widespread distribution across most of sub-Saharan Africa, occurring between Senegal, South Africa and Ethiopia (Monadjem *et al.* 2021).

Our observation of a giant water bug preying on *A. nana* took place on 27 June 2022 in a temporary rain pond situated between dry rice paddies in the village of Bironqui (12° 22' 22.8" N, 15° 12' 10.8" W) in Oio region, Guinea-Bissau (Fig. 1A; surface area ca. 30 m², depth at center ca. 0.5 m; no aquatic vegetation present; calm, muddy water at the time of observation). The surrounding region harbors a rich but poorly described bat fauna with over 15 bat species known to occur locally (K. Chen *et al.*, unpubl. data, 2022). In

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Received 9 January 2023; accepted 29 May 2023.



Figure 1 (A) Temporary rain pond in a rice paddy in Guinea-Bissau, West Africa, where the observation took place (specific location of observation highlighted by arrow). (B) *Lethocerus cordofanus* specimen. (C) *Afronycteris nana* specimen.

contrast, the lethocerine fauna of continental Africa consists of a single described species, *Lethocerus cordofanus* (Mayr, 1853), whose coarse range includes Guinea-Bissau (Pérez Goodwyn 2006).

At ca. 20:30 h, while checking the mist net (erected on 27 June 2022 at ca. 20:00 h across the middle of the pond using bamboo support rods depicted in Fig. 1A; checked every ~5 min throughout the nighttime surveillance period) for entangled bats, the authors observed an adult giant water bug later visually identified as *L. cordofanus* (S. Ohba, S. Ferreira, pers. comm., 2022; Fig. 1B; total length 7.1 cm, measured from anterior clypeus to posterior respiratory siphon) swimming at the surface of the temporary pond ca. 1.5 m away from the water margin, with a freshly incapacitated bat in its raptorial forelegs (location in pond highlighted by arrow in Fig. 1A). The giant water bug's rostrum was embedded inside the bat's right ventral pectoral cavity, indicative of feeding behavior. Upon removal from the temporary pond, the giant water bug released the dead bat, which was collected and later identified as an adult female *A. nana* (Fig. 1C; forearm length 28 mm, total body length not including tail ca. 9.5 cm).

As we did not witness the giant water bug actively capturing and killing its prey, we cannot rule out the possibility of necrophagy. However, the underlying circumstances of our field observation suggested that predation was a more parsimonious explanation than necrophagy for several reasons. First, vesper bats have

been documented to be competent swimmers, capable of swimming against a current in open water for several minutes without appearing exhausted or in danger of drowning (Craft & Dexter 1955; Patten & Patten 1956). As such, we believe it is reasonable to assume that our *A. nana* specimen did not drown in the calm waters of the temporary rain pond due to its innate locomotive ineptitude in water. Second, there is an increasing body of evidence supporting that lethocerine bugs prey on small terrestrial vertebrates when given the opportunity; the presence of a small bat such as *A. nana* swimming on the surface of a pond does not, a priori, constitute an exception to the well-documented behavioral propensity of predation on small vertebrates by lethocerine bugs. Finally, vesper bats are known to frequently interact with water bodies, with a preference for calm water bodies such as temporary rain ponds (Warren *et al.* 2000; Vindigni *et al.* 2009), both to drink and to hunt insect prey that aggregate around such ponds. Natural collision with stationary obstacles such as branches have been experimentally demonstrated to occur among free-flying insectivorous bats (e.g. *A. nana*) in published reports (Orbach & Fenton 2010), suggesting that a collision with a mist net, while artificial, was largely a consequence of happenstance rather than a prerequisite to our observed outcome. In short, the spatial overlap that is necessary for a predator–prey interaction to occur naturally between *L. cordofanus* and *A. nana* in Guinea-Bissau is made propitious by the foraging

ecologies of both species. Indeed, published records of aquatic predators such as fishes and frogs hunting bats that forage above water bodies (reviewed in Mikula 2015) supports the notion that predation by *L. cordofanus*—while rare—can occur under natural circumstances. Accordingly, this observation seems to constitute the first reported instance of predation on a bat and indeed, to our knowledge, any adult mammal, by a giant water bug.

We collected and preserved the giant water bug and bat in 96% ethanol solution. Both specimens are being temporarily stored in a refrigeration unit located at the KAFO Peasant Federation in Djalicunda, Oio Region, Guinea-Bissau, awaiting export to the Natural History Museum of Lisbon, Portugal for permanent storage.

In keeping with the sentiment that insects are “the little things that run the world” (Wilson 1987), we highlight a novel instance of opportunistic predation where bats play the role of prey rather than predator of insects. Reporting rare and unusual species interactions supplies nuance to our understanding of ecological complexity and contributes to the foundation of natural history that is particularly lacking in remote, understudied tropical ecosystems.

ACKNOWLEDGMENTS

We thank the following colleagues for assistance: Shin-ya Ohba and Sónia Ferreira (identification of *Lethocerus cordofanus*); Francisco de Silva (macrophotography of specimens); and the Morin Lab (manuscript feedback). In addition, we acknowledge the KAFO Peasant Federation of Djalicunda for help in acquiring land use permissions for fieldwork conducted in the Oio Region of Guinea-Bissau and IBAP – Instituto da Biodiversidade e Áreas Protegidas, the Nature Conservation Authority in Guinea-Bissau for licensing captures and transport of biological samples.

FUNDING INFORMATION

This work was funded by Portuguese Funds through the FCT – Foundation for Science and Technology, I.P., within the scope of the project PTDC/ASP-AGR/0876/2020, and structural funds to cE3c (UID/BIA/00329/2022).

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