NOTAS SOBRE

MAMÍFEROS SUDAMERICANOS

Sociedad Argentina para el Estudio de los Mamíferos

Notas sobre Mamíferos Sudamericanos 2022, vol. 4
http://doi.org/10.31687/SaremNMS22.5.1
Versión on-line ISSN 2618-4788

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MAMÍFEROS
SUDAMERICANOS

Potential feeding event of *Priodontes maximus* (Cingulata: Dasypodidae) by *Desmodus rotundus* (Chiroptera: Desmodontinae) in the Cerrado, Western Brazil

Marcione B. de Oliveira (1), Henrique S. F. de Andrade (2), José L. P. Cordeiro (3), and Luiz Flamarion B. de Oliveira (4)

(1) Programa de Pós-Graduação em Zoologia, Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil. (2) Parque Sesc Serra Azul, Mato Grosso, Brazil. (3) Fundação Oswaldo Cruz, Fiocruz Ceará, Ceará, Brazil. (4) Museu Nacional, Departamento de Vertebrados, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil. [correspondence: oliveira01marcione@gmail.com]

Citación: de Oliveira, M. B., H. S. F. de Andrade, J. L. P. Cordeiro, & L. F. B. de Oliveira. 2022. Potential feeding event of *Priodontes maximus* (Cingulata: Dasypodidae) by *Desmodus rotundus* (Chiroptera: Desmodontinae) in the Cerrado, Western Brazil. Notas sobre Mamíferos Sudamericanos 4:e22.5.1.

ABSTRACT
Hematophagous bats are fascinating mammals due to their social structure and complex anatomical and physiological characters. We present evidence of the potential use of the giant armadillo (*Priodontes maximus*) in the feeding spectrum of the common vampire bat *Desmodus rotundus*. Observations were made in the Parque Sesc Serra Azul, located in the municipality of Rosário Oeste, Mato Grosso, Brazil, using camera traps. Although hematophagous bats use native prey in nature, records of this feeding activity are less common. The use of camera traps has become an efficient tool to obtain ecological data on many mammals and allows us to assess interactions and associations between species in non-invasive ways.

Keywords: camera traps, common vampire bat, giant-armadillo, hematophagous, potential prey

RESUMO – Potencial evento de alimentação de *Priodontes maximus* (Cingulata: Dasypodidae) por *Desmodus rotundus* (Chiroptera: Desmodontinae) no cerrado, oeste do Brasil. Os morcegos hematófagos se caracterizam por uma complexa estrutura social e características anatômicas e fisiológicas particulares. São apresentadas evidências do uso potencial do tatu-canastra (*Priodontes maximus*) no espectro alimentar do morcego-vampiro-comum *Desmodus rotundus*. As observações foram realizadas no Parque Sesc Serra Azul, município de Rosário Oeste, Mato Grosso, Brasil, usando armadilhas fotográficas. Embora os morcegos hematófagos predem espécies nativas na natureza, os registros dessa atividade alimentar são raros. O uso de armadilhas fotográficas tem se tornado uma ferramenta eficiente para obter dados ecológicos sobre diversos mamíferos e permite avaliar as interações e associações entre as espécies de forma não invasiva.

Palavras chave: armadilhas fotográficas, hematófago, morcego-vampiro-comum, presa potencial, tatu-canastra

The subfamily Desmodontinae includes three species, *Desmodus rotundus* (É. Geoffroy, 1810), *Diaemus youngii* (Jentink, 1893), and *Diphylla ecaudata* Spix, 1823

Recibido el 15 de diciembre de 2021. Aceptado el 8 de abril de 2022. Editora asociada: Analía L. Giménez.

(Simmons & Cirranello 2020). The species of this subfamily live in sympatry, are endemic to the New World, and subsist exclusively on blood (Reis et al. 2017). They have specific adaptations to their diet, such as large, pointed, stylet-shaped incisors that are longer than the canines and the deeply furrowed lower lip (Greenhall & Schmidt 1988; Reis et al. 2017). Their prey includes birds, wild mammals, domestic animals, and humans (Gonçalves et al. 2002; Dantas-Torres et al. 2005; Galetti et al. 2016). Among these species, *D. rotundus*, or common vampire bat, has the largest distribution, being present in all countries of South America, Central America to Mexico (Greenhall et al. 1983; Simmons & Cirranello 2020).

The common vampire bat has several morphological adaptations (e.g., walking, running, and jumping) that allow the species to feed on the ground. These characteristics are associated with the exploitation of a variety of prey and its greater complexity in foraging strategies (Greenhall 1972; Sazima & Uieda 1980; Riskin & Hermanson 2005; Riskin et al. 2006; Reyes-Amaya & Jerez 2013; Reyes-Amaya et al. 2017). They have an extremely elongated cecum stomach, which allows a considerable amount of blood to be stored (Greenhall & Schmidt 1988), and the ability to inhibit hemostasis in the host, producing natural anticoagulants (Greenhall 1972; Greenhall & Schmidt 1988; Gohlke et al. 1996).

The activity pattern of *D. rotundus* is more intense in the early night hours, with the highest peak in the second hour after sunset (Marinho-Filho & Sazima 1989). They tend to fly low while moving during foraging and attack prey, usually between 50 and 150 cm in height (Greenhall et al. 1971; Ávila-Flores et al. 2019). All or part of the group may disperse or feed together (Carter & Wilkinson 2013; Stockmaier et al. 2018). They also have a visual acuity comparable to some nocturnal rodents, being very likely to use vision for long-distance orientation. Olfactory acuity is similar to that of other small mammals, but it is more sensitive than an insectivorous bat (Bahlman & Kelt 2007). Therefore, they could locate the prey resting areas by the smell of droppings (Bahlman & Kelt 2007). Additionally, vampire bats possess a thermal sensitive organ, the Jacobson organ, which aids identifying the warmest vascularized region of its prey (Greenhall & Schmidt 1988).

It is known that common vampire bats feed mainly on the blood of medium to large mammals (Greenhall et al. 1983; Gonçalves et al. 2020; Carter et al. 2021). Some direct observations of this interaction, with *D. rotundus* feeding on capybaras (*Hydrochoerus hydrochaeris* (Linnaeus, 1766)), were made in Apure in Venezuela (Carranza 1982; Greenhall & Schmidt 1988). In Brazil, 17 observations of these interactions with capybaras were recorded (Gonçalves et al. 2020). Vampire bats were observed feeding on the ear of sea lion (*Otaria flavescens* (Shaw, 1800); Mann 1951 *apud* Catenazzi & Donnelly 2008); this is a common record for the region, where there are also reports of the vampire bat sharing caves with sea lions on the islands off the coast of northern Chile (Mann 1951 *apud* Catenazzi & Donnelly 2008).

Camera traps have helped record wild animals chased or preyed upon by vampire bats. The most common records in the literature are interactions where vampire bats approach other wild animals, such as tapir (*Tapirus terrestris* (Linnaeus, 1758);

Castellanos & Banegas 2015; Galetti et al. 2016; Gnocchi & Srbek-Araujo 2017; Zortéa et al. 2018), and some less common records as with puma (*Puma concolor* (Linnaeus, 1771)), southern tamandua (*Tamandua tetradactyla* (Linnaeus, 1758); Kays 2016), peccary (*Pecari tajacu* (Linnaeus, 1758); Voigt & Kingston 2016; Zortéa et al. 2018), and preying on deers (*Odocoileus virginianus* (Zimmermann, 1780); Sánchez-Cordero et al. 2011; Tello-Mera & Mandujano 2016), and *Mazama americana* (Erxleben, 1777) (Galetti et al. 2016; Zortéa et al. 2018).

Birds are considered a secondary food source of the common vampire bat (Bobrowiec et al. 2015). The few records show interactions with sea birds, such as pelicans, cormorants (Mann 1951 *apud* Catenazzi & Donnelly 2008), and penguins (Luna-Jorquera & Culik 1995). However, with the introduction of domesticated animals in the Neotropics, along with the ongoing defaunation process, vampire bats have expanded their diet to include cattle, horses, goats, pigs and sheep, and less frequent, poultry and humans (Goodwin & Greenhall 1961; Delpietro et al. 1992; Galetti et al. 2016). The introduction of exotic species has also provided new and abundant food resources. *Desmodus rotundus* was photographed preying on a chital deer (*Axis axis* (Erxleben, 1777)) in Argentina, the sambar deer (*Cervus unicolor* Kerr, 1792) in Brazil, and feral pigs (*Sus scrofa* Linnaeus, 1758*)* in Argentina, Brazil, and Mexico (Costa & Esbérard 2011; Galetti et al. 2016; Pereira et al. 2016; Calfayan et al. 2019; Hernández-Pérez et al. 2019).

We used camera traps to monitor mammals in the protected area of the Parque Sesc Serra Azul, located on the left bank of the Cuiabazinho River, municipality of Rosário Oeste, Mato Grosso, western Brazil (Fig. 1). The study region is part of the Cerrado ecoregion and covers approximately 5,000 hectares (Louzada et al. 2015). The vegetation varies considerably in the area and is partially fragmented by anthropic activities but in an advanced state of recovery, presenting varied physiography as extensive pastures, cerrado, seasonally forests, and flooded forests (Pennington et al. 2006). The climate of the region is typical of the savannah, type "Aw", according to the classification of Köppen-Geiger, with concentrated rainfall in the summer months (Alvares et al. 2013). Annual rainfall varies between 1,000 and 1,600 mm (Alvares et al. 2013).

Seven camera traps (CamPark, T70 Trail Cameram, and Bushnell) were installed at sampling points within the vegetation zones of the park for exploratory purposes. The cameras operated 24 hours a day, and for each event, a video of 15 or 30 seconds was recorded. One of the videos was recorded from a camera that operated locally for 36 days (December 1, 2019–January 5, 2020; Video S1) and another for 39 days (April 26–June 4, 2021; Video S2).

We describe the potential predation between *D. rotundus* and the giant armadillo (*Priodontes maximus* (Kerr, 1792), a species in the Vulnerable category, VU; IUCN 2021), based on video records from camera traps. The giant armadillo is the largest species of the Cingulata Order, and an adult can reach 155.9 cm in body length and weigh up to 44.4 kg in nature (Silveira et al. 2009). The hairless upperparts are composed of bone armor, usually between 11 to 13 moving bands at the back and 3 to 4 at the back of the neck; these shields are highly flexible between each other (Emmons & Feer 1999).

The common vampire bat was recorded on the back of a giant armadillo on December 21, 2019, at 01:30 (Latitude -14.514306; Longitude -55.756278). The bat was in the median position on the armadillo's back, probably associated with the areas between mobile plates during animal displacement, which facilitate feeding through malleable tissues near the vascularized region (Fig. 2). On May 8, 2021, a second registration was made at 23:59 (Latitude -14.477583; Longitude -55.702083). In this video, the common vampire bat chases and possibly tries to feed on the armadillo's tail (see videos in Supplementary online material).

The two species, bat and armadillo, have nocturnal activity patterns. However, the low incidence of vampire bat records feeding on *P. maximus*, may be directly related to the circadian rhythm of both species and the rarity of the armadillo. Observations through camera traps of a common vampire bat preying on a giant armadillo were recorded in a previous study at 02:45 (Zortéa et al. 2018); however, both species have divergent activity peaks. The vampire bats, more active in the early evening, being able to reduce their activity during the periods of greater intensity of the moonlight (Flores-Crespo et al. 1972; Marinho-Filho & Sazima 1989), and the activity peak of the giant armadillo has been observed between 22:00 and 04:00 (Silveira et al. 2009; Aya-Cuero et al. 2017). Another species of armadillo, *Dasypus novemcinctus* Linnaeus, 1758, also was recorded with the highest activity peak between 18:00 and 24:00 hours (Ríos-Solís et al. 2021), reinforcing a mainly nocturnal pattern of activities for the armadillo's species. Moreover, giant armadillos are not easily found in degraded habitats, while populations of vampire bats tend to be higher in altered areas due to the presence of domestic animals (Delpietro et al. 1992; Gomes & Uieda 2004; Costa & Esbérard 2011; Mialhe 2013). Some other factors can also negatively influence the populations of these bats as decreased availability of food and daytime shelters (Voigt & Kelm 2006; Streicker & Allgeier 2016; Gonçalves et al. 2017). In captivity, the common vampire bat predation was observed on *Dasypus* sp. During the interaction, the bat bit between the bands of the armadillo's tail (Schmidt & Greenhall 1972; Greenhall & Schmidt 1988).

In the last two decades, camera traps have exponentially increased the survey of non-invasive information, which would otherwise be difficult to obtain (Kays 2016). It has become an efficient tool for getting ecological data from many mammals, including small mammals (flying or not), medium and large (Rovero et al. 2014; Kays 2016).

Fecal samples have been used extensively in mammalian diet studies based on the morphological classification of digested prey remains. However, conventional microscope-based fecal analyzes are not possible in hematophagous bats. Therefore, molecular analyses in feces or blood have been successfully used to infer the prey preference of the common vampire bat (Bobrowiec et al. 2015; Bohmann et al. 2018). Molecular analysis has corroborated that the diet of *D. rotundus* is based mainly on the blood of mammals (Bobrowiec et al. 2015; Bohmann et al. 2018), and secondarily on the blood of chickens (Bobrowiec et al. 2015). Although genetic approaches offer an attractive solution to rebuild vampire bat diets with high specificity, existing methods have not yet reached a technical level that would make them profitable and efficient for large-scale applications.

Studies using stable carbon isotopic has shown evidence of the predation of common vampire bats on cattle (Herrera et al. 1998; Voigt & Kelm 2006; Streicker & Allgeier 2016). Because livestock is temporally and spatially more stable, it may be a more viable resource than wild animals. Finally, serological analysis of digestive tract contents, using the precipitin test technique (Greenhall & Schmidt 1988), detect the blood of domestic and wild animals, including humans and squirrels (Greenhall & Schmidt 1988). A less common prey, the South American sea lion *O. flavescens* was recorded by recordings with night-vision cameras and stable isotopes in the diet of *D. rotundus* (Catenazzi & Donnelly 2008).

Records of vampire bat predation on medium to large-mammals species are uncommon. They range from direct visualization and camera traps to more modern techniques, such as isotope and DNA analysis. Camera traps are an additional method as they allow assessing the interactions between species in a context closer to the functionality of natural communities. Compared to other methods, observation can be maintained for longer and is less expensive than laboratory analysis. Our contribution to the record, which is extremely rare and important to understand and predict predation by *D. rotundus*, would help in future studies on the behavior of the two species.

ACKNOWLEDGEMENTS

This work was supported by Polo Socio Ambiental Sesc Pantanal. We are especially grateful to Marcus W. Kramm for the camera sampling assistance. Our gratitude to Christiane C. Rodrigues and Cristina Cuiabália R. P. Neves, for the enthusiastic incentive to work in the Parque Sesc Serra Azul. Marcione B. Oliveira thanks to the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for the PhD scholarship (CNPq 162273/2018-5). The manuscript was finalized with support of FAPERJ (Fundação de Amparo à Pesquisa do Estado do Rio de Janeiro; Proc.: E-26/200.119/2019).

SUPPLEMENTARY ONLINE MATERIAL

Supplement 1

Video S1. A common vampire bat (*Desmodus rotundus*) was recorded possibly feeding on a giant armadillo (*Priodontes maximus*) at Parque Sesc Serra Azul, Mato Grosso state, western Brazil.

Supplement 2

Video S2. The common vampire bat (*Desmodus rotundus*) chases and possibly tries to feed on the armadillo’s tail (*Priodontes maximus*) at Parque Sesc Serra Azul, Mato Grosso state, western Brazil.

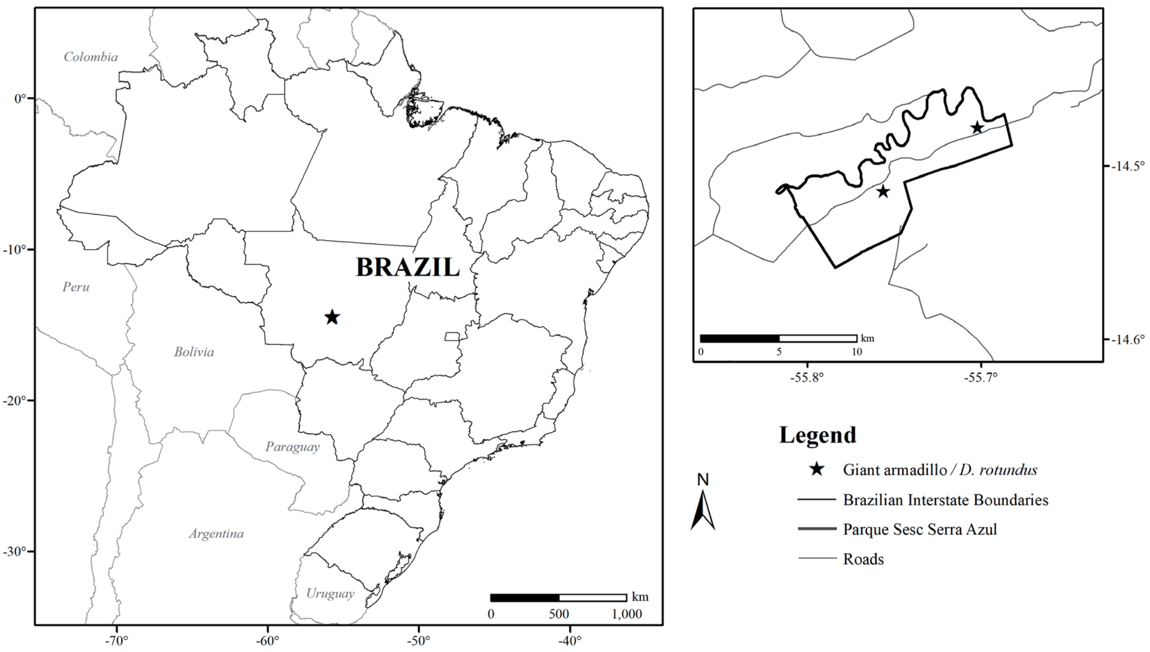

Figure 1. Map of Parque Sesc Serra Azul, Mato Grosso, western Brazil, location of the records made by the present study.

Figure 2. The moment when the common vampire bat (*Desmodus rotundus*) is recorded possibly feeding the giant armadillo (*Priodontes maximus*) in Parque Sesc Serra Azul, Mato Grosso state, western Brazil, recorded by a camera trap.

LITERATURE CITED

Alvares, C. A., J. L. Stape, P. C. Sentelhas, J. L. De Moraes Gonçalves, & G. Sparovek. 2013. Köppen's climate classification map for Brazil. Meteorologische Zeitschrift 22:711–728. https://doi.org/10.1127/0941-2948/2013/0507

Ávila-Flores, R., A. L. Bolaina-Badal, A. Gallegos-Ruiz, & W. S. Sánchez-Gómez. 2019. Use of linear features by the common vampire bat (*Desmodus rotundus*) in a tropical cattle-ranching landscape. Therya 10:229–234. https://doi.org/10.12933/therya-19-890

Aya-Cuero, C., A. Rodríguez-Bolaños, & M. Superina. 2017. Population density, activity patterns, and ecological importance of giant armadillos (*Priodontes maximus*) in Colombia. Journal of Mammalogy 98:770–778. https://doi.org/10.1093/jmammal/gyx006

Bahlman, J. W., & D. A. Kelt. 2007. Use of olfaction during prey location by the common vampire bat (*Desmodus rotundus*). Biotropica 39:147–149. https://doi.org/10.1111/j.1744-7429.2006.00218.x

Bobrowiec, P. E. D., M. R. Lemes, & R. Gribel. 2015. Prey preference of the common vampire bat (*Desmodus rotundus*, Chiroptera) using molecular analysis. Journal of Mammalogy 96:54–63. https://doi.org/10.1093/jmammal/gyu002

Bohmann, K., et al. 2018. Using DNA metabarcoding for simultaneous inference of common vampire bat diet and population structure. Molecular Ecology Resources 18:1050–1063. https://doi.org/10.1111/1755-0998.12891

Calfayan, L. M., G. Bonnot, & I. E. Gómez-Villafañe. 2019. Case reports of common vampire bats *Desmodus rotundus* (Chiroptera: Phyllostomidae: Desmodontinae) attacking wild exotic mammals in Argentina. Notas Sobre Mamíferos Sudamericanos 01:e19.0.05. http://doi.org/10.31687/saremNMS.19.0.05

Carranza, J. 1982. Murciélago hematófago *Desmodus rotundus* parasitando a un chiguire *Hydrochoerus hydrochaeris*. Doñana Acta Vertebrata 9:414–415.

Carter, G., & G. Wilkinson. 2013. Does food sharing in vampire bats demonstrate reciprocity? Communicative & Integrative Biology 6:e25783. https://doi.org/10.4161/cib.25783

Carter, G., B. Brown, I. Razik, & S. Ripperger. 2021. Penguins, Falcons, and Mountain Lions: The Extraordinary Host Diversity of Vampire Bats. 50 Years of Bat Research (M. B. Fenton, R. M. Brigham, S. Mistry, A. Kurta, E. H. Gillam, A. Russell, & J. Ortega, eds.). Springer, Cham. https://doi.org/10.1007/978-3-030-54727-1_10

Castellanos, A., & G. Banegas. 2015. Ecological and anthropogenic drivers of rabies exposure in vampire bats: Implications for transmission and control. Proceedings of the Royal Society B: Biological Sciences Society 279:3384–3392. https://doi.org/10.1098/rspb.2012.0538

Catenazzi, A., & M. A. Donnelly. 2008. Sea lion *Otaria flavescens* as host of the common vampire bat *Desmodus rotundus.* Marine Ecology Progress Series 360:285–289. https://doi.org/10.3354/meps07393

Costa, L. M., & C. E. L. Esbérard. 2011. *Desmodus rotundus* (Mammalia: Chiroptera), na costa sul do estado do Rio de Janeiro. Brazilian Journal of Biology 71:739–46. https://doi.org/10.1590/S1519-69842011000400020

Dantas-Torres, F., C. Valença, & G. V. De andrade Filho. 2005. First record of *Desmodus rotundus* in urban area from the city of Olinda, Pernambuco, Northeastern Brazil: A case report. Revista do Instituto de Medicina Tropical de São Paulo 47:107–108. https://doi.org/10.1590/S0036-46652005000200010

Delpietro, H. A., N. Marchevsky, & E. Simonetti. 1992. Relative population densities and predation of the common vampire bat (*Desmodus rotundus*) in natural and cattle-raising areas in north-east Argentina. Preventive Veterinary Medicine 14:13–20. https://doi.org/10.1016/0167-5877(92)90080-Y

Emmons, L. H., & F. Feer. 1999. Neotropical Rainforest mammals: a field guide. University of Chicago Press, Chicago.

Flores-Crespo, R., S. B. Linhart, R. J. Burns, & G. C. Mitchell. 1972. Foraging Behavior of the Common Vampire Bat Related to Moonlight. Journal of Mammalogy 53:366–368.

Galetti, M., F. Pedrosa, A. Keuroghlian, & I. Sazima. 2016. Liquid lunch – vampire bats feed on invasive feral pigs and other ungulates. Frontiers in Ecology and the Environment 14:505–506. https://doi.org/10.1002/fee.1431

Gnocchi, A. P., & A. C. Srbek-Araujo. 2017. Common Vampire Bat (*Desmodus rotundus*) feeding on Lowland Tapir (*Tapirus terrestris*) in an Atlantic Forest remnant in southeastern Brazil. Biota Neotropica 17. https://doi.org/10.1590/1676-0611-BN-2017-0326

Gohlke, M., et al. 1996. O-linked L-fucose is present in *Desmodus rotundus* salivary plasminogen activator. Journal of Biological Chemistry 271:7381–7386. https://doi.org/10.1074/jbc.271.13.7381

Gomes, M. N., & W. Uieda. 2004. Abrigos diurnos, composição de colônias, dimorfismo sexual e reprodução do morcego hematófago *Desmodus rotundus* (E. Geoffroy) (Chiroptera, Phyllostomidae) no Estado de São Paulo, Brasil. Revista Brasileira de Zoologia 21:629–638.

Gonçalves, F., E. Fischer, & R. Dirzo. 2017. Forest conversion to cattle ranching differentially affects taxonomic and functional groups of Neotropical bats. Biological Conservation 210:343–348. http://dx.doi.org/10.1016/j.biocon.2017.04.021

Gonçalves, F., M. et al. 2020. Prey choice of the common vampire bat on introduced species in an Atlantic forest land-bridge island. Acta Chiropterologica 22:167–174. https://doi.org/10.1101/2020.04.02.022236

Gonçalves, M. A., R. J. Sà-Neto, & T. K. Brazil. 2002. Outbreak of aggressions and transmission of rabies in human beings by vampire bats in Northeastern Brazil. Revista da Sociedade Brasileira de Medicina Tropical 35:461–464. https://doi.org/10.1590/S0037-86822002000500006

Goodwin, G. G., & A. M. Greenhall. 1961. A Review of the Bats of Trinidad and Tobago: Descriptions, Rabies. Bulletin of the American Museum of Natural History 122:42–559.

Greenhall, A. M. 1972. The biting and feeding habits of the Vampire bat, *Desmodus rotundus.* Journal of Zoology 168:451–461. https://doi.org/10.1111/j.1469-7998.1972.tb01361.x

Greenhall, A. M., G. Joermann, & U. Schmidt. 1983. *Desmodus rotundus.* Mammalian Species 202:1–6.

Greenhall, A. M., & U. Schmidt. 1988. Natural history of vampire bats. CRC Press, Florida.

Greenhall, A. M., U. Schmidt, & W. Lopez-Forment. 1971. Attacking Behavior of the Vampire Bat, *Desmodus rotundus*, Under Field Conditions in Mexico. Biotropica 3:136–141.

Hernández-Pérez, E. L., G. Castillo-Vela, G. García-Marmolejo, M. S. López, & R. Reyna-Hurtado. 2019. Wild pig (*Sus scrofa*) as prey of the common vampire bat (*Desmodus rotundus*). Therya 10:195–199. https://doi.org/10.12933/therya-19-685

Herrera, L. G., T. H. Fleming, & L. S. Sternberg. 1998. Trophic relationships in a neotropical bat community: A preliminary study using carbon and nitrogen isotopic signatures. Tropical Ecology 39:23–29.

IUCN. 2021. The IUCN Red List Category. Version 2021-3. <https://www.iucnredlist.org>.

Kays, R. 2016. Candid creatures: how camera traps reveal the mysteries of nature. JHU Press.

Louzada, N. S. V., A. C. do Monte Lima, L. M. Pessôa, J. L. P. Cordeiro, & L. F. B. Oliveira. 2015. New records of phyllostomid bats for the state of Mato Grosso and for the Cerrado of Midwestern Brazil (Mammalia: Chiroptera). Check List 11:1644. http://dx.doi.org/10.15560/11.3.1644

Luna-Jorquera, G., & B. M. Culik. 1995. Penguins bled by vampires. Journal für Ornithologie 136:471–472.

Marinho-Filho, J. S., & I. Sazima. 1989. Activity patterns of six phyllostomid bats species in southeastern Brazil. Revista Brasileira de Biologia 49:777–782.

Mialhe, P. J. 2013. Characterization of *Desmodus rotundus* (E. Geoffroy, 1810) (Chiroptera, Phyllostomidae) shelters in the Municipality of São Pedro-SP. Brazilian Journal of Biology 73:521–526. https://doi.org/10.1590/S1519-69842013000300009

Pennington, R. T., G. P. Lewis, & J. A. Ratter. 2006. Neotropical savannas and seasonally dry forests: plant diversity, biogeography, and conservation. The Systematics Association CRC press, Department of Zoology, The Natural History Museum, London.

Pereira, A., C. B. Batista, D. Bender, N. R. dos Reis, & S. Bazilio. 2016. Report on *Desmodus rotundus* (Chiroptera, Phyllostomidae) feeding on *Sus scrofa* (Artiodactyla, Suidae) blood. Boletim da Sociedade Brasileira de Mastozoologia 77:151–153.

Reis, N. R., A. L. Peracchi, C. B. Batista, I. P. Lima, & A. D. Pereira. 2017. História Natural dos Morcegos Brasileiros: Chave de identificação de Espécies. Technical Books Editora, Rio de Janeiro.

Reyes-Amaya, N., & A. Jerez. 2013. Postnatal cranial ontogeny of the common vampire bat *Desmodus rotundus* (Chiroptera: Phyllostomidae). Chiroptera Neotropical 19:1198–1211.

Reyes-Amaya, N., A. Jerez, & D. Flores. 2017. Morphology and postnatal development of lower hindlimbs in *Desmodus rotundus* (Chiroptera: Phyllostomidae): a comparative study. The Anatomical Record 300:2150–2165. https://doi.org/10.1002/ar.23646

Ríos-Solís, J. A., J. C. López-Acosta, & M. C. MacSwiney. 2021. Potential attack of the common vampire bat (*Desmodus rotundus*) on nine-banded armadillo (*Dasypus novemcinctus*) in northern Oaxaca, México. Therya Notes 2:147–150. https://doi.org/10.12933/therya_notes-21-52

Riskin, D. K., & J. W. Hermanson. 2005. Biomechanics: Independent evolution of running in vampire bats. Nature 434:292–292. https://doi.org/10.1038/434292a

Riskin, D. K., S. Parsons, W. A. Schutt, G. G. Carter, & J. W. Hermanson. 2006. Terrestrial locomotion of the New Zealand short-tailed bat *Mystacina tuberculata* and the common vampire bat *Desmodus rotundus.* Journal of Experimental Biology 209:1725–1736. https://doi.org/10.1242/jeb.02186

Rovero, F., E. Martin, M. Rosa, J. A. Ahumada, & D. Spitale. 2014. Estimating species richness and modelling habitat preferences of tropical forest mammals from camera trap data. PLoS ONE 9:e103300. https://doi.org/10.1371/journal.pone.0103300

Sánchez-Cordero, V., F. Botello, G. Magaña-Cota, & J. Iglesias. 2011. Vampire bats, *Desmodus rotundus*, feeding on white-tailed deer, *Odocoileus virginianus.* Mammalia 75:91–92. https://doi.org/10.1515/MAMM.2010.065

Sazima, I., & W. Uieda. 1980. Feeding behavior of the white-winged vampire bat, *Diaemus youngii*, on poultry. Journal of Mammalogy 61:102–104.

Schmidt, U., & A. M. Greenhall. 1972. Preliminary studies of the interactions between feeding vampire bats, *Desmodus rotundus*, under natural and laboratory conditions. Mammalia 36:241–246. https://doi.org/10.1515/mamm.1972.36.2.241

Silveira, L., A. T. de Almeida Jácomo, M. M. Furtado, N. M. Torres, R. Sollmann, & C. Vynne. 2009. Ecology of the Giant Armadillo (*Priodontes maximus*) in the Grasslands of Central Brazil. Edentata 2009:25–34. https://doi.org/10.1896/020.010.0112

Simmons, N. B., & A. L. Cirranello. 2020. Bat species of the world: a taxonomic and geographic database. <https://batnames.org/>.

Stockmaier, S., D. I. Bolnick, R. A. Page, & G. G. Carter. 2018. An immune challenge reduces social grooming in vampire bats. Animal Behaviour 140:141–149. https://doi.org/10.1016/j.anbehav.2018.04.021

Streicker, D. G., & J. E. Allgeier. 2016. Foraging choices of vampire bats in diverse landscapes: potential implications for land-use change and disease transmission. Journal of Applied Ecology 53:1280–1288. https://doi.org/10.1111/1365-2664.12690

Tello-Mera, E. L., & S. Mandujano. 2016. Primer registro fotográfico de murciélagos hematófagos *Desmodus rotundus* (Chiroptera: Phyllostomidae) alimentándose de *Odocoileus virginianus* (Artiodactyla: Cervidae) en la Reserva de la Biosfera Tehuacán-Cuicatlán, México. Mammalogy Notes 3:17–19

Voigt, C. C., & D. H. Kelm. 2006. Host Preference of the Common Vampire Bat (*Desmodus rotundus*; Chiroptera) Assessed by Stable Isotopes. Journal of Mammalogy 87:1–6. https://doi.org/10.1644/05-MAMM-F-276R1.1

Voigt, C. C., & T. Kingston. 2016. Bats in the Anthropocene: Conservation of Bats in a Changing World. Springer Cham, London/NY.

Zortéa, M., D. A. Silva, & A. M. Calaça. 2018. Susceptibility of targets to the vampire bat *Desmodus rotundus* are proportional to their abundance in Atlantic Forest fragments? Iheringia. Série Zoologia 108:2015–2018. https://doi.org/10.1590/1678-4766e2018037