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Artículo

NEW OBSERVATIONS OF LIVING *Echimys saturnus* (DARK TREE RAT, ECHIMYIDAE) FROM EASTERN ECUADOR

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ABSTRACT. The dark tree rat, *Echimys saturnus* (Thomas, 1928) is a poorly-known member of the Echimyidae family known from only a few records at scattered localities in the eastern Andean foothills. All *Echimys* species are difficult to see or capture and little is known about their geographic range and behavior. Here we report new observations, activity patterns and what, to our knowledge, are the first videos obtained for this species.

RESUMEN. **Nuevas observaciones de *Echimys saturnus* (rata arborícola oscura, Echimyidae) del este de Ecuador**. La rata arborícola oscura, *Echimys saturnus* (Thomas, 1928), es un miembro poco conocido de la familia Echimyidae, con solo algunos pocos registros de localidades dispersas de las estribaciones orientales de los Andes. Los miembros del género *Echimys* son difíciles de observar o capturar y poco se sabe acerca de su distribución geográfica y comportamiento. Aquí presentamos nuevas observaciones, patrones de actividad y los que, hasta donde sabemos, son los primeros videos obtenidos para esta especie.

Key words: Behavior. Camera trap. Echimyidae. *Echimys saturnus*. Tree rat.

Palabras clave: Cámaras trampa. Comportamiento. Echimyidae. *Echimys saturnus*. Rata arborícola oscura.

INTRODUCTION

The dark tree rat, *Echimys saturnus*, is a poorly-known member of the Echimyidae family (spiny rats and tree rats) (Blake et al., 2010). Virtually nothing is known about this very infrequently seen or collected species (Emmons et al., 2015). Arboreal echimyids comprise several species allocated in 12 genera in three subfamilies (Carvalho, 2000; Iack-Ximenes et al., 2005). The genus *Echimys* is restricted to three species: *E. chrysurus* (Zimmermann, 1780), *E. saturnus* (Thomas, 1928), and *E. vierai* (Iack- Ximenes, De Vivo, and Percequillo, 2005) (Emmons et al., 2015). All *Echimys* species are difficult to see or capture and little is known about their geographic range and behavior (Emmons and Feer, 1997; Blake et al., 2010).

Echimys saturnus is known only from a few scattered localities from the eastern Andean foothills and adjacent lowlands of Ecuador and northern Perú, on the upper Marañon River (Iack-Ximenes et al., 2005), to at least

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1000 m a.s.l. in lowland and premontane rainforest (Emmons and Feer, 1997; Woods and Kilpatrick, 2005). In Ecuador it has been recorded in Cerro Galeras (Napo Province) and Río Pucuno, Río Cotapino and Tiputini Biodiversity Station (Orellana Province) (Emmons et al., 2015). Like other members of the genus, it is reported to be arboreal and to nest in hollow trees with one or two young once or twice per year (Emmons and Feer, 1997; Eisenberg and Redford, 1999; Blake et al., 2010). The species is externally identifiable, being the only large, blackish rat in its range with a fully-furred tail, the distal portion of which is white (Emmons and Feer, 1997). It is listed as DD (Data Deficient) under the IUCN Red List (Tirira and Solari, 2008) primarily due to the absence of recent information on its threats and conservation status. In a previous paper, Blake et al. (2010) reported new records and the first photographs of living *E. saturnus* in eastern Ecuador. Here we report new observations, activity patterns and what, to our knowledge, are the first videos obtained for this species.

STUDY AREA AND METHODS

We conducted our research at Tiputini Biodiversity Station (TBS), Orellana Province, Ecuador (S0° 38.221' W76° 08.992', 190-270 m elevation). TBS was founded in 1994 by the Universidad San Francisco de Quito (USFQ) in a tract of undisturbed lowland rainforest within the c. 2.7 million-ha Yasuní Biosphere Reserve, one of the most biologically diverse regions on earth (Bass et al., 2010). The station and nearby areas contain a variety of habitats, including terra firme and várzea forest, palm swamps and other wetlands, as well as areas of natural succession that follow tree-falls and wind-throws or other natural disturbances (Blake et al., 2010). The mean annual precipitation at Yasuní Research Station, approximately 30 km WSW of TBS, is about 3100 mm. Rainiest months are from April through June; January and August can be relatively dry (Blake et al., 2014).

Camera Trapping

We used Bushnell Trophy Cam camera traps triggered by an infrared motion and heat detector to document the occurrence of animals at a mineral lick. Previous records of *Echimys* (Blake et al., 2010) were obtained when monitoring 4 mineral licks located in old-growth forest located north of the Tiputini River. The mineral lick in this study is located along the Tiputini River, ~4.5 km in a straight line from the main camp (0° 37.464' S, 76° 06.738' W). The lick is a shallow cave in a vertical wall, ~5 meters above surrounding ground level, 2.5 m wide x 1.2 m high, at ~15 meters from the river in várzea forest. Frequent visitors to the saltlick during the day include two species of primates, red howler monkeys (*Alouatta seniculus*) and white-bellied spider monkeys (*Ateles belzebuth*), and several species of birds, including common piping guan (*Pipile pipile*), plumbeous pigeon (*Columba plumbea*), ruddy quail-dove (*Geotrygon montana*), speckled chachalaca (*Ortalis guttata*), mealy amazon (*Amazona farinosa*) and yellow-crowned amazon (*Amazona ochrocephala*). Frequent visitors at night include two-toed sloth (*Choloepus didactylus*), bicolored porcupine (*Coendou bicolor*) and mottled owl (*Ciccaba virgata*).

One camera was attached to a tree 6 m up from the ground facing the front of the cave at a distance of 4 m and remained active continuously from January through May 2014. To obtain better videos from different perspectives and to improve captures and identification, two more cameras were added in the second period, from November 2014 through July 2015. One of these cameras was placed on the left side of the cave 1 m from the entrance, and the other was set at approximately 8 m above the cave and attached to a tree that animals use to access the mineral lick. Even though three cameras were deployed, we considered the trap effort as only one camera, since all cameras together make up one sampling unit and do not accumulate effort independently. We checked cameras weekly to replace memory cards and batteries. All three cameras remained active continuously (except when batteries failed or other malfunctions occurred); date and time were stored on the metadata of each file. We set cameras to take footage with a minimum time between videos of 1 second with durations of 30-60 seconds (depending on the size of the memory card). Videos were classified as belonging to independent visits if more than 30 min had elapsed since the last video taken of a specific visit.

RESULTS AND DISCUSSION

We obtained a total of 47.5 minutes (72 videos, 26 independent visits) of effective footage (where the animal is in frame) of *E. saturnus* during 424 trap-days. Images were identified

Fig. 1. *Echimys saturnus* (rear view with details of the tail) approaching mineral lick at Tiputini Biodiversity Station, Ecuador.

Fig. 2. *Echimys saturnus* (front view) approaching mineral lick at Tiputini Biodiversity Station, Ecuador.

as *E. saturnus* based on body length, length and position of ears (buried in the hair of the head), and tail being much longer than the head and body, densely haired and black at base with variable length of white on or near tip (Emmons et al., 2015) **(Figs. 1-2)**. All videos were taken during night hours on infrared mode. The earliest record was at 19:46 and the latest at 02:08, matching the reported nocturnal pattern for this species (Emmons and Feer, 1997). Activity was highest between 22:00 h and 23:00 h (**Fig. 3**) with the greatest number of independent visits in February 2014 (**Fig. 4**). Except in April, *E. saturnus* was recorded every month during the first period of 2014, with visits ranging in duration from 1 to 25 minutes. On three occasions (January 2014) we recorded two individuals together, one considerably smaller than the other, most likely a young individual. In the second period, we recorded no *E. saturnus* in November, but we obtained videos of a single individual every month from December 2014 through March 2015, particularly drier months. No records were obtained in April, May and June of 2015 but new visits were recorded in July. In this period visits ranged from 1 to 52 minutes, and we recorded more than one independent visit in one day only once.

Blake et al. (2010) previously reported on eight images of single individuals and one with three individuals at a mineral lick, either moving towards or away from the water on mudflat areas that border a stream channel. That low number of records (after an effort of ~800 trap days) suggested that individuals visited that lick rarely. In contrast, our systematic records of *E. saturnus* suggest that the individuals are frequent visitors of that specific lick, and that they

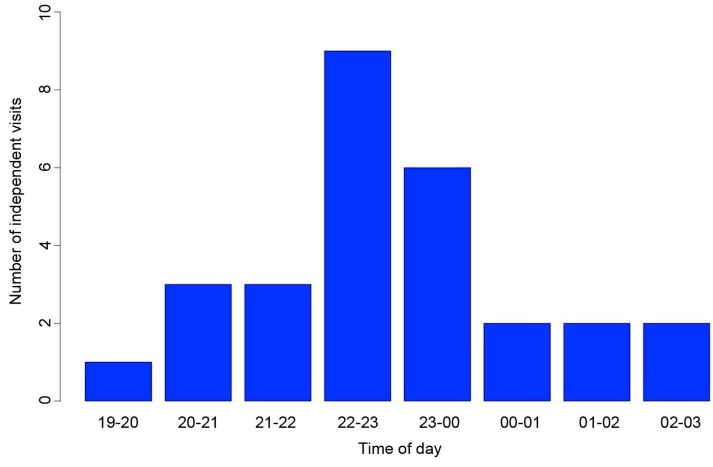

Fig. 3. Hourly activity (number of records across all months) of *Echimys saturnus* at a mineral lick at Tiputini Biodiversity Station, Ecuador.

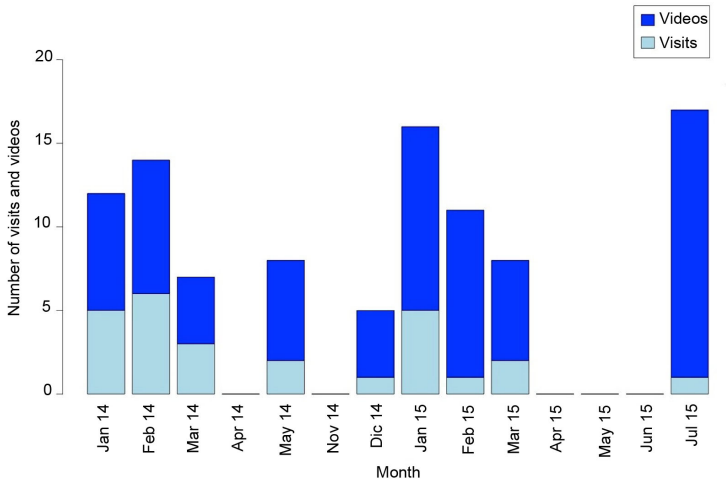

Fig. 4. Number of independent visits and number of videos of *Echimys saturnus* per month from January through May 2014 and from November 2014 through July-2015.

remain constantly in the area. They changed their behavior pattern seasonally and were more active in drier months (Dec-Mar) of both years. Emmons et al. (2015) suggested that repeated use of mineral licks by *E. saturnus* might indicate an herbivorous diet. A lack of significant differences in mineral content among ten licks examined at Tiputini (J. Fabara, unpubl. undergraduate thesis, Universidad San Francisco de Quito) suggests that use of particular sites may be related to factors other than mineral content (Blake et al., 2011). Individuals were recorded actively feeding on clay when at the cave (6 events) and when not actively feeding; individuals were recorded moving towards or leaving the mineral lick from above or to the side, sniffing or resting. On three occasions we recorded individuals that had lost the tip of its tail, a fairly common occurrence among Echimyidae (L. Emmons, pers. comm.). Although the rest of individuals varied in size and in the amount of white on the tail, we were not able to distinguish individuals with certainty. These new records provide more detailed evidence regarding use of mineral licks by this species. Further studies that document the diet of this species might shed light on the reasons for use of such sites.

Camera traps have proven very useful in ecological, conservation and behavioral research, non-invasively recording presence and behavior of animals in their natural environment (O´Connell et al., 2011). Although still images are commonly used in camera trap studies and are easier to process, videos are useful when the goal is not simply to detect animals but also to observe behavior (Glen et al., 2013). For example, in studies of nest predation of ground-nesting birds (Sanders and Maloney, 2002), bait removal in vertebrate pest control (Glen and Dickman, 2003) or seed selection, predation and removal in terrestrial rodents (Jansen and Den Ouden, 2005; Pires and Galetti, 2012). Villete et al. (2015) determined that videos were optimal for detecting rodents, because cameras set to take simple images often failed to obtain a useable photograph because the animals moved quickly, triggering the camera as they entered a trap or went behind it. Videos are also more appealing to the general public, capturing the attention of the viewers and helping to raise awareness on conservation initiatives (Swinnen et al., 2014).

The videos on which this paper is based can be seen at: https://www.youtube.com/watch?v=R0RfyHfBmXg&feature=youtu.be

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