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Natural History

Frugivory and Seed predation of *Jacaratia spinosa* (Caricaceae) by Sumichrast's Vesper Rat, *Nyctomys sumichrasti* (Rodentia: Cricetidae)

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Abstract

Animal-plant interactions are ubiquitous and critical for tropical ecosystem functioning. Neotropical rodents perform key ecosystem functions such as seed dispersal and predation, however few information is available regarding their ecological interactions. Here, we reported the interaction between the Sumichrast's Vesper Rat, *Nyctomys sumichrasti*, and the plant *Jacaratia spinosa* in the Central Caribbean of Costa Rica. Rodents were observed feeding on the flesh and seeds of the plants. Natural history observations such as this are critical to the knowledge on the feeding links of poorly known Neotropical rodents.

Key words: Animal-plant interaction, Costa Rica, Veragua Rainforest, fleshy fruits, Neotropical rodents.

Resumen

Las interacciones animal-planta son ubicuas y críticas para el funcionamiento de los ecosistemas tripicales. Los roedores neotropicales desempeñan funciones clave del ecosistema, como la dispersión de semillas y la depredación, sin embargo hay poca información disponible sobre sus interacciones ecológicas. Aquí, informamos sobre la interacción entre la rata *Nyctomys sumichrasti* y la planta *Jacaratia spinosa* en el Caribe Central de Costa Rica. Se observaron roedores alimentándose de la pulpa y semillas de las plantas. Las observaciones de la historia natural como esta son fundamentales para generar y aumentar el conocimiento la dieta de los roedores neotropicales poco conocidos.

Palabras clave: Interacción animal-planta, Costa Rica, Bosque lluvioso Veragua, frutos carnosos, roedores Neotropicales.

Animals and plants interact in diverse and multiple ways reflecting the complexity of natural histories of partner species (Jordano 2016). In tropical ecosystems, for example, where up to 90% of plants interact with vertebrates (Jordano 2001), understanding the nature and extent of these links and their outcomes can help us to elucidate the evolution of species interactions, as well as the potential implications of the loss of components in

the ecological networks (Carreira et al. 2020). In this sense, despite is well known that many seeds of tropical plants are dispersed and/or predated by vertebrates (Howe 1986; Jordano 2000), detailed information on these interactions are scarce and what disperse and/or predate what is unknown for many plant species. Among mammals, for example, growing evidence suggests that small rodents may play antagonistic roles, either dispersing (Sahley et al. 2016) or predating (Janzen 1982; Leiser-Miller et al. 2019) seeds of multiple plant species. In hyperdiverse forests, where many animal-plant interactions are unknown, are rapidly disappearing or changing due to factors such as habitat loss and/or defaunation (Cardillo et al. 2008), documenting these interactions may help us to understand and quantify the role of small vertebrates on ecological interactions with implication on plant population dynamics (Hulme 1998).

The Sumichrast's Vesper Rat, *Nyctomys sumichrasti* (Saussure 1860) is a medium-sized, nocturnal, and arboreal Neotropical rodent species distributed from Jalisco and Veracruz, Mexico, except Yucatán Peninsula, to eastern Panama (Reid 2009). It is mainly recognized by its orange upperparts, its creamy white underparts, large eyes surrounded by dark eye rings, and a dark and long-haired tail with a pronounced terminal tuft (Reid 2009). Dietary information suggests that *Nyctomys sumichrasti* feeds mainly on fruits, seeds, and leaves (Genoways and Jones 1972; Eisenberg 1989; Ceballos 1990; Timm and Vriesendorp 2003; Hunt et al. 2004; Bessesen and Saborío-R 2009; Villalobos-Chaves et al. 2020) and despite is one of the most well-known Neotropical rodent species, basic aspects of its natural history, including its ecological roles are poorly understood.

Dietary information of *N. sumichrasti* is scarce and available data suggest that this species can eat seeds in captivity. However, information about seed predation is limited to these observations (Hunt et al. 2004) or assumptions by other authors (Villalobos-Chaves et al. 2020). Here, we reported on the interaction of the Sumichrast's Vesper Rat with the fruits and seeds of the Neotropical plant *Jacaratia spinosa* (Figure 1a). Observations were made at Veragua Rainforest (09°55'30"N, 083°11'28"W, WGS84; 420 masl), located in the Central Caribbean of Costa Rica, on the northern edge of the Matama mountains, in the Talamanca mountain range. This private reserve comprises mature forest, a successional forest at different stages of regeneration, open areas, small gardens, and anthropogenic structures (Salas-Solano et al. 2020). On two consecutive nights on August 2018, we observed adult individual Sumichrast's Vesper Rats of unknown sex visiting the ripe fruits and predating the seeds of a *J. spinosa* tree (Caricaceae). Observations were performed from 19h37 to 19h56 (first day) and from 18h58 to 19h06 (second day), approximately at 3 m high on the tree. During these times, the rodents were observed eating the inside of ripe fruits, different each day, and photographed/filmed in the second night to document the feeding interaction. Animals used their mouth to take portions of the flesh and seeds with each chew (Figure 1b). Once extracted, the rodents released their front legs from the fruit and use their front feet to manipulate and chew the seeds one by one (Figure 1c). While doing this, a considerable proportion of the removed flesh of the fruit fell off to the ground, including some whole seeds and the predated ones (Figure 1d, Video S1). Based on the observations, only one fruit was exploited by the rodents per night and no other animal was observed consuming the flesh nor the seeds of the *J. spinosa* tree. Lastly, and as documented by other authors (Timm and Vriesendorp 2003; Villalobos-Chaves et al. 2020), while predating on the seeds of *J. spinosa*, *N. sumichrasti* were always using its long tail and hind feet to support itself. The use of these morphological traits to move and stabilize themselves while foraging may allow this species to exploit resources on other strata not available for other rodents (Villalobos-Chaves et al. 2020).

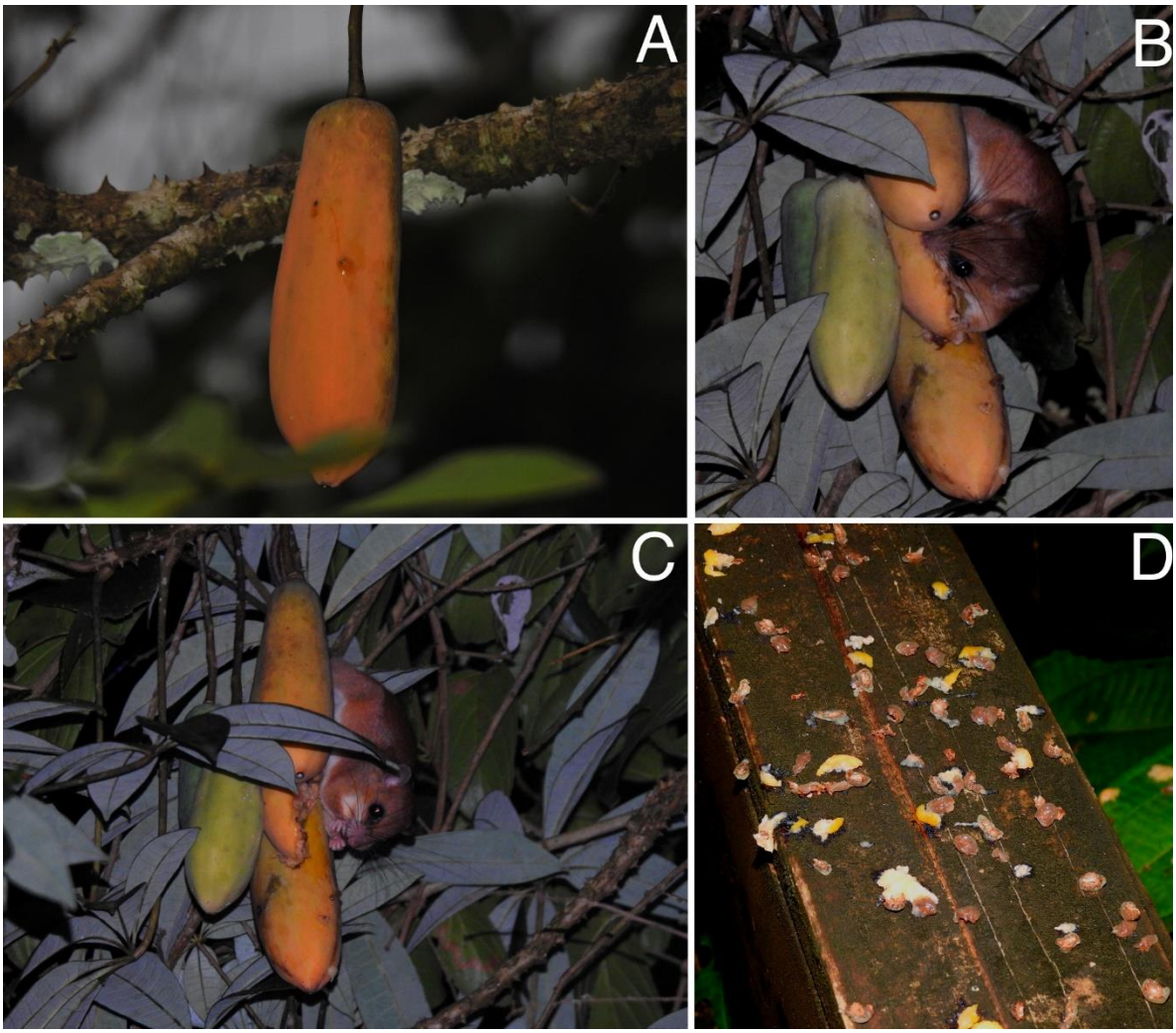

FIGURE 1. Sumichstart's Vesper Rat, *Nyctomys sumichrasti*, feeding on fruits and predating on seeds of *Jacaratia spinosa* at Veragua Rainforest, Costa Rica. (A) Details of a ripe fruit of *J. spinosa*. (B) An individual *N. sumichrasti* taking portions of the fruit of *J. spinosa*. (C) Details of manipulation and later seed predation of the seeds of *J. spinosa*. (D) Predated seeds (mostly) and small portions of flesh dropped by the rodents during the feeding process.

J. spinosa (Caricaceae) is a widespread tree distributed throughout the Neotropical region from Guatemala to northeast Argentina (Carvalho and Renner 2012). Through its distribution *J. spinosa* fruits are attractive and nutritive items documented in the diet of the lowland tapir *Tapirus terrestris*, the opossum *Didelphis aurita*, the tortoise *Chelonoidis denticulate*, the black and white tegu *Tupinambis merianae*, peccaries, monkeys and birds (Pack et al. 1999; Henry et al. 2000; Riba-Hernández et al. 2003; Felton et al. 2008; Genovese et al. 2008; Jerozolimski et al. 2009; Casella 2011; Ramos-Martınez et al. 2012; Carvalho and Renner 2012; Carvalho et al. 2015; Bello et al. 2017). However, this is the first time a rodent species is detected consuming the flesh of the *J. spinosa* fruits and predating their seeds. As been documented before (Villalobos-Chaves et al. 2020), our observations suggest that *N. sumichrasti* might be an opportunistic visitor of *J. spinosa*. In addition, given that damaged seeds were dropped on the ground during the feeding process (Figure 1d, Video S1), we suggest that future efforts are needed to better understand the extent of this

ecological interaction. Natural history observations like this are key to understand the role of species interacting with their plant partners. This kind of observation increase the knowledge of the feeding links, frugivore networks, and food webs of complex and highly diverse Neotropical ecosystems.

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