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PREVIOSULY UNDESCRIBED FOOD RESOURCES OF ELEVEN NEOTROPICAL BIRD SPECIES

RECURSOS ALIMENTICIOS NO DESCRITOS PREVIAMENTE EN ONCE ESPECIES DE AVES NEOTROPICALES

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Abstract

Feeding events of unsual prey items are rarely recorded in the field. Here we report diet resources for eleven Neotropical bird species. We include an observation of scavenging behavior for the Black Hawk-Eagle (*Spizaetus tyrannus*), the first record of wood consumption by the Crimson-fronted Parakeet (*Psittacara finschi*), moss consumption by the Mealy Parrot (*Amazona farinosa*), mycophagy by the Yellow-faced Grassquit (*Tiaris olivaceus*), and reports of unknown or uncommon diet sources for the Ruddy Turnstone (*Arenaria interpres*), the Rufescent Tiger-Heron (*Tigrisoma lineatum*), the Gray-headed Kite (*Leptodon cayanensis*), the White-tailed Kite *(Elanus leucurus*), the Lesson's Motmot (*Momotus lessonii*), the White-crowned Parrot (*Pionus senilis*), and the Tropical Kingbird (*Tyrannus melancholicus*).

Palabras clave: foraging behavior, mycophagy, nestling predation, omnivorous diet, scavenging behavior.

Resumen

Los eventos de alimentación en aves son rara vez observados y registrados en el campo. En esta nota reportamos nuevos recursos alimenticios para once especies de aves Neotropicales. Incluimos una observación de comportamiento de tipo carroñero en *Spizaetus tyrannus*, el primer reporte de *Psittacara finschi* comiendo madera, *Amazona farinosa* alimentándose de musgo y micofagia en *Tiaris olivaceus*. Además reportamos fuentes de alimento desconocidas, o poco comunes, para *Arenaria interpres*, *Tigrisoma lineatum*, *Leptodon cayanensis*, *Elanus leucurus*, *Momotus lessonii*, *Pionus senilis* y *Tyrannus melancholicus*.

Key words: aves carroñeras, comportamiento de forrajeo, depredación de nidos, micofagia, omnivoría.

Knowledge of the natural history (*e.g.*, breeding season and diet) of an organism is important to understand its behaviors and ecological processes (Janzen 1983). However, many aspects of the natural history of certain species (especially for tropical organisms) are still unknown. For example, predation events are rarely recorded in nature, even in well-structured diet studies (*e.g.*, Robinson & Robinson 2001), because it is very difficult to follow individuals throughout the day and record all items that are consumed. Even for common or well-known species, reports of previously undescribed predation events or unknown diet items are continuously appearing (*e.g.*, Delgado-V & Brooks 2003, Sandoval *et al.* 2008, Reid & Sánchez-Gutiérrez 2010, Sandoval-Comte *et al.* 2014). Here, we report previously unrecorded diet items and feeding behaviors of 11 species of birds observed in the Neotropical region.

Species Accounts

Ruddy Turnstone (*Arenaria interpres*) – We observed an individual with molting plumage eating crackers and dry bean seeds on the 27th of February, 2018, at Alemanes beach, Isla Santa Cruz, Galapagos, Ecuador (0° 45' S – 90° 18' W, 0 m a.s.l.). The turnstone followed several ground finches (*Geospiza* spp.) that approached people on the beach to eat leftover crackers and dry bean seeds (Fig. 1). Then, the turnstone took a piece of cracker from the ground with its beak and moved away from the ground finches. Before eating the cracker, the turnstone put it on the beach ground, picked it up and dropped it twice with its beak, and then swallowed it. The dry bean seed was eaten in a similar way to the cracker. The Ruddy Turnstone's diet in non-breeding areas usually mainly consists of arthropods, marine invertebrates (*e.g.*, echinoderms, mollusks,

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crustaceans, or annelids), small fish, and carrion (*e.g.*, fish or mammals) (Van Gils *et al.* 2018). The consumption of uncommon food sources such as crackers and dry bean seeds in this area was likely associated with the reduced abundance of other resources or as an opportunistic behavior.; hence, increasing the food intake before initiating migration towards its breeding area.

Figure 1. ***Arenaria interpres.*** **(A) An individual approaching people on the beach to pick up a piece of cracker. (B) The same individual (as depicted in A) after picking up a dry bean seed (white-arrow) and moving away from groundfinches on the 27th of February, 2018, Isla Santa Cruz, Galapagos, Ecuador.**

Rufescent Tiger-Heron (*Tigrisoma lineatum*) – We observed a juvenile Rufescent Tiger-Heron eating a Buff-breasted Wren (*Cantorchilus leucotis*) on the 9th of January, 2015, at the Hotel Gamboa Resort, Gamboa, Colón, Panamá (09° 07' N – 79° 42' W, 30 m a.s.l.). The heron was walking on the border of the river Chagres in the middle of tall grasses, with a dead Buff-breasted Wren in its beak, and then swallowed the prey with an up and down head movement (Fig. 2A). On the 27th of January, 2015, at Gatuncillo, Colón, Panamá (9° 16' N – 79° 39' W, 100 m a.s.l.), we observed a Rufescent Tiger-Heron eating a colubrid snake. The heron was holding the middle part of the snake's body with its beak on the side of an artificial lake; the snake was moving vigorously although its head seemed to be injured. The heron stretched its neck allowing the snake's head to slip right into its beak and then pressed it firmly until it reduced the prey's movement (Fig. 2B). Finally, the heron swallowed the snake, starting by the head, which included forward and backward movements of the body, and stretching and inflating its neck. All herons and egret species (Ardeidae) are known to primarily feed on aquatic animals such as fish (Gimenes *et al.* 2007). The diet of the Rufescent Tiger-Heron is dominated by fish and insects, but it occasionally includes snakes and frogs (Beltzer 1990, Briso *et al.* 2014). Although several authors report small birds as part of the Rufescent Tiger-Heron's diet (Willard 1985, Gimenes *et al.* 2007, Briso *et al.* 2014), none of them specify the prey species. In addition, we report a new case of snake predation for this species. We suggest that the diet of the Rufescent Tiger-Heron was opportunistic as reported by Briso *et al.* (2014) when its predation on anurans was observed. Thus, birds and snakes may be an important portion of the Rufescent Tiger-Heron's diet when they are abundant.

Figure 2. ***Tigrisoma lineatum.*** **(A) A juvenile eating a Buff-breasted Wren (*Cantorchilus leucotis*) on the 9th of January, 2015, Gamboa, Panamá. (B) An Adult eating a colubrid snake on the 27th of January, 2015, Gatuncillo de Colón, Panamá.**

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Gray-headed Kite (*Leptodon cayanensis*) – We observed an adult Gray-headed Kite perched on a lateral branch of a Guanacaste tree (*Enterolobium cyclocarpum*) with a greater sac-winged bat (*Saccopteryx bilineata*) in its claw (Fig. 3) on the 31st of March, 2014, at Finca Santa Matilde de Coen, Chinandega, Nicaragua (12° 48' N – 86° 53' W, 10 m a.s.l.). During 5 min, the kite held the bat with the same claw and brought it closer to its beak twice without biting it. The kite then flew away inside the riparian forest with the bat in its claw.

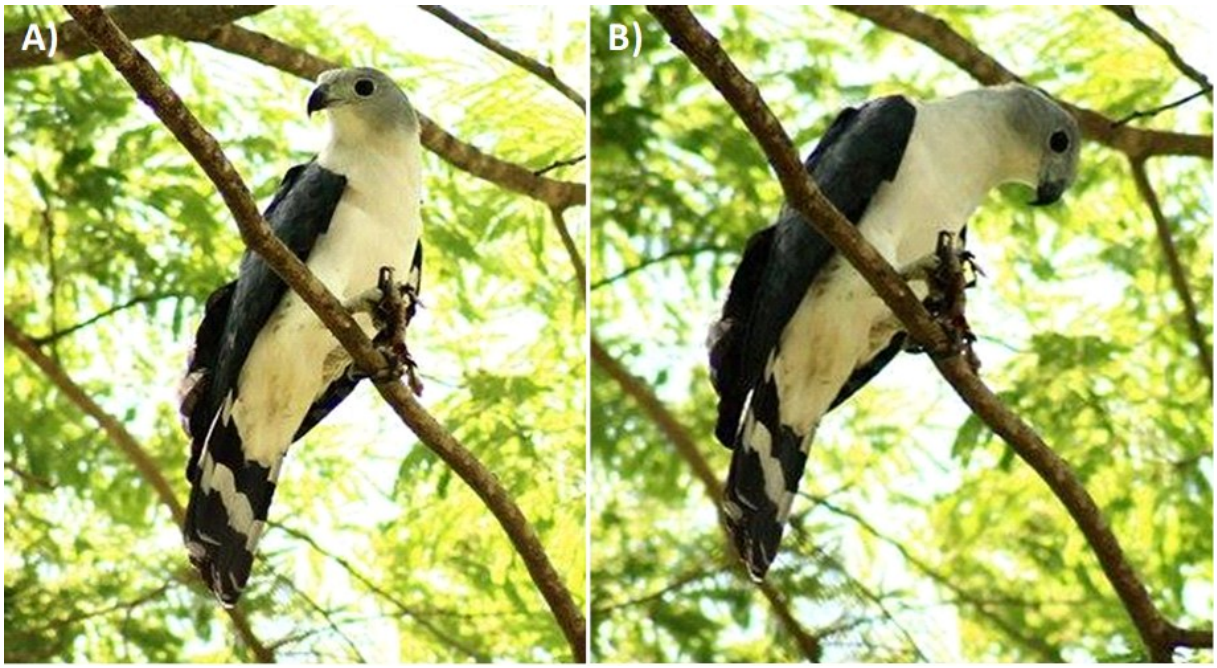

Figure 3. ***Leptodon cayanensis*****. (A, B) An adult holding a greater sac-winged bat (*Saccopteryx bilineata*) in its claw on the 31st of March, 2014, Chinandega, Nicaragua.**

White-tailed Kite (*Elanus leucurus*) – We observed an adult White-tailed Kite capturing a vesper bat (Vespertilionidae) on the 21st of June, 2006, in Barva, Heredia, Costa Rica (10° 01' N – 84° 08' W; 1.100 m a.s.l.). At ~16:30 h, we observed the kite hovering *ca.* 30 m over grasslands and, at the same moment, a bat passed flying at *ca.* 50 m from the kite. The kite stopped hovering and flew towards the bat, which immediately flew to a tree in a garden and perched on the edge of a bromeliad leaf 7 m off the ground. After the bat perched, the kite continued to fly far from the tree, and then returned to the tree *ca.* 1 min later. When the kite approached the bromeliad, it turned its body 90° towards the plant and captured the bat with its right claw. The kite continued flying with the bat, presumably to find a place to eat it. Raptor predation on bats seems to be a fairly common and opportunistic event; according to a review by Mikula *et al.* (2016), these flying mammals have been recorded as part of the diets of 143 species of diurnal raptors from 47 genera. For the genus *Elanus*, there are reports of predation on bats only by the Black-winged Kite (*E. caeruleus*). For the genus *Leptodon*, this is the first report worldwide (Mikula *et al.* 2016). Although most of these species only hunt bats to supplement their diets (Baker 1962), the Bat Hawk (*Macheiramphus alcinus*) and the Bat Falcon (*Falco rufigularis*) are regular predators of bats. In the Neotropics, where bats are very abundant (LaVal & Rodríguez-H 2002), it is likely that they are included in the diets of numerous raptor species, although these kinds of events are difficult to record.

Black Hawk-Eagle (*Spizaetus tyrannus*) – We observed a Black Hawk-Eagle scavenging on the carcasses of a paca (*Cuniculus paca*) on the 15th of November, 2008, at El Imposible National Park, Ahuachapán, El Salvador (13° 50' N – 89° 55' W, 1.300 m a.s.l.). The eagle was part of a group of four Black Vultures (*Coragyps atratus*) and two Turkey Vultures (*Cathartes aura*) that were ripping off the rest of the flesh attached to the bones of the dead paca on the ground of the forest edge. The observed behavior is similar to the scavenging behavior described for the closely related Ornate Hawk-Eagle (*S. ornatus*) in Brazil (Jones & Dorward 2014). Although the Black Hawk-Eagle is classified as an active hunter, specialized in hunting ambush birds and mammals from perches inside the forest or from the air (Robinson 1994, Ferguson-Lees & Christie 2001), scavenging could be an opportunistic behavior in the case

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of the scarcity of living prey (Jones & Dorward 2014).

Lesson's Motmot (*Momotus lessonii*) – We observed an adult Lesson's Motmot predating a nestling of a Clay-colored Thrush (*Turdus grayi*) on the 6th of May, 2013, in Brasil de Mora, San José, Costa Rica (9° 55' N - 84° 14' W, 790 m a.s.l.). The motmot was first seen perched on a branch holding the nestling in its bill. We suggest that the nestling was already dead and headless. The motmot was repeatedly hitting the nestling against a branch when suddenly a pair of the Clay-colored Thrushes began to 'harass' the motmot. After being mobbed by the thrushes for 1–2 min, the motmot flew *ca.* 10 m away, passed over a mesh fence, and landed on the ground where it continued to smash the prey against the ground for approximately 4 min (Fig. 4A). Another motmot landed on a branch ∼1 m above and wagged its tail causing the motmot (with the nestling) to fly away. On the 19th of October, 2018, at the same locality, we observed a Lesson's Motmot predating on a juvenile brown rat (*Rattus norvegicus*). As in the other observation, the motmot was first seen perched on a superficial root holding the already dead prey in its bill (Fig. 4B). The motmot hit the juvenile rat against the root repeatedly for at least 35 min, while continuously changing its position within the perch site and occasionally dropping its prey on the ground to eventually pick it up again to hit it against the ground at another angle. A dog that passed by made the motmot change its perch site to a branch in the same tree *ca.* 2 m above the ground (Fig. 4C). The same behavior of smashing its prey against the perch was seen here for *ca.* 2 min until the motmot dropped it to the ground, picked it up, and flew out of our sight with the rat in its bill. Although we could not see the consumption of either the two events, we assume that the preys were consumed because similar and bigger prey have been previously reported as items in the Lesson's Motmot's diet (*e.g.*, Chacón-Madrigal & Barrantes 2004, Reid & Sánchez-Gutiérrez 2010). Motmots are well known for being omnivorous although their diet is mainly composed of invertebrates and fruits (Remsen *et al.* 1993, Stiles & Skutch 2007). Predation on birds by the Lesson's motmot is quite rare with predation reports only of a hummingbird (García-C & Zahawi 2006) and of a fledgling seed-eater (Reid & Sánchez-Gutiérrez 2010), indicating the opportunistic and omnivorous behavior of this species. It is also important to note our observation of a third predator species of the Clay-Colored Thrush nestlings besides araçaris and forest-falcons (Robinson & Robinson 2001), and presumably squirrels (Dyrcz 1983). Rodents are known to be predated by motmots but information is scarce with only two reports, one of a rice rat in Southern Costa Rica (Reid & Sánchez-Gutiérrez 2010) and one of a grass mouse in South America (Delgado-V & Brooks 2003).

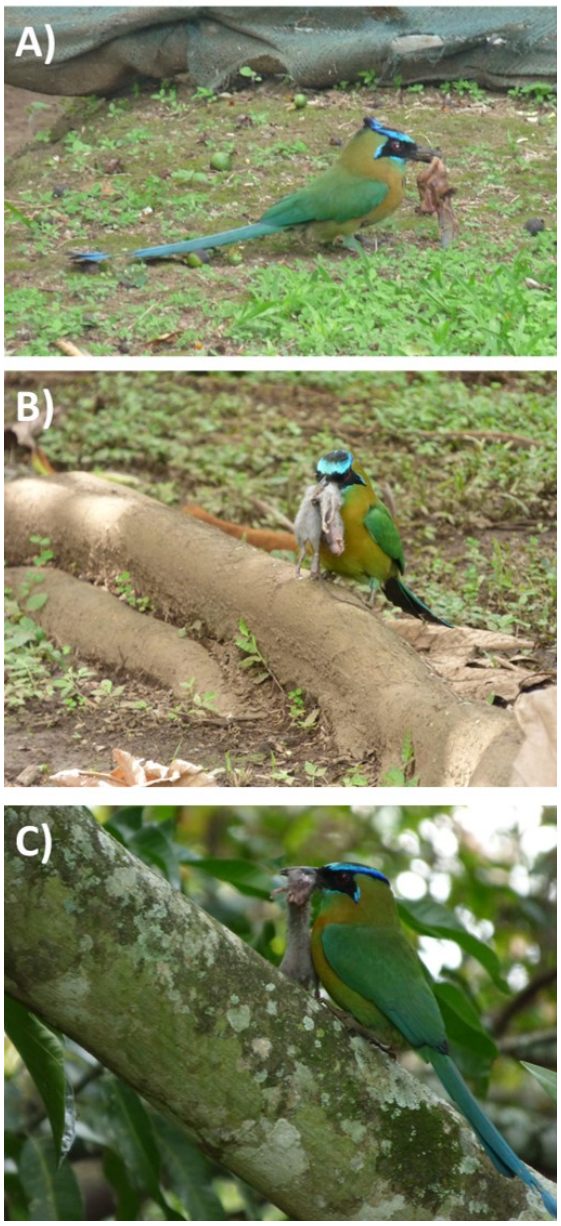

Figure 4. ***Momotus lessonii.*** **(A) An individual holding a smashed Clay-colored Thrush nestling (*Turdus grayi*) on the 6th of May, 2013, San José, Costa Rica. (B, C) An individual holding a juvenile brown rat (*Rattus norvegicus*) in its bill on the 19th of October, 2018, San José, Costa Rica.**

Crimson-fronted Parakeet (*Psittacara finschi*) – We observed five Crimson-fronted Parakeets consuming the cortex of a *Melaleuca quinquenervia* (Myrtaceae) on the 17th of September, 2008, in Ciudad de la Investigación, Universidad de Costa Rica, San José, Costa Rica (09° 56' N – 84° 02' W, 1.226 m a.s.l.). The parakeets bit the external layer of the branches and main trunk several times and ate small pieces of the cortex. We observed this behavior for *ca.* 5 min until the individuals

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flew off of the tree. The consumption of wood is uncommon within parrots and allies, with reports of the chicks of the Scarlet Macaw (*Ara macao*), Red-crowned Parrot (*Amazona viridigenalis*), Lilac-crowned Parrot (*Amazona finschi*) (Enkerlin-Hoeflich & Hogan 1997, Renton 1998, Renton 2006), in adults of six species (no species names provided) at Madre de Dios, Peru (Lee *et al.* 2014), and four species (*Ara chloropterus*, *A. macao*, *A. severus*, and *Pionites leucogaster*) in Manu National Park and Tambopata-Candamo Reserve Zone, Peru (Gilardi & Toft 2012). The consumption of wood function is unknown, but it may provide fiber and minerals or help in food detoxification similar to clay.

White-crowned Parrot (*Pionus senilis*) – We observed a flock of 16 White-crowned Parrots in the canopy of an oak tree (*Quercus* sp., Fagaceae) eating green acorns on the 7th of December, 2008, at Reserva Biológica El Copal, Jiménez, Cartago, Costa Rica (09° 47' N – 83° 45' W, 1.100 m a.s.l.). The parrots first grabbed the acorns with their beaks then passed it to their feet. After holding the acorn with their feet, the parrots pecked the acorns and started to turn them with their feet, making a circle with their heads close to the fruit tip at the same time (Fig. 5). Then they dropped the acorn and grab another one. This behavior was observed for *ca.* 12 min. The diet of this parrot is poorly documented, but mainly consists of fruits and seeds, and the consumption of acorns has not been previously recorded (Stiles & Skutch 2007, Collar *et al.* 2018). Although acorns are part of the diet of several bird species in North America (Van Dersal 1940) and of introduced parrots (*Amazona oratrix* and *A. aestiva xanthopteryx*) in Germany (Martens *et al.* 2013), to our best knowledge, there has been no published records on Neotropical parrot species eating acorns in their natural habitats.

Figure 5. An acorn that was eaten and dropped by a White-crowned Parrot *Pionus senilis* from an oak tree (*Quercus* sp.) on the 7th of December, 2008, Cartago, Costa Rica. The hole made to consume the core of the acorn is shown.

Mealy Parrot (*Amazona farinosa*) – An individual of the Mealy Parrot was observed eating the mosses off of a tree on the 13th of September, 2015, at Rainforest Adventures Atlantic Park Pococí, Limón, Costa Rica (10° 11' N – 83° 55' W, 550 m a.s.l.). The parrot grabbed a piece of moss from a branch with its foot and then moved it to its beak (Fig. 6A) and ate small pieces. The parrot then grabbed another piece of moss with its beak (Fig. 6B), passed it to its foot, and ate small pieces. Moss consumption by Neotropical parrots is not reported in the literature to our knowledge. Although, lichens have been reported as part of the diet of the Blue-and-Yellow (*Ara ararauna*) and Red-and-Green Macaw (*A. chloropterus*) in Peru (Lee *et al.* 2014). The reason why this parrot ate moss is unknown, but it may help in food detoxification.

Figure 6. *Amazona farinosa*. (A, B) An individual eating and grabbing pieces of moss from a branch with its beak on the 13th of September, 2015, Limón, Costa Rica.

Tropical Kingbird (*Tyrannus melacholicus*) – We observed an individual of the Tropical Kingbird feeding on a common house gecko (*Hemidactylus frenatus*) on the 9th of July, 2006, in Guadalupe, San José, Costa Rica (9° 56' N – 84° 03' W, 1.200 m a.s.l.). The flycatcher flew from an electrical wire to a wall where the gecko was perched, and

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the gecko fell to the ground. The flycatcher came back to the wire and kept looking at the ground for around 2 min to then descend and catch the gecko. With the gecko in its beak, the flycatcher returned to its perch and started hitting the gecko against the wire for less than 1 min to then swallow it with lateral head movements. The Tropical Kingbird diet is dominated by arthropods and fruits (Skutch 1980, Wheelwrigth *et al.* 1984, Fitzpatrick 2004), and except for one piscivory report (González-Oreja & Jiménez-Moreno 2018), vertebrates are rare in its diet. However, in Costa Rica, the common house gecko is commonly found around human habitations throughout the country (0–1.600 m a.s.l.), and this abundance makes the gecko potential prey for other vertebrates, especially birds (Barquero & Hilje 2005, Sandoval *et al.* 2008).

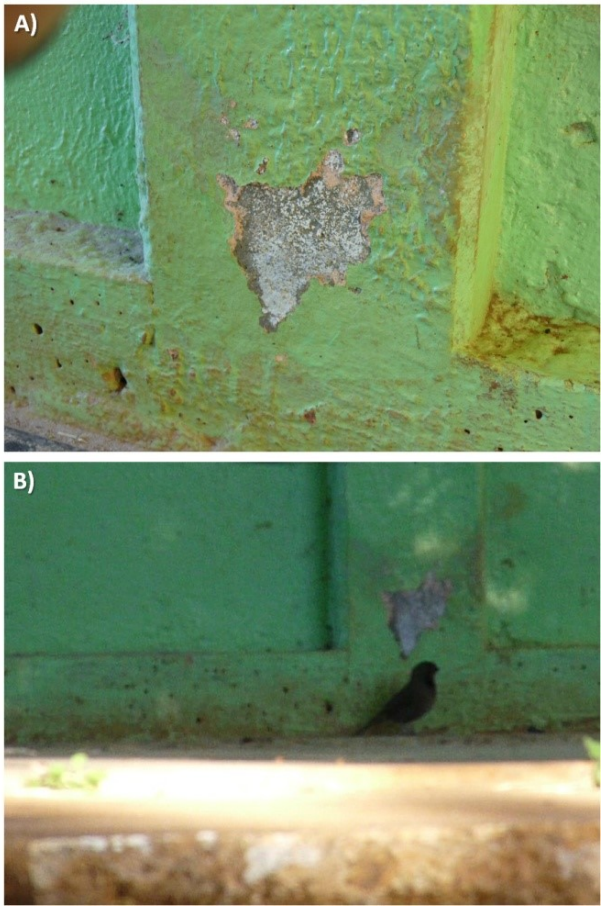

Figure 7. ***Tiaris olivaceus*****. (A) White mold on a concrete wall and (B) a Yellow-faced Grassquit female next to the mold after eating of it on the 20th of December, 2012, San José, Costa Rica.**

Yellow-faced Grassquit (*Tiaris olivaceus*) – We observed a female of the Yellow-faced Grassquit eating a white mold from a concrete wall on the 20th of December, 2012, in La Potenciana, San José, Costa Rica (9° 47' N – 84° 27' W, 1.310 m a.s.l.). The grassquit was perching on the ground next to the wall (Fig. 7), and with small jumps towards the wall, it picked pieces of the white mold with its beak. This behavior was observed for approximately 5 min. Although mycophagy by birds has been known since 1904 (Bailey 1904), reports of this behavior are uncommon (Tanney & Hutchison 2011), even when it has been observed in species from different families such as Dromaiidae, Casuariidae, Megapodiidae, Menuridae, Odontophoridae, Phasianidae, Tetraonidae, Psittacidae, Prunellidae, and Alaudidae (Simpson 2000, Tanney & Hutchison 2011, Elliott & Vernes 2018). Benefits of mycophagy to birds include amino acids and digestible nitrogen (Wallis *et al.* 2012). This species may have been using the mold to complement its granivorous diet.

Conclusions

We provided new information on the diet items of 11 Neotropical bird species, which adds valuable information to recent reports (*e.g.*, Acevedo-Quintero 2012, Sandoval *et al.* 2008, Acosta-Chaves *et al.* 2015). Some of the consumption observations reported here, such as the feeding of the tree cortex and moss by parrots, the crackers by the Ruddy Turnstone, and the fungus by the Yellow-faced Grassquit, are rare and, to our knowledge, poorly understood. These of observations are essential to our understanding of some basic aspects of the natural history of Neotropical birds, and are especially important given the difficulty in recording such events in the field (Speakman 1991, Acosta & Morún 2014) in combination with the decline in field biology skills to capture these occurrences (Warren 2015).

Acknowledgements

LS thanks Vicerrectoría de Investigación for supporting the project Colecciones del Museo de Zoología (11-B6-773) and the Escuela de Biología, Universidad de Costa Rica, for their part-time support. We also thank Freddy Vargas, Alan Rodríguez, and Rainforest Adventures Atlantic Park for sharing and allowing us to use the observation of the Mealy Parrot.

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