

FIELD NOTE

Fruit-eating by an obligate insectivore: palm fruit consumption in wild northern tamanduas (*Tamandua mexicana*) in Panamá

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Abstract Anteaters (Myrmecophagidae and Cyclopedidae) are known to be specialist predators of ants and termites. Many types of fruits are included in the diets of captive anteaters, even though fruit-eating in the wild has only rarely been reported. During a 2008–2010 telemetry study of northern tamanduas (*Tamandua mexicana*) on Barro Colorado Island, Panamá, several individuals were witnessed consuming ripe fruits of the palm tree *Attalea butyracea*. I propose that northern tamanduas regularly seek out fruit as a supplement to their insect diet. *Attalea butyracea* fruit is seasonally abundant throughout Central America and can provide low-cost enrichment for captive tamanduas.

Keywords: anteater, *Attalea butyracea*, diet, palm fruit, *Tamandua mexicana*

Consumo de frutos por un insectívoro obligado: ingesta de frutos de palmera en tamandúas silvestres (*Tamandua mexicana*) en Panamá

Resumen Los osos hormigueros (Myrmecophagidae y Cyclopedidae) son depredadores especializados de las hormigas y las termitas. Diversas frutas están incluidas en la dieta de los osos hormigueros mantenidos en cautiverio, aunque no hay muchos registros del consumo de frutas en estado silvestre. Durante una investigación de telemetría (2008–2010) con *Tamandua mexicana* en la Isla de Barro Colorado, Panamá, la autora fue testiga del consumo de frutos maduros de la palmera *Attalea butyracea* por parte de tamandúas. Se propone que *T. mexicana* busca frutos como suplemento a su dieta de insectos. Los frutos de *A. butyracea* son abundantes y están disponibles estacionalmente en toda América Central. Podrían ser utilizados como elemento de enriquecimiento a bajo costo para tamandúas mantenidos en cautiverio.

Palabras clave: *Attalea butyracea*, dieta, fruto de la palma, tamandúa, *Tamandua mexicana*

Anteaters (Myrmecophagidae and Cyclopedidae) are known in the wild to be obligate specialists on social insects, consuming primarily ants and termites, and occasionally bees, beetle larvae, and other aggregated arthropods (Silveira, 1968; Lubin *et al.*, 1977; Best & Harada, 1985; Redford, 1985, 1986; Medri *et al.*, 2003; Miranda *et al.*, 2003; Miranda *et al.*, 2009). Nevertheless, anteaters in captivity are regularly maintained on diets that include a wide variety of fruit, in addition to meat, milk, dry animal chow, and honey (Meritt, 1976; Cuarón, 1987; Oyarzun *et al.*, 1996; Morford & Meyers, 2003; Pérez Jimeno, 2003; Huff, 2010; Kusuda *et al.*, 2011). It is

unclear how fruits have become part of the standard captive diet since the scarce reports of wild anteaters consuming fruit have implied that the behavior is infrequent (Meritt, 1975). One previous observer of a northern tamandua (*Tamandua mexicana*) eating fruit suggested it was the accidental consequence of the anteater seeking out and consuming insect larvae living inside the fruit (van Eijk, 2005).

During a recent telemetry study of the northern tamandua population on Barro Colorado Island, Panama (9°9'N, 79°51'W), several individuals were witnessed consuming the ripe fruits of the palm

Attalea butyracea. On 19 June and again on 26 June 2009, a female *T. mexicana* was observed climbing into a palm and sitting down on top of a large cluster of palm fruits. Plucking one at a time, her method was to hold the fruit in one forepaw, crack the hard exocarp by squeezing the largest two claws against the pad of the forepaw, and then use the claws on the opposite forepaw to pinch, scoop, and scrape the pulp out of the fruit (FIG. 1A–C). Simultaneously, the anteater flicked her tongue in and out of the fruit and used her lips to pull bits of pulp away from the seed. When she finished with each fruit, she simply dropped it. The anteater did not consume every fruit that she chose, but during 63 minutes of observation she spent an average of 1 min 54 s on each fruit she ate ($n = 7$ fruits). Another researcher reported a different individual consuming *A. butyracea* fruits in the same manner on 8 July 2009 (Margaret Crofoot, pers. comm.).

In a concurrent study of animal visitation to fruiting palm trees conducted between June and August 2009, northern tamanduas represented 4% of the mammalian visits to *A. butyracea* fruit aggregations (on the ground) but only at 10% of the trees that were monitored, suggesting that not all *A. butyracea* trees and fallen fruits attracted the tamanduas living in the vicinity (Maas, 2010). However, the results of that study were from cameras aimed at fruit already on the ground, so anteaters feeding on fruits still in the tree, like those witnessed, would have been missed. The single previous record of a northern tamandua feeding on fruit (*A. butyracea*, on the ground) reported that the fruits being consumed were ripe and contained large numbers of fly larvae which could be seen trying to escape from the fruit (van Eijk, 2005). No fly larvae were apparent in observations of the anteaters feeding in the trees.



FIGURE 1. Northern tamandua consuming fruits of the palm *Attalea butyracea* on Barro Colorado Island, Panamá, June 2009. A) Anteater sitting on fruit cluster in the palm tree (Photo by Nick Baker). B) Close-up of fruit-eating behavior. C) Video-still showing the use of the largest claws to manipulate the fruit (Photos by author).

Furthermore, five of the fruits discarded by the animal bore no evidence of having been infested by insects.

On 16 February 2010, at the same study site, a male *T. mexicana* kept overnight was offered thawed, peeled *A. butyracea* fruits. He chose the softest (most ripe) fruits to consume and ate five over three hours, using both forepaws and his tongue in the same manner as previously described for the female. On 1 March 2010, a pregnant female kept overnight was also offered thawed fruits, and although she sniffed at the fruits and removed them from their container, she did not consume any. Finally, during my study I was not able to successfully lure any northern tamanduas into a trap baited with *A. butyracea* fruits. A single trap used in an arboreal mammal census on the island during the 1990s was baited with either mango or papaya and caught a young *T. mexicana* that consumed the fruit (Karen Reiss, pers. comm.).

Fruits offered to anteaters in captivity are typically acidic, such as oranges, mangos, and apples (Meritt, 1976; Morford & Meyers, 2003; Huff, 2010). For example, oranges have a pH of 2.8–4.2 (Grobler *et al.*, 1989). To compare the acidity of palm fruits to those consumed in captivity, seven *A. butyracea* fruits were collected from one of the palms that the female tamandua had been seen feeding in. Two of the fruits had been partially consumed by the anteater, the others had fallen from the tree as a consequence of her foraging. Each fruit was peeled and the soft mesocarp was diced and homogenized. Two pH strips per fruit sample, sensitive in the range of 3–7, were applied to each mixture and the pH was recorded. The average pH of seven fruits was 5.07 (range 5–5.5). If the acidity of the tested fruits was representative of those usually consumed by the tamandua, *A. butyracea* is considerably less acidic than many of the fruits fed to captive animals.

Based on the observations and the scattered reports in the literature, I propose that wild northern tamanduas seek out fruit as a regular part of their diet. The morphology of their mouths, however, may prevent them from consuming whole fruits and seeds, especially for larger fruits such as those of *A. butyracea*. As a result there is unlikely to be evidence of this fruit-eating habit in the feces, and this may explain why the behavior is perceived to be uncommon.

Attalea butyracea is a common and widely distributed palm species across the Neotropics (Silvius, 2002) and produces large clusters containing hundreds of individual fruits (FIG. 1A). Where northern tamanduas are held in captive conditions within their natural geographic range, fruits of *A. butyracea* should be seasonally available and are easily collected in large quantities and stored frozen, providing a low-cost option for dietary supplementation. An additional benefit of *A. butyracea* fruit is that it can be

safely given intact to the animals and the process of selecting, opening, and consuming the fruit should provide behavioral enrichment and stimulation.

REFERENCES

- Best, R. C. & A. Y. Harada. 1985. Food habits of the silky anteater (*Cyclopes didactylus*) in the central Amazon. *Journal of Mammalogy* 66: 780–781.
- Cuarón, A. D. 1987. Hand-rearing a Mexican anteater *Tamandua mexicana* at Tuxtla Gutiérrez Zoo. *International Zoo Yearbook*: 255–260.
- Grobler, S. R., P. J. C. Senekal & T. J. V. W. Kotze. 1989. The degree of enamel erosion by five different kinds of fruit. *Clinical Preventive Dentistry* 11: 23–28.
- Huff, A. 2010. Behavior of captive giant anteaters (*Myrmecophaga tridactyla*) in response to novel food enrichment. Masters Thesis, Middle Tennessee State University, Murfreesboro. 57 pp.
- Kusuda, S., T. Endoh, H. Tanaka, I. Adachi, O. Doi & J. Kimura. 2011. Relationship between gonadal steroid hormones and vulvar bleeding in southern tamandua, *Tamandua tetradactyla*. *Zoo Biology* 30: 212–217.
- Lubin, Y. D., G. G. Montgomery & O. P. Young. 1977. Food resources of anteaters [Edentata, Myrmecophagidae] part 1: A year's census of arboreal nests of ants and termites on Barro Colorado Island, Panama canal zone. *Biotropica* 9: 26–34.
- Maas, V. 2010. Competition and resource partitioning in a Neotropical frugivorous mammal community. Masters Thesis, Wageningen University, Wageningen. 30 pp.
- Medri, Í. M., G. M. Mourão & A. Y. Harada. 2003. Dieta de tamanduá-bandeira (*Myrmecophaga tridactyla*) no Pantanal da Nhecolândia, Brasil. *Edentata* 5: 29–34.
- Meritt, D. A. 1975. The lesser anteater *Tamandua tetradactyla* in captivity. *International Zoo Yearbook* 15: 41–44.
- Meritt, D. A. 1976. The nutrition of edentates. *International Zoo Yearbook* 16: 38–46.
- Miranda, G. H. B., F. H. G. Rodrigues, Í. M. Medri & F. V. dos Santos. 2003. Giant anteater (*Myrmecophaga tridactyla*) beehive foraging at Emas National Park, Brazil. *Edentata* 5: 55.
- Miranda, F. R., R. Veloso, M. Superina & F. J. Zara. 2009. Food habits of wild silky anteaters (*Cyclopes didactylus*) of São Luis do Maranhão, Brazil. *Edentata* 8–10: 1–5.
- Morford, S. & M. A. Meyers. 2003. Giant anteater (*Myrmecophaga tridactyla*) diet survey. *Edentata* 5: 20–24.
- Oyarzun, S. E., G. J. Crawshaw & E. V. Valdes. 1996. Nutrition of the tamandua I. Nutrient composition of termites (*Nasutitermes* spp.) and stomach contents from wild tamanduas (*Tamandua tetradactyla*). *Zoo Biology* 15: 509–524.
- Pérez Jimeno, G. 2003. Crianza artificial y manejo reproductivo de los tamandúá (*Tamandua tetradactyla*) en el Jardín Zoológico de Rosario, Argentina. *Edentata* 5: 24–28.
- Redford, K. H. 1985. Feeding and food preference in captive and wild giant anteaters *Myrmecophaga tridactyla*. *Journal of Zoology (London)* 205: 559–572.
- Redford, K. H. 1986. Dietary specialization and variation in two mammalian myrmecophages: variation in mammalian myrmecophagy. *Revista Chilena de Historia Natural* 59: 201–208.
- Silveira, E. K. P. 1968. Notas sobre a história natural do tamandúá mirim (*Tamandua tetradactyla chiriquensis*, Allen 1904, Myrmecophagidae), com referências à fauna do istmo do Panamá. *Vellozia* 6: 9–31.
- Silvius, K. M. 2002. Spatio-temporal patterns of palm endocarp use by three Amazonian forest mammals: granivory or 'grubivory'? *Journal of Tropical Ecology* 18: 707–723.
- van Eijk, P. 2005. The impact of hunting on seed dispersal, survival and seedling recruitment in a tropical palm species. Interactions among agoutis, bruchid beetles and the palm *Astrocaryum standleyanum* in a Panamanian rainforest. Masters Thesis, Rijksuniversiteit Groningen, Haren. 59 pp.

Received 14 August 2011; Accepted 3 October 2011