Scientific and traditional knowledge meet: diet of the lowland tapir *Tapirus terrestris* in the Orinoquia region of Colombia

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Abstract

Scientific and traditional knowledge meet: diet of the lowland tapir Tapirus terrestris *in the Orinoquia region of Colombia.* The lowland tapir *Tapirus terrestris* is the second largest mammal in South America. It occupies a wide variety of ecosystems where it fulfills key functional roles. It is mainly folivorous, supplementing its diet with fruits, insects, and aquatic invertebrates. The lowland tapir is considered fundamental in shaping forest undergrowth and in seed dispersal processes. Despite its functional importance, ecological aspects related to diet, habitat use, and food preferences are still unknown in much of its geographic range. Currently, these aspects in the Colombian Orinoquia are unknown. We wanted to develop an approximation to the diet of the lowland tapir in the Colombian Orinoquia based on analysis of fecal samples and traditional knowledge derived from citizen science monitoring. Fecal samples were collected between October 2015 and July 2018 and vegetation monitoring and interviews with local communities were implemented. We recorded a total of 37 species of plants, 23 species of which were determined through traditional knowledge. The most representative species in fecal samples were *Rudgea crassiloba, Attalea butyracea, Inga alba* and *Cecropia peltata*. The plants most commonly recognized by local communities were *Mauritia flexuosa, A. butyracea*, *Bellucia grossularioides* and *I. alba*. Our results provide insight into the importance of tapirs in the consumption of large seeds such as *M. flexuosa* and *A. butyracea* that are considered of economic relevance for local communities. Incorporating citizen science monitoring allowed us to identify plant species that are taxonomically difficult to distinguish and to evaluate new information related to the natural history of cryptic species such as tapirs. This information is crucial to establish conservation strategies for the lowland tapir in the Orinoquia region of Colombia.

Key words: Citizen science monitoring, Conservation, Diet, Ecology, Feeding, Foraging, Human communities

Resumen

El conocimiento científico y el tradicional se encuentran: la dieta de la danta o tapir de tierras bajas Tapirus terrestris *en la región de Orinoquia, en Colombia*. La danta o tapir de tierras bajas *Tapirus terrestris* es el segundo mamífero más grande de América del Sur y habita una gran variedad de ecosistemas donde cumple algunas funciones clave. Se trata de una especie principalmente folívora, que complementa su dieta con frutas, insectos e invertebrados acuáticos. La danta de tierras bajas se considera fundamental en la configuración del sotobosque y en los procesos de dispersión de semillas. A pesar de su importancia funcional, aún se desconocen algunos aspectos ecológicos relacionados con la dieta, el uso del hábitat y las preferencias alimentarias en gran parte de su rango geográfico. Actualmente, estos aspectos son aún desconocidos en la Orinoquia colombiana. El trabajo buscó realizar una aproximación a la dieta de la danta en la Orinoquia colombiana a partir de muestras fecales y del conocimiento tradicional recabado mediante técnicas de monitoreo basadas en la ciencia ciudadana. Las muestras fecales se recolectaron entre octubre de 2015 y julio de 2018 y se llevaron a cabo actividades de reconocimiento de vegetación y entrevistas a las comunidades locales. Se registraron 37 especies de plantas de las que 23 fueron determinadas gracias al conocimiento tradicional. Las especies más representativas en las muestras fecales fueron *Rudgea crassiloba*, *Attalea butyracea*, *Inga alba* y *Cecropia peltata*. Las plantas más reconocidas por las comunidades locales fueron *Mauritia flexuosa*, *A. butyracea*, *Bellucia grossularioides* e *I. alba*. Nuestros resultados ponen de manifiesto la importancia de

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las dantas en el consumo de semillas grandes como las de *M. flexuosa* y *A. butyracea*, que se consideran de interés económico para las comunidades locales. Asimismo, la incorporación de la ciencia ciudadana permitió registrar especies de difícil determinación taxonómica y evaluar nuevos datos relativos a la historia natural de especies crípticas como las dantas. Esta información es crucial para empezar a construir estrategias de conservación para la danta de tierras bajas en la región de Orinoquia, en Colombia.

Palabras clave: Monitoreo basado en la ciencia ciudadana, Conservación, Dieta, Ecología, Alimentación, Comunidades humanas

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Introduction

The lowland tapir *Tapirus terrestris* is the second largest mammal in South America. Its range extends from Colombia to the north of Argentina, an area considered the largest geographical range among extant tapir species (García et al., 2012; Fleming et al., 2022). Among the habitats it occupies are evergreen tropical forests, deciduous and sub–deciduous tropical forests, cloud forests, swamps, and mangroves (Cordeiro et al., 2016). In the Orinoquia region of Colombia the lowland tapir frequents flooded savannahs, and gallery, dense and riparian forests. The species is categorized as Vulnerable (VU) mainly due to habitat loss, fragmentation, and poaching (Varela et al., 2019).

Tapirs are mainly folivorous and frugivorous, but their diet also includes stems, bark, and flowers depending on the temporal availability of these items. Occasionally, they consume insects, aquatic plants, and invertebrates, and they take advantage of salt and mineral agglomerations (*salados* in Spanish) to meet their nutritional requirements (Chalukian et al., 2013). Salados are areas within forests that have a high salt content; several mammals and bird species herein consume soil (geophagy) and/or drink water to supplement their diet with minerals. The species most frequently found in these areas are frugivorous and herbivorous (Bravo et al., 2010).

This behavior around the salados may be a consequence of low availability of minerals, mainly nitrogen and sodium, in the ecosystems (Link et al., 2012). Salados not only help tapirs to meet their requirements but also to neutralize toxins from some plants that are part of their diet (Medici et al., 2012). Secondary forests are generally preferred for foraging due to their high production of young leaves that is stimulated by the increase in light (de Luca and Pardini, 2017). In contrast, habitats altered for agriculture, plantations, and grazing are usually avoided (García et al., 2012).

The lowland tapir is considered a key species in ecosystems since it fulfills a series of key ecological roles in the dynamics of tropical forests. The species is considered an important seed disperser, especially as the almost–exclusive disperser of large palm seeds (Franco–Quimbay and Rojas–Robles, 2014). Also, they disperse a wide spectrum of plant species, with approximately 300 species belonging to 66 families having been recorded in their diet (Galetti et al., 2001; Tobler et al., 2008; Medici et al., 2012; Barcelos et al., 2013). Lowland tapirs are one of the few species of large mammals that defecate a wide variety of intact seeds (Tobler et al., 2010). They are also considered ecosystem engineers because through herbivory, they help to mold the underground dynamics of the forests, thus contributing to regeneration and maintenance of the forest understory and canopy (Fragoso, 1997). Though frugivory, tapirs are key determinants of primary distribution, flux, and genetic structure of the plans they disperse (Giombini et al., 2016). Additionally, they act in the identification and creation of mineral stones in tropical forests (Wallace et al., 2012; Cruz et al., 2014). Tapirs are also considered key resources for top predators (i.e., jaguars and cougars) (Azevedo et al., 2016; Entringer et al., 2022) as well for indigenous communities in the Amazon (Bodmer et al., 2020).

Despite the ecological importance of tapirs, relevant aspects of their ecology (e.g., diet, selection and habitat use, population structure, and density) are still unknown in much of their geographic range. In Colombia, few studies have described diet and habitat use, and most have focused on *Tapirus terrestris* in the Caribbean (Arias–Alzate, 2008) and Amazonian populations (Vélez et al., 2017). Dietary aspects, foraging, and preferences of the lowland tapir in the Orinoquia region remain unknown. In this study, we propose an approximation of the diet of the lowland tapir in the Colombian Orinoquia, integrating scientific and traditional knowledge of human communities. The findings will help generate greater understanding related to habitat use that will serve as support for the development of conservation and management strategies focused on tapirs in this region.

Material and methods

Study area

The Orinoquia region of Colombia is divided into four departments, three of which compose the study area: Arauca, Casanare, and Vichada. In Arauca, data were collected in the municipalities of Puerto Rondón (6º 30' 11.98'' N, 70º 41' 38.87'' W) y Cravo Norte (6º 25' 11.98'' N, 69º 49' 35.35'' W); at Casanare in Paz de Ariporo (6º 3' 33.56'' N, 69º 58' 50.82'' W); and at Vichada in La Primavera (5º 44' 51.01'' N, 69º 8' 18.78'' W) and Puerto Carreño (6º 7' 11.93'' N, 67º 45' 50.07'' W) (fig. 1). In general, annual temperature ranges between 22 ºC and 36 ºC, and rainfall averages 2,000 mm. The region has a unimodal regime where the rainy season (winter) lasts from May to October and the dry season (summer) from November to April. The Orinoquia is characterized by large extensions of savannas and complex networks of gallery and riparian forests. The Orinoquia is complex and diverse and presents functional relationships with the Amazon and Andean regions, which makes it specifically different from the Venezuelan Orinoco (Lasso et al., 2011). Consequently, the Orinoquia has biotic and abiotic particularities, and there is an ensemble of diverse, unique ecosystems, ecological functions, and ecosystem services. The Orinoquia is considered one of the richest and most biodiverse areas of Colombia (Correa–Gómez and Stevenson, 2010).

It presents strong transformations in a large part of its territory due to predominant anthropic activities such as non–traditional extensive livestock farming and monocultures. In general, the region has traditionally been devoted to ranching and its cultural development is strongly linked to dairy farming and traditional livestock management. Transformation and habitat loss are predominant in the department of Casanare, due to the rapid expansion of palm oil and rice crops (Ocampo–Peñuela et al., 2018). In Arauca, forest loss and fragmentation occurs mainly because of active armed conflict and fossil–fuel extraction (Cárdenas Sánchez and Dueñas Ruíz, 2021). In Vichada, landcover transformation is linked to the expansion of reforesting of exotic and invasive species such as acacia and eucalyptus.

Gallery and riparian forests can be classified as deciduous, semi–deciduous, or evergreen, and are affected by seasonality and plant composition. These forests are key elements in sustaining biodiversity because of their structural and functional heterogeneity (Correa–Gómez and Stevenson, 2010). This structural and functional heterogeneity, in addition to the small area occupied compared to other forest ecosystems in Colombia, makes these ecosystems key elements for the conservation of particular species of fauna and flora. In contrast, savannas are characterized as being transition zones between forests, operating as biological corridors and as permanence sites for a high richness of specialist species such as the Llanos long–nosed armadillo *Dayspus sabanicola* (Superina et al., 2014). The savannas can be classified as woody, open seasonal, hyper–seasonal or semi–seasonal savannas, depending on annual precipitation levels (Hernández–Valencia et al., 2018; Rodríguez–Durán et al., 2018). Hyper–seasonal savannas or floodplain savannas are endemic to the Llanos of Colombia and Venezuela.

Fecal sample collection and preparation

Fecal samples were collected between October 2015 and July 2018 during six camera trap monitoring events. Camera trap installation sites were selected according to a previous spatial distribution modeling and habitat suitability analysis for the species in the Orinoquia region. Camera traps were installed to validate the distribution models and generate regional conservation strategies for tapirs. At each sampling site, a grid composed of 1 km^2 grids was generated. Forty cameras were randomly installed therein, and programmed to operate for 24 hours during 60 effective sampling days. Installation sites within each grid were selected based on the observation of footprints, feeders, trails, and feces following the methodology proposed by TEAM Network (Jansen et al., 2014).

In camera trap deployments, 12 fecal samples were recorded and collected. Additionally, three samples were collected in areas where vegetation surveys and interviews with local communities were carried out, but camera traps were not installed. As information on the composition of plant communities was available, fecal samples were incorporated into the diet analysis. Fecal samples were collected whole for further analysis and were preserved in 70 % alcohol to prevent plant material decomposition. During the laboratory phase, each fecal sample was separated into 15 g subsamples to facilitate processing.

Dietary items were separated and categorized as seeds, vegetable fibers, leaves, flowers, and arthropods. Plant material was oven–dried for two days at 60 ºC to prevent fungal growth during storage. Arthropods were preserved in 70 % alcohol. The various seeds found in the samples were separated according to their by morphology (size, color, and shape) and classified by morphotypes. Taxonomic identification of seeds was performed by a botanic specialist and by comparing morphotypes with available reference collections at the Museum (MPUJ) and Herbarium (HPUJ) of Pontificia Universidad Javeriana, Bogotá–Colombia.

Vegetation surveys and compilation of traditional knowledge

Vegetation surveys were carried out in six 20 x 50 m Gentry–type transects in each sampling point (Gentry, 1988). In total, 10 transects were conducted in each department. At each survey point, an area of 1 ha was sampled, mainly in gallery, riparian and dense forests. Within transects, we counted all individual samples that had stems ≥ 2.5 cm or CAP ≥ 7.8 cm (1.3 m from the soil surface).

Plant surveys and transects were implemented with members of the local communities of each sampling point. During the collection of botanical samples, we collected information on common names, traditional uses, and whether the plant was consumed by tapirs. Furthermore, interviews were carried out with community leaders, older adults, sawyers, and those who had extensive botanical knowledge of the region. Plant species consumed by tapirs were identified from traditional knowledge of local communities.

Data analysis

The number of samples in which a food item was found was considered in relation to the total number of samples analyzed to obtain the overall proportion of each item. Composition of the plant assemblage found in the fecal samples was described and analyzed using a range–abundance curve. Additionally, a rarefaction analysis was carried out to determine total representativeness of the samples and to estimate the expected value of the number of plant species that could be added to the diet. A species accumulation curve was generated using EstimatesS 9 (Colwell et al., 2012).

Results

A total of 15 fecal samples were analyzed and information on the traditional knowledge of 28 people was collected. Diet was composed of 37 species and 17 families (table 1). Of the total records, 14 species were identified through fecal samples and 23 through traditional knowledge. The material determined from the feces was mainly composed of vegetable fibers and leaves (72.42 %), seeds (22.36 %), flowers (3.08 %), and insects (2.14 %). The presence of arthropods was considered an item of both accidental consumption and potential contamination of fecal samples during decomposition.

The families best represented in the diet were Rubiaceae (24 %), Arecaceae (16 %), Fabaceae (8 %), and Moraceae (8 %). Additionally, the plant assemblage consumed by tapirs was composed of trees (21), forbs

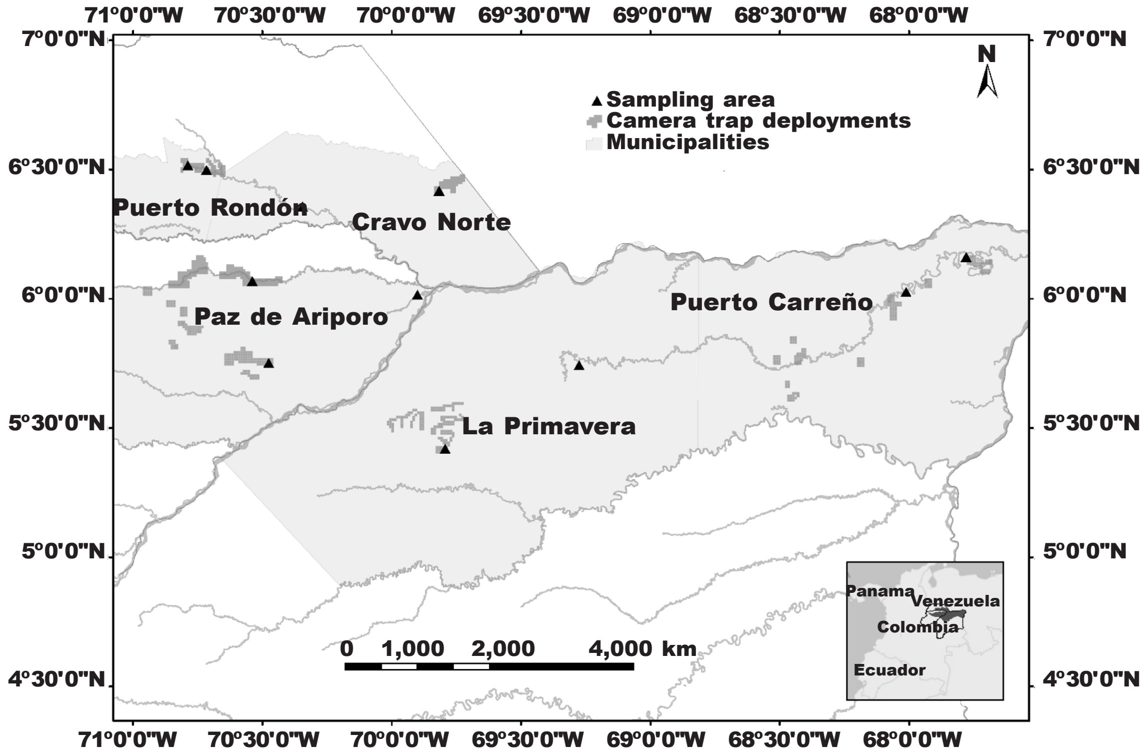

Fig. 1. General location of the study area. Black triangles represent sampling areas within municipalities. Arauca: Puerto Rondón and Cravo Norte; Casanare: Paz de Ariporo; Vichada: La Primavera and Puerto Carreño.

Fig. 1. Localización general del área de estudio. Los triángulos negros representan los sitios de muestreo dentro de los municipios. Arauca: Puerto Rondón and y Cravo Norte; Casanare: Paz de Ariporo; Vichada: La Primavera y Puerto Carreño.

(8), shrubs (4), ferns (2), and vines (2). According to the species accumulation curve, this is a plausible representation (98 %) of the plant assemblage consumed by the lowland tapir (fig. 2).

Plant species that presented a higher abundance in the fecal samples were *Rudgea crassiloba* (15 %), *Attalea butyracea* (12 %), *Inga alba* (10 %) and *Cecropia peltata* (10 %) (fig. 3). Other plants exhibited an evenness representation within the assemblage. Plant species consumed by tapirs that were mostly recognized by local communities were *Mauritia flexuosa, A. butyracea, Bellucia grossularioides* and *I. alba*.

Discussion

Our results indicate that tapirs are mainly folivorous and frugivorous. This dietary pattern is consistent with other studies conducted in South America (Henry et al., 2000; Tobler et al., 2010; Chalukian et al., 2013). According to the items found in fecal samples, tapirs in the Orinoquia region consume a high variety of fruits compared to studies with a larger sample size (Galetti et al., 2001; Chalukian et al., 2013; Vélez et al., 2017). Therefore, it is possible that tapirs are feeding on a greater number of plant species in the Orinoquia region, considering that they employ an opportunistic foraging strategy (Chalukian et al., 2013), especially during periods of low fruit availability. This observation should be further evaluated, and comparisons should be made between seasons in order to determine dietary preferences, plant importance during reproductive stages, and differential uses of resources between sexes. Comparing our list of plant species with results published in other studies (Salas, 1996; Henry et al., 2000; Galetti et al., 2000; Tobler et al., 2010; Franco–Quimbay and Rojas–Robles, 2014; Giombini et al., 2016; Vélez et al., 2017; Paolucci et al., 2019) we found 23 new species in the diet of the lowland tapir.

Although the curve reached the asymptote, a greater number of plant species in tapir diet can be expected because of the high diversity provided by gallery, riparian and dense forest exhibit. Additionally, if vegetable fibers and leaves are analyzed with histological techniques (Flores–Cascante et al., 2013), the probabilities of adding new plant species could increase. This can also occur if sampling efforts are increased, evaluating seasonal changes (Tobler et

Table 1. Plant species that are part of the lowland tapir's diet in the Colombian Orinoquia. Information on the local common name, part of the plant consumed by tapirs (PC: L, leaves; F, fruits; I, inflorescences; S, stems) and species found in the fecal samples (FS) is associated.

Tabla 1. Especies de plantas que componen la dieta de la danta de tierras bajas en la Orinoquia colombiana. Se indican el nombre común local, la parte de la planta que consumen las dantas (PC: L, hojas; F, frutos; I, inflorescencias; S, tallos) y las especies que se encontraron en las muestras fecales (FS).

Family	Species	Common name	PC	FS
Adiantaceae	*Adiantum latifolium* Lam.	Helecho	L	-
Anacardiaceae	*Spondias mombin* L.	Jobo	F	-
Annonaceae	*Annona montana* Macfad.	Guanábana	F, L	-
Apocynaceae	*Lacmellea edulis* H.Karst.	Leche miel	F	-
Arecaceae	*Astrocaryum jauari* Mart.	Macanilla	F	-
	Attalea butyracea (Mutis ex L.f.) Wess.Boer	Palma real	F	Seeds
	Attalea maripa (Aubl.) Mart.	Cucurita	F	Seeds
	Bactris major Jacq.	Cubarro	F	Seeds
	Mauritia flexuosa L.f.	Moriche	F	Seeds
	Syagrus orinocensis (Spruce) Burret	Churruway	F	Seeds
Asteraceae	*Vernonanthura brasiliana* (L.) H.Rob.	Estoraque	L	-
Costaceae	*Costus spiralis* (Jacq.) Roscoe	Caña flota	L, I	-
Chrysobalanaceae	*Licania* aff. *leptostachya* Benth.	Garrapato	F, S	-
Clusiaceae	*Garcinia madruno* (Kunth) Hammel	Madroño	F	Seeds
Fabaceae	*Copaifera pubiflora* Benth.	Aceite	F	-
	Enterolobium cyclocarpum (Jacq.) Griseb	Dormidero	F	-
	Inga alba (Sw.) Willd.	Guamo silvestre	F	Seeds
Melastomataceae	*Bellucia grossularioides* (L.) Triana	Níspero	F	-
	Mouriri myrtillioides (Sw.) Poir.	Cometure	Fs	-
Moraceae	*Ficus insipida* Willd.	Matapalo	F	Seeds
	Ficus pertusa L.f.	Matapalo	F	Seeds
	Ficus trigona L.f.	Matapalo	F	Seeds
Piperaceae	*Peperomia pellucida* (L.) Kunth	Berro	L, S	Seeds
	Piper obliquum Ruiz and Pav.	Pimienta	F	Seeds
Poaceae	*Hymenachne amplexicaulis* (Rudge) Nees	Gramalote	L, S	-
Polygonaceae	*Coccoloba caracasana* Meins.	Papaturro	F	-
	Coccoloba obtusifolia Jacq.	Vinagre	F	-
Rubiaceae	*Alibertia edulis* (Rich.) A.Rich. ex DC.	Pero	F	-
	Duroia micrantha (Ladbr.) Zarucchi and J.H.Kirkbr.	Carutillo	F	-
	Genipa americana L.	Caruto	F	-
	Isertia haenkeana DC.	Coralillo	L	-
	Palicourea crocea (Sw.) Schult.	Cafecillo	F, L	-
	Psychotria capitata Ruiz and Pav.	Jazmín	F, L	-
	Psychotria carthagenensis Jacq.	Amyruca	F, L	-
	Psychotria glomerulata (Donn. Sm.)	Guachamacá	F, L	-
	Rudgea crassiloba (Benth.) B.L.Rob.	Cafecillo	F, L	Seeds
Urticaceae	*Cecropia peltata* L.	Yarumo	L, I	Seeds

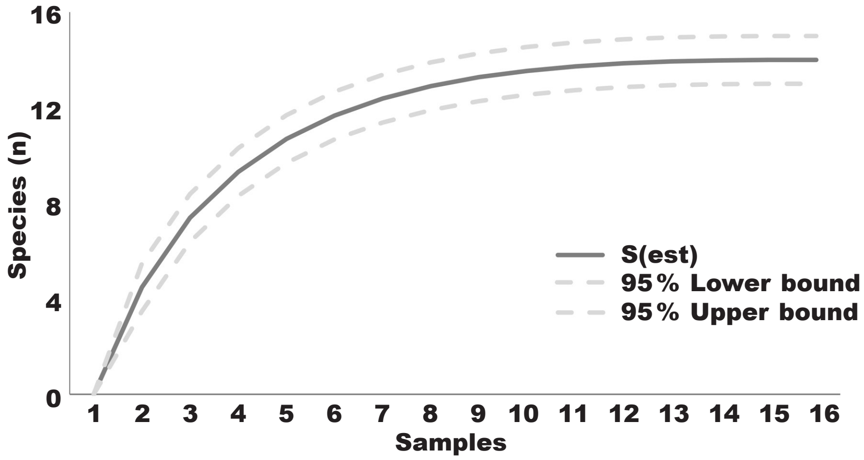

Fig. 2. Accumulation curve of plant species consumed by the lowland tapir *Tapirus terrestris*. Only those species that were found in fecal samples were included in the rarefaction analysis. Confidence intervals at 95% are included.

Fig. 2. Curva de acumulación de las especies vegetales consumidas por la danta de tierras bajas Tapirus terrestris. *En el análisis de rarefacción solo se incluyeron las especies que se habían encontrado en las muestras fecales. Los intervalos de confianza son del 95%.*

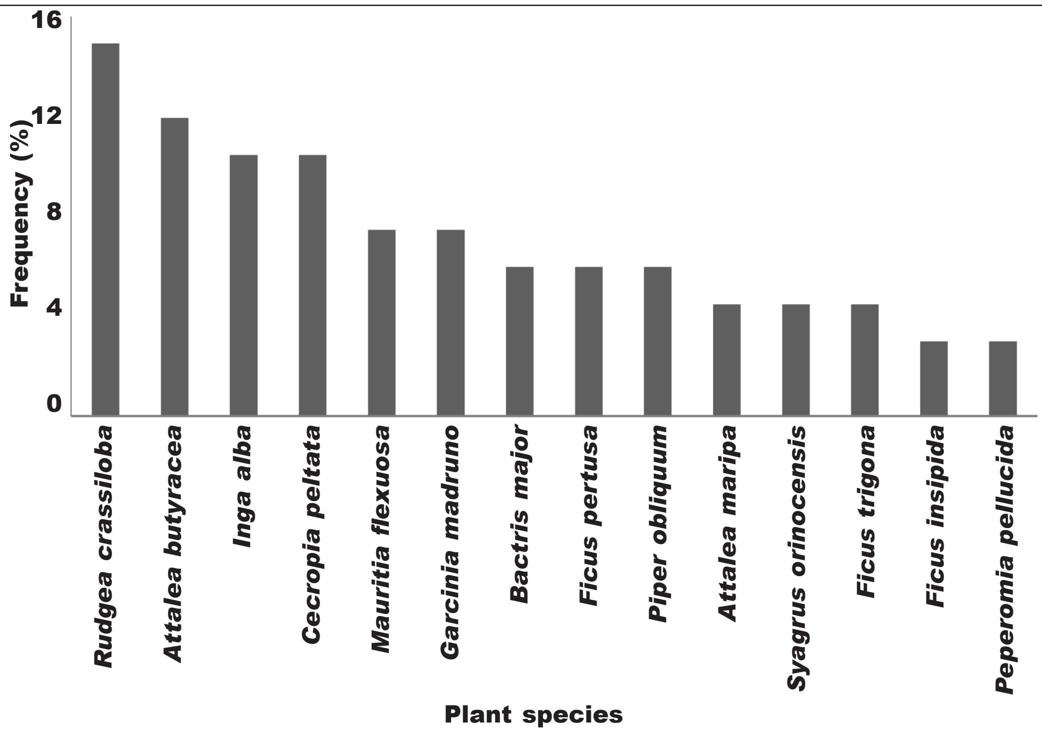

Fig. 3. Rank–abundance curve of plant species found in tapir's fecal samples. Estimations are based on the appearance frequency of the plant species in each fecal sample analyzed.

Fig. 3. Curva de rango–abundancia de las especies vegetales encontradas en las muestras fecales de danta. Las estimaciones se basan en la frecuencia de aparición de las especies vegetales en cada una de las muestras fecales analizadas.

al., 2010; Chalukian et al., 2013; Vélez et al., 2017) and possible differential consumptions of items between males and females, as has been reported in other species of frugivorous mammals (Alviz and Pérez–Torres, 2020).

In terms of species richness, Rubiaceae and Arecaceae were the most representative families. These results differ from those previously reported in the Peruvian Amazon (Tobler et al., 2010), in French Guiana (Henry et al., 2006), and in the Colombian Amazon (Solano et al., 1996), where Moraceae dominated the communities. Rubiaceae is one of the most abundant families in the neotropics, with *Psychotria* being the richest and most diverse genus (Koch et al., 2010). Fruits and leaves of species such as *P. carthagenensis* and *P. glomerulata* are frequently consumed by tapirs. The seeds of these plant species were found in the fecal samples and their use was reported through traditional knowledge. *Psychotria* species are characterized as being medicinal plants and many of them are used to treat various types of cancer (da Silva Junior et al., 2016). Species such as *P. carthagenensis* are also reported as a bioindicator of habitats in good state of conservation (da Silva Junior et al., 2021). Therefore, tapirs may be fulfilling an important role in seed dispersal of these species and in the maintenance of their natural populations.

The high frequency of the genera of the Arecaceae family is consistent with that reported in Peru (Bodmer, 1990) and Brazil (Fragoso and Huffman, 2000). These patterns suggest that changes in the tapir diet are a response to changes in plant phenology and availability of food resources throughout their geographic range. Similarly, changes could be a consequence of differential requirements during reproductive stages and between sexes (Alviz and Pérez–Torres, 2020). Arecaceae contain multiple keystone species as they are essential in the water regulation processes of tropical forests and provide multiple resources (i.e., food, shelter, habitat) for a wide variety of vertebrate fauna (Vormisto et al., 2004; Pintaud et al., 2008; Balslev et al., 2016; van der Hoek et al., 2019; Quinteros–Gómez et al., 2021). Since various seeds of the genera *Mauritia*, *Attalea* and *Syagrus* were found intact in the fecal samples, tapirs can be considered dispersers of these palm species in the Orinoquia region. These species are characterized by having edible fruits that are actively used by local communities, especially during fruiting periods. Likewise, this constitutes an opportunity to develop germination experiments and evaluate seed viability.

Among the plant species recorded, those that are constantly recognized by the human communities that tapirs consume are those that have fleshy fruit and are frequently used for human consumption, such as the moriche *Mauritia fleuxosa* and the royal palm (*Attalea butyracea*). The moriche is a keystone species that occurs in the floodplains of the Orinoquia region. It can be found in aggregations of hundreds of individuals in the savannahs (morichales), and in dozens of individuals associated with gallery and riparian forests (mixed morichales) (Virapongse et al., 2017). In addition to being a source of food and shelter for a wide variety of animals, moriche is also used by local human communities for construction materials, fibers for handicrafts, and medicinal oils. According to observations made through camera traps, tapirs actively forage in these ecosystems in search of food resources and shelter. Moriche fruits are available in the Orinoquia during the wet season (May to November), which makes it a relatively constant food source.

The royal palm, unlike the moriche, is an abundant species and is widely distributed in Colombia (Olivares and Galeano, 2013). Because it is an abundant species, fruit production and fruit availability is constant throughout the year (Pintaud et al., 2008). Several samplings allowed determination of the constant use of the fruits by several species of fauna, such as agoutis *Cuniculus paca*, black agoutis *Dasyprocta fuliginosa*, peccaries *Pecari tajacu*, and tayras *Eira barbara*. Local human communities in the Orinoquia use the leaves in roof building, in handicrafts, and also in some religious ceremonies. Fruits and sap are also used to make wine. Unlike the role played by tapirs as a seed disperser of royal palms, the role of other vertebrate species in this dispersal process is still unclear. Some of them (i.e., *P. tajacu*) could act as seed predator based on previous reports (Pérez–Cortez and Reyna–Hurtado, 2008; Galetti et al., 2015).

Through plant surveys and their relationship with traditional knowledge, other lesser–known species could be identified in the tapirs' diet, such as the species of the genera *Psychotria* spp., *Rudgea* spp. o *Palicourea* spp., some ferns *Adiantum latifolium*, and herbaceous species *Piper obliquum*. Since only stem and leaf fragments of these species are obtained in fecal samples, their taxonomic determination is difficult, and they are not generally considered in research focused on diet and foraging. It is important to include micro–histological methods in diet analyses in the future. Traditional knowledge, on the other hand, allowed us to record more than 50 % of the plants species presented here and consumed by tapirs in the Orinoquia region. Traditional knowledge can thus constitute a plausible tool in scientific research, publications, and conservation processes, especially in megadiverse countries such as Colombia.

Conclusions

Combining analysis of fecal samples with the traditional knowledge of local communities allowed us to describe the diet of tapirs in the Orinoquia region of Colombia using a broader and more complete approach. Incorporating the traditional knowledge of local human communities is fundamental for the understanding of ecological processes that are difficult to determine with current methodologies. Local human communities, especially those located in remote places, have extensive knowledge of nature and ecological processes. It is key for researchers to incorporate this traditional and social knowledge. Managing and publishing this type of knowledge for cryptic and threatened species is of vital importance to implement concrete conservation strategies focused on the reality of various regions in megadiverse countries.

Integrating such an approach into the analyses allowed us to record new species in the diet of the lowland tapir. Many of these species are key to the economic support of local human communities and have incalculable cultural value. Due to the role that tapirs play in ecosystems, local communities tend to conserve them and recognize them as fundamental species for the maintenance of forests.

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