



# BOLETÍN DEL CENTRO DE INVESTIGACIONES BIOLÓGICAS

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## EATING THE FORBIDDEN FRUIT? AVOCADO CONSUMPTION BY NEOTROPICAL BIRDS AT AN URBAN GARDEN.

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### ABSTRACT

The consumption of fruits by birds that visited a feeder in an urban garden in Guanare, Venezuela, was evaluated. There was an emphasis in the analysis of the consumption of avocado (*Persea americana*) whose fruit, leaves and seed have been found to be toxic for some animals. The number of visits to the feeder of each species was counted. The time spent in the consumption of each fruit type was calculated prorating the duration of every visit according to the number of pecks in each one of them. In a first trial, avocado, papaya, plantain, banana, and mango were offered simultaneously. Birds of the Turdidae family (*Turdus leucomelas* and *T. nudigenis*) consumed exclusively avocado, while *Sicalis flaveola* and *Thraupis episcopus* preferred mango and plantain, respectively. In a second trial, Musaceae fruits (plantain or banana) and avocado were offered. Of the total time devoted to the consumption of avocado, 80% belonged to only three species: the two thrushes and the Red-crowned Woodpecker (*Melanerpes rubricapillus*). The other species either did not consume avocado or consumed Musaceae fruits during a high percentage of their time at the feeder, as was the case of *T. episcopus* (92.2%), *Mimus gilvus* (87.8%), *Cacicus cela* (97.9%), *Psarocolius decumanus* (92.9%) and *Euphonia lanirostris* (83.1%) It is the first time that the consumption of the *P. americana* fruit has been evaluated in Neotropical birds. The non-preference (or rejection) of some birds for avocado deserves to be investigated in more detail.

**Key words:** Avocado; *Persea americana*; birds; fruit selection; feeder; urban.

## ¿COMIENDO LA FRUTA PROHIBIDA? CONSUMO DE AGUACATE POR AVES NEOTROPICALES EN UN COMEDERO DE UN JARDÍN URBANO.

### RESUMEN

Se evaluó el consumo de frutas por parte de animales silvestres que visitaron un comedero en un jardín urbano de Guanare, Venezuela, con énfasis en el análisis del consumo de aguacate (*Persea americana*) cuya fruta, hojas y semilla han sido señaladas como tóxicas para algunos animales. Para cada especie se cuantificó el número de visitas al comedero. Se calculó el tiempo empleado en el consumo de cada fruta prorrateando el tiempo total de la visita de acuerdo al número de picoteos en cada una de ellas. En una primera prueba se ofreció simultáneamente aguacate, papaya, plátano, y mango. Las aves de la familia Turdidae (*Turdus leucomelas* y *T. nudigenis*) consumieron exclusivamente aguacate, mientras que *Sicalis flaveola* y *Thraupis episcopus* prefirieron mango y musáceas (plátano o banana), respectivamente. En una segunda prueba se ofreció solo musáceas y aguacate. Del total del tiempo dedicado por todas las especies al consumo del aguacate, 80% correspondió a solo tres especies: los dos Turdidae y *Melanerpes rubricapillus*. Las otras especies o bien no consumieron aguacate o consumieron frutos de Musaceae en un alto porcentaje de sus tiempos en el comedero, como fue el caso de *T. episcopus* (92.2%), *Mimus gilvus* (87.8%), *Cacicus cela* (97.9%), *Psarocolius decumanus* (92,9%) y *Euphonia laniirostris* (83.1%). Es la primera vez que se evalúa el consumo del fruto *P. americana* en aves neotropicales. La no preferencia (o rechazo) de algunas aves por el aguacate merece ser investigado con más detalle.

**Palabras clave:** Aguacate; *Persea americana*; aves; selección de frutas; comedero; urbano.

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### INTRODUCTION

The investigations carried out in Latin American countries on the fauna that visit feeders are scarce. The main goals of the few papers that have been found were to test some ecological theories about behavior, such as neophobia (aversive responses to novel stimuli) by some birds (Echeverría *et al.* 2006, Echeverría and

Vasallo 2008), the interactions and hierarchies established among birds that access to the feeder (Levín *et al.* 2000; Sainz-Borgo 2017), or the possible anti-predatory function of the grouping of certain species when accessing to the feeder (Sainz-Borgo and Levín 2012). The food offered in all these studies has been very varied and in no case has food preference been the object of analysis.

Since 2005, informal notes began to be taken on the preferences of animals for the fruits or fruit remains offered in feeders placed in the same garden where the present investigation took place. Preliminary analyzes of these observations have already been published (Seijas and Seijas-Falkenhagen 2020a). It should be noted that whenever pieces of avocado (*Persea americana*) were placed in the feeder, only birds of the Turdidae family (*Turdus leucomelas* and *T. nudigenis*) seemed to be interested in that fruit.

In the search for bibliographical references on avocado consumption by wildlife, it was found that the scarce available literature accounts mostly on the toxicity of the leaves, bark, seeds and even the ripe fruit of *P. americana* for various domestic or captive animals, as will be discussed later. A few references were found on the consumption of avocado by wild animals. Hardy (1973), for example, mentioned having received information that the Canary-winged parakeet *Brotogeris versicolurus* (a species native to South America) feeds on the fruits of this tree and Clark (1976) indicated that the House finch (*Carpodacus mexicanus*) has been identified as causing damage to immature fruits of *P. americana*. Vereá *et al.* (2016) reported that the thrushes *Turdus leucomelas* and *T. nudigenis* consume avocado fruits in orchards of that plant.

The objective of this study is to evaluate the consumption of fruits by birds that visit a feeder. Even though in the trials carried out various types of fruits were offered, the study focuses on avocado consumption, considering that given the toxicity demonstrated by different parts of this plant in some animals, feeding on its fruit constitutes a novelty that deserves to be highlighted.

## **MATERIALS AND METHODS.**

The study was carried out in the garden of a house on the outer edge of the city of Guanare, Portuguesa state, Venezuela. Details on the characteristics of this garden

and the feeder are found in Seijas and Seijas-Falkenhagen (2020a, b). The feeder used to attract the animals consisted of a square cement block (40cmx40cm and 5 cm thick) placed at ground level. On the surface of this block, pieces of selected fruits were placed and covered with a mesh (5x5) of plastic-covered wires. The mesh prevented the animals from taking away or turning around the food, and also served as a perch for the birds when accessing the food. The activities of the animals were recorded on video with a cell phone placed on a tripod at a height of 30 cm and 70 cm away from the feeder. The storage capacity on the phone card (3.6 MB) limited the duration of the recorded videos. For each sampling day, the first recording started at sunrise. Before every new recording, if necessary, the pieces of fruits were replenished to ensure the offer of each type of fruit was *ad libitum*. For each species, the number of visits per recording hour (v/h) and the time at the feeder (in minutes) per recording hour (min/h) were calculated. The time spent consuming each fruit piece was estimated prorating the total time of the visit according to the number of pecks in each one of them.

Two trials were carried out. In the first one, on May 20, 2020, pieces of four fruits were offered simultaneously: mango (*Mangifera indica*), papaya (*Carica papaya*), plantain (*Musa paradisiaca*) and avocado (*Persea americana*). Pieces of each of them were placed in a different corner of the feeder. Six recordings of  $9 \pm 0.68$  minutes were made with approximately 15 minutes in between, so the time elapsed between the beginning of the first recording and the end of the last one was just over two hours. Preliminary analysis of this first trial seemed to indicate a rejection by some bird species to feed on avocado. Thus, a second trial was performed where pieces of a Musaceae (most frequently plantain, but occasionally *Musa sapientum*) and avocado were offered to the animals. Plantain was selected to contrast with avocado, since in previous studies this fruit always turned out to be preferred by birds. During five consecutive days (December 21 to 25, 2020), four or five video-recordings were made with an average duration of 10.3 minutes, for a mean duration of daily recordings of 47.3 minutes. A piece of Musaceae was placed in one corner of the feeder, in another corner a piece of avocado and, in a third one, pieces of these two fruits were placed close to each other, although not in contact. Each day of recording, the arrangement of the fruits was varied, to reduce a possible bias in the selection of the animals due to the location of the pieces in the feeder. With this second trial, it was expected to

determine not only that some animals did not consume avocado, but that they visited less the piece of Musaceae that was next to the avocado, which would be taken as an indication of rejection of that fruit.

Two-sample paired tests (Wilcoxon) were performed to determine the significance of the differences in times used by each species in the consumption of pairs of fruit offered simultaneously. Statistical analyzes were carried out with the open access program Past 4.02 (Hammer *et al.* 2001, Hammer 2020).

## RESULTS

Sixteen species of birds visited the feeder during the two trials; only nine of them in the first trial and thirteen in the second (Table 1).

**Table 1.** Number of visits to the feeder and total time spend consuming fruits (in seconds) by the different bird species. Total recording time of each trial, in hours, is indicated within brackets. Only visits in which birds pecked any of the fruit pieces at least once were used for calculations of Time (min/hour).

Families and species	Four fruits [0.90h]			Avocado & plantain [3.94h]		
	Visits(*)	Time (s)	min/hour	Visits(*)	Time (s)	min/hour
Fringillidae						
<i>Euphonia laniirostris</i>	-	-	-	42(29)	525	2.2
Icteridae						
<i>Cacicus cela</i>	-	-	-	17(16)	580	2.5
<i>Psarocolius decumanus</i>	-	-	-	17(13)	386	1.6
Mimidae						
<i>Mimus gilvus</i>	-	-	-	46(38)	1948	8.2
Picidae						
<i>Melanerpes rubricapillus</i>	-	-	-	17(15)	968	4.1
Thraupidae						
<i>Ramphocelus carbo</i>	4(4)	140	2.6	-	-	-

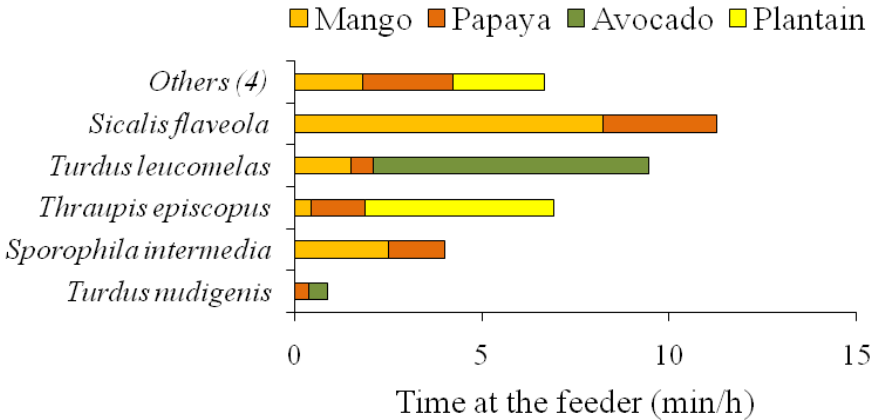
Continuación **Tabla 1.**

<i>Saltator coerulescens</i>	-	-	-	8(5)	81	0.3
<i>Sicalis flaveola</i>	20(19)	609	11.3	-	-	-
<i>Sporophila intermedia</i>	8(6)	217	4.0	-	-	-
<i>Stilpnia cayana</i>	5(3)	55	1.0	23(17)	137	0.6
<i>Thraupis episcopus</i>	18(16)	375	6.9	613(398)	4519	19.1
<i>Thraupis palmarum</i>	3(3)	109	2	17(10)	71	0.3
Troglodytidae						
<i>Campylorhynchus nuchalis</i>	2(2)	56	1	1(0)	-	-
Turdidae						
<i>Turdus leucomelas</i>	18(17)	511	9.5	318(243)	5081	21.5
<i>Turdus nudigenis</i>	6(4)	48	0.9	22(15)	336	1.4

\*Visits in which birds pecked any of the fruit pieces at least once.

In the first trial, the mango pieces were the ones where birds spent most of their consuming time (37%), followed, in decreasing order, by papaya (23.9%), avocado (20.1%) and plantain (19.1%). The preeminence of mango over other fruits was due to the time spent by the Saffron Finch (*Sicalis flaveola*) and, to a lesser extent, by the Gray Seedeater (*Sporophila intermedia*) on its consumption. These two birds were also the ones that spent the most time consuming papaya.

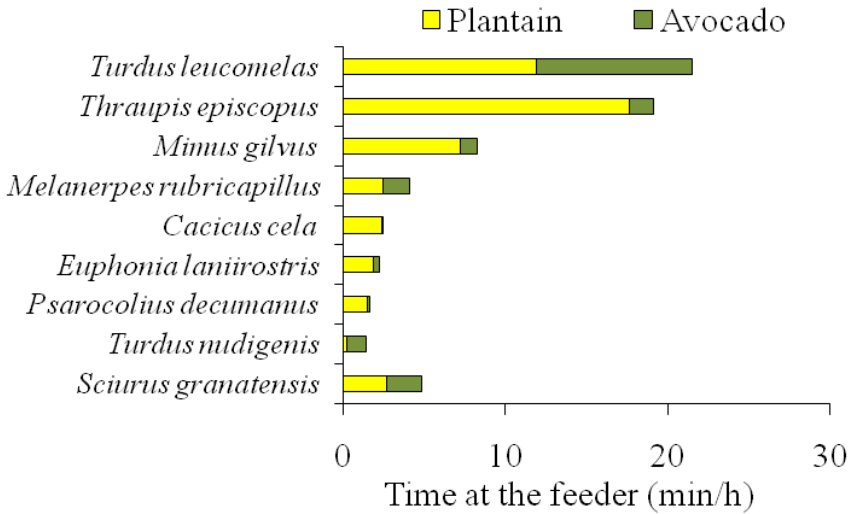
Given the short duration of the trial, the number of visits by some birds was too low for statistical analysis. Most of the species consumed at least two fruits, but the Turdidae (*Turdus leucomelas* and *T. nudigenis*) were the only ones to consume avocado (Fig. 1). These two thrushes spent 76.0% of the time in their 21 visits to the feeder consuming that fruit. The Saffron Finch, in 19 visits to the feeder, consumed mainly mango (73.2%) instead of papaya. Finally, the Blue-gray Tanager (*Thraupis episcopus*, n = 16) spent 72.8% of its time to the consumption of plantain.



**Figure 1.** Cumulative time at the feeder of each species feeding on the fruits offered. The species included in “Others” are *Ramphocelus carbo*, *Thraupis palmarum*; *Stilpnia cayana* and *Campylorhynchus nuchalis*.

The second trial, in which pieces of plantain (or occasionally banana) and avocado were offered, was carried out seven months after the first one, and with a recording effort 4.4 times greater. The location and arrangement of the fruit pieces was not found to influence the frequency of visits by the animals, and would not be considered from here on. In this trial, even though there was a preference for the consumption of Musaceae, animals other than the thrushes feed also on the avocado. The Blue-gray Tanager (92.2%), the Tropical Mockingbird (*Mimus gilvus*, 87.7%), the Yellow-rumped Cacique (*Cacicus cela*, 97.9%), the Crested Oropendola (*Psarocolius decumanus*, 92.6%) and the Thick-billed Euphonia (*Euphonia laniirostris*, 83.1%) showed a clear preference for Musaceae (Fig. 2). To this group favoring Musaceae we can add species that visited the feeder with relative low frequency and were not included in Fig. 2. That was the case of the Grayish Saltator (*Saltator coerulescens*), the Burnished-buff Tanager (*Stilpnia cayana*) and the Palm Tanager (*Thraupis palmarum*). The first one never ate avocado in its eight visits, while *S. cayana* only pecked that fruit once (in 23 visits) and *T. palmarum* pecked it twice (in 17 visits).





**Figure 2.** Time spent consuming plantain or avocado by the different bird species.

The thrushes and the Red-crowned Woodpecker (*Melanerpes rubricapillus*) accounted for 80% of the total time dedicated to the consumption of avocado by all visitors. However, with the exception of *T. nudigenis*, these species consumed plantain in a higher proportion than avocado, although in any case the differences were statistically significant (Wilcoxon paired tests,  $P > 0.17$  or greater). A species not included in this study that also visited the feeder was the Red-tailed Squirrel (*Sciurus granatensis*) which consumed mainly plantain (55% of the time at the feeder).

## DISCUSSION

To highlight the courage and bravery of someone, there is a saying in Venezuela that expresses: “he [or she] is braver than the person who ate the first avocado” which refers to how risky it seems to be to consume a fruit that never loses its color green (in the most common varieties in Venezuela) and that,

supposedly, wild animals do not eat. The fear that the avocado fruit could be poisonous, as the aforementioned saying implies, seems to have some basis, although there is no evidence that humans are in danger after its consumption. On the contrary, its high content in calories, proteins, fatty acids and vitamins (Burger 1994; Borchert *et al.* 2008; Gouegni and Abubakar 2013) has made it a highly appreciated fruit whose cultivation has spread throughout the world. However, the leaves, bark, immature fruits, and seed of *P. americana* have been identified as toxic for various animals, such as laboratory mice, rabbits, cattle, goats, horses, and ostriches (McKenzie and Brown 1991, Buoro *et al.* 1994, Burguer *et al.* 1994, Padilla-Camberos *et al.* 2013). The toxicity of ripe fruit has also been demonstrated for cage birds such as Australian parakeets (Budgerigar, *Melopsittacus undulatus*; Cockatiel, *Nymphicus hollandicus*) and canaries (*Serinus canaria*) (Hargis *et al.* 1989). These cases of poisoning have turned avocado into a kind of “forbidden fruit” that, in the opinion of Kovalkovicova *et al.* (2009) “Feeding avocados to any non-human animal should be completely avoided”.

Not all varieties of avocados have been shown to be toxic to wildlife and one native to Guatemala seems to have the strongest effects (Burger *et al.* 1994, Hargis *et al.* 1989). The variety of avocado used in the present research is not known, but it was probably a local variety, or a hybrid between the many varieties that have been developed over the years.

Isolated avocado trees planted in family gardens offer few opportunities for birds and other animals to consume its fruits. Fruits remain green on the tree and ripen only after they have been harvested. It is a highly valued and expensive fruit, and it is not usually offered to animals. Even in commercial plantations of *P. americana*, at least in Venezuela, the consumption by animals of fruits that ripen as they fall from trees has gone unnoticed, if we take into account that Vereza *et al.* (2011) did not mention in their research in an avocado orchard, whether or not any of the birds they observed ate the fruits of that tree. However, Borchert *et al.* (2008) showed that in orchards of *P. Americana* in California (USA), avocado fruits is consumed by various species of mammals (bears, domestic dogs, coyotes, squirrels and other wild animals) but not by birds.

The consumption of avocado by Neotropical wild birds is for the first time evaluated in the present study. Birds of the family Turdidae (thrushes) were the

ones that showed the highest consumption of avocado, which confirms preliminary observations in Seijas and Seijas- Falkenhagen (2020a). It was rather surprising to observe the consumption of avocado by Red- crowned woodpeckers and by Red-tailed squirrels, animals that had never been observed eating this fruit. Some other species of birds also pecked the pieces of avocado supplied, but seemingly, consumption was always low (if there was any) since in many occasions birds (especially *T. episcopus*) were observed to shake their beaks as if to get rid of the collected portion. A case that is worth highlighting is that of the Burnished-buff Tanager, a species that only pecked on the avocado once in its 28 visits to the feeder (taking the two trials together). This species, in a previous study (Seijas and Seijas-Falkenhagen 2020b), was regarded as the most generalist of all the birds visiting the feeder, since it never showed a preference for any of the pairs of fruits that were offered, which included papaya, plantain, banana and mango, so avoiding avocado consumption may be interpreted as a rejection of that fruit.

The Saffron Finch and the Gray Seedeater only went down to the feeder when mangoes were offered, as had happened in previous trials carried out in mid-May 2020 (Seijas and Seijas- Falkenhagen 2020b) even though these species are observed in the garden throughout the year. The Blue-gray Tanager, for its part, confirmed its preference for Musaceae fruits, as had been shown in the cited article.

No strange behavior was observed in the animals that ate avocado repeatedly (thrushes, woodpeckers and squirrels) during the five days that the videos of the second trial were recorded. The negative effects described for some species that have consumed this fruit manifest themselves in a matter of a few hours (Hargis *et al.* 1989, Kovalkovicova *et al.* 2009). The animals that came to the feeder were not marked, but a few birds had physical features that allowed them to be individualized. This is the case of a Blue-gray Tanager with only one leg, another with a deformed neck; a Tropical Mockingbird with a partially broken beak, and a Thickbilled Euphonia with a scar on its chest. All of them pecked the avocado at least once and were still observed in the feeder weeks after the samplings.

The animals that consume avocado without ostensible consequences, including those in the present study, are original from the American continents, while those

that have been mentioned in the literature (horses, goats, mice, rabbits, ostriches, Australian Psittacines and others) as affected by the consumption of some part of the *P. americana* tree, are original from other continents. It is beyond the scope of this study to investigate whether this is merely a coincidence. The apparent rejection or non-preference of some birds to avocado deserves to be investigated in more detail. Many chemical compounds have been found in the avocado fruit (Bhuyan *et al.* 2019) and the role they play in defining preferences for consumption by birds and other animals is worth investigating.

The present investigation is based on samplings carried out in two short periods with a separation of several months between them. One could speculate on the effect that this fact may have had on the results. Although it is necessary to carry out more samplings, the results in previous publications (Seijas and Seijas-Falkenhagen 2020a,b) and data that are still being processed for the rainy season, seem to indicate that even though the frequency of visits to the feeder by each bird species may vary over time, their preferences per fruit type do not change.

It must be mentioned that this research is part of a project with samplings carried out over a whole year. In the published works, the preferences of the birds for the different fruits offered in the feeder and the interactions established among them have been analyzed. New publications could complement the findings of those already published. The information collected throughout the articles that emerge will allow planning new studies aimed at laying the foundations for the management of these feeders, in such a way that they better fulfill the objective of conserving and enhancing the wildlife of urban environments.

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## REFERENCES

BORCHERT, M., F. W. DAVIS and J. KREITLER. 2008. Carnivore use of an avocado

orchard in Southern California. California Fish and Game. 94(2): 61-74.

BUORO, I. B. J., S. B. NYAMWANGE, D. CHAI and S. M. MUNYUA. 1994. Putative avocado toxicity in two dogs. Onderstepoort Journal of Veterinary Research. 61: 107- 109.

BURGER, W. P., T. W. NAUDÉ, I. B. J. VAN RENSBURG, C. J. BOTHA and A. C. E. PIENAAR. 1994. Cardiomyopathy in ostriches (*Struthio camelus*) due to avocado (*Persea americana* var. *guatemalensis*) intoxication. Journal of South Africa Veterinary Association. 65(3): 113-118.

BHUYAN, D. J., M. A. ALSHERBINY, S. PERERA, M. LOW, A. BASU, O. A. DEVI, M. S. BAROOAH, C. G. LI and K. PAPOUTSIS. 2019. The odyssey of bioactive compounds in avocado (*Persea americana*) and their health benefits. Antioxidants. 8(426): 1-53.

CLARK, D. O. 1976. An overview of depredating bird damage control in California, p. 21-27. In: Bird Control Seminar Proceedings. University of Nebraska, Lincoln.

ECHEVERRÍA, A. I. and A. I. VASSALLO. 2008. Novelty responses in a bird assemblage inhabiting an urban area. Ethology 114: 616-624.

ECHEVERRÍA, A. I., A. I. VASSALLO and J. P. ISACCH. 2006. Experimental analysis of novelty responses in a bird assemblage inhabiting a suburban marsh. Canadian Journal of Zoology. 84: 974-980.

GOUEGNI, E. F. and H. ABUBAKAR. 2013. Phytochemical, toxicological, biochemical and haematological studies on avocado (*Persea americana*) in experimental animals. Nigerian Food Journal. 31(1): 64-69.

HAMMER, O. 2020. Past: Paleontological STatistics. Version 4.02 reference manual. Natural History Museum, University of Oslo, Oslo, Norway.

HAMMER, O., D. A. T. HARPER and P. D. RYAN. 2001. PAST: Paleontological statistical software package for education and data analysis. Paleontologia Electronica. 4(1): 1-9.

HARDY, J. W. 1973. Feral exotic birds in Southern California. *The Auk*. 85(4): 506-512.

HARGIS, A. M., E. STAUBER, S. CASTEEL and D. EITNER. 1989. Avocado (*Persea americana*) intoxication in caged birds. *Journal of the American Veterinary Medical Association*. 194(1): 64-66.

KOVALKOVICOVA, N., I. SUTIAKOVA, J. PIST and V. SUTIAK. 2009. Some food toxic for pets. *Interdisciplinary Toxicology*. 2(3): 169-176.

LEVÍN, L., L. FAJARDO and N. CEBALLOS. 2000. Orden de llegada y agresiones en aves urbanas en una fuente de alimento controlada. *Ecotropicos*. 13(2): 75-80.

MCKENZIE, R. A. and O. P. BROWN. 1991. Avocado (*Persea americana*) poisoning of horses. *Australian Veterinary Journal*. 68(2): 77-78.

PADILLA-CAMBEROS, E., M. MARTÍNEZ-VELÁZQUEZ, J. M. FLORES-FERNÁNDEZ and S. VILLANUEVA-RODRÍGUEZ. 2013. Acute toxicity and genotoxic activity of avocado seed extract (*Persea americana* Mill., c.v. Hass). *The Scientific World Journal* (Article ID 245828):4.

SAINZ-BORGO, C. 2017. Estudio del comportamiento de aves que visitan una fuente artificial de alimento. *Bol. Centro de Invest. Biol.* 50(3): 212-224.

SAINZ-BORGO, C. and L. E. LEVÍN. 2012. Análisis experimental de la función antidepredadora del agrupamiento en aves que visitan una fuente de alimento. *Ecotropicos*. 25(1):15-21.

SEIJAS, A. E. and S. F. Seijas-Falkenhagen. 2020a. *Fauna de mi casa*. Kindle Direct Publishing. Columbia, S.C. (USA). ISBN-979-86-19-52082-8.

—. 2020b. Birds at a feeder in an urban garden in Venezuela: Abundances, interactions and fruit preferences. *Anartia*. 31: 1-15.

VEREA, C., O. Navas and A. SOLÓRZANO. 2011. La avifauna de un aguacatero del norte de Venezuela. *Bol. Centro Invest. Biológicas*. 45(1): 35-54.

VEREA, C., N. ESPÓSITO and M. LENTINO. 2016. *Paraulatas de Venezuela*. Kindle Direct Publishing, Columbia, S. C. (USA). ISBN-978-15-37-668994.



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