Revista Venezolana de Ornitología 11: 12–17, 2021

New insights on the biology of the Pale-eyed Pygmy-tyrant *Atalotriccus pilaris* of Venezuela

Cristina Sainz-Borgo

Departamento de Biología de Organismos, Universidad Simón Bolívar, Caracas, Venezuela. cristinasainzb@usb.ve

Abstract.– The Pale-eyed Pygmy-Tyrant *Atalotriccus pilaris* is a small tyrant flycatcher, characterized by greatly shortened and narrow outer four primaries. Many aspects of its biology and ecology remain poorly known. The general aim of this study was to quantify some aspects of morphology, diet, breeding and molt of the species. I examined museum specimens of the three Venezuelan sub-species: *A. p. pilaris* from south-western Venezuela, *A. p. venezuelensis* from northern Venezuela, and *A. p. griseiceps* from Bolívar state (south of Venezuela). Additionally, 31 captured individuals of *A. p. venezuelensis* were examined and measured. Morphometric differences between subspecies, age and sex were determined (the 8th and 7th primaries were longer in females than males for both subspecies and the 10th primary was wider in males for *A. p. venezuelensis*. *A. p. pilaris* had a greater number of morphometric differences between sexes than *A. p. venezuelensis*. Eye coloration was related to age: most adults had a white iris (85%), whereas juveniles were dark. According to museum specimen labels, seven adult males (17%), and eight juveniles (57%) of *A. p. venezuelensis* had dark eyes; for *A. p. pilaris*, two adults (17%) males and two juveniles (25%). I captured several molting individuals between September and December 2013. Birds with brood patches were captured during three different periods: August 2012 to January 2013, November 2013 to January 2014, and May to June 2014. Diet, based on examination of feces from captured individuals consisted mainly of insects (96%) and a lower proportion fruit (4%). New information is presented here about morphometric traits, iris coloration, molt, breeding period, and diet of Pale-eyed Pygmy-Tyrant. However, similar studies on related genera such as *Lophotriccus* and *Hemitriccus* are needed to fill the current gaps of information in reproductive behavior, morphology traits and song, among others.

Key words. Breeding, iris coloration, morphometric variation, Tyrannidae

Resumen.– Nueva información sobre la biología del Atrapamoscas Pigmeo Ojiblanco *Atalotriccus pilaris* de Venezuela.– El Atrapamoscas Pigmeo Ojiblanco *Atalotriccus pilaris* es un pequeño Tyrannidae caracterizado por presentar las cuatro primarias externas cortas y delgadas. El objetivo general de este estudio consistió en cuantificar algunos aspectos de su morfología, dieta, reproducción y muda. Se examinaron especímenes de museo de las tres subespecies venezolanas: *A. p. pilaris* del suroeste de Venezuela, *A. p. venezuelensis* del norte de Venezuela y *A. p. griseiceps* del estado Bolívar. Adicionalmente, 31 individuos capturados en redes de neblina fueron examinados y medidos. Las variaciones morfométricas entre subespecies, edad y sexo fueron determinadas (la 8va y 7ma primaria es más larga en las hembras que en los machos para ambas subespecies, y la 10ma primaria es más larga en hembras que en machos para *A. p. venezuelensis*, *A. p. pilaris* presentó un mayor número de diferencias morfométricas entre sexos que *A. p. venezuelensis*). Para ambas subespecies la coloración del iris estuvo relacionada con la edad, la mayor parte de los adultos (85%) presentaron iris claros, y los juveniles iris oscuros. Con respecto a los especímenes de museos, siete machos adultos (17%) y ocho juveniles (57%) de *A. p. venezuelensis* presentaron iris oscuros, mientras que para *A. p. pilaris*, dos machos adultos (17%) y dos juveniles (25%) tuvieron esta característica. Se capturaron varios individuos mudando entre Septiembre y Diciembre del 2013. Las aves con parches reproductivos fueron capturadas durante tres períodos en el trabajo de campo: agosto y noviembre de 2012 hasta enero de 2013, noviembre de 2013 a enero de 2014, y mayo y junio de 2014. La dieta consistió mayoritariamente en insectos y en menor proporción frutas. En este trabajo se presenta información novedosa sobre rasgos morfométricos, coloración del iris, muda, período reproductivo y dieta del Atrapamoscas Pigmeo Ojiblanco. Sin embargo, estudios similares en este y otros géneros relacionados como *Lophotriccus* y *Hemitriccus* son necesarios para llenar los vacíos de información en esta familia en cuanto a comportamiento, rasgos morfológicos y cantos, entre otros.

Palabras claves. Coloración del iris, reproducción, Tyrannidae, variación morfométrica

INTRODUCTION

One of the most diverse families of birds in the neotropics is Tyrannidae. Information on the biology of many of its species is abundant (Skutch, 1967, Sherry 1984, Hilty 2003). However, there are species for which little is known, such as the Pale-eyed Pygmy-Tyrant *Atalotriccus pilaris*. This is a small flycatcher belonging to a monotypic genus that typically have a small bill and short, narrow outer four primaries (Ridgely and Tudor 1994), similar to Helmeted-Pygmy Tyrant *Lophotriccus galeatus* (Restall *et al* 2006). This specie also has pale yellow irises, dusky wings with two narrow yellowish wing bars, and shows no sexual dimorphism (Hilty 2003). It is usually found in dry or deciduous forests in Venezuela, northeast Colombia, Panama, western Guyana, and the extreme north of Brazil (Ridgely and Tudor 1994, Hilty 2003). It is very common around 1,000 m asl, but it has been recorded from sea level to 2,000 m (Ridgely and Tudor 1994, Hilty 2003,). There are four described subspecies: *A. p. griseiceps* (eastern Colombia, eastern Venezuela, western Guyana), *A. p. pilaris* (northern Colombia and northwestern Venezuela), *A. p. venezuelensis* (north and central Venezuela) and *A. p. wilcoxi* (Panama) (Restall *et al* 2006, Clock 2020). They usually forage in pairs at mid levels of trees, sallying to tops of leaves to pick insects by gleaning foliage (Restall *et al* 2006). This bird is inconspicuous but produces

Cristina Sainz-Borgo https://orcid.org/0000-0001-9252-2524.

a loud call disproportionate to its body size (Phelps and Meyer de Schauensee 1994). Lanyon (1988) recommended that *Atalotriccus* should be merged into *Lophotriccus* because their behaviors and vocal calls are similar; Tello and Bates (2007) recommend that *Lophotriccus, Hemitriccus* (*Snethlagea*) *minor*, and *Atalotriccus* be included in the genus *Oncostoma* by genetic similarities. However, Ridgely and Tudor (1994) and Restall *et al* (2006) maintained they should be kept as separate genera.

Only a few studies have been focused on specific aspects of the the Pale-eyed Pygmy-Tyrant such as diet, parasite prevalence, foraging behavior, and abundance. Nonetheless, these studies provided few information about the biology of the species (Fitzpatrick 1980, Poulin 1994a, 1994b, Matta *et al* 2004). The primary aim of this study was to provide new information on some aspects of the biology of Pale-eyed Pygmy-Tyrant, focusing on morphology, diet, breeding, molt and behavior.

METHODS

Morphometric analyses. I examined museum specimens of the three Venezuelan subspecies at the Colección Ornitológica Phelps (COP), Caracas, Venezuela: *A. p. pilaris* (12 males, five females, and eight juveniles unsexed) from western Venezuela (Zulia and Táchira states); *A. p. venezuelensis* (41 males, 18 females, and seven juveniles) from northern Venezuela (states Portuguesa, Guárico, Miranda, Aragua, Falcón, Monagas, Trujillo, Anzoátegui, Sucre) and Barinas, and *A. p. griseiceps* (two males, one female and two unsexed specimens) from southern Venezuela (Bolívar state), collected between 1939 and 2007. I measured lengths of culmen, tarsus, tail, wing length, 10th to 7th primaries, and the greatest width of 10th primaries. Wing, bill, and tail lengths were measured according to Winker (1998). Measures of bill were taken with calipers accurate to 0.1 mm, and the wing and tail length with a rule accurate to 0.5 mm. Data on gonad size and molting period was recorded from the labels of museum specimens. The juveniles were identified because they were cataloged on the label.

Statistical analyses. I used Mann-Whitney tests, PCA analyses and Pearson correlation coefficients to compare morphometrics between *A. p. venezuelensis* and *A. p. pilaris,* and between sexes and age classes, using the software Statistica. Data from *A. p. griseiceps* were excluded from the analyses because of the small sample size.

Molt, breeding, and diet. Field work was conducted from April 2012 to March 2013, and from September 2013 to July 2014 in a semi-deciduous forest patch (2 ha), located at the Arboretum Experimental Station, Instituto de Biología Experimental, Universidad Central de Venezuela (10°30´36”N–66°53´92”W; 1,100 m asl), near a residential zone in the city. Eight mist nets (12 m x 2.8 m, 36 mm mesh) were placed along the main path of the study area. The mist nets were open from 06:30 h to 15:30 h and reviewed every 15 minutes (2,944 net-hours).

Iris coloration. I recorded color of the iris and the presence/absence of a brood patch for all captured individuals. To describe the extent of the breeding season, I recorded all individuals that presented brood patches in phases two and three according to Pyle (1997). For each captured I recorded color of the iris and the presence of brood patch. To describe the extent of the breeding season, I recorded all individuals that presented breeding patches in phases two and three according to Pyle (1997). Phase two was characterized by an increase in size of the blood vessels in the abdomen, the presence of thicker skin and filled with fluid; and phase three was identified when the skin of the abdomen appeared grayish and wrinkled (Pyle 1997). I recorded molt for each individual by determining whether

TABLE 1. Average measurements of museum specimens (mm) of the three Pale-eyed Pygmy-Tyrant subspecies studied in Venezuela.

Measurements	*A. p. pilaris* (X±SD)			*A. p. venezuelensis* (X±SD)			*A. p. griseiceps* (X±SD)		
	Male (*n*=12)	Female (*n* =5)	Juvenil (*n* =8)	Male (*n* =41)	Female (*n* =18)	Juvenil (*n* =7)	Male (*n* =2)	Female (*n* =1)	Juvenil (*n* =2)
Wing length	41±2.1	40,25±0.35	38.5±2.08	42.4±1.66	40±17.61	40.66±1.21	41.6±0.56	43	42.4±0.14
10th primary length	27.6±2.5	27.75±3.59	26.28±1.38	29.13±1.42	27.55±13.3	28.83±3.6	30±1.06	27	29.75±2.47
9th primary length	28.14±3.07	28.33±1.15	26.2±2.77	30.05±2.46	28.77±13.06	28.33±2.88	32.5±0.70	30	29.75±0.35
8th primary length	25.14±0.37	30.5±1.29	28.5±3.01	28.39±3.12	29±13.41	26.5±2.94	33.75±0.35	32	29.25±3.18
7th primary length	25.22±5.33	30.5±2.12	31±3.53	26.79±3.63	29.11±10.10	27±5.65	34.75±0.35	33	29.75±1.06
10th primary wide	1.35±0.49	1.6±0.56	1.5±0.71	4.5±5.2	2.0±0.75	6.5±7.77	1.6±0.70	1.6	1.375±0.17
Tail length	33.33±6.68	34±1.63	32.71±3.86	35.44±4.06	31.44±14.27	36±4	30.75±0.35	36	38±4.24
Bill length	10.33±1.15	11.35±0.77	9.5±0.71	10.25±3.20	9.87±0.97	9±4.64	9.75±0.35	10.6	8.95±1.48
Tarsus length	17.25±0.35	14±4.24	16.9±1.34	17.5±2.12	17.66±7.99	17.29	17.5±0.42	18.6	15.37±0.38
Total length	98.77±7.42	92.45±4.19	86.71±7.73	97.07±7.04	90.17±7.08	91.57±4.79	98.5±0.70	103	91±5.65

individuals presented a collagenous shield at the base of flight (primaries, secondaries, rectrices) and body feathers (head, chest, abdomen, and back coverts). For flight feathers, only symmetric molting was considered as real molt, because asymmetric molts are produced by accidental loss of feathers (Lentino *et al* 2009).

Diet analyses. Each captured bird was placed in a plastic box covered with a black cloth and a metal grid in the bottom for 20 minutes to obtain feces. Fecal samples were collected between September 2013 and July 2014. Feces were stored in glass vials with 70% ethanol and later observed under a stereoscopic microscope (Wild Heerbrug) in the Laboratory of Ornithology at the Universidad Simón Bolívar (Caracas, Venezuela). Food items were identified to order or family. The plant samples were identified using the Lau (2010) data base and Navas (2009) for the arthropods identification.

Behavioral observations. I conducted behavioral observations at the E. S. Arboretum. The behaviors recorded were: flight, song and perched time of the individuals. Each bird was observed until it away outside the visual field, using binoculars 8 x 40 and with naked eyes between 6:00 to 15:00 h two times each month.

RESULTS

Morphometric analyses. I documented that there were differences between subspecies, and between individuals of different age and sex in the morphometric characteristics tested (Tables 1 and 2). PCA analysis shows that only 42% of the total variance could be explained by the two first eigenvalues. Wing and total length were similar between sexes for *A. p. pilaris* and *A. p. venezuelensis* (Mann Whitney U Test, $P > 0.05$). The 10th primary was longer in males of *A. p. pilaris* than in females (Mann Whitney U Test, $P = 0.012$). The 9th outer primary length was similar between sexes in both subspecies, but the length of the 8th and 7th primaries were longer in females for *A. p. pilaris* and *A. p. venezuelensis* (Mann Whitney U Test, $P = 0.014$). The 10th primary was wider in males than in females and juveniles for *A. p. pilaris* (Mann Whitney U Test, $P = 0.009$), but similar among all individuals for *A. p. venezuelensis* (Mann Whitney U Test, $P > 0.05$). The tail was longer in females of *A. p. pilaris* (Mann Whitney U Test, $P = 0.0027$), and in males of *A. p. venezuelensis* (Mann Whitney U Test, $P = 0.001$). The bill was longer in females of *A. p. pilaris* ($P = 0.009$), and longer in the males in *A. p. venezuelensis* (Mann Whitney U Test, $P = 0.006$). Males also have a longer tarsus than females in *A. p. pilaris* (Mann Whitney U Test, $P = 0.00009$), but were similar in *A. p. venezuelensis* (Mann Whitney U Test, $P > 0.05$). The tarsus was longer in *A. p. venezuelensis* than in *A. p. pilaris* (Mann Whitney U Test, $P = 0.0357$). I did not find correlations between the variables, except the length of wing and tail in *A. p. pilaris* (Pearson Coefficient $P = 0{,}038$, $r = 0{,}38$). Juveniles showed a shorter bill for both subspecies (Mann Whitney U Test, $P = 0.00059$ for *A. p. venezuelensis*, $P = 0.0177$ for *A. p. pilaris*), and tarsus length was also shorter than in adults for both subspecies (Mann Whitney U Test, $P = 0.0125$ for *A. p. venezuelensis*, $P = 0.021$ for *A. p. pilaris*). The 10th primary of juveniles was shorter than in adults for *A. p. venezuelensis* (Mann Whitney U Test, $P = 0.015$), but similar for adults and juveniles of *A. p. pilaris* (Mann Whitney U Test, $P > 0.05$).

FIGURE 1. Two individuals of *A. p. venezuelensis* captured at Arboretum Experimental Station, Caracas, Venezuela. Dark eyed individual (left) and white eyed individual (right).

TABLE 2. Statistically significant differences between comparations of several measurements traits in *A. p. pilaris* and *A. p. venezuelensis* studied in Venezuela.

Subspecie	Measurements	Stadistical Result	P value
A. p. pilaris	10th primary wide	male > female	P<0.05
A. p. pilaris	10th primary length	male > female	P<0.01
A. p. pilaris	Bill lenght	female > male	P<0.01
A. p. venezuelensis	Bill lenght	male > female	P<0.01
A. p. pilaris	Tarsus lenght	male > female	P<0.01

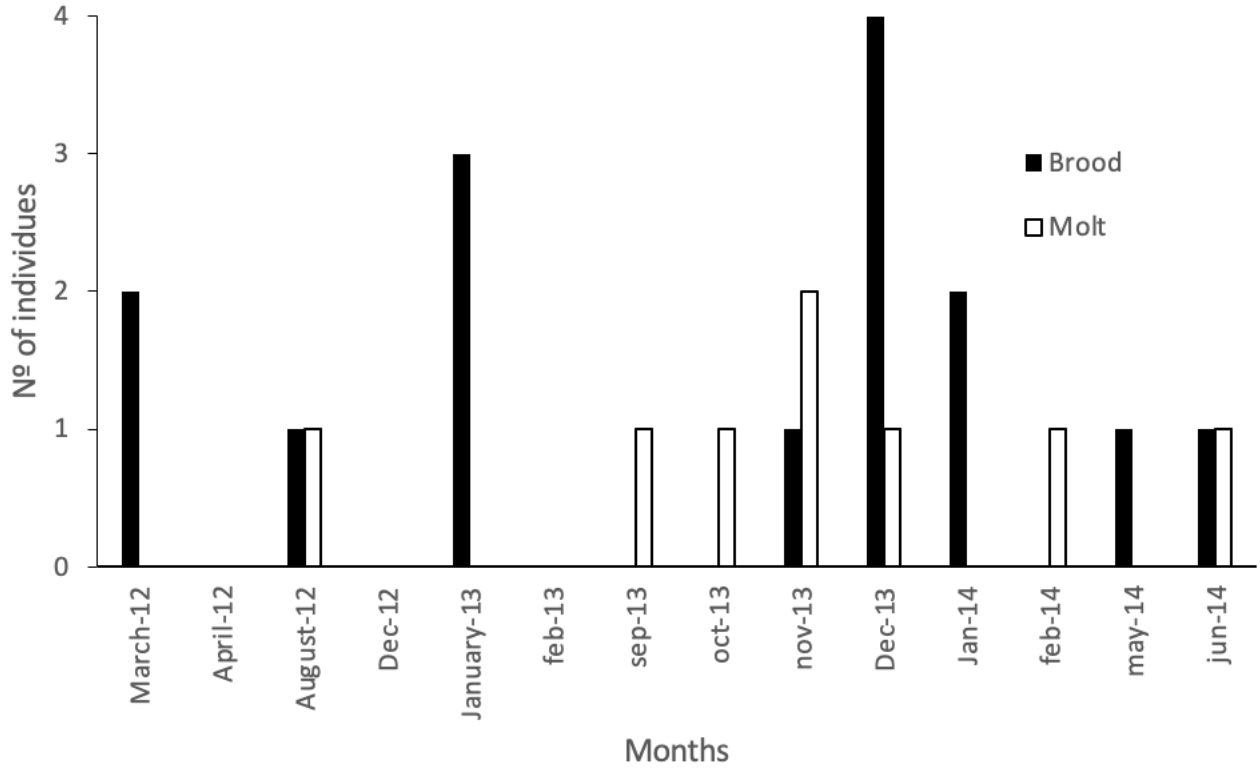

FIGURE 2. Number of individues in the cycle of brood and molt during the sampling period of individuals of *A. p. venezuelensis* mist-netted at Arboretum Experimental Station, Caracas, Venezuela.

Iris coloration. According to museum specimen labels, seven adult males (17%), and eight juveniles (57%) of *A. p. venezuelensis* had dark irises; in the same way, for *A. p. pilaris*, two adults (17%) males and two juveniles (25%) had dark irises too. No females presented dark eyes. From captured adults, 86% (n = 24) presented white irises, and 14% (n = 4) dark ones (Fig 1). From juveniles, 75% (n = 3) presented white eyes and one individual had dark eyes.

That bird, banded on 14 February 2013, was recaptured nine months later, on 1 November 2013 and presented white eyes. One adult presented a brood patch and dark eyes.

Molt and reproduction. From museum specimens, all adult males in both subspecies had developed gonads, while in females only 21%. From captured individuals 25% were classified as reproductive based on brood patch development. Individuals with brood patch were captured during three periods: August and November 2012 to January 2013, November 2013 to January 2014, and May to June 2014. Eight individuals were molting at the time of capture. Molt records occurred in August 2012, from September to October 2013, and February and June 2014. Six individuals were molting body feathers, two were molting primaries and body, one was molting primaries, secondaries, rectrices and body, and one only primaries. There was an overlap between breeding and molt periods during November and December 2013 (Fig 2).

Diet. I collected 20 fecal samples of *A. p. venezuelensis*, 12 in wet season and eight in dry season, containing 15 different food types (arthropod fragments, Coleoptera, Lepidoptera, Isoptera, Curculionidae, Orthoptera, Araneae, Hymenoptera, Apidae, Diptera, Blatodea, Formicidae, *Clusia*, Lauraceae and insect eggs). The most abundant type were Formicidae and Coleoptera. Only two samples contained fruit pulp and seeds (*Clusia* sp. and Lauraceae). During the wet season, the birds consumed a larger number of food items than in the dry season (Fig 3), and only Coleoptera were consumed more in the dry season.

Behavior. I observed 38 individuals, foraging in pairs or in groups of three, between the mid height level and the canopy of the forest, including 16 between 6:30 to 8:30 h; eight between 8:30 to 10:30 h, 10 between 10:30 to 12:30 h, and one bird at 15:00 h. The birds sang more frequently between 6:30 to 10:30 h. Frequently I observed that while the birds were singing they moved their wings in a manner similar to the begging behavior performed by juveniles in many Passeriformes species (Gill 1986). Many captures were two individuals together, so, when an individual was trapped in the mistnet another one followed. In most cases when an individual was mist-netted, one or two others stayed close to the mist-nets emitting calls.

DISCUSSION

The current study provides new information on several aspects of the biology of the Pale-eyed Pygmy-Tyrant. My results indicate a predictable variation between sexes in the width and length of outer primaries, because the 8th and

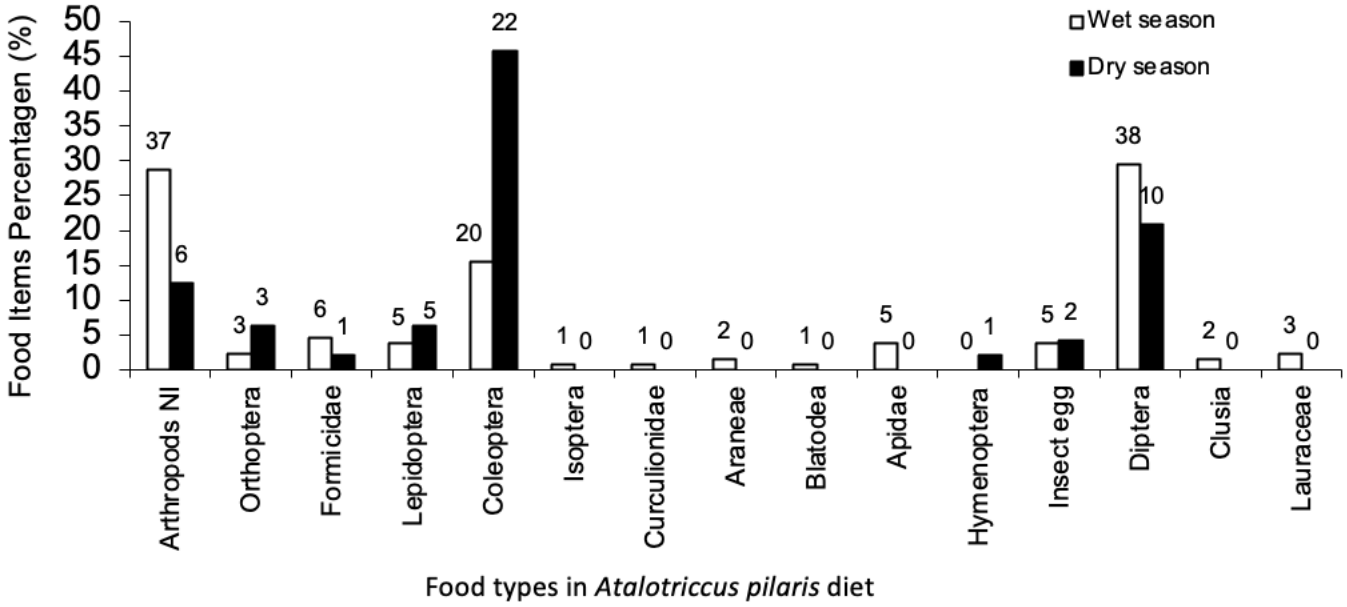

FIGURE 3. Relative abundance of food types in feces (*n* = 20) of *A. p. venezuelensis* in dry and wet season at Arboretum Experimental Station, Caracas, Venezuela (number of items above each bar).

7th primaries were longer in females than males for both sub-species and the 10th primary was wider in males for *A. p. venezuelensis*. The short and narrow primaries likely are related to displays (Ridgely and Tudor 1994) and, therefore, the differences found between sexes is consistent with that function. Similar differences between sexes are reported for Olive-striped Flycatcher *Mionectes olivaceus* (Lentino *et al* 2009, Botero-Delgadillo 2010) and *Lophotriccus* (Restall *et al* 2006). *A. p. pilaris* had a greater number of morphometric differences between sexes than *A. p. venezuelensis*. Between these subspecies, differences were only found in tarsus and bill lengths. Geographic variation in some morphometric traits has been reported in some other flycatcher species, such as *Empidonax* sp, *Contopus* sp, Mountain Elaenia *Elaenia frantzii* and Great Kiskadee *Pitangus sulphuratus* (Fitzpatrick 2004).

Differences in eye colour appear related to age because most adults had white irises. The case of the banded dark-eyed individual with white eyes six months later since its first capture show the variation for iris colour related to age for Pale-eyed Pygmy-Tyrant. Differences in iris coloration were reported for Tyrannidae in other species such as the Black-and-White Tody-Tyrant *Poecilotriccus minor*, the Snecthlages Tody-Tyrant *Hemitriccus minor*, the Johannes´s Tody-Tyrant *Hemitriccus johannis*, the Slate-Headed Tody-Flycatcher *Poecilotriccus sylvia*, the Ringed Antpipit *Corythrops torquatus*, the Rough-legged Tyrannulet *Phyllomyias burmeisteri*, and the Amazonian Inezia *Inezia subflava* (Restall *et al* 2006). The reason for such colour variations is unknown, although in some cases juveniles have brown eyes (Restall *et al* 2006).

The peak of reproduction was between November 2013 and January 2014, similar to results reported by Verea *et al* (2009) in several natural and cultivated environments from northern Venezuela. These results are in contrast to those reported by Schäfer and Phelps (1954) in the Henri Pittier National Park (northern Venezuela), who described the peak of reproduction as occurring between May and June. One bird captured during the present study had both dark iris and a brood patch, indicating sexual maturity for an apparent juvenile. Molting occurred between September to June and overlapped with breeding in November and December. A similar pattern of overlap was reported by Verea *et al* (2009) for 185 birds species, including *A. pilaris*, in a pristine dry forest in northern Venezuela, and for Lentino *et al* (2009), in the birds of Henri Pittier National Park.

The diet of Pale-eyed Pygmy-Tyrant consisted mainly of insects and a lower proportion of fruit, similar to the findings of Poulin *et al* (1994a). Most of the food types identified in fecal samples were consumed in greater proportions during the wet season than in the dry season, except Coleoptera, which was more abundant during the dry season. These differences in the consumption of several food items could be explained by the seasonality of the food resources (Poulin *et al* 1994a). At the study area, most of the plants fruit during the wet season (López and Ramírez 2013). The variety of food items suggests that, similar to other flycatchers such as Fuscous Flycatcher *Cnemotriccus fuscatus* (Gaiotti and Pinho 2013), Pale-eyed Pygmy-Tyrant is somewhat omnivorous, depending on the food availability in the area.

This new information presented here about morphometric traits, iris coloration, molt, breeding period, and diet of Pale-eyed Pygmy-Tyrant contributed to understanding the biology and ecology of the Tyrannidae, however, additional

studies on this species are needed to fill the current information gaps related with the functions of the outer and narrowed primaries, probably related with displays.

ACKNOWLEDGMENTS

The author would like to thank Adriana Rodríguez-Ferraro, Kaspar Delhey, Jhon Blake and an anonymous referee for the suggestions that helped improve the manuscript. Improvements in English usage were provided by Phil Whitford through the Association of Field Ornithologists' program of editorial assistance, coordinated by Daniel Brooks. Carlos Verea and Sandra Giner helped with fieldwork; Juan José Cruz assisted with statistical analyses, and Luis Levin of the E. S. Arboretum provided logistical support. **The author declares no conflicts of interest associated with this publication.**

REFERENCE LIST

Botero-Delgadillo E. 2010. Criterios morfométricos y cualitativos para la determinación de la edad y el sexo en *Mionectes olivaceus* (Tyrannidae). *El Hornero* 25: 9–16

Clock BM. 2020. Pale-eyed Pygmy-Tyrant (*Atalotriccus pilaris*). Birds of the World: Cornell Lab of Ornithology, Ithaca, USA. Online Document. *URL*: https://www.doi.org/10.2173/bow.peptyr1.01. Reviewed: May 2020

Fitzpatrick JW. 1980. Foraging behavior of Neotropical tyrant flycatchers. *The Condor* 82: 43–57

Fitzpatrick JW. 2004. Family Tyrannidae (tyrant-flycatchers). Pp. 170–462 *en* J del Hoyo, A Elliott and DA Christie (eds). Handbook of the Birds of the World. Volume 9: Cotingas to Pipits and Wagtails. Lynx Editions, Barcelona, Spain

Gaiotti MG and JB Pinho. 2013. Diet of the Fuscous Flycatcher *Cnemotriccus fuscatus* (Wied, 1831) Aves, Tyrannidae - in three habitats of the northern Pantanal, Mato Grosso. *Brazilian Journal of Biology* 73: 841–845

Gill F. 1986. Ornithology (1st ed). Freeman & Company, New York, USA

Hilty SL. 2003. Birds of Venezuela. Princeton University Press, Princeton, USA

Lanyon WE. 1988. A phylogeny of flatbirds and tody-tyrant assemblage of tyrant flycatchers. *American Museum Novitates* 2923: 1–41

Lentino M, A Rodríguez, V Malave, M Rojas and MA García. 2009. Manual de Anillado para el Paso Portachuelo, Parque Nacional Henri Pittier, Venezuela. Sociedad Conservacionista Audubon de Venezuela, Caracas, Venezuela

López M and N Ramírez. 2004. Composición florística y abundancia de las especies en un remanente de bosque deciduo secundario. *Acta Biológica Venezuelica* 24: 29–71

Matta NE, N Basto, R Gutiérrez, OA Rodríguez and EC Greiner. 2004. Prevalence of blood parasites in Tyrannidae (flycatchers) in the eastern plains of Colombia. *Memórias do Instituto Oswaldo Cruz* 99: 271–274

Navas A. 2009. Dispersión de semillas por aves desde el bosque nativo hasta la plantación de pinos de la USB. Tesis Especial de Grado, Departamento de Biología, Universidad Simón Bolívar, Caracas, Venezuela

Phelps WH (Jr) and R Meyer de Schauensee. 1994. Una Guía de las Aves de Venezuela. Editorial ExLibris, Caracas, Venezuela

Poulin B, G Lefebvre and R McNeil. 1994a. Diets of land birds from Northeastern Venezuela. *The Condor* 96: 354–367

Poulin B, G Lefebvre and R McNeil. 1994b. Characteristics of feeding guilds and variation in diets of bird species of three adjacent tropical sites. *Biotropica* 26: 187–198

Pyle P. 1997. Identification Guide to North American Birds. Part I: Columbidae to Ploceidae. Slate Creek Press, California, USA

Restall R, C Rodner and M Lentino. 1996. Birds of Northern South America: An Identification Guide. Volume 1: Species Accounts. Christopher Helm, London, UK

Ridgely RS and G Tudor. 1989. The Birds of South America. Volume 1: The Oscine Passerines. University of Texas Press, Austin, USA

Schäfer E and WH Phelps. 1954. Las aves del Parque Nacional "Henri Pittier" (Rancho Grande) y sus funciones ecológicas. *Boletín de la Sociedad Venezolana de Ciencias Naturales* 83: 3–167

Sherry T. 1984. Comparative dietary ecology of sympatric, insectivorous Neotropical flycatchers (Tyrannidae). *Ecological Monograph* 54: 313–338

Skutch AF. 1967. Life Histories of Central American Highland Birds. *Publications of the Nuttall Ornithological Club* 7: 1–213.

Tello JG and JM Bates. 2007. Molecular phylogenetics of the tody-tyrant and flatbill assemblage of tyrant flycatchers (Tyrannidae). *The Auk* 124: 134–154

Verea C, A Solórzano, M Díaz, L Parra, MA Araujo, F Antón, O Navas, OJL Ruíz and A Fernández-Badillo. 2009. Registros de actividad reproductora y muda en algunas aves del norte de Venezuela. *Ornitología Neotropical* 20: 181–201

Winker K. 1998. Suggestions for measuring external characters of birds. *Ornitología Neotropical* 9: 23–30

Recibido: 01/06/2021 **Aceptado**: 09/11/2021

Cómo citar este documento:
Sainz-Borgo C. 2021. New insights on the biology of the Pale-eyed Pygmy-tyrant *Atalotriccus pilaris* in Venezuela. *Revista Venezolana de Ornitología* 11: 12–17.