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Nota Científica

COLORATION ANOMALY OF A MALE COLLARED TROGON (*TROGON COLLARIS*)

Resumen. Reportamos la observación de un macho adulto de *Trogon collaris* con vientre amarillo, similar al color del vientre de *Trogon violaceus* o *Trogon melanocephalus*. El pico era de color amarillo sucio y el anillo orbital era oscuro. Con base en publicaciones sobre coloración anormal en otras especies, asumimos que fueron alteraciones genéticas o de desarrollo del individuo las que causaron el color amarillo en lugar del rojo usual del plumaje ventral.

Collared Trogon (*Trogon collaris*) occurs in several disjunct areas from central Mexico to the northern half of South America east of the Andes (AOU 1998. *Check-list of North American birds*. 7th ed. AOU. Washington D.C.). At least eight subspecies are recognized (Dickinson 2003. *The Howard and Moore complete checklist of the birds of the world*. 3rd ed. Princeton Univ. Press), and *T. c. puella* is the only subspecies occurring in northern Mesoamerica. In Guatemala, Collared Trogon is widely distributed in humid forests from sea level to approx. 2500 m (Howell & Webb 1995. *A guide to the birds of Mexico and northern Central America*. Oxford Univ. Press; Eisermann & Avendaño 2006. In: E. Cano (ed.) *Biodiversidad de Guatemala, Vol. 1*. Univ. del Valle de Guatemala. Guatemala. 525-623).

Coloration anomalies in birds have been frequently described involving many species. These anomalies can be caused by hybridization and alterations of mechanisms of bird coloration (Hill & McGraw (eds.) 2006. *Bird coloration. I. Mechanisms and measurements*. Harvard Univ. Press), including unusual lack of pigments (albinism), unusual dominance of dark pigments (melanism), deposition of ingested pigments (e.g. Gross 1965. *J. Field Ornithol.* 36:67-71; Gross 1965. *J. Field Ornithol.* 36:240-242; Hill 2002. *A red bird in a brown bag: the function and evolution of colorful plumage coloration in the House Finch*. Oxford Univ. Press), and other pigmentation modifications (McGraw *et al.* 2003. *Condor* 105:587-592).

Slight individual or geographical variations in the coloration of trogons have been described, e.g. orange to red-orange belly in Orange-bellied Trogon (*T. aurantiiventris*; Stiles & Skutch 1989. *A guide to the birds of Costa Rica*. Cornell Univ. Press) and different grade of paleness in ventral red plumage among different subspecies of Elegant Trogon (*T. elegans*; Webster 1984. *Condor* 86:204-207). Haverschmidt (1968. *Auk* 85:499) reported Violaceous Trogons (*T. violaceus*) with some red feathers within the yellow-orange plumage. We are not aware of descriptions of strong alterations in Collared Trogon. Here we report a coloration anomaly in a male Collared Trogon which was seen near Antigua Guatemala.

Non-standardized bird observations were made approx. 5 km southeast of Antigua Guatemala at Montaña La Carmona (14°32'N 90°42'W), Guatemala, on 23 January

2005, 8:00-12:00 h (CST). We surveyed pine-oak woodland at an elevation of 1900-2150 m. The forest was dominated by the following trees: oak (*Quercus* sp.), cypress (*Cupressus lusitanicus*), pine (*Pinus* sp.), and American Hornbeam (*Carpinus caroliniana*). Nomenclature of bird species follows AOU (1998. *op. cit.*).

At approx. 10:10 h our attention was drawn to a trogon, which we identified as Collared Trogon (*Trogon collaris*) by its warning call. The bird was perched on a branch in the forest understory approx. 3 m above ground. We saw the trogon at a distance of 30 m for approx. 5 min. under favorable light conditions. Observation with 10x42 binoculars revealed an obvious yellow belly. According to closer inspection with 40x spotting scope we can describe the bird as follows: Feathers on back, head and chest were dark metallic green. The face had a black mask. The eye was dark with a bare dark brown or black orbital ring. The bill was sooty yellow. A white chest band separated the green chest from the yellow belly. The yellow resembled the color of the belly of Violaceous Trogon (*T. violaceus*) or Black-headed Trogon (*T. melanocephalus*). Primaries were black with white edges. The undertail was barred black and white, by which we identified the bird as an adult male based on plate 33 in Howell & Webb (1995. *op. cit.*). The uppertail was green with black tip. The edge of the uppertail appeared barred black and white.

We identified the observed bird as Collared Trogon (*Trogon collaris*) based on voice and coloration features. The yellow belly did not match previous descriptions of this species. Table 1 gives an account of color descriptions of adult males in the range of *T. c. puella*, published by several authors. All reviewed accounts include red as color of the belly. KO examined 139 skins of Collared Trogon in the collection of the Smithsonian NMNH; none of the specimens showed any hint of yellow. The Orange-bellied Trogon (*Trogon aurantiiventris*) of Costa Rica and Panama (AOU 1998. *op. cit.*) has been discussed to be probably a color morph of Collared Trogon (Salvin & Godman 1888-1904. *Biologia Centrali Americana. Aves, Vol. 2*. Taylor & Francis, London; Wetmore 1968. *The birds of the Republic of Panama, part 2*. Smithsonian Misc. Coll. 150; Stiles & Skutch 1989. *op. cit.*). Ecology, voice, and all exterior features, except the orange belly, are identical to the Collared Trogon (Stiles & Skutch 1989. *op. cit.*). Recent phylogenetic data has proven very close relationship between both taxa (Moyle 2005. *Biol. J. Linnean Society* 84:725-738). We are not aware of descriptions of yellow-bellied *T. aurantiiventris*.

Dark eyerings and sooty yellow bills appear to be an intraspecific variation of *T. collaris*. Some authors described a similar eyering color, and descriptions of bill color vary from greenish-yellow to orange (Table 1).

We can only suggest on probable reasons for the coloration anomaly of the ventral plumage. While iridescent greens of head and back plumage of trogons are based on structural coloration (Durrer & Villiger 1966. *J. Ornithol.* 107:1-26), red and yellow ventral feathers are assumed to be colored by carotenoid pigments (Johnsgard 2000. *Trogons*

and quetzals of the world. Smithsonian Institution Press. Washington and London). Although some parrots have similar colors that are not carotenoids (McGraw & Nogare 2004. *Comparative Biochemistry and Physiology*, B 138:229-233), the spectrum from normal red Collared Trogons examined in the Smithsonian NMNH (KO, unpublished data) suggested a typical saturated red carotenoid as compared to orioles (Hofmann *et al.* 2007. *J. Avian Biology* 38:163-171.)

Table 1

Color of exterior parts of adult male Collared Trogons according to several authors.

Publication	Belly	Bill	Orbital ring
Gould (1845. <i>Proc. Zool. Soc. London</i> , Part 8:18-20)	scarlet	orange	-
Ridgway (1911. <i>Bull. U. S. National Museum</i> 50, part 5)	pure deep geranium red	yellow	-
Dickey & van Rossem (1938. <i>Field Mus. Nat. Hist., Zool. Ser.</i> 23)	-	dull yellow	dusky brown
Skutch (1956. <i>Auk</i> 73:354-366)	bright red	bright yellow	dark brown
Smithe (1966. <i>The birds of Tikal</i> . Natural History Press, New York)	bright red	yellow	obscure-brownish
Land (1970. <i>Birds of Guatemala</i> . Livingston, Wynnewood, PA)	red	greenish-yellow	no noticeable eyering
Ridgely & Gwynne (1989. <i>A guide to the birds of Panama with Costa Rica, Nicaragua, and Honduras</i> . Princeton Univ. Press)	red	yellow	inconspicuous brown
Stiles & Skutch (1989. <i>op. cit.</i>)	red	yellow	no conspicuous bare
Howell & Webb (1995. <i>op. cit.</i>)	red	bright yellow	orange-red
Johnsgard (2000. <i>op. cit.</i>)	pure deep red	yellow	inconspicuous brown
Jones (2003. <i>Birds of Belize</i> . Univ. of Texas Press)	red	yellow	red

Carotenoids cannot be synthesized by birds, they need to be ingested (Brush 1981. In: Bauernfeind, J. C. (ed.) *Carotenoids as colourants and vitamin A precursors*. Academic Press, London. 539-562). Food can therefore affect the coloration, which has been tested on several species. Pink plumage flush in Elegant Tern (*Sterna elegans*), Franklin's Gull (*Larus pipixcan*), and Ring-billed Gull (*Larus delawarensis*) is caused by carotenoids (Hudon & Brush 1990. *Condor* 92:798-801; McGraw & Hardy 2006. *J. Field Ornith.* 77:29-33). The plumage in male House Finches (*Carpodacus mexicanus*) is carotene-based and varies from pale yellow to bright red (Hill *et al.* 2002. *Proc. Royal Soc. London*, B 269:1119-1124). Hill & Benkman (1995. *Wilson Bull.* 107:555-557) reported a drastic change in coloration in Red Crossbills (*Loxia curvirostra*) in a feeding experiment with huge quantities of carotenoids. Experimental manipulation of carotenoid supply changed yellow plumage of American Goldfinches (*Carduelis tristis*) to orange and the scarlet red plumage of Northern Cardinals (*Cardinalis cardinalis*) to pale red (McGraw *et al.* 2001. *Physiological and Biochemical Zoology* 74:843-852). This suggests that the yellow ventral plumage of the Collared Trogon can not be caused uniquely by a lack of carotenoids in the food, but by genetic or developmental changes (e.g. mutation, hormones, carotenoid deposition, carotenoid modification). McGraw *et al.* (2003. *op. cit.*) reported a mutant yellow Northern Cardinal lacking all of four primary red carotenoids; it had instead a yellow carotenoid.

A distinct character of the population of Collared Trogon at Montaña La Carmona is unlikely, because a normally colored Collared Trogon has been seen previously there (KE, pers. observ.). The Violaceous Trogon (*T. violaceus*) has been observed at the lower parts of Montaña La Carmona at approx. 1700 m (KE, pers. observ.). To our knowledge no hybrid between Collared and Violaceous Trogon has been reported. We do not believe the observed bird was an F1 hybrid, because almost all exterior features and the voice matched descriptions of Collared Trogon. Our observations of anomalous breast coloration in *Trogon collaris* increase our understanding of plumage color variation across birds, and specifically in this relatively unstudied tropical genus and species.

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