

ONTOGENY OF BILL COLOR IN MALE STREAMERTAIL HUMMINGBIRDS (*TROCHILUS*)

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Abstract: Gill *et al.* (Condor 75:170-176, 1973) concluded on the basis of male bill color that the Red-billed Streamertail (*Trochilus polytmus*) and Black-billed Streamertail (*T. scitulus*) hybridized where their geographic ranges meet in eastern Jamaica. Schuchmann (1978) questioned the existence of a hybrid zone, arguing that bill color was an unreliable indicator of hybridization because the extent of red coloration in *T. polytmus* increased with age. Here I show that males of *T. polytmus* attain adult bill color with the completion of the first prebasic molt. Bill color thus provides a genuine marker of hybridization in males in first basic or definitive basic plumage.

Key words: bill color, Black-billed Streamertail, Jamaica, ontogeny, Red-billed Streamertail, *Trochilus polytmus*, *Trochilus scitulus*

Resumen: ONTOGENIA DEL COLOR DEL PICO EN MACHOS DE COLIBRÍES (*TROCHILUS*). Gill *et al.* (Condor 75:170-176, 1973) concluyeron sobre la base del color del pico que el Colibrí de Pico Rojo (*Polytmus trochilus*) y el de Pico Negro (*T. scitulus*) se hibridizan en las áreas donde sus distribuciones geográficas se superponen en el Este de Jamaica. Schuchmann (1978) cuestionó la existencia de una zona de hibridación, argumentando que el color del pico no era un indicador fiable de la hibridación porque el grado de coloración roja en *T. polytmus* aumenta con la edad. Aquí se muestra que los machos de *T. polytmus* alcanzan el color del pico adulto con el completamiento de la primera muda prebásica. El color del pico por tanto provee un indicador genuino de hibridación en los machos en los plumajes básicos primarios o definitivos.

Palabras clave: color del pico, Jamaica, ontogenia, *Trochilus polytmus*, *Trochilus scitulus*

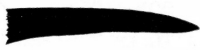
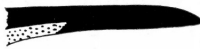



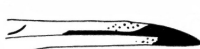

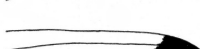
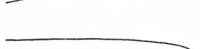
Résumé : ONTOGENÈSE DE LA COULEUR DU BEC DES COLIBRIS MÂLES DU GENRE *TROCHILUS*. Gill *et al.* (Condor 75:170-176, 1973) ont conclu sur la base de la couleur du bec des mâles que le Colibri à tête noire (*Trochilus polytmus*) et Colibri à bec noir (*T. scitulus*) s'hybrident lorsque leurs aires de répartition se rencontrent dans l'est de la Jamaïque. Schuchmann (1978) s'interroge sur l'existence d'une zone d'hybridation, faisant valoir que la couleur du bec n'est pas un indicateur fiable de l'hybridation, car l'étendue de la coloration rouge chez *T. polytmus* augmente avec l'âge. Je montre ici que les mâles de *T. polytmus* acquièrent une couleur d'adulte à la fin de leur première mue pré-basique. La couleur du bec fournit ainsi un véritable marqueur de l'hybridation chez les mâles en plumage basique (non-nicheur).

Mots clés : couleur du bec, Colibri à bec noir, Jamaïque, ontogénèse, Colibri à tête noire, *Trochilus polytmus*, Colibri à bec noir, *Trochilus scitulus*

Bill color is the principal morphological character differentiating the endemic Jamaican streamertails, *Trochilus polytmus* and *T. scitulus* (Brewster and Bangs 1901, Gill *et al.* 1973, Schuchmann 1978). The Black-billed Streamertail (*T. scitulus*), which has an entirely black bill, is restricted to the extreme eastern tip of the island in Portland and St. Thomas parishes. The better known Red-billed Streamertail (*T. polytmus*) occurs widely in the forested remainder of Jamaica except for areas along the southern coast that experience a prolonged dry season. Both species are spectacular but the coral-red bill and flamboyant plumage of male *T. polytmus* create one of the most visually arresting displays among hummingbirds. Strong sexual dimorphism in bill color suggests it is a sexually selected trait.

Gill *et al.* (1973) examined *Trochilus* specimens

in museum collections and made field surveys of streamertail populations in the Rio Grande Valley. Male bill color was categorized according to a hybrid index ranging from pure black to solid red (Fig. 1). Bills of *T. scitulus* were invariably black (category 1) whereas typical adult *T. polytmus* had bright red bills narrowly tipped with black (categories 7 and 8). Gill *et al.* (1973) concluded that *T. polytmus* and *T. scitulus* exhibited a limited amount of hybridization in the zone of contact based on intermediate bill color of males in some populations. Bill color categories from the Kingston reference sample ranged from 4-8 in subadults to 6-9 in adults. Based on the Kingston values, Gill *et al.* (1973) conservatively considered adult males with bills in categories 2-5 and subadult males with bills in categories 2-3 as hybrids. Some 28 years later,

Category	Bill	Reference specimen
1		typical <i>scitulus</i>
2		JI 150
3		AMNH 482427
4		ANSP 170280
5		ANSP 170270
6		ANSP 170262
7		AMNH 482408
8		typical <i>polytmus</i>
9		AMNH 482411




Black  Dark red  Red 

Fig.1. Bill color categories of male Streamertails (*Trochilus*). Redrawn with permission from Gill *et al.* (1973). Copyright © 1973 by the Cooper Ornithological Society.

MacColl and Lewis (2000) made binocular surveys of streamertail populations at many of the same locations and concurred with Gill *et al.*'s (1973) diagnosis of hybridization.

Even though Gill *et al.* (1973) were careful to stratify bill color data by age class, Schuchmann (1978) questioned the existence of a hybrid zone, arguing that intermediate bill color was an unreliable indicator of hybridization because the extent of red coloration increased with age in *T. polytmus*. Neither Schuchmann (1978) nor Gill *et al.* (1973) conclusively determined at what age bill color becomes a valid marker for hybridization. Here I show that bill color is a dependable indicator of hybridization in males in first basic and definitive basic plumages.

METHODS

I mist-netted males of *T. polytmus* at four sites located outside the morphological hybrid zone: Windsor Great House, Trelawny Parish (18.360° N,



Fig. 2. Recently fledged male of *Trochilus polytmus* in juvenal plumage. The fledgling was captured by hand as it feebly hovered and took nectar from the blossoms of Otaheite Apple (*Syzygium malaccense*) on 31 March 2006 near Windsor House, Trelawny Parish. Note the sheathed primaries.

77.661° W; WGS-84), Somerset Falls, Portland Parish (18.196° N, 76.554° W), Burlington, Portland Parish (18.185° N, 76.495° W), and Springbank, Portland Parish (18.176° N, 76.471° W). These were compared with male *T. scitulus* from Nonsuch (18.154° N, 76.418° W), San San (18.169° N, 76.396° W), Cambridge (18.123° N, 76.384° W), and Ecclesdown (18.090° N, 76.348° W), all in Portland Parish. Red bill color in *T. polytmus* fades rapidly after death and turns pinkish-gray within weeks in museum specimen indicating that it is produced by blood-infused tissues rather than carotenoid pigments. Portions of the ramphotheca suffused with low to high concentrations of melanin appear somewhat darker in specimens but it is difficult to determine what the color in life would have been. Descriptions of bill color in this paper are thus based on digital photographs of living or freshly euthanized males. Photographs and voucher specimens (rounded skins, partial skeletons, and tissues) collected under licenses issued by the National Environment and Planning Agency (NEPA), Kingston, are deposited in the research collection of the National Museum of Natural History (USNM), Smithsonian Institution.

RESULTS AND DISCUSSION

The molt sequence of male streamertails has not been studied in detail but it appears that the juvenal plumage is replaced by a first basic plumage followed by the spectacular definitive basic plumage, replete with a pair of elongated streamers (Gosse 1847, Blake 1956, Gill *et al.* 1973). Males fledge in

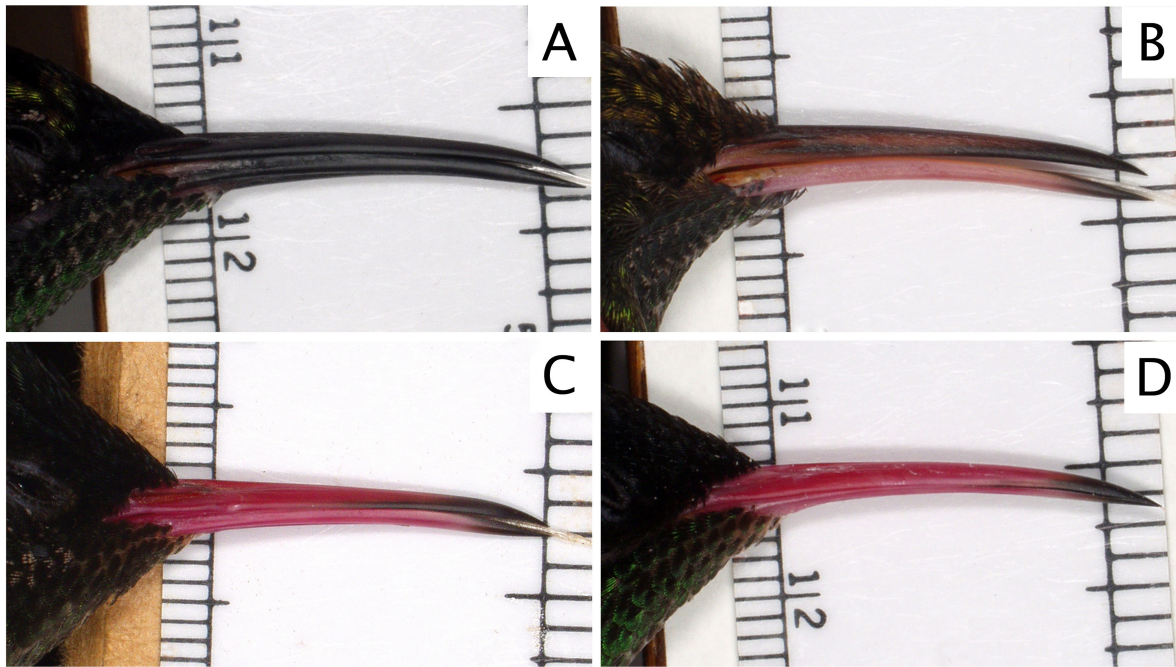


Fig. 3. Ontological variation in bill color in male streamertails (*Trochilus*): (A) *scitulus*, juvenal plumage, USNM 636162, Nonsuch, Portland Parish; (B) *polytmus*, juvenal plumage, USNM 636153, Springbank, Portland Parish; (C) *polytmus*, first basic plumage, USNM 636175, Windsor House, Trelawny Parish; (D) *polytmus*, first basic plumage, USNM 636156, Springbank, Portland Parish. Both individuals in juvenal plumage possess fine striations on the maxillary ramphotheca.

a dull green juvenal plumage unlike that of immature or adult females (Fig. 2). The juvenal plumage is replaced incrementally over a period of months by a first prebasic molt of the body plumage which features a glossy black crown with attenuated tails at the sides and intensely iridescent green feathering from chin to lower belly. Subadult males in first basic plumage are similar in appearance to adult males in definitive basic plumage, but lack the extravagantly elongated rectrices (fourth pair from the

center) present in the latter.

Reddish bill coloration in *T. polytmus* first appears in nestlings. In newly fledged males, the proximal two-thirds of the lower mandible are pinkish-red whereas the maxillary ramphotheca shows a suffusion of pink, particularly below the nasal operculum (Fig. 2). Streamertails in juvenal plumage exhibit fine striations or wrinkling on the maxillary ramphotheca, a character indicative of immaturity in hummingbirds (Ortiz-Crespo 1972). Juvenal males

Table 1. Bill color of male *Trochilus polytmus* in basic plumage based on specimens from Somerset Falls ($n = 5$), Burlington ($n = 10$), Springbank ($n = 7$), and Windsor ($n = 9$). Bill color categories from Fig. 1.

	Bill Color Categories			
	1–5	6–7	8	9
First basic plumage	0	9	3	0
First basic plumage undergoing definitive prebasic molt	0	3	2	0
Definitive basic plumage	0	2	12	0

of *T. polytmus* undergoing prebasic molt, and that still exhibit some bill striations, retain substantial deposits of melanin in the maxillary ramphotheca (Fig. 3A). However, melanin progressively disappears with age so that males in first basic plumage have smooth, predominately red bills (Table 1; Fig. 3B, 3C) corresponding to bill color categories 6-8 (Gill *et al.* 1973). Males in definitive basic plumage have bills in color categories 7-8. Bill color of *T. scitulus* is entirely black in juvenal and basic plumages corresponding to bill color category 1 (Fig. 3D).

These observations confirm Gill *et al.*'s (1973) contention that bill color is a reliable indicator of hybridization in streamertails. Males in first basic and definitive basic plumage with bills in categories 2-5 are presumed to be hybrids. This finding will facilitate the measurement of the morphological hybrid zone between *Trochilus scitulus* and *T. polytmus*.

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