

Three anomalies: A scythebill in the Greater Antillean Grackle (blackbird), a crown pattern in the Rock Beauty (angelfish), and a double spot in the Butter Hamlet (grouper), and their possible genetic significance

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Abstract: Three anomalies are described: a scythebill in Greater Antillean Grackle, *Quiscalus niger* (Boddaert) (Passeriformes: Emberizidae), a crown color pattern in Rock Beauty, *Holacanthus tricolor* (Bloch) (Perciformes: Pomacanthidae), and a double-spot color pattern in Butter Hamlet, *Hypoplectrus unicolor* (Walbaum) (Perciformes: Pomacanthidae). Bill anomalies are generally thought to be genetic in origin and genetic changes in bill shape can occur rapidly in a population. The scythebill anomaly demonstrates how quickly a drastic bill modification may occur. The crown color pattern anomaly is similar to distinctive markings found in other members of this genus [Queen Angelfish, *H. ciliaris* (Linnaeus) and hybrid Townsend Angelfish *H. ciliaris* X *H. bermudensis* Goode] in the tropical western Atlantic. It suggests how quickly this pattern could have originated in the other species, and/or some propensity of this pattern in the genus. The distinct double-spot color pattern anomaly suggests how quickly new color patterns can originate in genus *Hypoplectrus*. This is important because species in this genus are distinguished almost solely on the basis of color pattern and speciation may be occurring rapidly. Anomalies should be recorded because they may give us some hints at the genetic origin of species characters and some could represent potentially inheritable characters. We suggest these potentially inheritable characters could be recognized and described when they first arise in an individual and before they become inherited by a population. Following these potentially inheritable characters could help to explain how such characters enter into a population. This approach to the study of inherited characters could fill a void in our knowledge of evolution and speciation. Rev. Biol. Trop. 54 (Suppl. 3): 161-169. Epub 2007 Jan. 15.

Key words: anomalies, crown color pattern, scythebill, double-spot color pattern, Rock Beauty, Greater Antillean Grackle, Butter Hamlet, Caribbean.

We describe three distinctive anomalies: a scythebill in Greater Antillean Grackle, *Quiscalus niger* (Boddaert) (Passeriformes: Emberizidae), a crown color pattern in Rock Beauty, *Holacanthus tricolor* (Bloch) (Perciformes: Pomacanthidae), and a double-spot color pattern in Butter Hamlet, *Hypoplectrus unicolor* (Walbaum) (Perciformes: Pomacanthidae). Since the cases discussed are rather diverse in background and methodology, we present each case, in

the chronological order of when we first found them, separately for clarity with its own introduction, materials and methods, results and discussion. The possible genetic significance of each anomaly is briefly discussed as is their collective importance as potentially inherited characters.

These three anomalies were selected for consideration because each appears to represent a genetically controlled trait in each species that at least has the potential to be inherited.

We suggest these potentially inheritable characters could be recognized and described when they first arise in an individual, and before they become inherited by a population. Following these potentially inheritable characters could help to explain how such characters enter into a population. This approach to the study of inherited characters could fill a void in our knowledge of evolution and speciation.

PRESENTATION OF CASES

A Scythebill in Greater Antillean Grackle from Southwestern Puerto Rico

The Greater Antillean Grackle, *Quiscalus niger*, is a relatively large (25-30 cm) blackbird in the family Emberizidae. It is only found in the Greater Antilles and the Cayman Islands. This bird is common in many open, low-land areas with some trees. It has a conical, sharply pointed bill (Fig. 1b). *Quiscalus niger* is relatively undisturbed by humans and frequently forages food scraps from humans in parks and around restaurants (Raffaele *et al.* 1998).

Campbell and Lack (1985) summarized bird bill anomalies, and Craves (1994) and

Anonymous (2003) summarized deformed bills in passerines (perching and song birds). They found anomalies were usually confined to the outer covering of the bill (rhamphotheca). Bill elongation with some degree of down curving was the most common anomaly, but lateral curvature [as normally seen in crossbills] was also quite common. Anomalies involving distorted growth are believed to have genetic origins, but the evidence is stronger in domestic fowls, than in wild birds. Bill anomalies have been found in many species and families of birds, but more frequently in passerines, and these are more often reported in bird species that have become commensal with humans. They suggest that some sort of bill anomalies may be found in between 1.0 to 0.1% of birds.

MATERIALS AND METHODS

We incidentally observed an unusual specimen of this bird in a flock of normally appearing *Q. niger* on the grounds of the Villa Parguera Hotel in La Parguera, Puerto Rico, in the open area between the hotel rooms and the Caribbean Sea on three occasions from June 1997 through September 1998, 17°58.4'N,

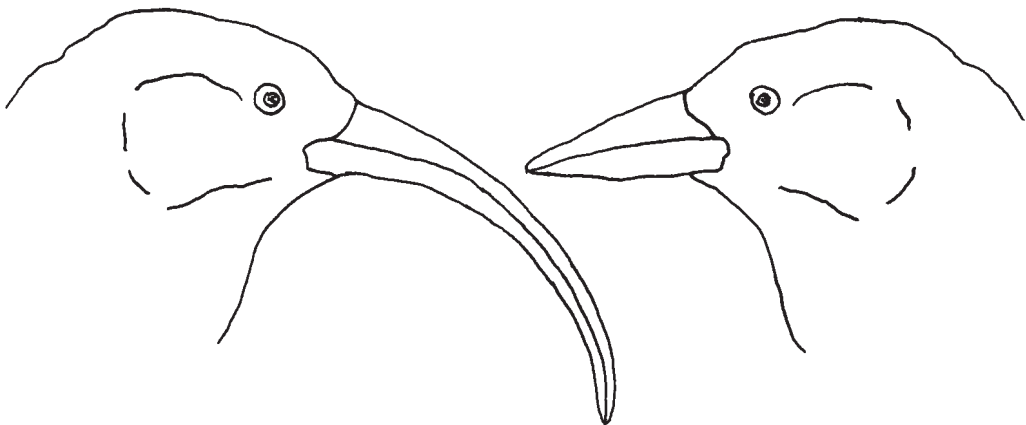


Fig. 1a. Left. Greater Antillean Grackle, *Quiscalus niger*, with an anomalous bill (scythebill); from field drawings by E.H. Williams made in La Parguera, Puerto Rico.

Fig. 1b. Right. Greater Antillean Grackle, *Quiscalus niger*, with a normally shaped bill.

Fig 1a. Izquierda. Chinchilín (mozambique, chango), *Quiscalus niger*, con un pico anómalo (pico de guadaña) tomado de dibujos de campo realizados por E.H. Williams en La Parguera, Puerto Rico.

Fig 1b. Derecha, *Quiscalus niger* con un pico normal.

67°03.0'W. We examined the specimen within 2 m distance and from 8-12 m with Nikon 10X35 6.6° WF binoculars for a total of 4 hr and made field drawings. Initial observations were made close enough (2 m) to probably cause behavior modifications; however, most subsequent observations were made from concealment and with little movement behind an opportunistic blind (low hedge, plastic lawn chairs).

RESULTS AND DISCUSSION

The *Q. niger* specimen possessed an abnormally shaped bill (Fig. 1a). We closely examined this abnormal bird and found that it otherwise conformed to all of the characters of the species. It was a female approximately 26 cm in length. The bird did not appear to differ from other, normally appearing, *Q. niger* in behavior. It associated with flocks and smaller groups of six to eight *Q. niger*. The abnormal *Q. niger* foraged and competed for seeds and other food items equally as well as the other associated birds. It did not appear to be ostracized, attacked, or harassed by other *Q. niger*. The abnormal *Q. niger* interacted with other *Q. niger* similarly to the normally appearing *Q. niger* observed. Our observations run contrary to the summary of Campbell and Lack (1985) that suggested behavioral changes, sometimes-drastic ones, were usually associated with bill anomalies, although Fox (1952) suggested that birds can adapt to extremely long bill anomalies.

Although Campbell and Lack (1985) suggested that bill elongation with some degree of down curving was the most common anomaly, the extension we described was much more drastic or extensive than the more limited extensions they considered common. We are aware of no similar reports of elongated bills in *Q. niger* (Blake 1957, Craves 1994, Anonymous 2003). Bill elongation has been noted in one specimen of *Q. mexicana* (Gmelin) (Great-tailed Grackle) from Ft. Worth, Texas (Sharp and Neill 1979), and two specimens of *Q. quiscula* (Linnaeus) (Common Grackle) from Pennsylvania (Mutchler 1976)

and Washtnaw County, Minnesota (Craves 1994). Snyder (1937) reports other beak anomalies in *Q. quiscula* from Canada. Arendt and Arendt (1986) report a bill anomaly in the closely related, *Margarops fuscatus* (Vieillot) (Pearly-eyed Thrasher) from Montserrat, West Indies; and Post (1981) described a crossed beak in the closely related *Agelaius xanthomus* (Sclater) (Yellow-shouldered Blackbird) collected at La Parguera, Puerto Rico. Bowdish (1904) described a greatly elongated beak in a *Melanerpes portoricensis* (Daudin) (Puerto Rican Woodpecker) (Picidae) he shot near Mayagüez, Puerto Rico.

The abnormal bill we observed appeared to be rather similar in shape to the bill of *Campylorhamphus procurviodes* (Lafrenaye) (Curved-billed Scythebill) (Dendrocolaptidae) found in the Central Amazonian Basin. We therefore call this unusual form of bill a "scythebill anomaly" and the *Q. niger* specimen a "scythe-billed Greater Antillean Grackle." This odd occurrence points out how quickly a drastically different bill (Figs. 1a, b) form can arise. Weiner (1995) demonstrated that bill form can change rapidly in a population. Should the scythebill abnormality prove beneficial to the abnormal grackle, and if it is inheritable, it could have speciation or evolutionary importance. Campbell and Lack (1985) suggested that bill anomalies are genetic in origin, thus the present anomaly could be assumed to be inheritable. Similar anomalous bill development should be looked for in *Q. niger*. Fox (1952) suggested that greatly elongated bills represented "new tools" to which some birds are able to adapt and use. He did not go so far as to suggest that these may be potentially inherited characters or to suggest any speciation possibilities, but did suggest that the character might be passed through several generations. He also emphasized that these individual birds with elongated beaks represented an opportunity to further study bird behavior.

The Hotel grounds may provide supplemental sources of food that may allow abnormal or damaged birds to survive and thrive that might not otherwise survive in the wild. Campbell and Lack (1985) suggested commensal species that

rely in part on food from humans might survive bill anomalies more often than wild birds. However, we never observed the anomalous *Q. niger* eating anything but natural foods, and a hotel grounds would be considered a normal habitat for grackles (Raffaele *et al.* 1998).

Documentation by photography would have improved this study. However, we could not obtain permission to photograph so close to guest rooms at the Villa Parguera Hotel.

A Crown Color Pattern in Rock Beauty from Southwestern Puerto Rico

Rock Beauty, *Holacanthus tricolor*, is a brilliant yellow and black colored, moderate-sized angelfish found in clear-water, coral-reef areas of the western North Atlantic. It occurs commonly, but is not used as a food fish.

We routinely closely examine *H. tricolor* because they host a large, external isopod, *Anilocra holacanthi* (Williams and Williams 1981). These fishes are also of interest because abnormal color patterns in it are caused by a turbellarian parasite (Grizzle and Williams 1985).

MATERIALS AND METHODS

On 12 October 2001 using SCUBA, we closely observed an approximately 17 cm total length (TL) *H. tricolor* in 19.8 m depth in the shelf edge coral reef 13 m N, or inshore, from the insular shelf drop-off S of La Parguera, Puerto Rico, 17°52.8'N, 67°02.7'W. An underwater camera was not available at the time, but field drawings were made of the *H. tricolor* specimen on a slate (Fig. 2b).

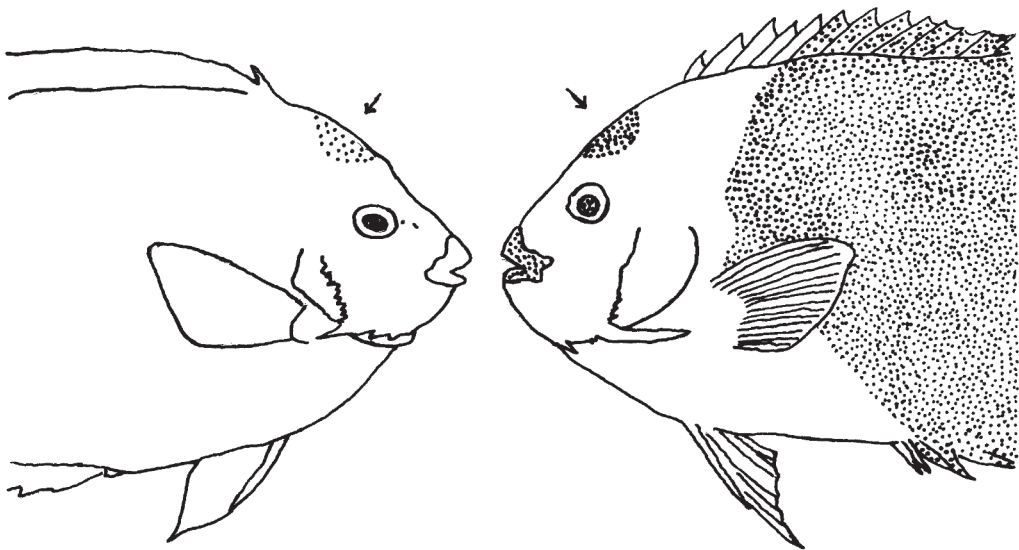


Fig. 2a. Left. Anterior end of a Queen Angelfish, *Holacanthus ciliaris*, illustrating the normal crown pattern on the forehead (arrow).

Fig. 2b. Right. Anterior end of a Rock Beauty, *Holacanthus tricolor*, taken from field drawings by E.H. Williams made near the insular shelf edge off La Parguera, Puerto Rico (12 October 2001). This illustrates an abnormal crown pattern on the forehead (arrow). Stippled areas were black and non-stippled areas were bright yellow.

Fig 2a. Izquierda. Parte anterior de un isabelita reina, *Holacanthus ciliaris*, ilustrando el patrón normal de corona en la frente (flecha).

Fig. 2b. Derecha. Parte anterior de *Holacanthus tricolor*, tomado de dibujos de campo realizados por E.H. Williams el 12 de octubre de 2001, cerca de la plataforma insular de La Parguera, Puerto Rico. Se ilustra el patrón anormal de corona en la frente (flecha). Las áreas punteadas son negras y las lisas son amarillo brillante.

RESULTS AND DISCUSSION

A darkly-pigmented oval surrounded by a lighter-pigmented ring on the foreheads of some angelfishes is called a "crown." The black-pigmented distinct oval on the forehead of the specimen we examined is similar except lacking the ring (Fig. 2b). This is apparently an odd color pattern in *H. tricolor* as we have examined many thousands of specimens of this fish throughout the West Indies and have not seen anything similar. It is of interest because another member of the genus *Holacanthus* in the West Indies, *H. ciliaris* (Linnaeus) (Queen Angelfish), has a distinct crown pattern (Fig. 2a). The apparently spontaneous expression of a pattern similar to the crown color pattern in the *H. tricolor* may suggest how quickly it could have originated in the other species, and/or some propensity of this pattern in the genus.

A similar crown pattern is seen in the *H. ciliaris* X *H. bermudensis* Goode hybrid (Townsend Angelfish). However, the otherwise normal color pattern of the specimen of *H. tricolor* that we observed would not suggest any hybridization between *H. ciliaris* and *H. tricolor*. We are unaware of any report of *H. tricolor* hybridization resulting in a crown pattern in the literature.

Attachment of the parasitic isopod, *A. holacanthi*, can cause an area of dark pigmentation on normally yellow-colored areas (Williams and Williams 1981); however, this isopod attaches under the eye and never on the forehead of *H. tricolor* (Williams and Williams 1981, Williams and Bunkley-Williams, unpub. data). Tissue-embedded turbellarians can cause normally yellow portions of *H. tricolor* to darken (Grizzle and Williams 1985); however, these color alterations are more diffuse and generalized than the crown pattern seen in the observed specimen. Breeding male *H. tricolor* are well known to develop darkened faces, but this pattern is also more diffuse and general than what we observed.

A Double-spot Pattern in Butter Hamlet from St. John, U.S. Virgin Islands

The Butter Hamlet, *Hypoplectrus unicolor*, is a grayish-white to yellow, miniature (<13 cm TL) grouper found in clear-water, coral-reef areas of the western North Atlantic. It occurs commonly in the Florida Keys, but only occasionally in the remainder of the West Indies. This fish has no economic aquarium or food-fish value, but is of taxonomic importance as the first described in a complex of hamlet species/subspecies/variants.

We routinely closely examine hamlets in the field because we are cooperating with a Department of Marine Sciences, University of Puerto Rico, graduate student working on hamlet biology including their parasites. We have also observed unusual geographic distribution patterns in some species/variants (Williams *et al.* 2006, Williams and Bunkley-Williams, unpubl. data).

MATERIALS AND METHODS

On 10 June 2002 using SCUBA, we closely observed an 11.4 cm TL *H. unicolor* in 12.2 m depth on an approximately 45° seaward slope of a rock ridge sparsely covered with largely dead, low-profile stony corals off Whistling Key, St. John, U.S. Virgin Islands, 18°22.1'N, 64°45.3'W. An underwater camera was not available, but field drawings of the *H. unicolor* specimen were made on a slate (Fig. 3b).

RESULTS AND DISCUSSION

Normally, a darkly-pigmented black saddle blotch occurs on the base of the caudal peduncle (Fig. 3a) of *H. unicolor*. In side view, this blotch appears to be a "spot" on either side of the caudal peduncle (Fig. 3a). The black blotch of the specimen we examined is similar

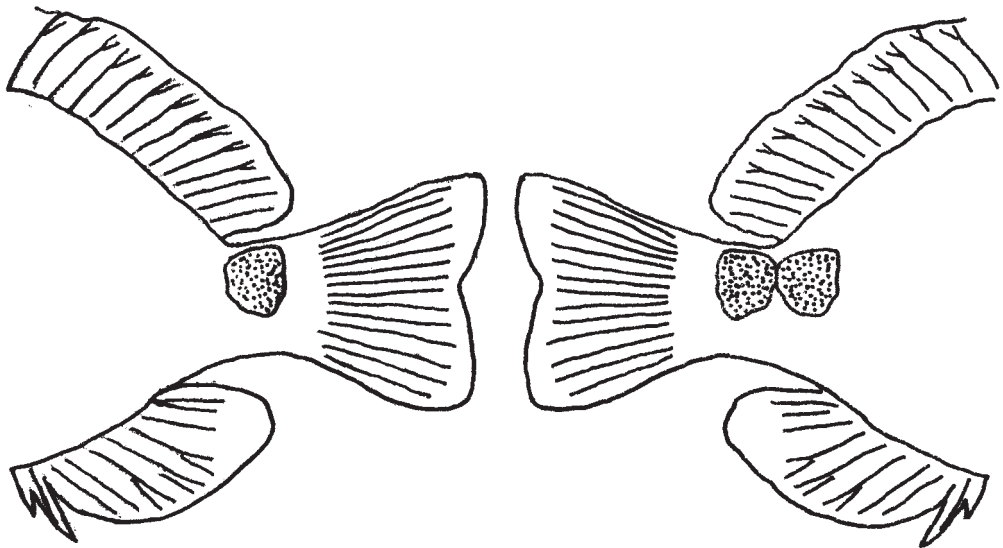


Fig. 3a. Left. Posterior end of a Butter Hamlet, *Hypoplectrus unicolor*, illustrating the normal black spot on the caudal peduncle (stippled area).

Fig. 3b. Right. Posterior end of a Butter Hamlet, *Hypoplectrus unicolor*, taken from field drawings by E.H. Williams off Whisling Key, St. John (10 June 2002, U.S. Virgin Islands), illustrating an atypical Double Spot on the caudal peduncle and posterior body (stippled area). Stippled areas were black and non-stippled areas light yellow to white.

Fig. 3a. Izquierda. Parte posterior de un vaca blanca, *Hypoplectrus unicolor*, con la mancha negra normal en el pedúnculo caudal (área punteada).

Fig. 3b. Derecha. Parte posterior de *Hypoplectrus unicolor*, tomado de dibujos de campo realizados por E.H. Williams en Whisling Key, St. John, Islas Vírgenes de los EEUU (10 de junio de 2002). Se ilustra una doble mancha atípica en el pedúnculo caudal y la parte posterior del cuerpo (área punteada). Las áreas punteadas son negras y las lisas son amarillo claro o blancas.

except it has been duplicated with a similar size and shape, and congruent anterior spot on both sides of the fish (Fig. 3b). This is apparently an odd “double-spot” color pattern in *H. unicolor* as we have examined many hundreds of specimens of this fish throughout the West Indies and have not seen anything similar. It is of interest because members of the genus *Hypoplectrus* (hamlets) in the West Indies are distinguished largely on the basis of color patterns and the origin, development, and genetic significance of distinctive color patterns is a subject of much debate (Thresher 1978, Graves and Rosenblatt 1980, Domeier 1994, Srinivasa Rao and Lakshmi 1999, McCartney *et al.* 2003, Ramon *et al.* 2003, Aguilar-Perera 2003, 2004, in press, García-Machado *et al.* 2004). Members of this genus are thought to have undergone recent and rapid speciation and/or

formation of color morphs (Ramon *et al.* 2003). The apparently spontaneous expression of a distinct, new color pattern in this specimen of *H. unicolor* may suggest how abruptly new patterns can originate. Following this new pattern may well be important in this genetically fluid genus. We are unaware of any report of a color pattern similar to the double-spot in the *H. unicolor* or in any other hamlet, *Hypoplectrus* spp., in the literature.

Species or color variants of hamlets usually chose to breed with partners that are identical in morphology, although hybridization between forms does occur (Domeier 1994). An anomaly such as the Double-spot Pattern could be the beginning of a new variant or species. This is at least some indication of how they might evolve.

After the presentation of this paper (Williams and Bunkley-Williams 2005), Steven

Piontek (pers. comm.) informed us that approximately half of the specimens of Butter Hamlets he had examined in the field and collected for the Curaçao Sea Aquarium over many years had a dark spot on the nose, while half were lacking the spot. We observed 15 specimens of Butter Hamlets during scuba dives at nine different sites 14-18 June 2005 (EHW 7, LBW 5), and three specimens in the Aquarium. Approximately half (N=10 of 18) had the nose spot, while eight lacked any trace of the spot. One pair about to breed seen 17:20 hrs 17 June 2005 each had the nose spot. Apparently variations in pigment spots commonly occur in this species and we hypothesize that it may affect mate choice.

CONCLUSIONS

Bill anomalies are generally thought to be genetic in origin. The scythebill anomaly demonstrates how quickly a drastic bill modification may occur. This is important because changes in bill shape can occur rapidly in a population. The crown color pattern anomaly in *Holocanthus tricolor* is similar to distinctive markings found in other members of this genus in the tropical western Atlantic. It suggests how abruptly this pattern could have originated in the other species, and/or some propensity of this pattern in the genus. The distinct double-spot color pattern anomaly suggests how quickly new color patterns can originate in genus *Hypoplectrus*. This is important because species in this genus are distinguished almost solely on the basis of color pattern and they are apparently in a period of rapid speciation. These and similar anomalies should be recorded because they may give us some hints at the genetic origin of species characters and some could represent potentially inheritable characters.

The existence of natural, spontaneous mutational changes that can be inherited is the basis of evolutionary theory (Darwin 1859, Gould 2002). Considerable disagreement exists among evolutionary biologists regarding the methods for studying adaptation in nature

(Baum and Larson 1991). A multitude of studies of this process have attempted to identify characters that have already been inherited in a species, subspecies, race, variant, or population. Macroevolutionary thought must assume "historical genesis" of adaptations (Bock and von Wahlert 1965, Williams 1966, Bock 1979, Gould and Lewontin 1979, Gould and Vrba 1982, Baum and Larson 1991) because the history of existing traits is not known. The origins of such characters already existing in a species are usually obscured by too much complexity and too many alternative possibilities. Retrogressing existing characters also seems a rather backward approach and "demonstration of the past action of natural selection ... is considered impractical" (Green 1986). We suggest searching for potentially inheritable characters (or precursors) before these are inherited into the genome of a species. However, potentially inheritable changes have been assumed to be so difficult to recognize and substantiate that the scientific literature is all but devoid of such cases. We should be more alert for such changes. These three recently observed examples of unusual changes in species characters may be instructive of the type of potentially inheritable changes that should be searched for, recorded, and followed to evaluate their evolutionary importance. We suggest these potentially inheritable characters could be recognized and described when they first arise in an individual and before they become inherited by a population. Following these potentially inheritable characters could help to explain how such characters enter into a population. Such a new approach to the study of inherited characters could fill a void in our knowledge of evolution and speciation.

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RESUMEN

Se describen tres anomalías: el pico de guadaña en el chinchilín, *Quiscalus niger* (Boddaert) (Passeriformes: Emberizidae), un patrón de color de corona en el isabelita medioluto, *Holacanthus tricolor* (Bloch) (Perciformes: Pomacanthidae), y un patrón de color de doble mancha en el vaca blanca, *Hypoplectrus unicolor* (Walbaum) (Perciformes: Pomacanthidae). Generalmente se piensa que las anomalías en el pico son de origen genético y que los cambios genéticos en la forma del pico pueden ocurrir rápidamente en una población. La anomalía del pico de guadaña demuestra cuan rápido puede ocurrir una modificación drástica del pico. La anomalía del patrón de color de corona es similar a otras marcas distintivas encontradas en otros miembros de este género [isabelita reina, *H. ciliaris* (Linnaeus) y el híbrido isabelita azul *H. ciliaris* X *H. bermudensis* Goode] en el Atlántico occidental tropical y también indica cambios rápidos. Esto es importante porque las especies de este género se distinguen casi solamente por patrones de color. Las anomalías deberían ser registradas ya que podrían darnos algunas pistas acerca del origen genético de las características de las especies. Proponemos que los caracteres potencialmente heredables pueden reconocerse y describirse cuando aparecen en un individuo, antes de que sean heredados a la población, llenando un vacío en nuestro conocimiento de la evolución y la especiación.

Palabras clave: anomalías, patrón de color de corona, pico de guadaña, patrón de color de doble mancha, isabelita medioluto, chinchilín (mozambique, chango), vaca blanca, Caribe.

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