

**Diagnoses of hybrid hummingbirds (Aves: Trochilidae). 16.  
Characterization of a striking intergeneric hybrid (*Lampornis  
clemenciae* × *Calypte anna*) from Ramsey Canyon, Huachuca  
Mountains, southeastern Arizona**

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*Abstract.*—A hummingbird specimen from Ramsey Canyon, Huachuca Mountains, southeastern Arizona, represents a hybrid of *Lampornis clemenciae* (Blue-throated Hummingbird) × *Calypte anna* (Anna's Hummingbird). The specimen, which constitutes the only verified instance of hybridization between a species in the “mountain gem” group of hummingbirds and a species in the “bee” group, exhibits a blended mosaic of plumage characters of the parental species.

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Mayr and Short (1970:54) announced one of the more striking examples of intergeneric hybridization discovered thus far among trochiline hummingbirds in a terse annotation: “A recently collected (Russell, unpubl.) hybrid of *L.[ampornis] clemenciae* × *Archilochus [Calypte] costae* (or possibly *A. anna*) has been seen by Short.” Although a formal diagnosis of the hybrid was never published, the record has been uncritically cited in the secondary literature (Panov 1989, Powers 1999, Stiles 1999, Williamson 2000, McCarthy 2006). My analysis indicates that the specimen represents a hybrid of *Lampornis clemenciae* (Blue-throated hummingbird) × *Calypte anna* (Anna's hummingbird). Here I provide a comprehensive assessment of the specimen employing the methods and assumptions outlined in Graves (1990) as modified by subsequent papers (Graves & Zusi 1990, Graves 1998, 1999a).

#### Materials and Methods

The mummified specimen was found dead in Ramsey Canyon, Cochise Coun-

ty, Arizona, by Joan Peabody on 26 Apr 1968. The unsexed specimen (Fig. 1), head turned to the side with wings slightly splayed, was deposited in the University of Arizona Zoological Collections (No. 9359) by Stephen M. Russell. Two notations are penciled on the specimen label: (a) “*Calypte costae* × *Lampornis clemenciae*,” and (b) “= *anna* × *clemenciae*. Note pink throat & size. ARP [Allan R. Phillips] ‘69.” I subjected the specimen to an analytical procedure termed the hybrid diagnosis (Graves 1990), which focuses on the identification of apomorphic character states in putative hybrids. Complete dominance and polygenic inheritance of plumage characters may prevent or obscure the expression of parental apomorphies in hybrids. When parental apomorphies cannot be identified, the parentage of a hybrid may be indicated, although less conclusively, by the presence or absence of a suite of plesiomorphic characters (Graves 1990, Graves & Zusi 1990, Graves 1998, 1999a).

Contrary to an earlier assessment (Baldrige et al. 1983), the specimen appears to be an adult male in definitive



Fig. 1. Ventral view of a probable hybrid, *Lampornis clemenciae* × *Calypte anna* (University of Arizona 9359).

plumage as judged by the smooth maxillary ramphotheca and the presence of a large iridescent gorget and coronal patch. Consequently, all description in this paper refers to definitive male plumage. Given the migratory behavior of North American hummingbirds, the Ramsey Canyon specimen could have been hatched at some distant location (e.g., California or Sonora, Mexico). Thus, I compared the specimen with series of all trochiline species (National Museum of Natural History, Smithsonian Institution) that regularly breed in California, Arizona, Sonora, and northwestern Chihuahua (Friedmann et al. 1950, Phillips et al. 1964, Howell & Webb 1995, Russell & Monson 1998): *Calypte anna*, *C. costae* (Costa's Hummingbird), *Selasphorus platycercus* (Broad-tailed Hummingbird), *S. rufus* (Rufous Hummingbird), *S. sasin* (Allen's Hummingbird), *Stellula calliope* (Calliope Hummingbird), *Archilochus alexandri* (Black-chinned

Hummingbird), *Calothorax lucifer* (Lucifer Hummingbird), *Heliomaster constantii* (Plain-capped Starthroat), *Eugenes fulgens* (Magnificent Hummingbird), *Lampornis clemenciae*, *Amazilia beryllina* (Beryline Hummingbird), *A. violiceps* (Violet-crowned Hummingbird), *Hylocharis leucotis* (White-eared Hummingbird), and *Cynanthus latirostris* (Broad-billed Hummingbird).

Measurements were taken with digital calipers and rounded to the nearest 0.1 mm: wing chord; bill length (from anterior extension of feathers); rectrix length (from point of insertion of the central rectrices to the tip of each rectrix), and width of the outermost rectrix (8 mm from tip). Rectrices (R1–R5) are numbered from the innermost to the outermost. A scatterplot of measurements was used to illustrate size differences among specimens. General color descriptions presented in Appendix 1 were made under natural light.

## Results and Discussion

I considered three hypotheses—the Ramsey Canyon specimen represents (i) a color morph of *Calypte anna* or *C. costae*, (ii) an undescribed species, or (iii) a hybrid. The first hypothesis can be rejected because the external measurements and proportions of the specimen are substantially different from those of all age classes of male *C. anna* (Table 1) and *C. costae* (Graves 2006). Although the second hypothesis seems highly improbable, a handful of recognized trochiline species are known from one or two specimens (Graves & Olson 1987, Graves 1993, 1999b). In any event, hybridization must be ruled out before species status is conferred. Evidence presented below suggests that the specimen represents an intergeneric hybrid, *Lampornis clemenciae* × *Calypte anna*. For brevity I refer to the specimen as a hybrid in the remainder of the paper.

Table 1.—Ranges (mean  $\pm$  one standard deviation) of measurements (mm) of adult males of *Calypte costae*, *C. anna*, *Lampornis clemenciae*, and the hybrid (*Lampornis clemenciae*  $\times$  *Calypte anna*; University of Arizona No. 9359).

Characters	<i>Calypte costae</i> (n = 22)	<i>Calypte anna</i> (n = 10)	<i>Lampornis clemenciae</i> (n = 10)	Hybrid AZ 9359
Wing chord	41.3–45.9 (43.9 $\pm$ 1.1)	48.2–50.3 (49.0 $\pm$ 0.8)	74.2–77.5 (75.3 $\pm$ 1.0)	60.4
Bill length	14.3–16.9 (15.6 $\pm$ 0.6)	15.2–17.7 (16.3 $\pm$ 0.9)	20.6–22.5 (21.6 $\pm$ 0.6)	19.9
Rectrix 1 length	17.7–20.6 (19.3 $\pm$ 0.8)	22.8–26.7 (24.7 $\pm$ 1.1)	42.2–44.3 (43.5 $\pm$ 0.7)	31.6
Rectrix 2 length	18.6–21.9 (20.5 $\pm$ 0.9)	23.3–25.5 (24.5 $\pm$ 0.7)	43.3–47.0 (45.3 $\pm$ 1.2)	33.6
Rectrix 3 length	20.8–24.7 (22.6 $\pm$ 0.9)	26.5–29.4 (28.1 $\pm$ 0.8)	45.2–48.0 (46.5 $\pm$ 1.1)	35.7
Rectrix 4 length	20.8–24.8 (22.8 $\pm$ 0.9)	31.1–33.4 (32.1 $\pm$ 0.9)	44.8–48.8 (47.0 $\pm$ 1.5)	36.0
Rectrix 5 length	20.1–23.6 (22.2 $\pm$ 1.0)	30.6–33.2 (31.9 $\pm$ 0.9)	45.1–49.7 (47.5 $\pm$ 1.6)	37.0
Rectrix 5 width	1.4–1.8 (1.7 $\pm$ 0.11)	3.0–3.6 (3.2 $\pm$ 0.2)	9.5–12.0 (10.5 $\pm$ 0.8)	4.8

Three plumage characters of the hybrid facilitated the identification of its parental species: (a) brilliant gorget; (b) brilliant frontlet and crown; and (c) rounded white spots at the tips of R4 and R5 (Figs. 1, 2; Appendix). Only two of the potential parental species, *Calypte costae* and *C. anna*, possess brilliant frontlets that contrast with the remainder of the capital feather tract (the crown but not the frontlet of *Eugenes fulgens* is brilliant), but neither species of *Calypte* has large white spots on the tips of R4 and R5. This indicates that one of the parental species was either *Calypte costae* or *C. anna* and that the white rectricial spots were contributed by the other parental species. Only two of the potential parental species (*Lampornis clemenciae* and *Heliomaster constantii*) exhibit white rectricial spots. However, the rectrices (R3–R5) of *H. constantii* are merely edged with white, eliminating that species from further consideration. Furthermore, the hybrid does not express the bold white malar stripe or white rump patch of *H. constantii*. Thus, plumage characters quickly lead to the conclusion that the hybrid represents the offspring of *L. clemenciae* and *Calypte* sp. (Mayr & Short 1970). The inheritance of iridescent color in hybrid hummingbirds is poorly understood. However, I assume that hybridization between *L. clemenciae* (blue gorget) and *C. costae* (violet gorget) would pro-

duce offspring with a bluish-violet gorget. The dull pinkish-rose iridescence emitted by the coronal patch and gorget of the hybrid is much more suggestive of the expected phenotype of *L. clemenciae*  $\times$  *C. anna* (rose-red gorget).

I tested this parental hypothesis with an examination of size and external proportions (Table 1). External measurements of trochiline hybrids invariably fall within the mensural ranges exhibited by their parental species as a consequence of a polygenic mode of inheritance (Banks & Johnson 1961, Buckley 1982, Graves 1990, Graves & Zusi 1990, Graves 1996). Measurements of the hybrid fall within the cumulative range of measurements of *Lampornis clemenciae* and *Calypte anna*. However, morphometric data do not rule out the possibility that *Calypte costae* was the smaller parental species. In summary, evidence obtained from plumage color and pattern, as well as from external size and shape, is consistent with the hypothesis that the Ramsey Canyon specimen represents a hybrid of *Lampornis clemenciae*  $\times$  *Calypte anna*. As such, it is the only documented hybrid between a species in the “mountain gem” group (i.e., *Lampornis*) of hummingbirds and a species from the “bee” group (i.e., *Calypte*) (Bleiweiss et al. 1997).

*Lampornis clemenciae* occurs during the breeding season in riparian woodland and oak-pine forest in mesic canyons in the



Fig. 2. Top panel: ventral views of adult males: (left) *Lampornis clemenciae*; (middle) a probable hybrid, *Lampornis clemenciae* × *Calypte anna* (University of Arizona 9359), and (right) *Calypte anna*. Lower left panel: coronal iridescence of hybrid. Lower right panel: head-on view of hybrid.

Huachuca Mountains and neighboring mountain ranges in southeastern Arizona and Sonora (Swarth 1904, Phillips et al. 1964, Russell & Monson 1998). Although

*Calypte anna* has been reported as a migrant and wintering visitor in southeastern Arizona since the 1890s (Phillips 1947, Zimmerman 1973), breeding in this region

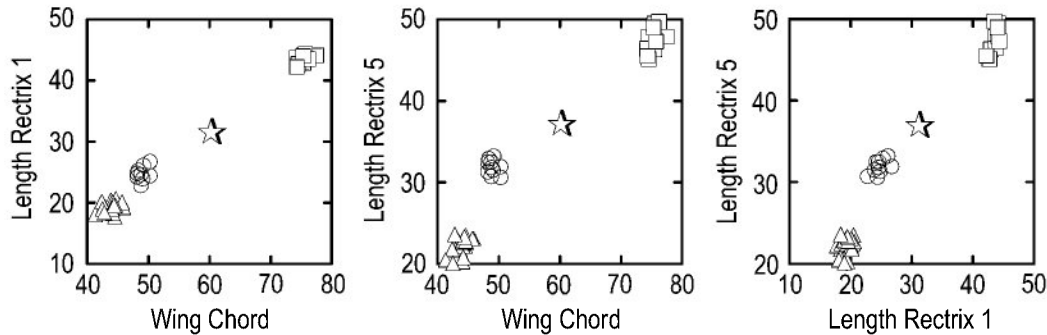


Fig. 3. Bivariate relationships of measurements (mm) of measurements (mm) of adult male *Calypte costae* ( $\Delta$ ), *C. anna* ( $\circ$ ), *Lampornis clemenciae* ( $\square$ ), and the hybrid (star) (*Lampornis clemenciae*  $\times$  *Calypte anna*; University of Arizona No. 9359).

was not recorded until the 1960s (Zimmerman 1973). During the time period when the Ramsey Canyon hybrid was recovered (1968), *Calypte anna* was most commonly encountered near exotic plantings in urban and suburban areas, but it also occurred sporadically in mesic montane canyons (Zimmerman 1973, Russell 1996). Hybridization between the largely allopatric *Lampornis clemenciae* and *C. anna* most likely occurred in the latter habitat.

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## Appendix 1

Comparative description of males of *Lampornis clemenciae*, *Calypte anna*, and a probable hybrid, *Lampornis clemenciae* × *Calypte anna* (University of Arizona No. 9359). Descriptions of structural colors are unusually subjective, as color seen by the observer varies according to the angle of inspection and direction of light. For this reason I use general color descriptions.

The dorsal plumage of *clemenciae* is dull green to olive-green, shading to bronzy-green on the rump and dark bronzy-olive on the crown. The longest uppertail coverts are bronzy or bluish-black. A thick white postocular stripe extends from the posterior margin of the eye down the side of the neck around the grayish-black auriculars.

In *anna*, feathers of the forecrown, loreal region, and crown (anterior from a line drawn across the crown 3–5 mm behind the eye) are tipped with rose-red discs, forming a brilliantly iridescent cap. A postocular stripe is absent. Plumage from the hindneck to the uppertail coverts is green, significantly brighter than in *clemenciae*.

The dorsal plumage of the hybrid combines elements of both parental species but is more similar to *anna*. In particular, feathers of the forecrown and crown are tipped with reflective discs that emit a pinkish-rose iridescence (Fig. 2). Scattered feathers along the posterior margin of the crown (~5–8 mm behind the eyes) are tipped with pinkish-rose iridescence. The hindneck, back, and rump of the hybrid are bronzy-green, similar in appearance to typical *clemenciae*, but notably darker than in *anna*. On the other hand, the longer uppertail coverts of the hybrid are bronzy-green, considerably paler than those of *clemenciae* but only slightly darker than those of *anna*. A thin grayish-white superciliary extends from the loreal area to the bronzy-green plumage on the sides of the neck.

In *clemenciae*, gorget feathers of the chin and throat are gray, broadly tipped with iridescent blue discs (narrowly margined with projecting buffy barbs in fresh plumage). The concealed portion of gorget feathers is dark gray or brownish-gray, slightly paler near the rachis. The posterior margin of the gorget is rounded. The gorget is bordered laterally by pale buff moustachial stripes. Feathers of the breast and abdomen are largely gray to brownish-gray; the sides and flanks are faintly glossed with bronzy-green. Vent feathers are white. Undertail coverts are gray to brownish-gray, narrowly to broadly margined with white.

In *anna*, the rose-red gorget covers the chin, throat, and auriculars, extending laterally to form a tapered point along each side of the throat. Gorget feathers are pale gray, broadly tipped with iridescent rose-red discs. Feather bases of the elongated lateral

gorget feathers (up to 11 mm long) are darker gray. A very narrow transitional band of green occurs between the gray base and rose-red disc in many gorget feathers. The gorget is bordered posteriorly by a band of grayish-white plumage across the lower throat and upper breast that extends underneath the lateral extensions of the gorget. The lower breast, sides, flanks, and abdomen are dull green mottled with grayish feather margins. Feathers along the ventral midline are broadly margined with gray or buffy-gray. Undertail coverts are bronzy-green broadly margined with pale gray. Pale margins become progressively wider with increasing feather length and the longest coverts are white or very pale gray with a diffuse, pale bronzy-green or grayish-green spot centered over the distal portion of the rachis.

The ventral plumage of the hybrid combines elements of *clemenciae* and *anna*. The hybrid's gorget, which covers the chin, throat, and auriculars exhibits a pinkish-rose iridescence when viewed head-on under direct light. The longest feathers in the lateral extensions of the gorget are ~9.0 mm. The concealed basal portion of gorget feathers is gray; a narrow transitional band of green occurs between the gray feather base and terminal pinkish-rose disc. Overall, the degree of melanization of the basal portion of the hybrid's gorget feathers is intermediate between that observed in *clemenciae* (dark gray) and *anna* (medium gray). The gorget is bordered laterally by short grayish-white moustachial stripes. The remainder of the hybrid's underparts, from the upper breast to vent, is similar to

that of *clemenciae*, but slightly paler, particularly near the posterior margin of the gorget and along the midline. The undertail coverts are similar in color and pattern to those of *clemenciae* but paler.

The rectrices of *clemenciae* and *anna* differ significantly in shape and color. The broad rectrices of *clemenciae* are black, glossed with indigo iridescence. The three outermost rectrices (R3–R5) are tipped with white. The extent of white is variable but it generally occupies the distal tenth of R3, the distal fifth of R4, and the distal third of R5. Rectrix 1 of *anna* is bright bronzy-green, rectrix 2 is darker, particularly on the medial vane. The narrower outer rectrices (R3–R5) of *anna* are gray along the margins (especially medially), grading to grayish black along the rachis and toward the tip.

The pattern of pigmentation and shape of the hybrid's rectrices are intermediate between those of *clemenciae* and *anna*. The innermost rectrix (R1) is black, lightly glossed with dull green. R2 is significantly darker, exhibiting faint green iridescence. The outer rectrices (R3–R5) are black, displaying a faint gloss under direct light. R3 is tipped with a small, wedge-shaped bronzy-green spot. The two outermost rectrices are tipped with a white spot, which occupies the distal eighth of R4 and the distal fifth of R5. Rectrix shape in the hybrid is roughly intermediate between that of *clemenciae* and *anna*.

Wing color in *clemenciae*, *anna*, and the hybrid are similar. The maxillary and mandibular ramphothecae of *clemenciae*, *anna*, and the hybrid are black.