CHLOROSTILBON BRACEI LAWRENCE, AN EXTINCT SPECIES OF HUMMINGBIRD FROM NEW PROVIDENCE ISLAND, BAHAMAS

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ABSTRACT.—*Chlorostilbon bracei* Lawrence, known from the unique holotype taken on New Providence Island, Bahamas, in 1877, is shown to be a valid species that is evidently now extinct. Compared with *C. ricordii* of Cuba and the Bahamas, *C. bracei* is smaller, has a longer bill, and has distinctly different plumage. Fossil evidence demonstrates that a small *Chlorostilbon*, tentatively referred to *C. bracei*, was present on New Providence in the Pleistocene. Populations of *C. ricordii* from Andros, Abaco, and Grand Bahama are indistinguishable from Cuban birds, and *C. ricordii* is therefore regarded as monotypic. *Received 18 June 1986, accepted 25 November 1986.*

THE first record of the genus *Chlorostilbon* in the Bahamas was Lawrence's (1877) description of *"Sporadinus" bracei* based on a single male specimen taken on New Providence (Fig. 1) by L. J. K. Brace that Lawrence regarded as being closest to *C. ricordii* of Cuba. Elliot (1878: 240) compared the specimen with the type of *C. ricordii*, "but was not able to satisfy myself that it was certainly distinct. More specimens of this bird, and perfect ones, are necessary before its proper specific position can be fully demonstrated." He listed *C. ricordii* from Cuba and "Abajo of the Bahamas" (= Abaco), apparently the first reference to *Chlorostilbon* elsewhere in the Bahamas.

Cory (1880) maintained *C. bracei* as a distinct species but later listed it as a synonym of *C. ricordii* with no comment (Cory 1886, 1889, 1890). Northrop (1891) reported *C. ricordii* as abundant on Andros, and additional records for Abaco and Grand Bahama were listed by Cory (1891a, b), Ridgway (1891), and Salvin (1892).

Palmer and Riley (1902) recognized *C. bracei* as a valid species and differentiated the other populations of *Chlorostilbon* in the Bahamas from those of Cuba as a new species, *"Riccordia" aeneoviridis*. Under this name Allen (1905: 127) mentioned that the birds occurred commonly on "Great Abaco, Little Abaco, and Great Bahama." Previously, however, Bonhote (1903: 293) had studied a series from Abaco and failed "to see the very smallest reason for separating the Abaco bird" from those of Cuba. He intimated that the occurrence of *Chlorostilbon* on New Providence was fortuitous because it was known only from a single specimen, and listed both *bracei* and *aeneoviridis* as synonyms of *C. ricordii*.

Riley (1905), saying nothing further about *C. bracei*, considered the other Bahaman birds as separable from those of Cuba and maintained them as a subspecies, *Riccordia ricordii aeneoviridis*. This treatment was followed by Ridgway (1911), who noted, however, "In case *Sporadinus bracei* Lawrence should prove not different from the ordinary Bahaman bird, the name of this form would then be *Riccordia ricordii bracei*" (p. 544, footnote). Todd and Worthington (1911) tentatively continued to segregate the Bahaman from Cuban birds under the name *aeneoviridis*, and while quoting a communication from Riley to the effect that the type of *C. bracei* was unique, they (1911: 423) doubted that the specimen "is anything more than an abnormal specimen of the ordinary Bahaman bird."

Cory (1918: 209) probably had the most influence on the present systematic status of *C. bracei*: "I have examined the type of *S. bracei* Lawrence. The specimen is a mummy in poor condition and apparently discolored (probably by preservative) and in my opinion is a discolored specimen of the bird which occurs commonly on Andros and Abaco Islands. The fact that no specimens of *Riccordia* [*Chlorostilbon*] have since been recorded from New Providence would suggest that no race exists there and that the occurrence of the type specimen of *bracei* on that island (if the locality given is correct) was accidental."

Bond (1936) was the first to use the combi-

nation *Riccordia ricordii bracei* to apply to all the Bahaman populations, in the opinion that "the unique type of *bracei* [was] a straggler to New Providence" (p. 206, footnote). He continued this treatment (Bond 1940: 15) and added further doubt by listing the type locality of *bracei* as " 'New Providence,' but possibly Andros or Abaco." With the use of the combination *Chlorostilbon ricordii bracei* for all Bahaman populations by Bond (1945, 1956), who continued to query the type locality, and by Peters (1945), this concept of the systematics of Bahaman *Chlorostilbon* became fixed in the literature, and the true nature of the type of *C. bracei* has been overlooked since.

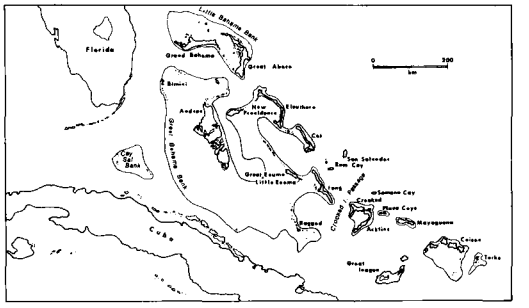

Fig. 1. Present-day islands in the Bahamas. Banks exposed during glacial periods in the Pleistocene are outlined.

The Provenance of the Holotype of *Chlorostilbon bracei*

The geographical origins of the holotype of *C. bracei* have been questioned by several authors. To establish the circumstances of its acquisition, we examined the correspondence from the collector, Lewis J. K. Brace, to Spencer F. Baird in the files of the Registrar, U.S. National Museum, and in the Archives of the Smithsonian Institution. This correspondence establishes beyond all doubt that the specimen was taken on New Providence. We were unable to learn more about Brace, apart from what is evident in the Baird correspondence and the indication that he probably lived on New Providence at least until 1922.

In a letter to Baird from Nassau, Brace wrote (16 July 1877): "the principal & most important communication I have to make is the fact that I procured on the 13th inst., about 3 miles from town, inland somewhat, a Humming bird, which, not having the descriptions of them, I have to beg you to identify for me. I send it you [sic] marked No. [left blank]. I also send, for what it may be worth, the following note of its measurements etc. made shortly after it was killed. Lgth 3 ¾" e[xtent] 4 ½" wing 1 ¾ width of wing near body 19/32" tail 1 1/12" culmen 11/16" commissure 13/16" tarsus [77]3/32"—bill, with a very slight curve, conically pointed, black-tarsi black—Above bronzed green with a golden sheen—head, like the back without the gold & a white spot immediately behind the eyes—gorget, unfortunately much injured, magnificent blue-green—beneath, green the feathers tipped ash gray—about anus, a white bar—wings purplish, when closed nearly reaching to end of tail—tail, mostly in sheaths, but those grown out are of nearly equal width, the 2 centre rectrices & under vanes of others greenish, inner vanes purplish black—crissum, grayish, the feathers edged with a faint tinge of cinnamon, a few near anus with a spot of green—on the flanks a pure white spot or rather patch, tipped bright cinnamon."

This detailed and sensitive description establishes that Brace was aware of the great significance of his discovery at the time. The description, down to the molting rectrices, matches exactly the holotype of *C. bracei*. There can be no doubt that the bird was obtained by Brace on New Providence on 13 July 1877.

In a letter to Baird (23 October 1877) Brace mentioned "I rec[d] a communication from Mr. G. N. Lawrence by which I am glad to see the Humming bird I wrote to you about, is probably a new species." On 18 March 1878, Brace wrote: "About the Sporadinus—it is certainly very singular I have not seen any other specimens of the male. I have procured several females & those sitting & procured *from the nest* [emphasis Brace's]. I hope to send specimens soon to the Smiths." This was followed by a letter on 30 August 1878: "Since receipt of you last of March 28th, sickness has cast its shadow around my house—thus I apologize for my long silence—I have forwarded by post to Mr. Lawrence, 2 females of his Sporadinus, one of which I have begged him to forward to the Smithsonian."

No further specimens of *Chlorostilbon* from New Providence were received at the Smithsonian (USNM) or at the American Museum of

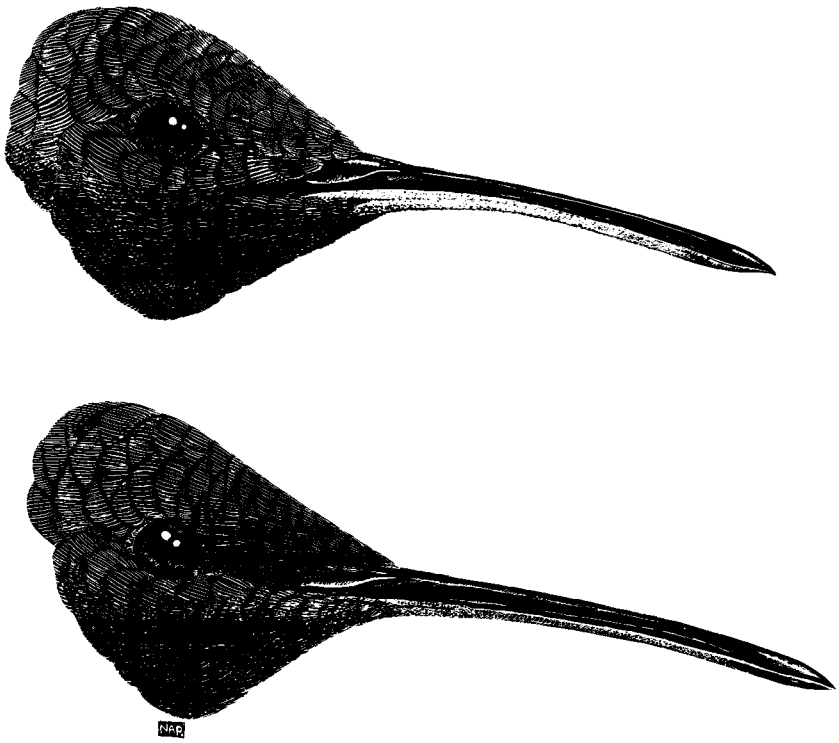

Fig. 2. Head and bill of male *Chlorostilbon ricordii* (upper) and holotype of *C. bracei* (lower) drawn to scale. Feathers extend anteriorly to the distal margin of the nasal flange in *C. bracei*. Ink drawing by Nancy A. Payzant.

Natural History (AMNH), where most of Lawrence's collection was deposited. However, we found two female specimens of *Philodice evelynae* (USNM 353320, collected 29 January 1878; AMNH 46643, collected 13 March 1878) taken by Brace on New Providence. Both specimens were identified correctly as *Philodice* on tags apparently prepared by Lawrence with the notation "Presented by L. J. K. Brace. . . ." A portion of Brace's original label is attached to the AMNH specimen: "Sporadinus Bracei L[awrence], ♀, Nassau, N[ew Providence], shot 29/1/78." This indicates that the "Sporadinus" females mentioned by Brace in correspondence were referable to *Philodice*. Thus, the type specimen of *C. bracei* is the only known extant skin.

CHARACTERS AND VALIDITY OF *CHLOROSTILBON BRACEI*

Plumage color and the possibility of postmortem change.—Cory suspected that the plumage of the type of *C. bracei* may have been discolored by preservatives. The effects of immersion in formalin or alcohol on the reflectance of hummingbird feathers has not been studied in controlled experiments. Fry (1985) found that green plumage of bee-eaters became bluish-green when stored in 70% ethanol. Postmortem change has been recorded in gorget color of hummingbird study skins not subjected to fluid preservatives (Graves 1986). However, the plumage of *Chlorostilbon* stored in 70% ethanol at the National Museum (e.g. *C. swainsonii* since 1927, *C. maugaeus* since 1977; USNM) is identical in color, when air dried, to that of study skins. The arrangement of the wings, head, and tail of the type and the texture of the plumage is consistent with it being an air-dried preparation of a freshly killed specimen.

The type of *C. bracei* was described partly before and after preservation as a mummy. In reference to potential effects of preservative fluids, Brace's observation that the head lacked the "golden sheen" of the back is important. In the formal description of *C. bracei*, prepared after the specimen was mummified, Lawrence (1877: 50) noted the difference in crown and back col-

TABLE 1. Measurements (mm) of selected characters of male *Chlorostilbon ricordii* and the type of *C. bracei*. The first primary of both wings of the type of *C. bracei* was being replaced. Wing chord was measured from the tip of the second primary; culmen length was measured from the anterior edge of the nasal flange. Values are ranges and means ± SD.

	Wing	Culmen
C. ricordii		
Abaco (n = 15)	49.9–52.5 50.9 ± 0.81	13.5–15.7 14.8 ± 0.55
Andros (n = 6)	47.2–49.1 48.5 ± 0.66	15.2–15.8 15.5 ± 0.26
Cuba (n = 17)	49.0–52.9 51.6 ± 0.99	14.2–16.0 15.1 ± 0.45
C. bracei		
(USNM 71386)	Right 45.2 Left 44.2	17.3

TABLE 2. Measurements (mm) of *C. ricordii* from Andros and fossil *Chlorostilbon* from New Providence.

	Humerus	Ulna
Andros		
USNM 553355 ♂	4.5	5.1
USNM 553485 ♂	4.5	5.0
USNM 553486 ♂	4.5	4.9
USNM 553488 ♀	4.3	4.7
New Providence		
USNM 283393	4.2	
USNM 283394		4.7+

or: "Crown and gorget of a glittering pale green; back, the two central and the next pair of tail-feathers, bronzed golden-green . . . breast and abdomen dull bronzy green." These and other early descriptions of the type (Brace in litt., Lawrence 1877, Todd and Worthington 1911, Cory 1918) are in general agreement with the appearance of the specimen today, and post-mortem change, if any, has been slight.

Comparison of C. bracei *and* C. ricordii.—The type of *C. bracei* is unquestionably male (*Chlorostilbon* are highly sexually dichromatic). *Chlorostilbon bracei* has a significantly shorter wing but a longer bill (two-tailed t-test, $P < 0.0001$) than males of the Bahaman and Cuban populations of *C. ricordii* (Table 1). The tail of the type of *C. bracei* is in molt. The lower mandible of *C. bracei* is entirely dark. A small percentage of male *C. ricordii* have dark lower mandibles; the majority have lower mandibles that are pale basally (number of males having a dark lower mandible: Bahamas, 0 of 38; Cuba, 1 of 79). A characteristic of *C. bracei* not noted previously is the forward extension of feathering past the anterior edge of the nasal flange (Fig. 2). In a large series of *C. ricordii* (USNM, males, n = 81; females, n = 34) the feathering extends forward, without exception, only to the posterior one- to two-thirds of the nasal flange, which is also more inflated than in *C. bracei*. The nasal feathering of other West Indian *Chlorostilbon* (*C. maugaeus*, n = 42; *C. swainsonii*, n = 16) is somewhat intermediate in this respect.

Plumage differences between *C. bracei* and *C. ricordii* are of the magnitude observed among unequivocal full species in the genus. The type of *C. bracei* has a reddish-bronze back and wing coverts that contrast with the bronze green of the crown, hindneck, rump, and central rectrices. The back, wing coverts, rump, and hindneck of *C. ricordii* are concolorous bronze green. From a ventral perspective, the differences are more striking. When viewed in direct light, the gorget of *C. bracei* is pale green, with silvery bluish or oily green reflections, depending on the angle of reflection, instead of rich golden green as in *C. ricordii*. Although the center of the gorget of the type of *C. bracei* is rumpled, the glittering feathers of the chin are smooth and are of the same color as the lateral and posterior gorget feathers. When viewed head-on in direct light, the brilliant reflectance of the gorget of *C. ricordii* extends posteriorly to the lower breast; the breast and belly are of the same color as the gorget and only slightly less glittering. In *C. bracei* the pale green brilliance of the gorget ends on the upper breast and contrasts with the bronzy green breast and belly, the feathers of which have extensive pale gray bases and narrow gray borders. The feather bases of male *C. ricordii* are dark gray. The undertail coverts of male *C. ricordii* are white and nearly immaculate; those of *C. bracei* are pale gray with buffy white borders. The tail of the type of *C. bracei*, which was being replaced, resembles that of *C. ricordii* and *C. swainsonii* of Hispanola in having bronzy green central rectrices (those of *C. maugaeus* are blue black, like the other rectrices).

In summary, *Chlorostilbon bracei* is a smaller bird, with a longer bill, and plumage that is distinctly different from *C. ricordii*. On this basis *C. bracei* must be regarded as a valid species known from a single specimen from New Providence and now presumed extinct.

Fig. 3. Left humeri of hummingbirds compared: (A) *Philodice evelynae*; (B) Pleistocene fossil from New Providence probably referable to *Chlorostilbon bracei*; (C) *C. ricordii* from Andros. Arrows indicate the areas of major apparent differences between the fossil and *C. ricordii*; e = ectepicondylar process, v = ventral tubercle. Scale in mm. Photograph by Victor E. Krantz, Smithsonian Institution.

Fossil record of Chlorostilbon bracei.—The paleontological record substantiates the occurrence of *Chlorostilbon* on New Providence. Several specimens of Trochilidae were obtained from a Pleistocene sink deposit on New Providence (Olson and Hilgartner 1982). Two of these, a humerus and an ulna, were referred to *Chlorostilbon ricordii*, as they were similar in size to that species and markedly different from *Philodice evelynae*, the only other hummingbird expected on New Providence. With the discovery of the distinctiveness of *C. bracei*, we compared these specimens with four skeletons of *Chlorostilbon ricordii* from Andros.

The fossil humerus is slightly smaller than any of the modern series, while the fossil ulna is near the minimum size of *C. ricordii* (Table 2). Because of the small sample size, the difference is not significant, but the smaller size of the fossils correlate well with the smaller size of the type of *C. bracei*.

There are also some qualitative differences between the fossil humerus and those of *C. ricordii* (Fig. 3). The ectepicondylar process in *C. bracei* is practically perpendicular to the shaft, whereas in *C. ricordii* it is angled strongly proximally; and the ventral tubercle is decidedly more gracile and does not slope as strongly distally. If these differences are consistent, the fossil *Chlorostilbon* from New Providence could be regarded as specifically distinct from *C. ricordii* and tentatively referred to *C. bracei*. The fossil evidence demonstrates that a small *Chlorostilbon* was present on New Providence in the Pleistocene, which further supports our contention that *C. bracei* was resident on New Providence and not a vagrant.

Status of Chlorostilbon ricordii aeneoviridis.—Geographic variation among island populations of *C. ricordii* is minor. Palmer and Riley (1902) compared populations from Cuba and Abaco and distinguished the latter as a separate species, *Ricordia aeneoviridis*: "The bird from Abaco is of a more coppery green both above and below than the bird from Cuba. In the Abaco bird the bill is slenderer, the fork of the tail less pronounced, and the middle tail feathers broader than in Cuban birds; also the tail of *ricordii* is not coppery bronze as in the Abaco birds." Bonhote (1903) noted that the middle rectrices of the Abaco specimens were slightly broader and the tail more coppery bronze than in Cuban specimens but that the differences did not seem to be consistent at the subspecific level. In a large series of specimens from Abaco (including the type of *aeneoviridis*), Andros, Grand Bahama, and Cuba we found that differences between populations in the length of the tail fork, rectrix width, and plumage color are subsumed by intrapopulational variation. We consider the Cuban and Bahaman populations of *Chlorostilbon* to be monotypic and thus place *Ricordia aeneoviridis* Palmer and Riley, 1902, in the synonomy of *C. ricordii* (Gervais, 1835).

DISCUSSION

It is curious that Brace was the only person to have encountered *Chlorostilbon* on New Providence. Bryant (1859) failed to find it during a 4-month stay 20 yr earlier. Brace wrote to Baird (26 January 1879) that "Prof. Cory of Boston [was] returning to your city by this steamer after some 5 weeks stay [in the Bahamas] with very good results he informs me." One may imagine that Brace told Cory exactly where the type of *C. bracei* was obtained, yet neither Cory nor any subsequent collector obtained the species on New Providence. A small population of *C. bracei* apparently survived undetected in the impenetrable coppice surrounding the town of Nassau until Brace's discovery in 1877, but disappeared soon afterwards. The cause of its extinction is not clear.

Changes in climate since the Wisconsinan

glaciation have been postulated as a major cause of vertebrate extinction in the Bahamas and elsewhere in the West Indies (Pregill and Olson 1981, Olson 1982). Fossils of an undetermined hummingbird species from New Providence exceeded both *Chlorostilbon* and *Philodice* in size (Olson and Hilgartner 1982). These specimens represent a species that is also extinct in the Bahamas. The paleontological evidence suggests New Providence may have had as many as three contemporaneous species of hummingbirds. Whatever precipitated the extinction of *C. bracei* and the larger hummingbird evidently had no noticeable effect on *Philodice evelynae*, which has been variously described over the past 125 yr as "common" or "abundant" on New Providence. Although human disturbance could have been a factor in the extinction of *C. bracei*, the last remnant of the species survived on the most populous island of the archipelago.

During the last glacial period, New Providence was part of a much larger island that is now the Great Bahama Bank. There is no reason to postulate that *C. bracei* was an autochthonous endemic that arose on New Providence. Fossils of it may be expected on other islands of the Great Bahama Bank, and perhaps elsewhere in the Bahamas. During interglacial periods of the Pleistocene the Bahamas would have been inundated to varying degrees, and during the maximum rise in sea level would have existed as a few small, scattered islets. Therefore, most of the apparently endemic elements in the fauna are probably relicts of species that were distributed widely in the West Indies in the past. For example, the Bahama Mockingbird (*Mimus gundlachii*), which today occurs outside the Bahamas only in a small, arid portion of Jamaica, is known from Pleistocene fossils in Puerto Rico (Olson 1985).

Although *Chlorostilbon bracei* remains an enigmatic bird, it should be restored as a full species and taken into account in analyses of speciation and biogeography of West Indian birds.

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