NESTING OF HICKS' SEEDEATER AT BARRO COLORADO ISLAND, CANAL ZONE

BY ALFRED O. GROSS

HICKS' SEEDEATER, *Sporophila aurita aurita* (Bonaparte), more recently designated as the Variable Seedeater, is a bird characteristic of the grasslands of tropical America. Its range extends from Costa Rica to Colombia, South America. It is a very abundant bird in the Canal Zone where it may be seen in large numbers in the grassy areas bordering the canal and Gatun Lake, as well as along much of the 47 miles of the railroad and highway between Cristobal and Panama City. It nests in tall grass and weeds and in shrubs and small trees. It has also invaded the towns and cities, where it may be found nesting in parks and close to the habitations of man.

This little seedeater is now a well established nesting bird on Barro Colorado, an island which over most of its 3,840 acres is covered by a lush tropical rain forest. It is not in general the kind of a place where one would expect to find a bird characteristic of the open country and grasslands to thrive and continue as a successful species. Barro Colorado was set aside as a reservation in 1923 so that its luxuriant vegetation and wealth of wildlife would be preserved for scientific study. An area of approximately 2.5 acres of the jungle was cleared about the laboratory buildings and planted with Bermuda grass in 1924. It is in this relatively small cleared area that Hicks' Seedeaters have established themselves on Barro Colorado Island.

When I visited the island from June to August, 1925, I did not see any of these birds, and I doubt if any of them had arrived at that time. During a second visit, in 1927, the Seedeaters were there in numbers. In paddling along the shore of the open area in a canoe one could see many of them riding on the long swaying stems of the tall grasses, busily engaged in feeding on the seeds which are their chief source of food. During the month of September, 1927, I found seven of their nests in the grass, weeds, and small shrubs of the lower level of the clearing, near the lake and remote from the laboratory buildings. At that time no other representatives of the Fringillidae were found nesting in the area occupied by the Hicks' Seedeaters. Since 1927 other species such as the Yellow-bellied Seedeater (*Sporophila nigricollis nigricollis*), the Panama Buff-throated Saltator (*Saltator maximus intermedius*) the Green-backed Sparrow (*Arremonops conirostris striaticeps*) and others have been noted in the clearing but never in large numbers. The abundance of Hicks' Seedeaters

has been noted at Barro Colorado by many observers since 1927, and it has now become an important member of the assemblage of birds to be seen in the clearing about the laboratory. The sweet and varied songs of the males are a conspicuous part of the chorus of calls and notes that may be heard throughout the day but especially during the early morning hours. On Barro Colorado the Hicks' Seedeater finds strange company among such birds as parrots, motmots, trogons, tinamous, and manakins. It is not unusual to see 50 to 60 different species during the course of a single day. Mr. Eugene Eisenmann has listed more than 150 species that have appeared in the clearing or the trees bordering the small area. Even the black howlers and white-faced monkeys are frequent visitors and form a part of the environment to which these seedeaters have come. The Hicks' Seedeater, like many of the other members of its group, is an adaptable species. It has successfully met all competition and has made itself an integral part of this unusual and complex association.

When I arrived at the island in June, 1949, these seedeaters were not only in the part of the clearing bordering the lake, which they occupied in 1927, but had invaded the area close to the laboratory. On June 29 a nest in the final stages of construction was found in an orange tree within a few feet of the main laboratory building. The tree grew on the steep slope of the hill on the northern side of the laboratory. The nest, though 26 feet above the base of the tree, was on the level of the first floor of the building and thus presented ideal conditions for observation.

Only the female was concerned with the building of the nest and while she was busily engaged two males were present and spent much of their time fighting and pursuing one another.

There is a marked difference in the coloration of the sexes. The female is a plain olive color above, much paler below, the abdomen is more or less white or a very pale yellow. The males are predominantly black with contrasting white markings. There is a considerable variation in the amount of white in different males and this difference was striking in these two males. One had much white on the chin, throat, sides of neck, underparts, and axillars; the other was of the so-called black-throated phase (Ridgway, 1901) in which the chin, throat, and rump were black, and the white on the neck and abdomen greatly reduced. The whole coloration of the latter gave the impression of a decidedly black individual. Because of the marked difference in the coloration of the two males they were readily identified and are designated in the following account as the dark and the light male, respectively. The variation in the color of different males has given origin to the very apt name, Variable Seedeater.

On June 30, 1949, the light male was seen to approach the female where she was perched on a lower branch of the orange tree containing the nest. The male flew from limb to limb, fluttering and circling about the female many times, but she seemed quite indifferent to his presence and ignored his attentions as she meticulously preened and adjusted her plumage. After about ten minutes the female flew to a nearby tree, the male pursuing her closely from branch to branch; the pursuit finally ended in the act of copulation. The light male then flew to the top of a lime tree and immediately began singing. This tree later proved to be his singing tree throughout the season. The dark male was not around at that time, but the challenging courtship song of the light bird apparently attracted the dark male which suddenly appeared in a Pitanga bush where he answered his rival with a similar vocal performance. About a half-hour later the female again alighted on the lower branch of the nesting tree. Both males immediately joined her and each went through its maneuvers, taking turns in alighting on the branch where the female was perched. Both the males were ignored and when either male approached too closely she half spread her wings and thrust her opened beak at them, causing them to dash aside. The two males were extremely active, highly excited, and flew in pursuit of each other or fluttered above or around the female. The light male finally flew at the dark male and they met in mid-air, fighting and vigorously fluttering their wings as they fell to the ground.

The next day, July first, I saw the dark male copulate with the female, and this was the first positive evidence that here was a definite case of polyandry. The female had accepted both males. That it was the same female was certain because each time after the act she flew to arrange materials at the nest near the top of the orange tree. I have no reason to believe that polyandry is a common practice among these seedeaters. A check on the Barro Colorado seedeaters revealed an excess of males in a ratio of about 2.5 to 1. On July 7, I found a newly-built nest in a lime tree near the lake on Barro Colorado Island where I saw two and, at one time, three males near the nest. Unfortunately this nest was destroyed before there was an opportunity to observe whether this female had mated with more than one male.

The nest in the orange tree was completed by July 1; the female nevertheless made frequent inspection trips to the nest but brought no nesting materials. She seldom remained for more than a few minutes, but during these visits she would arrange certain fibers as she fitted her body into the bowl and carefully molded it to the proper shape. During much of this time the two males were in their respective singing trees giving their challenging songs.

THE SONG

The song of the males is a complicated but pleasing series of musical notes. The songs vary in quality as well as in the number of notes uttered. One interpretation of the song which I made on July 4, 1949, was *Chee-a, chee-a, chee-a tweet, o-wee, tweet o-wee, tsche, tsche, tsche, tsche—tookey! tookey! tookey!* The last *tookey* notes were frequently omitted. The whole song is rather rapid, the first notes are loud, rather high pitched, and followed by a kind of warble somewhat suggestive of certain notes uttered by the Indigo Bunting. At times the males uttered the introduction alone without the following musical portion. The time required to utter the different versions was from two to four seconds. The complete songs were given four to six times a minute. Representative intervals between songs in seconds for a four-minute period are as follows: 12, 9, 13, 11, 8; 11, 13, 20, 14; 9, 13, 9, 8, 14, 9; and 14, 21, 12, 19. These records indicate the frequency and persistence of the singing by the males during the height of the nesting season. The singing usually started at dawn and ended at sunset. I never heard them singing at night. The frequency varied and sometimes no singing was heard for several hours. They were not heard during the torrential downpours of rain which were frequent during this, the rainy season. The heat of mid-day did not seem to influence their singing, but the presence and the challenging song of the other male did seem to make a difference. The birds when disturbed utter a loud, clear, high-pitched *tseep, tseep, tseep* frequently repeated. The female gives a similar note at times, especially on being disturbed, as when I climbed the tree to examine the contents of the nest. Singing by the males did not cease at the time of the hatching of the young as it does in the case of certain other birds. In the case of the two males of this nest it increased in frequency and intensity over what it was near the end of incubation.

INCUBATION

The first egg of the nest in the orange tree, chosen for detailed observations, was laid on the morning of July 3. On July 4, the female was seen to go on the nest at 9 a. m. and to leave at 11. When I visited the nest a few minutes later there were two eggs, a complete set. On July 5, the female was on the nest each time during my many visits throughout the day, and it was obvious that incubation had begun. During the first day only the light male was seen in the vicinity of the nesting tree. The next morning I saw the light male copulate with the female. In the afternoon the dark male was again seen and both males attended the female each time she was seen away

from the nest. At times when the female was incubating her eggs the males occupied their singing trees. The males sometimes exhibited evidence of defending their territory by chasing such birds as the Honey Creepers, *Cyanerpes cyaneus cyaneus*, and Bananaquits, *Coereba mexicana mexicana*, whenever these smaller birds alighted in their singing trees. However, they seemed to pay little attention to the larger birds such as the Streaked Flycatcher (*Myiodynastes maculatus nobilis*), the Blue Tanager (*Thraupis cana diaconus*), and the Palm Tanager (*Thraupis palmarum atripennis*) which frequently alighted in the trees, sometimes very near to them. Although both males came to the female when she left the nest and accompanied her on feeding trips, neither male was seen to visit her at the nest. I never saw the males feed the female, as is frequently done by certain other species of Fringillidae.

The female incubated her eggs closely on heavily clouded or rainy days and only left the nest to feed, usually early in the morning and again two or three times later in the day. The two males were very attentive at such times, and as incubation proceeded they seemed to be reconciled to each other's presence and less fighting occurred. The following notes were made on July 13 when the eggs had been incubated for eight days: 6:00 a. m., there is a beautiful colorful sunrise and the trees which a few minutes before were in obscure light are now brightly illuminated; 6:02, the light male starts singing from his perch in the top of the lime tree; 6:04, the light male is uttering his complete song six or seven times each minute; 6:08, the dark male appears in the Pitanga bush, utters several chirps, and then bursts into full song, apparently in answer to his co-mate; 6:25, the female has left her nest and worked her way down to the lower branches of the nesting tree. In response to her feeble chirps both males abruptly stopped their singing and came to her. They flew in small circles about the female and one of the males flew directly at her, causing her to seek another perch. When the males again ventured too close she warded them off by thrusting with her beak but never actually striking them; 6:38, the female flew to the ground and mounted a tall seed-laden grass stem which bent and swayed back and forth under her weight. She worked her way to the end of the stem to feed on the seeds. The two males, one on either side about five to ten feet away from the female, also fed on seeds. During 12 minutes the trio fed in this manner, but now and then the males in turn would fly in a circle above the female and then return to another grass stem; 6:50, the female returned to a low branch of the orange tree to preen her feathers methodically. The males followed her and again went through their circling maneuvers, but

always keeping a considerable distance from the female and from each other; 7:02, the female flew directly to her nest to continue her task of incubating the eggs. The two males left the vicinity of the nesting tree together and flew to the lower area of the clearing, probably to continue their feeding. The dark male returned at 10:00, the light male at 10:30, and both sang intermittently during the remainder of the morning; at times one or both would be absent from the vicinity. The female left the nest at noon after three hours of continuous incubation. During these long periods at the nest the female frequently shifted her position, and with each change she apparently adjusted her body to the eggs. Sometimes the periods at and away from the nest were of shorter duration. Arbib (MS) who watched an incubating bird at Gatun during a clear, warm day found ". . . the female during a 144-minute period left the nest eight times. Her absence varied from 4 to 20 minutes and her spells at incubation 1 to 25 minutes. During this time she spent 84 minutes on the nest and 60 minutes away from it." The female at my nest returned to incubate at 2:15 p. m. and remained on the nest until 4:30. The males had not been seen since noon but appeared soon after the female alighted on the lower branch of the nesting tree. For 18 minutes the males circled about the female, at times alighting on the branch near her. Finally all three flew away and disappeared into the jungle. No acts of copulation, other than those previously noted, were observed. At 5:45 the female returned to the nest after an absence of an hour and 15 minutes. When settled on the nest her tail pointed upward at a sharp angle and her head was pulled down low in the nest with her eyes level with the brim of the nest. When I left the nest at 5:50 p. m. the female was on the nest and both males were singing. With minor variations the behavior of the three birds was similar during the following two days.

On July 16, the eggs were intact at 6 o'clock in the afternoon, but both eggs had hatched when I visited the nest at seven the next morning. Judging from the moist down, the young had just emerged, establishing the incubation of this clutch of the Hicks' Seedeater as 12 days. The egg shells had been removed. Skutch (1945) also found the incubation periods of two sets of eggs of this seedeater to be 12 days.

EARLY NEST LIFE OF THE YOUNG

I never saw the males visit the nest during the incubation period, but an hour after I found the two young they were being fed by the light male as well as by the female. The female at frequent intervals brooded the young for 15 to 20 minutes at a time. At one time when the female was brooding, the light male flew to the nest and perched

on its edge. The female stood back on the opposite side of the nest as the male fed the young a regurgitated mass of food delivered by quick thrusts into the widely-opened mouths. The male remained 2.5 minutes and as soon as he left the female slipped into the nest to continue brooding. I did not see the dark male this first day, but on the following day both males were in evidence; they took turns in feeding the young and both did considerable singing.

Most of the food consisted of a viscid milky material probably derived from the seeds on which they were seen to feed, but a number of insect larvae were included in the diet. For example, at 4:30 of the afternoon of July 18 when the young were two days old the female was seen exploring the leaves of some pepper plants infested with small green larvae. She was seen to mince one of the larvae in her beak and then fly to the nest to feed it piecemeal to the two young. On July 19 the light male appeared at the nest with a brownish green larva more than an inch in length. He extended his beak with the wriggling larva towards the female. She took hold of the distant end and minced it thoroughly in her beak while the male held the other end and likewise crushed his part. Then both birds pulled until the larva parted. The female minced her half of the larva again before delivering it to one of the young. The male presented his part to the female and she in turn fed it to the other young. I saw no insects or insect larvae fed to these young after the fourth day, although the nest was under daily observation. At nests studied during October, 1927, insects constituted a more important part of the food of the young during the entire nest life.

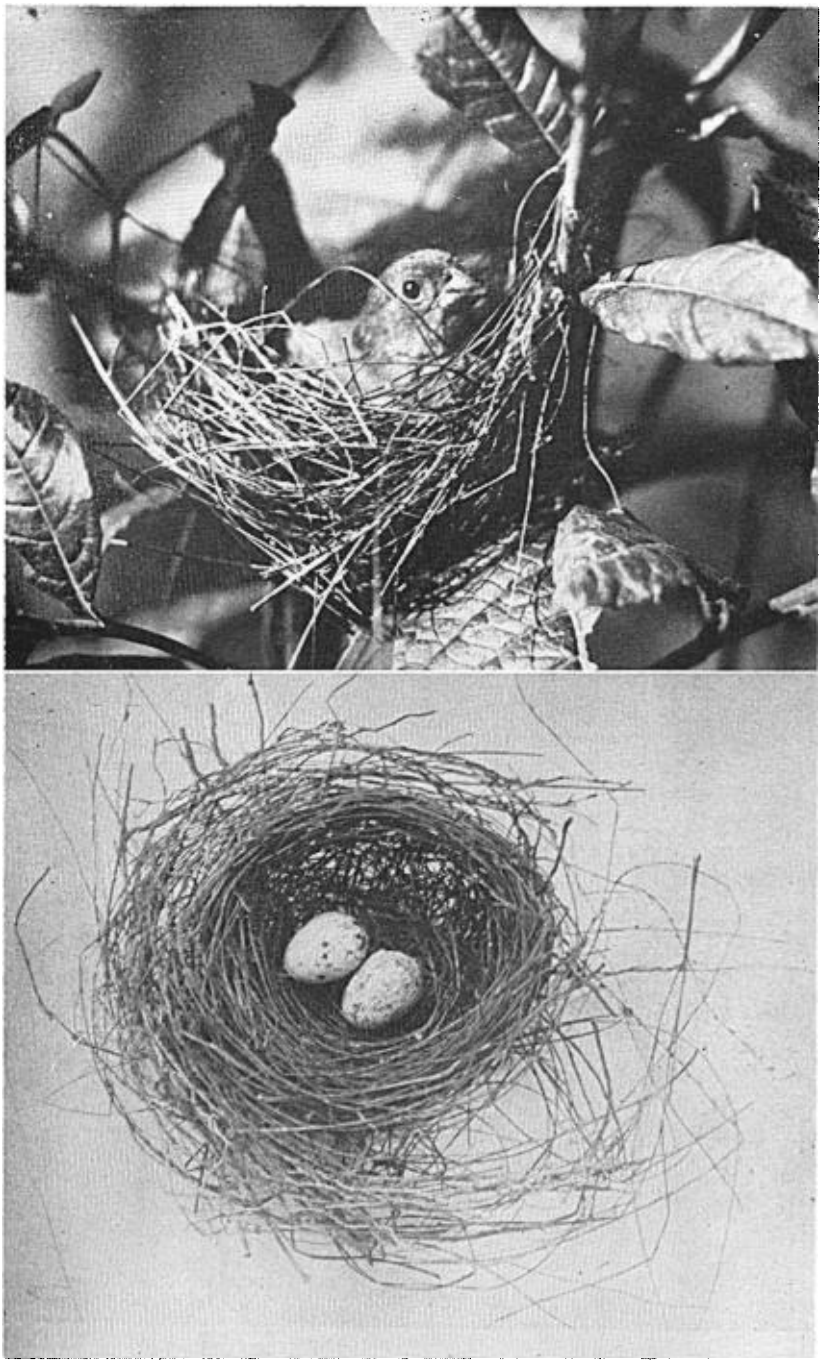
On July 24, when the nestlings were six days old, continuous observations were made of the activities of the birds about the nest from 5 o'clock in the morning, when it was still dark, until 7:30 in the evening, more than an hour after sunset. The activities of the seedeaters, correlated with the time of day and the presence of other birds and mammals, proved most interesting but space does not permit more than a brief summary of the notes. At this stage of development the young were not brooded, and no adults were present when the observations began. It was not until 6:09 a. m. that the first song of one of the adult males was heard. Three minutes later both of the males were heard singing in their respective singing trees. Soon thereafter the female appeared at the nest for the first time, not to deliver food but to remove a large brownish faecal sac. The female delivered the first food to the young at 6:18 and then made two subsequent feedings before the light male brought food at 6:35 and the dark male at 6:47. The last food for the day was delivered by the female at 6:13 p. m.

During the approximately 12 hours of continuous observation the young were fed 56 times—29 times by the female, 17 times by the light male, and only 10 times by the dark male. The males sang frequently during the course of the day and sometimes one or the other and on two occasions both males accompanied the female when she fed the young without delivering food themselves. The young were fed on an average of once every 13 minutes during the 12 hours, but feeding was more frequent during the early morning and late afternoon hours of the day. The actual feeding required just a few seconds but the adults would linger at the nest for 10 to 20 seconds after the food was delivered. The longer periods included waiting to secure a faecal sac, which sometimes involved a gentle prodding of the young by the adults. At this stage the faecal sacs were carried away, but during the first days of nest life the faeces were eaten by the adults, a usual procedure for the birds of this group. The young at this age were not brooded at any time during the day of observations. Furthermore, several visits with a flashlight to the nest during the preceding and following nights never revealed the adults in the nesting tree. I never was able to determine where the adults spent the night.

On July 22, I observed peculiar behavior on the part of the female. At 8:24 a. m., after feeding the young she carefully scrutinized the nest and the young, poking her bill down into the nest and among the young for three minutes. She then spent 19 minutes carefully going over the entire exterior of the nest, thrusting her beak into the fibers as if making repairs to the structure. During this time the young were fed by the dark male, who seemed to pay no attention to the female and what she was doing. The next day the procedure was repeated and, stationed at a nearer observation post, I carefully followed her movements with my binoculars. The bird was not manipulating nesting fibers but was methodically ridding the nest of ants. Ants are very numerous in the tropics and I have seen nests which were overrun by the pests and the young finally killed. The female Hicks' Seedeater was seen to grasp the ants in her beak, crush them, turn her head, and drop them. Some of the ants may have been eaten, but I did not see the bird applying the juices of the ants to her plumage. However, Skutch (1948) includes this seedeater among the birds he has observed "anting." An examination of the branches of the orange tree revealed a considerable number of ants.

NESTING RECORDS AND THE NEST

In the Canal Zone there are nesting records of Hicks' Seedeater from the last week of May to October. At Barro Colorado Island in 1927



(*Top*) FEMALE HICKS' SEEDEATER INCUBATING TWO EGGS IN NEST ON WEED STALK. BARRO COLORADO ISLAND, SEPTEMBER 21, 1927. (*Bottom*) NEST AND EGGS OF HICKS' SEEDEATER ON BARRO COLORADO ISLAND, OCTOBER 27, 1927.

the nesting season seemed to be at its height in September, when I found seven occupied nests in the relatively small area of the clearing. Doubtless there were others which escaped my notice. Two of these nests still contained young during the second week of October, and another nest with two eggs was found as late as October 22, 1927. I know of no nesting records in the Canal Zone for the months from November to April.

TABLE 1

MEASUREMENTS IN INCHES OF THREE NESTS FOUND ON BARRO COLORADO ISLAND

No.	*Date*	*Location*	*Height from ground*	*Outside diameter*	*Outside depth*	*Inside depth*	*Inside diameter*
1.	Sept. 22, 1927	small tree	5 ft., 8 in.	3.25 x 4.35	2.25	2.0	2 x 2.25
3.	June 30, 1949	croton bush	3 ft., 6 in.	3.0 x 3.5	2.50	1.75	1.85
3.	July 1, 1949	lime tree	11 ft., 8 in.	3.0 x 3.75	2.55	2.25	1.62

In Costa Rica, according to Alexander Skutch (letter), "the Hicks' Seedeater nests later than most small birds beginning in May in an unusually wet year, but not until June or July when the dry season has been long and severe. It waits until the grasses, which spring up with the return of the rain, have set seeds with which to feed the nestlings. It rarely nests later than August although there may be a nest or two in a sort of subsidiary breeding season at the beginning of the dry season in December and January." (See also Skutch, 1950.)

The nests in the Canal Zone have been located in a diversity of situations, ranging from those built in weed stalks and grasses to others located in shrubs and in trees at elevations well above the ground. An extreme case being a nest built 26 feet from the ground near the top of an orange tree. Most nests on Barro Colorado Island were located in small trees or shrubs.

The nests of Hicks' Seedeaters are usually made of plant fibers, fine grass stems, and rootlets, firmly interwoven to produce a neat substantial structure (Plate 11). Some of the nests are insecurely attached to branches and stems of the plants, shrubs, or trees in which they are built. This sometimes results in a nest tipping to one side when the frail attachments become loosed or broken from one cause or another. One nest under observation during September, 1927, tilted over after the incubation of the eggs was well-advanced, causing the adults to desert it. Mr. Robert Arbib who studied a nest at Gatun during August, 1934, recorded a similar experience in his unpublished notes on this species.

Nest Number 1 was made up entirely of long slender plant fibers of uniform size. It was insecurely fastened to the main and three small

lateral branches of a small tree. Some of the fibers were wound about several of the leaf stems. Nest Number 2 was made up of light brown fibers interwoven with dark-colored rootlets. The fibers on the outside of the nest were similar to those that made up the lining. Nest Number 3 was near the tip of an upper branch of a lime tree and well supported and attached to five small branches. The entire nest was made up of reddish brown fibers some of which exceeded two feet in length. These fibers were identified by Dr. I. W. Bailey of the Harvard Institute for Research in General Plant Morphology as rhizomorphs from *Marasmius sarmentosus* Berk. Many of these fibers protruded from the main part of the nest, presenting a ragged appearance. The interior of the nest was smooth, and neatly and compactly woven. Two of several other nests examined contained coal black fibers that closely resembled horse hair, but which also proved to be rhizomorphs of a fungus.

THE EGGS

The following description is based on two fresh eggs examined July 4, 1949. All of the color determinations are based on Ridgway (1912). The ground color was Pearl Gray, marked with spots and blotches of Pale Mouse Gray and Quaker Drab. Over these paler markings were blotches and marks of Benzo Brown and a few linear marks of Dark Mouse Gray, some of them approaching black in color. The latter were distributed chiefly on the circumference nearer the larger end of the egg. The smaller ends had a few small spots of Pale Mouse Gray.

In the 15 nests of the Hicks' Seedeater I have examined, there were but 2 eggs or 2 young. Two is the usual number, but rarely three may comprise a complete set. Skutch informs me that he has found as many as 70 nests at San Isidro, Costa Rica, and of these only one contained 3 eggs; all others had two eggs or two young. David E. Harrower (1936) reports four nests of this seedeater at Gatun, Canal Zone, each containing two eggs. Mr. Eugene Eisenmann has found

TABLE 2

MEASUREMENTS OF THREE SETS OF EGGS OF HICKS' SEEDEATER

Date	*Weight in grams*	*Long diameter in mm.*	*Short diameter in mm.*
September 22, 1927	1.76	16.1	14.4
	1.65	17.5	13.4
September 18, 1927	1.64	17.6	13.2
	1.75	18.6	14.5
July 4, 1949	1.80	18.5	13.6
	2.00	18.7	13.8
Average	1.76	18.1	13.8

several nests in which there were three eggs or three young: at Juan Franco, District of Panama City, a nest of three young on June 17, 1948; in 1949 one nest with three young, and two nests with two eggs each; and on June 23, 1951, two nests on Barro Colorado, of which one contained three and the other one had two young.

The average measurements of 8 eggs from Costa Rica reported by Skutch (1945) are 17.3 by 13.1 mm., and the average measurements of 23 eggs made more recently by Skutch are 17.4 by 13.0 mm. Measurements made by Harrower (1936) at Gatun, Canal Zone, are 16.5 to 17.5 by 12.7 to 13.3 mm.

DEVELOPMENT OF THE YOUNG

For comparative weights and dimensions see Table 3.

First day.—July 17, 1949. The down a few hours after hatching is Dark Neutral Gray blending to Light Neutral Gray at tips. Tufts of down present on crown, nape, humeral, crural, and spinal regions, also two very small ventro-lateral tufts. Down varies in length: on crown 8 mm; spinal region 6 mm.; and ventro-lateral tufts only 3 mm. Naked parts of body vary from Buff-pink to Light Ochraceous-buff; tarsus and toes, Warm Buff; nails, Ivory Yellow; lining of mouth, Peach Red; and exposed edges of gape, Barium Yellow. Young similar to this on second day except that feather papillae of remiges appear faintly along edge of manus.

Fourth day.—July 20, 1949. Because of great growth of young, down tracts appear thinner and more diffuse. Color of down has faded to Mouse Gray. Dorsal apteria have changed to Brownish Drab, and ventral naked parts to Light Grayish Vinaceous. Tarsus and toes are Vinaceous-buff, and exposed parts of gape have changed to Napthalene Yellow. Eyelids are separated by mere slit 3 mm. in length, but eyes are not as yet held open. Some tracts of juvenal plumage are now outlined by rapidly growing papillae; remiges are 3 to 4 mm., wing coverts 2 mm., but rectrices only 0.2 mm. in length. Papillae of feathers of ventral and spinal tracts are barely visible.

Sixth day.—July 22, 1949. All feather tracts are well defined, but feather papillae of the capital tract barely protrude through integument.

Eighth day.—July 24, 1949. At this time the young are alert and active and exhibit fear when approached, sit erect resting on their tarsi, and partially support themselves by their wings. Eyes are held wide open; iris is dark brown. Papillae of juvenal plumage, especially on wings, are most conspicuous feature of contour of young. Most down, excepting that of crown and spinal region, has been frayed or worn away. Process of unsheathing of papillae has progressed rapidly: those of secondaries, 6 mm.; and those of greater wing-coverts are freed for 10 to 12 mm.

Tenth day.—July 26, 1949. On the morning of July 26, the young were seen perched high on the edge of the nest where they were being fed by the female and the two males. At ten days the unsheathing of the papillae of the juvenal plumage has progressed so extensively that viewed from above the bird appears completely covered with feathers, excepting the middle of the crown where the feathers still retain their sheaths. Only minor tufts of down remain on the crown; elsewhere the down has been lost. Feathers of side of head, nape, back, greater and lesser wing coverts are Slate-olive. Primaries and secondaries are Deep Mouse Gray, coverts of secondaries

edged with Grayish Olive. Feathers of belly are Cream-buff which shades to Ecru-olive on flanks and to Olive on breast. Chin and throat are lighter, with distinct tinge of yellow. Lining of wings is Deep Colonial Buff. Maxilla is Dusky Drab; mandible, Hair Brown; edges of gape, Baryta Yellow; tarsus and toes, Light Brownish Drab; and claws, Light Drab.

TABLE 3

WEIGHTS IN GRAMS AND DIMENSIONS IN MILLIMETERS OF YOUNG AND ADULT HICKS' SEEDEATERS

	Young—1949							*Adults—1927*	
								Male	*Female*
Date	*July 17*	*18*	*20*	*22*	*24*	*26*	*27*	*Aug. 28*	*28*
Age in days	0	1	3	5	7	9	10		
Weight	1.35	1.95	4.19	6.05	7.35	8.20	7.40	9.70	9.45
Length	28.0	32.5	44.0	58.5	62.0	67.0	71.0	112.0	110.0
Culmen	3.5	4.9	5.0	6.1	7.0	7.2	7.5	9.5	9.9
Bill depth		4.5	5.1	5.9	6.2	6.3	6.3	7.2	7.0
Bill width		3.6	4.0	5.0	5.1	5.1	5.2		
Eye to tip of bill	6.0	6.7	7.8	8.1	8.9	9.1	9.2	11.5	11.5
Nostril to tip of bill	2.1	2.2	2.9	3.1	4.0	4.2	4.3	7.0	7.5
Extent	22.0	31.0	49.6	89.8	116.	138.	142.	173.	168.
Wing	9.0	9.2	12.0	13.0	15.0	17.0	17.5	52.0	51.0
Tarsus	7.6	8.0	10.1	14.5	14.9	15.6	15.8	17.5	17.3
Toe-toe	8.7	9.4	12.0	13.5	20.5	25.0	26.0		
First toe	4.9	5.1	6.9	9.8	10.5	11.0	11.2	12.0	12.0
First toe nail	1.8	1.9	2.2	2.9	3.0	4.9	5.8	6.2	6.3
Third toe	4.7	5.0	8.5	11.0	13.1	14.0	14.1	15.0	15.0
Third toe nail	1.8	1.9	2.2	2.8	3.5	4.9	5.5	6.0	5.8
Middle tail feather	—	—	0.2	1.2	3.1	5.0	8.0	42.0	42.0
Unsheathing tail feather	—	—	—	—	0.5	1.6	5.0	—	—
Fifth primary	—	—	3.0	14.9	22.5	28.0	32.0	40.0	40.0
Unsheathing fifth primary	—	—	—	—	3.0	16.0	22.0	—	—

Twelfth day.—July 28, 1949. The young left the nest on the tenth day and remained perched near the nest. On the twelfth day the young were capable of short flights and by easy stages gradually left the vicinity of the nesting tree. Under normal conditions in which the young were not disturbed by my frequent visits to the nest they remained in the nest 12 days and in the case of one nest in 1927 they did not leave until the thirteenth day.

In one instance a nest was destroyed by some predator, and the same pair of birds constructed a second nest. I was unable to determine whether or not two broods were raised during any one nesting season by a single pair of birds. During September and October, 1927, I saw several family groups feeding on the seeds of the tall grasses of the clearing. The young secured their own food. The family groups were maintained for a considerable length of time, and I saw no tendency on the part of the adults to desert the young for another attempt at nesting at that period of the breeding season.

PARASITES

On August 30, 1926, Dr. James Zetek noticed tiny nodules on the necks of two nestlings of a nest he found in a small orange tree of the

clearing on Barro Colorado Island. On September 3 one of the birds was dead, and the other with many tumor-like masses on its neck was in such bad condition that it died soon after it was taken from the nest for detailed examination. It was heavily infested; Dr. Zetek counted a total of 47 larvae which emerged from the one bird. The larvae were allowed to pupate and a number of the adult parasites were reared. The specimens were identified by Dr. Charles T. Greene, Curator of Diptera of the U. S. National Museum, Washington, D. C., as the dipterous parasite, *Philornis pici* Macquart. Mr. Eugene Eisenmann reports that on July 3, 1950, he found in a nest on Barro Colorado Island a young Hicks' Seedeater which was parasitized by a fly, presumably of the species mentioned above. Mr. Eisenmann states there was a large perforated lump on the cheek and another at the shoulder of the fledgling where the feathers were not well grown. As is true in general of many birds in the tropics, especially those building open nests on or near the ground, the Hicks' Seedeater is subject to predators as well as parasites during the nesting season. Less than half of about 50 nests of various species I have observed on Barro Colorado Island have been successful in rearing their young to maturity.

SUMMARY

1. Hicks' Seedeater is permanently established as a nesting species on Barro Colorado Island, Canal Zone.

2. The female built the nest, in those instances in which nest construction was observed.

3. Two males copulated with a single female, establishing a definite case of polyandry for Hicks' Seedeater.

4. The incubation period of Hicks' Seedeater was 12 days. Only the female incubated the eggs.

5. Both males assisted the female in feeding the young.

6. A few insect larvae were fed to the young during the first few days, but the greater part of the food, seen delivered in 1949, was a white viscid substance, probably predigested seeds, that was fed by regurgitation. A larger percentage of insects was fed to the young of nests studied in 1927.

7. The female was observed collecting and killing ants which had infested the nest.

8. Nests of Hicks' Seedeater are located in a diversity of situations that range from among grasses and weeds to well above the ground in shrubs and trees.

9. Nests of Hicks' Seedeater have been found in the Canal Zone

from May to October inclusive. No records were obtained from November to April.

10. The usual set of eggs is two. A few cases are cited where there were three eggs or young in one nest.

11. Descriptions of various ages of the young and a table of weights and measurements of the young and adults are given.

12. A dipterous parasite, *Philornis pici*, was the cause of death of two young.

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THE HAWAIIAN COOT

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Distribution and Abundance.—The Hawaiian Coot, *Fulica americana alai* Peale or "alae keokeo," is one of the few native birds of Hawaii that has maintained itself in sufficient numbers to be fairly common on most islands at the present time. In the past, it was abundant on all the major islands, particularly Oahu, Maui, Molokai, and Kauai, which possessed coastal brackish and fresh-water ponds or marshes, reservoirs, or large streams (Wilson and Evans, 1890–1899; and others). In 1891 Munro (1944) saw from 500 to 600 coots on a "lagoon" near Lihue, Kauai. Perkins (1903) reported that the coots gathered in flocks of considerable size and from 50 to 100 occurred together on a "fair-sized pond."

The Hawaiian Coot lives from sea level to 500 feet elevation in both arid and semi-humid regions wherever there is some open fresh or brackish water bordered by emergent aquatic vegetation or heavy stands of grass. It is non-migratory and has no obvious seasonal