

THE BREEDING BEHAVIOR OF THE BLUE-BLACK GRASSQUIT

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The Blue-black Grassquit (*Volatinia jacarina*) is a common seedeater, resident over an extensive range from Sonora and Tamaulipas south through tropical America to northern Chile and northern Argentina. It occurs from sea level up to the lower part of the Subtropical Zone. Its habitat is always grassland.

The study of the Blue-black Grassquit reported here was carried out in the Panamá Canal Zone at 9° 7' north latitude. The nesting area under observation was about one mile from the town of Gamboa at the junction of the Chagres River with the Panamá Canal. The topography there is broken with hills rising 95 feet to 250 feet above sea level.

There are two regularly recurring seasons in this part of Panamá, the wet and the dry. The rainy season lasts from May to mid-December. The rest of the year is dry, although some precipitation occurs. The onset of each season varies a little from year to year. Relative humidity averages in the upper 80's during the rainy season and in the middle 70's the rest of the year. The total annual rainfall at Gamboa, from 1955 through 1959, was 77.81, 80.95, 83.54, 69.70, and 74.20 inches, respectively. The departure from normal precipitation for these years ranged from -17.57 to -3.87 inches. This long period of deficits in rainfall was broken in 1960 when precipitation measured 94.56 inches. All nests were discovered in the rainy season.

Temperature readings are not regularly reported from Gamboa but are about two degrees lower than at the hydrographic station at Balboa, sixteen miles away and nearer the Pacific Ocean. There, the absolute minimum reading, to date, is 63° F., the absolute maximum is 98.2° F. The daily average fluctuation in temperature over the 24-hour period in March, typical for the dry season, is 18.1° F. and in October it is 11.9° F. Meteorological data were supplied by the Meteorological and Hydrographic Branch of the Panamá Canal Company.

The area occupied by the grassquits is a grassy, weedy clearing in tropical deciduous forest. Trees from 30 to 75 feet high rim the opening on three sides. Observations were made from the only residence within more than a mile. Surrounding the house were patches of mixed weeds and grass which were partly confined by hedges of shrubs—hibiscus (*Hibiscus rosa-sinensis*), dwarf star jasmine (*Jasminum pubescens*), Hawaiian ti (*Cordyline terminalis*), and fish-tail fern (*Nephrolepis biserrata*). An enormous corotú tree (*Enterolobium cyclocarpum*), many mango trees (*Mangifera indica*), a mangosteen tree (*Garcinia mangostana*), and numerous shrubs gave abundant escape cover. Birds and nests were sheltered from rain and direct sunlight by the shrubs, leafy weeds, and thick mats of Java grass, the latter interspersed with thorny mimosa (*Mimosa pudica*), ivy, "spirit weed" (*Momordica charantia*), and other creepers. Bare branches of dead shrubs, clotheslines, telephone and electric lines, trees and the inflorescence of a Cuban palm (*Chrysalidocarpus lutescens*) were constantly used as singing and calling perches. Seeds from short grasses and weeds, berry-like fruits of weeds such as the wild lantana (*Lantana comara*), and abundant insects and their larvae vary the diet. Most important of all as a food source is the Guinea grass (*Panicum maximum*) which has taken over several patches in the clearing, some near the house and others on a perimeter distant an eighth to a quarter of a mile from the house.

Scope of observation.—From 1955 through 1957, 478 hours were spent in concentrated observation. The data thus obtained were supplemented by spot checking on 316 days between 1955 and 1961. Fourteen pairs of Blue-black Grassquits and 22 nests constitute the principal source of information (table 1). Not all pairs contributed equally

TABLE 1
 OCCURRENCE AND SUCCESS OF NESTS OF BLUE-BLACK GRASSQUITS FROM 1955 TO 1959

Year	Number of pairs	Number of nests	Number of eggs	Number hatched	Number fledged
1955	1	1	3	3	3
1956	5	9	22	18	10
1957	4	8	18	8	7
1958	2	2	5	5	5
1959	2	2	5	5	5
Totals	14	22	53	39	30

to the findings. Five pairs in 1956, designated by the symbols, A-1, A-2, A-3, A-4, A-5, and four pairs of 1957, designated by B-1, B-2, B-3, B-4, were given most attention. Territories of A-1, A-3 and A-4 were north of the house, those of A-2 and A-5 were south of it. Although A-2 and A-5 are designated separately, quite probably they are the same pair. The two nests concerned were close enough together to have been within the territory established by A-2. Timing also tends to confirm this supposition. The three nestlings of A-2 were all destroyed by August 1. Two nestlings were found in the nest of pair A-5 on September 8.

Displays.—The spectacular vaults, which characterize the male's behavior, are an exaggerated hop aided by his wings. Typically he leaves his perch in a vertical lift of some 12 to 18 inches, reverses at the top of the flight and returns to the same spot. Such leaps are performed from the several perches defining his territory. Frequently he faces one way, then turns to face the opposite way with the next jump. The male's call note, *t-s-e-u*, accompanies the jump at times. The action is deliberate and rhythmic. Early in the breeding season, for many consecutive days solitary males in transitional plumage went through the routine of jumping accompanied with calls, using perches that were not employed later for territorial markers.

On August 7, 1956, when the breeding season was well advanced, a male made 41 hops in succession, each accompanied by his call. He then added 45 calls without hops (9:00–9:08 a.m.). On the same day he was timed between 5:10 and 5:17 p.m., when he made 36 vaults with calls. On August 31, in 24 minutes he vaulted with calls 105 times in succession, then added 148 calls—all from the same perch. Both early and late in the breeding season more calls are given without hops than with them. These spurts of enormous energy seem to be compensated for by the short pauses between leaps. Intervals between either leaps and calls or between calls alone are about the same. In the foregoing instances the pauses were five or six seconds.

The height of the jump varies considerably according to the occasion. For example, one nest was 28 inches from the ground on a blade of a fish-tail fern behind a hedge of taller crotons (*Codiaeum variegatum*). The bird was on the ground facing the hedge, cautiously approaching in short hops. He gave his location call and was answered from a position some distance from the nest. Immediately he made three vertical leaps approximately five feet high and went over the hedge and down to the nest. In another situation a nest was close to the ground in deep grass. Although the territorial perches were higher than the nest, to see the nest his jumps from these perches were higher than those of the routine territorial performance.

Many times the male of pair A-1 perched on horizontal wires of a trellis some distance below the top. This location left no head room for his usual leaps. He met this situation by jumping at an angle of about 45° and returning to his perch along the same

diagonal path. At times this male and others lifted themselves vertically but returned through a path describing a smooth curve. The male of pair B-1 decoyed a lizard away from his two juveniles, just out of the nest, by performing short vertical hops before his dazzled enemy.

It was noted that the males did not display while the chicks were coming out of the shells or when the young were leaving the nest. During these events males as well as females are much occupied at the nest.

Pair relations.—The remarkable jumping behavior may serve in pair formation. Before nesting was begun in 1956, a male was seen to do his leaps in a circle around a female while she continued to feed without visible response. In July of 1956, while pair A-2 was feeding nestlings, the two adults were seen to bill each other close to the nest. Nuptial feeding was noted on August 16, 1957, when the male of pair B-1 fed his mate on the nest at 12:52 p.m. and again at 1:09. In both instances the female left the nest immediately afterward. On the eighth day after the third egg was laid, the pair of 1958 copulated at 8:33 a.m. Three days later their three eggs were hatched. They built another nest which contained the first egg on August 23. Thus courting seems to continue through the breeding season.

The pairs are monogamous through the season and may stay together longer. On February 8, 1960, what appeared to be members of a family group were feeding together. There were three individuals, one in the blue-black plumage of an adult male, one in transitional feathers—brownish back and head, but with all black tail—and a female identified by her rayed throat. What appeared to be the same group was feeding together in the same place the next day. This time the young male mounted a twelve-inch stepping stone and did a few awkward jumps as though practicing or experimenting. The female continued to feed busily. The male in blue-black array stood very still with his back to the performance, then moved slowly out of sight into a fern hedge.

Voice.—The Blue-black Grassquit's call, when given in full voice, is a rapid nasal trill which ends in a clear, sweet tone. The sound may be represented by the letters *t-s-e-u*. It may be given alone or may accompany his jump. In the latter case it begins just after he leaves his perch and concludes with the landing. Females were never heard to give this call. Variations of the initial consonant sound constitute the rest of the repertoire of both male and female birds. Changes are produced by differences in volume, rate of delivery, and emphasis or force.

In situations of high excitement or "interest," the initial sound is uttered rapidly with lightly explosive force. It may be represented by *tst* or *tsk*. Both parents make this sound while feeding the young. The presence of an intruder near the nest has caused the female to make this sound, which in turn touched off the male's territorial display. In A-1's second nest there had been only one egg in the set and the nestling was out of the shell before 6:00 a.m. At 7:40 the female was on a cestrum bush (*Cestrum nocturnum*), a few feet from the nest, repeating *tsk* as was the male at a little distance on an orchid trellis. Between these two points were four parallel clotheslines, supported on gas pipes. Both parents then flew about these perches and came to rest on a line where they faced the nest. They continued the *tsk* sound, flipping their tails and moving back and forth on the wires. This excited behavior lasted eleven minutes before the female flew to the nest with the male close behind her. Both perched on tall grass stems from which they could see down into the nest. In a moment the female descended to brood the nestling. The male returned to the trellis and gave his calls with jumps.

Another vocal variation has a slightly nasal "strumming" quality suggesting a softly plucked string. Frequently this sound signals domestic business around the nest. At

times this note sounds like *cha* or *chu* and is heard when one of the pair is on the nest and the other arrives. The sitting bird replies with the same note. The inquirer may be satisfied and leave at once, or a dialogue may ensue in which the same note is used by each bird. The latter routine is more apt to follow when the female has been sitting a very long time during a corresponding absence of her mate. Both have been heard to use the syllable "conversationally" when perched near each other at a distance from the nest. In all cases the variations in these calls are slight and the descriptions are suggestive rather than imitative of the sounds produced.

The young seem to spend a voiceless infancy. After they are fledged, they begin at once to give their location calls which are repeated incessantly as they make their way through grass and weeds, able to fly no more than three feet at a time. Their location calls are a series of single-note, two-note, or three-note calls. A sample sequence would be 2-notes (5 times), 3-notes (18 times), single-note (4 times), 2-notes (10 times), and so on. They are silent only while they are being fed or are trying to help themselves by stabbing at their surroundings. Their calls diminish as they become more practiced. On the sixth day out the juveniles of pair B-1 gave only a few location calls from 6:00 to 11:27 a.m. and none after 6:53.

Territories.—In the nesting area space relationships among natural and artificial features such as trees, shrubs, and electric lines were the same from year to year. During a season, second and third nests of the same pairs were within the territory established for the first nest. For mapping purposes boundaries of territories were determined by drawing lines between calling perches. There were trespasses and conflicts after the claims were defined. Disputes took place on the ground within trespassed boundaries.

At the beginning of the season of 1957, four males held adjacent claims in an irregularly fan-shaped space centered at the northwest corner of the house. Counter-clockwise, east to west, their territories were, in order, B-2, B-3, B-1, and B-4. B-2's nest was on top of a terrace about eight feet high and some 30 feet from the northeast corner of the house. For his principal calling perch this bird used the inflorescence on one of three stems of a Cuban palm, 20 feet north of the house. B-1, with a nest at the northwest corner of the house, held a second stem. B-3, whose nest was in an hibiscus hedge between these two territories, owned the third stem. The fourth territory joined B-1's on its west boundary. There were many clashes among the three in the palm. Each took advantage of any laxness of another bird. When B-2's nest was robbed, he failed to give his territorial calls, and B-1 promptly took charge of the neglected perch.

When the nestlings of B-1 were fledged, the parents guided them in a circuitous route across small segments of the others' claims causing brief encounters with the neighbors. It was also observed that B-1 used temporary calling perches while the young birds were making slow progress toward the chosen cover. By the juveniles' fourth day, B-1 was again using only his original perches which had not been released. From both the regular and temporary perches he could see the juveniles, feed them from time to time, and work on his second nest.

Of the many species frequenting this location usually there was at least one other nesting in the area occupied by the volatinias, notably Green-backed Sparrows (*Arremonops conirostris*), Gray-capped Flycatchers (*Myiozetetes granadensis*) and Yellow-bellied Seedeaters (*Sporophila nigricollis*). Only the Green-backed Sparrows had serious disputes with the volatinias. Both had nests in the grass only a few feet apart. The sparrows also used the clotheslines and the top of the orchid trellis as perches, most often while they were feeding nestlings. When challenged by the grassquits, they refused to move but did not attack their small competitors.

Nests.—The nest of the Blue-black Grassquit is a small, shallow but very durable cup. Both members of a pair build. The male takes the initiative but the female always helps, even with the second and third nests while there still are juveniles to be fed. The materials are tough fibers—tendrils, rootlets, and grass stems. The nest is not quite symmetrical. For nine nests, inside diameters measured from 1.75 to 2.0 inches; outside diameters varied from 1.75 to 3.5 inches. Depth inside varied from 1.0 to 1.5 inches, outside depth from 1.5 to 2.25 inches. These small cups look very spacious for three nestlings a day old, but by the sixth day they are just comfortably filled.

The height from the ground for 15 nests was from three inches to 8.75 feet. The median height was 9 inches. Three nests were three inches from the ground. Slightly less than half of the nests were close to the ground, concealed in grass and weeds. One nest was on fish-tail fern; the rest were in shrubs—croton, hibiscus, and dwarf star jasmine. Throughout the season those that built first nests close to the ground followed that arrangement for later nests. Those that began in shrubbery continued to use shrubs, although some found it convenient to change from one species to another.

Eggs and nest success.—The eggs of Blue-black Grassquits are bluish-white with brownish or purplish spots slightly concentrated at the larger end. In 13 of 22 nests there were 3 eggs; in 6 nests there were 2. Two nests contained one egg and one nest had no egg. The average number per nest was 2.4. Of 53 eggs, 39 were hatched. Thirty of the nestlings were fledged (table 1). The ratio of the number of nestlings to the number of eggs was 73.5 per cent; of fledglings to nestlings, 77 per cent; of fledglings to eggs, 56.6 per cent. Predation was the primary cause of losses, accounting for 19 as compared with

TABLE 2

INTERVALS BETWEEN NESTS IN PAIRS OF BLUE-BLACK GRASSQUITS

Pair	Date vacated	Date of first egg	Interval	Notes
1956				
A-1				
1st nest	July 24			3 fledglings (3 eggs)
2nd nest	Sept. 1	Aug. 11	18 days	1 fledgling (1 egg)
3rd nest		Sept. 10	9 days	2 eggs; lost
A-3				
1st nest	Aug. 23			1 fledgling (3 eggs)
2nd nest		Sept. 6	14 days	2 eggs; lost
A-4				
1st nest	Sept. 4			3 fledglings (3 eggs)
2nd nest		Sept. 18	14 days	2 eggs; lost
1957				
B-1				
1st nest	July 30			2 fledglings (3 eggs) ¹
2nd nest		Aug. 5	6 days	2 fledged (3 eggs, 1 infertile)
3rd nest				Nest finished Sept. 5(?)
B-2				
1st nest	Aug. 13			3 eggs; lost
2nd nest	Sept. 15	Sept. 10	28 days	1 egg; lost
3rd nest		Oct. 4	19 days	2 eggs; lost ²

¹ A tree-climbing snake caught one nestling; the two remaining nestlings jumped out of the nest about two days earlier than would be expected; both survived.

² The nest was attached to a tall, leafy weed nine inches above ground. Grass cutters carefully removed all weeds and grass surrounding the nest. The pair watched the nest for many days, until the eggs were lost, but did not incubate. Two years later the same accident befell two pairs of grassquits at a time when there were nestlings. Twice the observer replaced the cover with fresh grass and weeds. Both nests were completely successful.

three losses due to accidents and one to an infertile egg. Predators were Black Vultures (*Coragyps atratus*), lizards and tree-climbing snakes.

Number of nests per pair.—How many nests are typical of Blue-black Grassquits for a season? Very limited data from three pairs in 1956 and two in 1957 are presented in table 2. The "interval" was defined arbitrarily as the time between vacating one nest and the appearance of the first egg in the next. "First nest" means the first nest seen by the observer. It may or may not be a pair's first nest of the season. The longest interval between first and second nests was 28 days; the shortest was 6 days. In one case the interval between second and third nests was definitely shorter than between first and second nests. Pairs A-1, A-3, and B-1 each produced four juveniles from six eggs. A-4 had three young from five eggs. None was from third nests. Three clutches in September of 1956 were lost to predators, as were B-2's first and second nests. B-1's third nest was complete by September 5 and was still intact when it was abandoned about September 11. No egg was seen, but it is possible, although not probable, that one was laid and was promptly taken by a snake. B-2, which had no success, built a third nest and laid in October. In contrast with the latter case, are three, or possibly four, others whose nest-building efforts were terminated with the failure of September nests.

With the small number of cases available it is not possible to generalize concerning the typical number of nests per pair per season, but so far it is evident that every pair attempts more than one nest. Three is the highest number of nests attributed to any one pair.

Incubation.—Both parent grassquits incubate, but the share taken by the male is more a gesture than a responsibility. The following are the known incubation sessions of the males of three pairs:

A-1	August 21	8:10 a.m. to 8:22 a.m.	12 minutes
A-3	September 11	7:19 to 7:25	6
B-2	August 9	5:03 p.m. to 5:09 p.m.	6
B-2	August 10	4:59 to 5:07	8
B-2	August 12	1:00 to 1:01	1

Sometimes the male was interrupted by the return of the female. At other times he ended the session voluntarily. The behavior seems too mercurial to be depended on in case of the loss of the female. But why does he incubate at all?

The second nest of B-1 was discovered in mid-afternoon on August 7, located near the top of a yellow-spotted croton, only eight feet from the window at the northwest corner of the house. This location afforded the best opportunity in three years to observe the volatinias. The shortest session was 18 minutes for the female and the longest was more than four hours and eight minutes. The average was more than two hours long. Skutch's formula (Pac. Coast Avif. No. 31, 1954:15) was used to compute attendance. Only completed sessions and recesses occurring in sequence were used in the computation. Attendance was 80 per cent.

Eggs are laid on successive days, early in the morning, making the interval between them about 24 hours. On August 2, 1958, hatching took place from early morning to mid-afternoon. One nestling was present when the nest was inspected at 7:40 a.m. At 12:30 p.m. the second nestling was half out of the shell and before 2:30 the third was hatched. At this stage the interval between the hatchings has been shortened as compared with the intervals between the laying of the eggs.

Incubation periods of four nests were 10 days and a few hours in three instances and 12 days in the other. The 12-day period was required for the one-egg set. This suggests that incubation followed the routine of the three-egg set in the first nest of this pair. It

would seem that sufficient time elapsed to produce a second and a third egg before incubation was begun in this case. The incubation periods were determined from time of laying of the last egg to the time of last hatching. In the case of the 10-day incubation period of C-1, the best observed case, the second egg was laid on July 22 and the third egg was laid on July 23, possibly before 7:00 a.m. The third egg hatched between 12:30 and 2:30 p.m. on August 2. Thus the period was possibly as long as 10 days and 8 hours.

Feeding the nestlings.—Both parents feed the young. As long as brooding continues, it follows the feedings. Also removal of the fecal sacs, grooming, and ridding the nest of vermin follow feedings. The latter ministrations are performed by the female. Usually the female fed each nestling in turn, giving several dips to each before repeating. Typically, the male gave two dips to each. Sometimes he fed only one nestling. Food is regurgitated by the parents for several days. Later it is carried in the bill—worms, small berry-like fruits, and insects. The staple food is the small green seed of Guinea grass.

For three days both parents ate the fecal sacs. On the fourth day the female carried them away a considerable distance before dropping them. One male was seen to dispose of them by both methods as late as the fifth day. A-1 female carried away the sacs after the fledglings had been out of the nest 24 hours.

Both parents varied their approach to the nest, the female more often than the male. Several times the female perched in two places before going to the nest. The male flew directly to it from his calling perch, unless the female was on the nest at the time. In that case, if the nest was in the grass he flew to a spot about three feet away, then crept slowly forward, giving the female time to leave.

Data from two nests, the first nest of A-1 and the second nest of B-1, were tabulated and the rate for each parent was computed for seven days. The sampling included 37 per cent of the daylight hours for the A-1 pair and about 50 per cent for the B-1 pair. All parents were feeding oftener at the end of the nestling period than at the beginning. All reached their highest rate-per-hour near the middle of the period. The rates of the males were more irregular and, on the average, they fed less often, although on one day each male exceeded the rate of his mate. B-1's nest was infected with parasites and the rates of both parents were lower than the corresponding rates of the A-1 pair. The range of rates for the B-1 male was from 0.59 to 1.6 visits per hour as against the A-1 male's range of 0.84 to 3.24. The ranges for the females were, respectively, 0.99 to 1.86 and 0.23 to 3.48. B-1 had two nestlings. If the meals were distributed equally, each young bird received food from the combined efforts of the parents from 0.79 to 1.74 times per hour. A-1 had three nestlings, each receiving food at the rate of 0.70 to 2.12 per hour. For the first two days the individuals in each nest were fed less than once per hour. The rate increased but did not average twice per hour per nestling for the period as a whole.

Brooding.—Records of brooding were made on four pairs, A-1 with two nests, and one nest each for A-2, A-3 and B-1. The females brood every day as long as there are young in the nest. Their sessions diminish in length and frequency as the rate of feeding increases. Only the nests of A-3 and B-1 were seen while the eggs were hatching. The male of A-1 brooded only on the first day at his first nest but changed his pattern at the second nest when he brooded from the fifth through the eighth day. Although the activity at this nest in the first few days was not noted, it is probable that he had brooded some every day. Both A-2 parents brooded all six days that the nest was watched. The males showed individual variations in the amount of time given to brooding. Their sessions averaged shorter and were fewer than those of the females.

Leaving the nest.—Young Blue-black Grassquits of the same brood generally leave the nest within a very short time of each other. Frequently all are out within the same

hour. They are not then well feathered. The young bird moves uncertainly with impulsive lurchings, using its wings as crutches. Three feet is about the limit of a flight initially, but in four to five hours the fledglings can take occasional flights of twelve to fifteen feet.

By the inducement of frequent feedings the female gets the first chick to shelter before she pays any attention to the next one. When there is a third, it is apt to be the least developed and is less likely to move around and be lost. The youngest fledgling of pair A-1 sat near the nest for 24 hours in intermittent periods of cold rain. When there is no interference, all of a brood can be seen within a few yards of the nest until well into the second day. The male watches the whole area on the alert and does not begin to feed his charges at once. In the first brood of B-1 it was two hours before either parent fed the second fledgling. During this famine period the young birds snap at weeds and grass, going through the motions of feeding themselves. They do not long remain entirely dependent for food.

The young are indifferent to territorial boundaries and frequently trespass, causing border disputes between neighboring grassquits and one or both parents. When either parent loses sight of one of the brood, it mounts a tall perch and scans the area. Having found the young one, it flies directly to the spot. On one occasion the second fledgling was caught by a snake while the parents were looking after the first one. The female came back to the nest. Not finding the fledgling, she mounted a tall weed and examined the surroundings. When she did not see the fledgling, she returned the way she had come, but in short hops on the ground instead of flying. Apparently she was still searching.

Fledging time in two nests was 9 days.

Length of the breeding season.—The length of time spent in pair formation and building the first nest was not determined. As shown in table 2, the intervals between nests range from six to 28 days, with 14 to 19 days the more usual interval. The time spent before the first nest is built may well be a month or even longer. The earliest nest found at Gamboa contained two eggs on July 16, 1956. The third egg was laid the next day. Spot checking in 1961 disclosed three males giving vaults and calls on May 6. Inflorescences appeared on the Guinea grass on May 9 and the first female was identified on May 10.

In 1954 a nest containing one egg was found on June 10, at Pedro Miguel, Canal Zone (Barnard, Condor, 58, 1956:229-231). This locality is eight miles from Gamboa and conditions of climate and cover are very similar. Nesting would have begun in May, possibly as early as the tenth.

Since predation accounted for the greatest number of losses of both eggs and young, the effort of the pairs can be indicated by the number of nests they built. Likewise the length of the season and its most profitable period may also be inferred from the distribution of nests by months as shown in table 3. Although there were 22 nests studied,

TABLE 3
DISTRIBUTION OF 21 NESTS BY MONTHS

Month	Number successful	Number failed	Total
July	2	0	2
August	3	2	5
September	6	3	9
October	2	3	5
	—	—	—
Totals	13	8	21

one was abandoned without having shown an egg. Since this pair had one infertile egg in the preceding nest, it seems more probable that there had been no egg rather than that one was lost. This nest is not accounted for in table 3.

The number of nests increased from July through August to its peak in September and declined rapidly to none in November. The latest a fledgling was seen was on October 23, 1959. The record covers five seasons of lower than average rainfall. Normally November has the greatest precipitation and the dry season begins by the middle of December.

SUMMARY

The Blue-black Grassquit (*Volatinia jacarina*) is widely distributed in the tropics of the Western Hemisphere at elevations from sea level to the border of the Subtropical Zone. The elevation in the study area in the Panamá Canal Zone where breeding behavior was observed is approximately 100 feet.

These grassquits have a varied diet but show marked preference for the small, green seeds of Guinea grass.

Nesting occurs in the rainy season reaching its peak in September. The very durable open-work nests are small, shallow cups of tough, wiry fibers. Three was the highest number attributed to a pair in one season. The pairs attempted more than one nest, as a general rule. Both parents build the nests with the male taking the initiative. More than half the nests were placed in shrubs; one was on a fish-tail fern and the rest were concealed in grass and weeds.

Fourteen pairs produced 53 eggs in 22 nests. In more than half of the nests there were three eggs; in less than one-third there were two eggs. Of 53 eggs, 73 per cent were hatched and 56.6 per cent were fledged. Incubation is largely the function of the female, although the males practice it to a very small degree. One female incubated 80 per cent of the observed time. Her longest session was more than four hours and eight minutes. Her average session was more than two hours.

Both parents feed the young. Brooding is done by both, although there is a tendency for the males to brood only on the first day of the nestling period.

Tucson, Arizona, April 9, 1962.